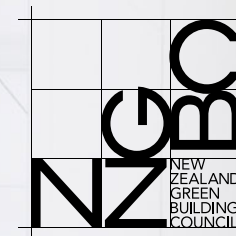


# The case for sustainable healthcare



green building council australia

greenstar





# About the Green Building Council of Australia



# About the New Zealand Green Building Council



Established in 2002, the Green Building Council of Australia (GBCA) is the nation’s authority on sustainable buildings, communities and cities. Our vision is to create healthy, resilient and positive places for people. Our purpose is to lead the sustainable transformation of Australia’s built environment. To do this, we:

- Rate the sustainability of buildings and communities through Australia’s only national, voluntary, holistic rating system – Green Star.
- Educate industry and government practitioners and decision-makers, and promote green building programs, technologies, design practices and operations.
- Advocate policies and programs that support our vision and purpose.

The GBCA represents over 600 individual companies with an annual turnover of more than \$40 billion. Members include major developers, professional services firms, banks, superannuation funds, product manufacturers, retailers and suppliers from small-to-medium enterprises to ASX 200-listed companies. We also have 40 local government, 26 state government departments and land organisations, and 18 university members.

All New Zealanders deserve to be safe, healthy and happy in our beautiful country – at home, at school, at work. Everywhere.

At the New Zealand Green Building Council (NZGBC), we’re a team of people who are passionate advocates for better buildings, because we know that better buildings mean healthier, happier Kiwis.

We do this by working alongside politicians, industry and other businesses to bring change.

We run trusted, robust authentication schemes, such as Green Star and Homestar, that highlight the many buildings that have proven their healthy, safe credentials. And we provide education for hundreds of New Zealanders every year keen to learn about the technical aspects behind better buildings.

Hundreds of Kiwi businesses are making their buildings better, thanks to independent and expert technical standards provided by the NZGBC.

Green buildings in Aotearoa are building momentum. Thousands of better buildings are being constructed, backed by billions of dollars. And those businesses involved, and the Kiwis living and working in these buildings, are healthier and happier.

New Zealanders want all of our buildings to be happy, healthy places. For our children. For our businesses. For our environment, and for our whānau.

## Contents

Green Building Council of Australia Foreword	01
New Zealand Green Building Council Foreword	02
What benefits will sustainable healthcare facilities deliver?	03
Green healthcare facilities are more cost effective	04
Case Study: Lyell McEwen Hospital Redevelopment, Stage C, South Australia	07
Case Study: Kay Jewelers Pavilion, Akron Children’s Hospital, Ohio, USA	08
Saving money on development costs	08
Green healthcare facilities are better places to heal	10
Case Study: Flinders Medical Centre – New South Wing, South Australia	11
Case Study: Olivia Newton-John Cancer & Wellness Centre, Victoria, Australia	14
Green hospitals can contribute to wider health benefits for the community	14
Green healthcare facilities are better places to work	17
The impact of improved productivity for your organisation	18
Case Study: Sunshine Coast University Hospital, Queensland, Australia	19
Case Study: Forte Health Building, Christchurch, New Zealand	21
Green hospitals can contribute to our national emissions reduction targets	23
Green healthcare facilities are future-proofed and more attractive to investors	25
New standards for investment	25
Leading sustainable investment	26
Unlocking the potential of Climate Bonds	26
Green Star-certified healthcare facilities deliver accountability and credibility	27
Opportunities to deliver greener, more sustainable healthcare facilities	28
Improving existing healthcare facilities	29
Case Study: Sydney Opera House, NSW, Australia	31
Designing and building new healthcare facilities	32
Innovation in Green Star projects	32
GBCA and NZGBC can help you achieve a Green Star rating	35



# Forewords



**Romilly Madew**  
Chief Executive Officer  
Green Building Council  
of Australia



green  
building  
council  
australia

**There is a growing awareness across industry, government and the community that we need to improve the way we design, build and operate the buildings in which we live, work, learn, play and heal. We now have more than two decades of research and thousands of projects around the world that demonstrate the benefits of green buildings, not just for the health of the environment, but for the health of those who use them. In Australia, there are almost 2000 Green Star-certified projects. A dozen of these are healthcare facilities, but the majority are office buildings. If banks and law firms are reaping the benefits of healthy, sustainable workplaces for their staff, then we should be providing the same for the doctors and nurses who help us heal and for patients who these facilities are built for.**

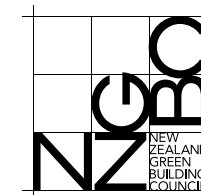
Australian healthcare spending was \$170 billion AUD in 2015-16 – or 10% of Australia’s gross domestic product (GDP) – up from \$107 billion, or 8.7% of GDP in 2005-06.<sup>1</sup> Our population is ageing. As the prevalence of serious health issues such as heart disease and diabetes increases and our tax-payer base declines, we must become smarter about stretching our healthcare spend further. Not only will building more sustainable healthcare facilities save money on energy and water costs, but they will boost employee satisfaction and productivity, reduce staff turnover and improve recovery times for patients.

Gail Vittori, Co-Director of the not-for-profit Center for Maximum Potential Building Systems in the US, and a leading voice internationally on sustainable building planning, design and construction, recently visited Australia to share her knowledge and insights. Gail encourages governments and healthcare leaders around the world to invest in ‘high-performance healing environments’. She advocates for creating a portfolio of low-carbon hospitals but notes, “It must be high-performing in reducing energy, but must also have access to natural light, for example. There has to be an integrated approach where all of these elements are essential.”

There are so many positive stories to tell about how buildings and communities are already delivering lower environmental impacts and greater social and economic benefits. This must also be the story of the healthcare sector and our whole built environment. I hope that *The case for sustainable healthcare* will be a catalyst for more sustainability stories in Australia and New Zealand.



**Andrew Eagles**  
Chief Executive Officer  
New Zealand Green  
Building Council



**Like most countries, New Zealand faces growing challenges with the health and ageing of our population, the health of our environment and a budget under pressure from all sides. What if we could take a holistic approach to human and environmental health that will also save serious money?**

We know we need healthier homes and buildings. We know we need to reduce energy and water use and reduce the waste we generate. We know we need to reduce greenhouse gas (GHG) emissions and other pollutants. Green buildings can deliver all these benefits, while improving our health, wellbeing and our ability to learn, work and live more productively.

Health is the second largest area of government spending in NZ (behind social security & welfare) and for the 2016-17 financial year spending was \$16.2 billion NZD. This is forecast to increase to \$17.2 billion in 2018 and \$18.1 billion in 2019.<sup>2</sup> Improving the indoor environments of our healthcare and aged-care facilities will be beneficial for the wellbeing of staff, patients, and our elderly. Reducing energy and water use in some of our most resource-hungry facilities will also have a significant ongoing benefit as costs continue to rise.

We have a positive start to build from with the number of Green Star-certified projects in NZ growing all the time, including government-owned assets. Certifying that buildings have a reduced environmental impact and improved health impacts aligns with the Living Standards Framework that the NZ Treasury is now using and recently, New Zealand’s Minister of Health, Hon. David Clark, MP, wrote to all District Health Boards (DHBs) outlining the Government’s expectations for 2018-2019. This included a directive for all DHBs to work together with other agencies and across government, to implement a strong response to climate change. “Plans to address climate change and health, need to incorporate both mitigation and adaptation strategies, underpinned by cost benefit analysis of co-benefits and financial savings.”<sup>3</sup>

The evidence is in. The co-benefits and financial savings of designing, building and operating greener hospitals are significant and we have an industry ready to work with the healthcare and aged-care sectors to deliver better facilities.

It is time to build on the achievements of industry and the commitment of the government. It is time for the healthcare and aged-care sector, industry and the community to ask for – and to commit to – better. When people experience a sustainable building, perhaps through a hospital visit, at school, or at work, it becomes something they look for in a home, or demand in a work or education environment. The more opportunities people have to experience the difference that a healthy, sustainable building makes for them and their families, the greater that demand will grow. And the benefits for all of us will grow, too.



# What benefits will sustainable healthcare facilities deliver?

Sustainable healthcare facilities:

- Are more cost effective
- Are better places to heal
- Can contribute to wider health benefits for the community
- Are better places to work
- Can contribute to national emissions reductions targets
- Are future-proofed and more attractive to investors
- Deliver accountability and credibility

Green Star certification is available for new buildings (Green Star - Design and As Built), fitouts (Green Star - Interiors) or for the operational management of buildings (Green Star - Performance).

Green Star certification provides a internationally-recognised, trusted mark of quality for the design, construction and operation of sustainable buildings, providing government, owners, staff, patients and the community with the assurance that they are gaining a quality building.

Healthcare facilities that have achieved certification and made improvements to their operations all report a range of benefits. Improved staff and patient satisfaction and wellbeing, and reductions in water, waste and emissions are resulting in cost savings too significant to ignore.

## Green healthcare facilities are more cost effective




Due to the nature of their round-the-clock operations, extensive air-conditioning, specialist medical equipment requirements – and because much of our healthcare infrastructure is ageing and poorly designed for energy efficiency – most of our hospitals and healthcare facilities are notorious energy-guzzlers and water users. They use at least twice as much energy and around six times as much water per square metre than commercial office buildings.<sup>4</sup>

*Built to Perform*, the Australian Sustainable Built Environment Council's (ASBEC) final report in their *Building Code Energy Performance Trajectory Project*, analysed eight building types across four climate zones. The 'archetypal hospital

ward' consistently demonstrated the highest energy consumption of all the building types and some of the biggest potential for improvement.<sup>5</sup>

In 2013, the GBCA's *The Value of Green Star: A Decade of Environmental Benefits*<sup>6</sup> analysed the data from 428 Green Star-certified buildings and compared it to 'average' Australian buildings and minimum practice benchmarks for water, energy, emissions and waste. The study found that Green Star-rated buildings are slashing greenhouse gas emissions, generating significant savings on energy and water-use and have prevented thousands of truckloads of waste going to landfill.

These results showed on average that Green Star-certified buildings:

-  use **66%** less electricity than average Australian buildings.
-  produce **62%** fewer greenhouse gas emissions than average Australian buildings.
-  use **51%** less potable water than if they had been built to meet minimum industry requirements.



## Green healthcare facilities are more cost effective (cont.)

More recently an analysis of Green Star-certified healthcare facilities showed that hospitals and healthcare facilities certified in 2017 and 2018 produce 57% fewer greenhouse gas emissions than average healthcare buildings. Overall, Green Star rated healthcare facilities are saving over 35,000 tonnes of greenhouse gas emissions every year.

The NZ Productivity Commission report on how NZ can transition to a low carbon economy was released in 2018. There was a clear focus on reducing embodied carbon in buildings, something which is captured by Green Star. The report also noted the importance of improving existing buildings as buildings consume more than half of New Zealand's operational electricity. Improving the energy efficiency of buildings provides a valuable avenue for tempering electricity demand, particularly as transport and other sectors electrify.<sup>7</sup> And given the nature of Australia's high-emission energy

Green Star healthcare facilities produce 57% fewer GHG emissions than average healthcare buildings.

generation, the opportunity to reduce energy use across the healthcare sector is something that neither country can afford to ignore.

In both Australia and New Zealand, energy costs have risen sharply in recent years and indications are that prices will continue to rise. In Australia, while there are differences from state to state, prices for households increased on average by 72% for electricity and 54% for gas in the 10 years to June 2013. Real electricity prices for businesses have seen similar increases.

The cost of both energy and water will continue to rise. The cost of disposing of waste will also continue to increase as landfill space dwindles and higher penalties are placed on waste to landfill. The cost of emissions generated will become a consideration as emissions trading schemes begin to play a bigger role in achieving emissions reduction targets. The Productivity Commission also noted that the carbon price per tonne is likely to rise ten-fold to \$200-250 NZD to achieve zero-carbon targets which will affect the prices of goods and services with carbon impacts.

Green Star encourages and rewards reducing energy and water use through implementing greater efficiencies and introducing renewable energy and features such as rainwater and grey water harvesting. Green Star also rewards diverting demolition and construction waste from landfill as well as putting processes in place within buildings to encourage and facilitate recycling and waste reduction. Measures to reduce energy and water use and waste have a proven positive benefit on operating budgets.

A study conducted in the US in 2008 (and updated in 2013) showed that the costs for LEED certification<sup>8</sup> was around 0.05% to 0.1% of a hospital's construction budget.<sup>9</sup>

Achieving a Green Star rating does not need to add significant cost to the project and sustainability features have proven that they will pay for themselves over and over again throughout the life of the asset. The World Green Building Council's *Business Case for Green Building* showed that a minimal 2% upfront cost to support green design can result, on average, in life cycle savings of 20% of total construction costs.<sup>10</sup> Research by Davis Langdon showed that for healthcare projects price indications were in the order of 0% to 3% for a 4 Star rating, 3% to 6% for a 5 Star rating and 10%+ for a 6 Star rating).<sup>11</sup> While this research can provide a useful indication, project costs may come in well under these premiums depending on what features have been included in the design from the outset.

Other studies have shown that capital cost premiums for green buildings are largely overstated, especially as green building practices become more common and industry expertise increases.

“

We would very much like to work in healthy, well lit, energy efficient hospital buildings. I think most healthcare professionals would. All NZ healthcare buildings should be rated to Green Star to help improve the value we get from buildings as long-term investments and to create future environments in which our patients, families and staff thrive.

– David Galler, Intensive Care Consultant, Counties Manakau District Health Board





## Lyell McEwen Hospital Redevelopment Stage C, South Australia

### CASE STUDY

▼ Lyell McEwen Hospital Redevelopment Stage C



SA Health's Inpatient Building, Lyell McEwen Hospital Redevelopment Stage C, achieved a 5 Star Green Star rating for its design. The project features high levels of natural daylight and outside fresh air ventilation, solar thermal panels to provide onsite generation of renewable heating energy and rainwater storage tanks to collect water from rooftops.

Passive design techniques such as high-performance glazing, insulation and external solar shading, combined with high technology mechanical solutions, are predicted to cut energy consumption and greenhouse gas emissions by 30%, when compared the Building Code of Australia's benchmarks.



## Kay Jewelers Pavilion, Akron Children's Hospital, Ohio, USA

### CASE STUDY

The Kay Jewelers Pavilion at the Akron Children's Hospital in Akron, Ohio, is a LEED Gold certified building, which is designed to support the health and wellbeing of patients and staff. There was a strong focus on Indoor Environment Quality through the use of low-VOC materials and furniture and maximised daylighting, as well as extensive use of indoor plants and views to the outside. The project team used a lean Integrated Project Delivery (Lean-IPD) approach to improve planning and decision making throughout all stages of building design and construction.

Not only does this project deliver 48.5% fewer GHG emissions than the US national average for healthcare facilities, improved occupant satisfaction and \$900,000 in annual energy cost savings, the project was completed \$44 million USD under budget and 54 days ahead of schedule – proving that green building, with a focus on health and wellbeing can be achieved on a cost effective basis.<sup>12</sup>



▲ Lyell McEwen Hospital Redevelopment Stage C

## Saving money on development costs

In NZ, a Green Star-certified childcare facility successfully applied for a reduction in the development contribution charges it was required to pay to the local council by demonstrating that it would have significantly reduced impact on infrastructure compared to average new buildings. The project could prove that:

- Vehicles per day (vpd) would be 156, compared with the council's projected 357 vpd – a reduction in traffic intensity of 56%.
- Potable water demand would be 9.06 litres per person per day (lpppd), compared with the council's projected 45 lpppd – a reduction of almost 80%.
- Water discharge would be 11.5 lpppd, compared with the council's projected 40 lpppd – a reduction of 71%.

This resulted in a reduction in the development contribution charges of 67%, or \$57,373 NZD, which doesn't include the waived charges for stormwater runoff due to the project's green roof and catchment tanks.





## Green healthcare facilities are better places to heal

Healthier hospitals mean healthier patients. The evidence shows that healthcare facilities designed to maximise daylight, views of nature, fresh air, thermal comfort and feelings of connectedness get better patient outcomes.

The Mackenzie Health Sciences Centre in Canada, for example, found that depressed patients in sunny rooms recovered 15% faster than those in darker rooms.<sup>13</sup> Similarly, the Inha University Hospital in Korea found a 41% reduction in average length of stay for patients in sunlit rooms over those in dull rooms.<sup>14</sup>

Medical errors fell 30% at The Barbara Ann Karmanos Cancer Institute in Detroit that allocated more space for their medication rooms, and installed acoustical panels to decrease noise levels. And the Bronson Methodist Hospital in Michigan found that applying green design principles such as improved

ventilation, private rooms, music, light and nature in its redevelopment project led to an 11% reduction in secondary infections.<sup>15</sup> The seminal study on the impacts of healthy hospitals in 1984 showed hospital stays reduced by 8.5% and supporting studies showed that patients with views of nature experienced faster recovery rates and patients in rooms with bright sunlight needed less pain medication.<sup>16</sup>

People's perception is also very important. Facilities that are designed to be sustainable and healthy – and that have the certification to prove it – are going to gain more trust and popularity within the community. Where people have a choice in healthcare and aged care facilities, they are most likely to choose the one that is designed to put their wellbeing, and that of the planet, first.

“On the high-performance side, we consider energy, water use and waste management and on the healing environments side, it's all about creating a place where people want to be; that really gives us a sense of connection.”

▲ Gail Vittori, Co-Director, Center for Maximum Potential Building Systems





## Flinders Medical Centre – New South Wing, South Australia

### CASE STUDY

▼ Flinders Medical Centre New South Wing



The New South Wing of Flinders Medical Centre (FMC) in South Australia achieved a 5 Star Green Star certification representing Australian Excellence.

The Green Star-rated extension houses FMC's women's health services and has been designed to deliver high quality patient care with a minimal environmental footprint.

According to Frank Zotti, Redevelopment Project Manager for FMC, the community has given the new facility its full support. "We've delivered 271 more babies in the new unit without needing to increase the number of beds. That's a 10% increase on previous years - all thanks to this fantastic green facility".

The extension features a 286-panel solar hot water system, a displacement

air-conditioning system that allows individual temperature control in patients' rooms, and specified low volatile organic compound (VOC) paints, adhesives and floor coverings for the entire project. Together with access to external views and a design which provides good levels of natural light, the extension offers a light filled, airy and stress-reducing hospital environment for patients and staff alike.

Kriston Symon, project team leader for AECOM, says it just seemed common sense for the project to focus on both health and environmental outcomes.

"There is a large amount of evidence showing that patient recovery rates improve when you provide high levels of Indoor Environmental Quality (IEQ) such as access to natural light," she says.



New South Wing's designers have risen to the challenge and built a terrific facility which places patients and the environment front and centre.

– South Australian Health Minister John Hill



"Many of the initiatives you see in New South Wing are good practice and should be incorporated into healthcare projects as a matter of course," Symon argues.

Did Green Star have a cost impact?

According to Frank Zotti, the cost of Green Star is difficult to quantify. "Financial consideration is difficult because many of the benefits, such as increased staff retention, staff productivity and improved patient recovery rates, are intangible," he explains, "We chose Green Star because it provides official recognition and allowed our achievements to be independently assessed and benchmarked".

For other teams considering Green Star, Zotti offers some straightforward advice: "The rewards are worth the effort."

To achieve its 5 Star Green Star rating, Flinders Medical Centre's New South Wing was awarded a range of points under each of the nine Green Star categories, including:

A Sustainable Procurement Guide was developed by the project team to help Flinders Medical Centre make smart and sustainable purchasing decisions, and also earned the project a credit under the Management category. SA Health has since used the guide on other health projects, ensuring that the sustainability lessons learnt at New South Wing are spread across the state.



New South Wing was awarded IEQ credits for a range of features, including low VOC paints, adhesives and sealants, external views and access to natural light, as well as independent temperature control of patient rooms.

The attention to clean air has clearly paid off. Since the new wing opened, births at FMC have risen from 2,761 in 2008-2009 to 3,012 in 2010-2011, an increase of almost 10%.

This increase in deliveries has occurred without the need to increase the number of beds and indicates the strong community support for the new facilities.

A 286-panel solar hot water system, the largest in South Australia, was installed to provide hot water across the entire FMC campus. This earned the New South Wing credits under the Energy category and has helped reduce energy costs by \$400,000 per year.

Other energy saving measures include a zoned air-conditioning system that delivers cooling and heating directly to where it is needed using the energy efficient Shaw Method. Developed in Australia, the system decouples humidity and temperature loads to prevent overcooling and subsequent reheating which occurs in conventional air-conditioning systems, halving energy consumption.

A separate upgrade also saw the installation of a new, energy efficient central cooling plant, which resulted in no net increase in carbon emissions from the construction of the new building. Overall, CO<sup>2</sup> emissions have been reduced by approximately 380 tonnes, equivalent to taking 74 cars off the road for a whole year.

South Australia's susceptibility to drought made minimising water use a priority. By installing an extensive rainwater harvesting system that provides water for urinals and toilets, as well as a water efficient heat rejection system, FMC has reduced water consumption by an estimated 20% in the new wing.



## Olivia Newton-John Cancer & Wellness Centre, Victoria, Australia

### CASE STUDY

▼ Olivia Newton-John Cancer & Wellness Centre



The Olivia Newton-John Cancer & Wellness Centre at the Austin Hospital is a holistic response to the many facets and needs of cancer care. Named after Australian entertainer and hospital patron, Olivia Newton-John – herself a breast cancer survivor – the centre provides world-class medical treatment and supportive care for patients and their families, with an emphasis on wellness and patient wellbeing. The eight-storey, \$189 million centre was the first certified Green Star – Healthcare Design project in Victoria.

International research has found that patients who have some influence over their immediate environment, and who

have access to natural light, ventilation and views, recover faster than those who do not.

The Olivia Newton-John Cancer & Wellness Centre embodies this approach to care, striving to create a health sanctuary rather than a typical hospital setting. Key to this design is the central courtyard that provides patients, staff and visitors with access to natural light, fresh air and views of nature. The therapy rooms are positioned to look over the gardens for massage and other treatments and in total 50% of the centre has a direct line of site to the outdoors. Building systems were also selected to maximise comfort levels, such as the

“

Kriston Symon explains

Our philosophy was to minimise the environmental footprint of the project and create a healthy environment for patients, visitors and staff. With this in mind, the extensive evidence connecting good IEQ to faster recovery rates and improved staff and patient health made IEQ credits a natural focus for the project.





choice of passive chilled beams over air conditioning. The end result is a truly restorative and comfortable environment.

"If you have a patient who has a very positive journey, in an environment where they feel comfortable, and their needs are met not just on a clinical level but are also supported at a social and spiritual level, their care journey will be optimised."  
-Project Director, Megan Gray.

The Olivia Newton-John Cancer & Wellness Centre set a clear brief for the selection of products and materials – they needed to meet the unique demands of a healthcare environment, support the centre's wellness philosophy and be sustainable, with low toxicity and low embodied energy.

Clever materials selection has created the desired relaxed and non-institutional atmosphere for the centre. Natural finishes, colours and textures, were chosen to create a sense of bringing the outdoors inside. While low VOC and low formaldehyde products were chosen for their low environmental impact. External materials also meet strict environmental criteria, including the use of structural steel and cement made with recycled content.

“

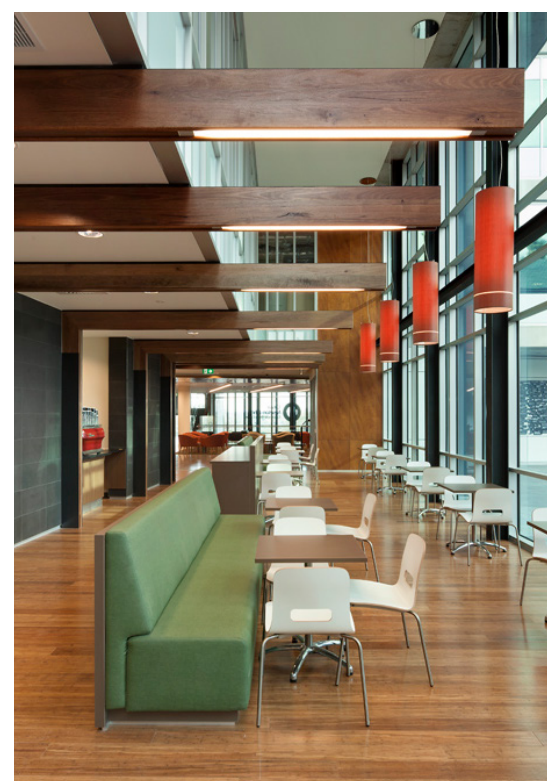
The Olivia Newton-John building has an extremely high environmental focus, particularly in terms of how it can facilitate better journeys and experiences for patients and their carers. Not clinically cold as many health spaces are but something that was warmer and inviting and more homely in terms of the feel and quality of the space

-Project Director, Megan Gray

Designed to be a tranquil retreat for patients, carers and staff, the Wellness Centre is set within landscaped gardens. To manage these gardens and other water usage with the Wellness Centre sustainably, the project placed a strong focus on water management.

The design incorporated a 120,000 litre rainwater storage facility which resulted in a 100% reduction in the use of potable water for landscape irrigation. Uniquely this storage facility draws on rainwater and the waste water from the reverse osmosis treatment undertaken in the centre's laboratories. Water from the rainwater storage is also reticulated to all toilets throughout the development.

"Environmental considerations influenced every aspect of Olivia Newton-John from materials selection to creating structures that would produce low emissions. This all had to be incorporated within a demanding healthcare environment and comply with relevant cleaning and quality standards." -Project Director, Megan Gray.



## Green hospitals can contribute to wider health benefits for the community

The health implications of green buildings go beyond the impacts on building occupants. Research published in 2017 calculated the link between green buildings and public health benefits for the first time. The study calculated the avoided GHG emissions of certified green buildings in five countries and used Harvard University's 'Co-Be Calculator' to determine the health impacts of this. The Co-Be calculator applies the social cost of carbon and the social cost of atmospheric release to translate these emissions reductions into health benefits. In the US alone (between 2000-2016), the emissions avoided by certified green buildings was determined to have resulted in avoiding an estimated:

**172-405**

premature deaths

**171**

hospital admissions

**11,000**

asthma exacerbations

**54,000**

respiratory symptoms

**21,000**

lost days of work

**16,000**

lost days of school<sup>17</sup>

Avoiding emissions-intensive energy production is particularly important in NZ and Australia where some providers are using coal and gas which can have impacts for local air quality.



Green healthcare facilities are better places to work

A growing body of research is demonstrating again and again that sustainable, healthy buildings are better places to work.

The WorldGBC's report, *Doing Right By Planet and People*,<sup>18</sup> showcased 11 certified projects from around the world. Every case study featured pre- and post-occupancy studies that showed employees were happier in their new green space. Results included:

- A reduction of four sick days per employee per year and a 27% reduction in staff turnover at the new Cundall office in the UK.
- A 64% reduction in reported allergy problems and a 68% reduction in reported respiratory problems at the Sherwin-Williams office refurbishment in El Salvador.
- At the new Floth office in Brisbane, Australia, 94.5% of employees are satisfied with the overall performance, health and productivity of the new building.
- ASID's employees at their new HQ in Washington DC, USA, were overwhelmingly satisfied with their new office and a study conducted showed a 19% reduction in absenteeism and a 16% reduction in presenteeism (where staff are present, but not working productively).

Harvard's T.H. Chan School of Public Health's Center for Health and the Global Environment undertook research to test the impacts of indoor environment quality on the cognitive function of building occupants. The study participants were exposed to conditions representative

of conventional office buildings, green buildings and green buildings with enhanced ventilation. At the end of each day, participants undertook a test of their cognitive function (a key driver in productivity) and the impacts were significant. On average, cognitive scores were:

- 61% higher in green building conditions
- 101% higher in enhanced green building conditions.<sup>19</sup>

Further research also showed that workers in green buildings also slept better, with 6% higher sleep scores than those working in conventional buildings. Another factor that demonstrates that where we work, or spend most of our day, continues to impact our health and wellbeing after we have left the building.

Because this study was designed to reflect indoor environments encountered by large numbers of people every day, these findings have far-ranging implications for worker productivity, decision-making and safety. In another study conducted by educational researchers, it was discovered that the quality of facilities had a "substantively important effect on teacher retention," even when statistically controlling for other potential factors like pay, parent and community involvement, age of the teacher, etc. In fact, researchers found that facility quality showed a greater predictive ability on teacher retention than teacher pay for this group of study participants.<sup>20</sup> Bronson Methodist Hospital in Michigan found that applying green design principles to improve IEQ led to a decrease in nursing turnover rates.<sup>21</sup>

The implications are dizzying. High indoor environment quality improves productivity, improves decision-making, improves staff satisfaction, reduces sick days and absenteeism, and reduces staff turnover. The cost savings potential of these impacts, not to mention the benefits for staff wellbeing and patient safety, are enormous. Cost savings attributed to improved energy and water efficiency may be easier to quantify and can be significant, but they are likely to be a small proportion of the total benefits that can be realised through delivering a certified green healthcare facility.

The impact of improved productivity for your organisation

Harvard University research found that green rated buildings improved productivity over 26%. Even a conservative estimate of improved productivity of 10% in a green building will lead to huge savings in large organisations such as hospitals. For example, in an organisation where the average employee costs \$90,000 per year, gaining a 10% uplift in productivity is worth \$9m per year for every 1000 employees.<sup>22</sup>

Design features such as connectivity, natural light and biophilia are all elements that can reduce turnover of medical professionals

– Gail Vittori, Co-Director, Center for Maximum Potential Building Systems

▼ Sunshine Coast University Hospital







## Sunshine Coast University Hospital, Queensland, Australia

### CASE STUDY

#### ▼ Sunshine Coast University Hospital



People flock to the Sunshine Coast to take advantage of its beautiful beaches, serene hinterland and wonderful climate. Huge population growth in the region led to the need for a large, state-of-the-art hospital and the latest healthcare facility to achieve Green Star certification shows that size and complexity should pose no barriers to achieving world-leading sustainability.

The \$1.8 billion Sunshine Coast University Hospital (SCUH) has achieved 6 Star Green Star Design and As Built certifications. SCUH was delivered by the Queensland Government in a Public Private Partnership with Exemplar Health – a consortium comprising Lendlease, Siemens and Capella Capital, with partners Spotless Facilities Services and Aurecon.

One of the biggest challenges for the project team was to design and construct a facility of 152,000m<sup>2</sup> that meets all necessary clinical requirements, but is not overwhelming for staff, patients and visitors. The building also had to capture the elements of the environment that will contribute to patient and occupant wellbeing – daylight, winter sun, sea breezes and the beautiful local

landscape – while managing harsher aspects of the climate, such as strong summer sun and heavy rainfall events.

Queensland Health had a number of sustainability goals which included:

- Providing a renewable and energy efficient infrastructure
- Preventing pollution, reducing waste and consumption and committing to recycling and recovery over disposal
- Maximising user wellbeing – including health, comfort and happiness
- Producing low emissions and minimising ecological impact
- A high-performance building fabric that is maintainable and durable
- Minimising recurrent operation costs
- Minimising potable water use.

Queensland Health also set a minimum requirement for the project to achieve 4 Star Green Star Design and As Built certifications. Lendlease and Aurecon worked with the GBCA for over a year to tailor the Green Star – Healthcare rating tool to respond to the size and complexity of the project. This resulted in a 417-page technical manual and the creation of project-specific tools to

assist the project team to coordinate the thousands of inputs and outputs that are needed for such a large and complex project.

While painstaking planning and project management was a critical factor in the project's delivery, the project team have created a hospital environment unlike anything most people will have experienced before. The result is a facility that contributes not just to the health and wellbeing of staff, patients and visitors, but one that reduces its impact on the environment as well.

Gardens, courtyards and outdoor spaces are an integral part of the hospital's design. They reflect the climate and landscape of the Sunshine Coast, while providing staff, patients and their families with a connection to nature and places of respite.

At the heart of the hospital is a central, landscaped courtyard which creates an outdoor room for patients, staff and visitors to use. Many of the rooms look out on the courtyard and benefit from the daylight and views of lush greenery, while rooms and areas on the external sides of the hospital have views over the surrounding neighbourhood, bush, water or wetlands. There are other smaller courtyards and planted areas throughout the hospital campus which provide green sanctuaries for staff, patients and visitors and which soften the urban scale of the facility.

Three-quarters of all patients and visitors have easy access to at least one place of respite, while all staff have access to a place of respite which is set aside exclusively for staff use. All places of respite are at least 25 metres away from any major road, car park, loading dock or waste collection facility to avoid noise, odour and air pollution. In total, there is around 49,000m<sup>2</sup> of green space – approximately a quarter of the ground plane site area. In addition to providing

respite, views, fresh air and daylight, they contribute to reducing the urban heat island effect of the hospital.

The project team have delivered excellent outcomes on a range of environmental measures including energy, water and a reduced impact on the environment.

Upon full occupancy of the hospital in 2021, the predicted reduction in energy consumption is estimated to be at least 20%, with a peak energy demand reduction of 40% compared to an equivalent facility. This will be achieved through a range of measures such as solar hot water and thermal energy storage systems, energy metering and energy efficient lighting, and represents significant operational savings for a tertiary hospital operating round the clock.

Given that Queensland is no stranger to droughts and flooding rains, water was a big focus of the project. A significant volume of rainwater is collected, along with setting high water efficiency targets. Rainwater is harvested from approximately 80% of SCUH's 38,000m<sup>2</sup> roof. There is a tank capacity of 1.5 million litres and 90% of all water harvested is reused.







Forte Health  
Building,  
Christchurch,  
New Zealand

▼ Forte Health building, Stephen Goodenough



Tenants report  
high satisfaction  
with the building  
using words like  
'comfortable',  
'modern', 'secure',  
'safe', and 'warm'.

CASE STUDY

New Zealand's first Green Star healthcare facility delivers efficiency, comfort and sustainability beyond expectations. Forte Health, located in the centre of Christchurch, is a multi-disciplinary medical practice and private hospital which achieved 4 Star Green Star certification in 2014.

Peter Davidson, co-owner and tenant of the building said that not only were the owners committed to sustainability throughout the build, but also to involving their colleagues on the journey. The owners had three key drivers for delivering a green building:

- Social conscience – to do the right thing for the environment and for Christchurch.
- Brand and marketing – to establish a point of difference and make a statement in their sector. The owners want Forte

to be a leading private hospital not just through providing excellent medical care, but also through delivering a high performing building that contributes to the health and wellbeing of clients and patients. They believe it would be a contradiction to have a building in which people were treated for their ailments, but where the building environment itself made them sick.

- Commercial and economic benefits – the owners know that investing in good whole-of-life building performance will result in lower operational costs. The aim was to realise long-term financial, brand and reputational benefits by going the extra mile in high quality design, construction and specifications from the outset of the project.

Technology plays an important part in the performance of this building which has reduced energy demand (and corresponding GHG emissions) by more than 40% compared with like buildings. State-of-the-art operating theatre ventilation and 'scavenging' devices take potentially infected air out of operating theatres to improve patient and surgical staff health. Occupancy-sensing DALI lighting was used throughout the entire base build and fitouts, and sub-metering has been implemented to not only understand the building's consumption habits, but also those of each tenant. A solar hot water system also contributes to the building's energy efficiency and high-efficiency water fittings reduce water use.

Perhaps even more critical than the technology installed, is the behaviour of the building occupants. The owners of Forte are also tenants of the building which helped drive their determination to create a healthy work environment, but also continues to propel their commitment to the efficient day-to-day running of the facility. The building manager is supported by the owners to help staff to understand how they can take control of workplace comfort and

building performance. He encourages good-natured inter-floor and inter-departmental competitiveness for actions such as turning off lights, proactively managing air-conditioning and reporting on waste sorting practices – reducing energy use and waste to landfill. Through this commitment to operating efficiently, energy and waste costs have come in well below original projections.

Tenants report high satisfaction with the building using words like 'comfortable', 'modern', 'secure', 'safe' and 'warm'. All tenancy fitouts use low-VOC and certified materials and products, and these principles will continue to be stipulated in future tenancy agreements. Patients also regularly make positive comments and many measures have been taken to make them feel comfortable and at ease, such as high levels of natural light, a concierge to provide greetings, directions and exit care, controllable air conditioning in each hospital room and practices such as allowing patients to walk to theatre where possible. At Forte, patient welfare, security and comfort – as well as sustainability – have been taken to new levels.

We had three key  
drivers for delivering  
a green building -  
social conscience,  
brand and marketing,  
and commercial and  
economic benefits.  
-Peter Davidson, Co-  
Owner & Tenant, Forte  
Health building



Green hospitals can contribute to our national emissions reduction targets

Australia and New Zealand are both signatories to the Paris Agreement. The purpose of the Paris Agreement is to:

- keep the global average temperature less than 2° C above pre-industrial levels, while pursuing efforts to limit the temperature increase to 1.5° C
- strengthen the ability of countries to deal with the impacts of climate change
- make sure that financial flows support the development of low-carbon and climate-resilient economies.

The Paris Agreement entered into force on 4 November 2016 and will take effect from 2020. It commits all signatory countries to take action on climate change through a Nationally Determined Contribution (NDC) which will apply from 2021. New Zealand’s NDC is to reduce greenhouse gas emissions by 30 per cent below 2005 levels by 2030.<sup>23</sup> Australia’s NDC is to reduce emissions by 26-28 per cent below 2005 levels by 2030.<sup>24</sup>

In Europe, the building sector is recognised as an area of significant potential for emission reductions and targets have already been in place for several years. The EU Performance Building Directive 2010 states that all new buildings must be nearly zero-energy buildings by 2020 and public buildings must achieve this by the end of 2018.<sup>25</sup> In the UK, since 2008 health authorities require that approvals for new healthcare facilities and refurbishments must include a commitment to achieving a BREEAM rating.<sup>26</sup> Around the world, certification is widely sought and globally there are 600 BREEAM-certified health facilities.

In Australia and New Zealand, buildings are responsible for around 23% and 20% of total emissions respectively. Australia has almost 700 public hospitals and over 620 private hospitals. New Zealand has 87 public hospitals and 80 private hospitals. If you consider the growing number of specialist clinics and aged-care facilities in both countries,

the healthcare and aged-care sectors offer huge opportunities for reducing emissions and contributing to NDCs. This is especially true in Australia where electricity is predominantly generated by burning coal.

To support the national emissions reduction target in Australia, states are setting their own targets and making plans for reducing emissions. These include:

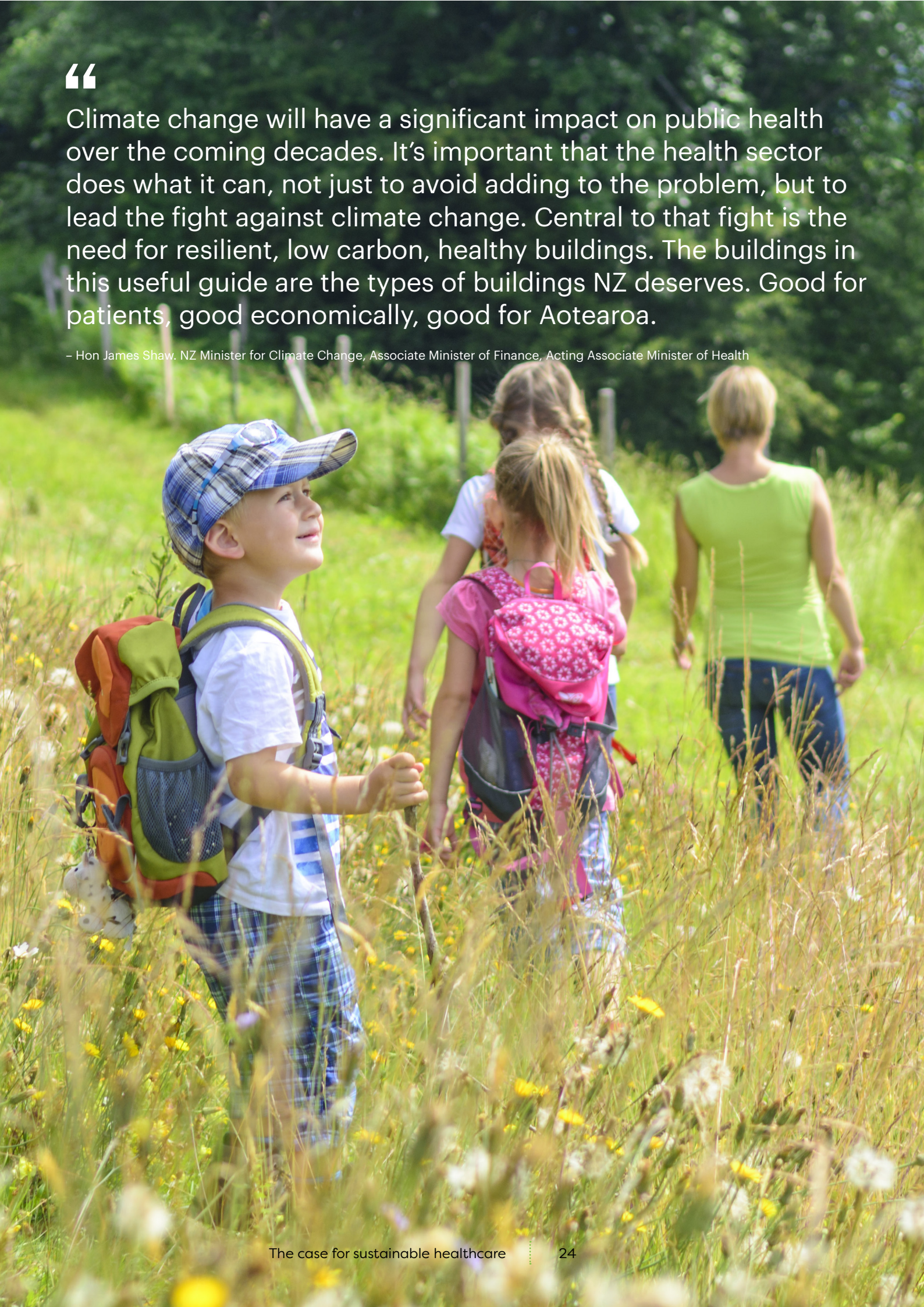
- The NSW Government’s Climate Change Policy Framework<sup>27</sup> has set a target of net zero emissions by 2050 and is supported by the Government Resource Efficiency Policy<sup>28</sup> which sets various targets for energy, water and waste in government operations.
- The ACT Government aims for net-zero emissions in the territory by 2050 at the latest in its Sustainable Energy Policy<sup>29</sup> and also has a target of achieving carbon neutrality in its own operations by 2020.
- The SA Government aims to achieve net-zero emissions by 2050 and improve energy efficiency of government buildings by 30% by 2020. The SA Government and the Adelaide City Council also aim to establish Adelaide as the world’s first carbon neutral city.

The New Zealand Government aims to reduce NZ’s emissions to net zero by 2050. It plans to introduce the Zero Carbon Bill that will set the new emissions reduction target for 2050. NZ’s Emissions Trading Scheme is the key policy tool for reducing emissions and meeting targets. The ETS will need to be strengthened and improved to align with new targets.<sup>30</sup> Now is the time to take advantage of opportunities to reduce energy use, emissions and operational costs to future-proof against possible future increases in the carbon price.

“

Climate change will have a significant impact on public health over the coming decades. It’s important that the health sector does what it can, not just to avoid adding to the problem, but to lead the fight against climate change. Central to that fight is the need for resilient, low carbon, healthy buildings. The buildings in this useful guide are the types of buildings NZ deserves. Good for patients, good economically, good for Aotearoa.

– Hon James Shaw, NZ Minister for Climate Change, Associate Minister of Finance, Acting Associate Minister of Health





Green  
healthcare  
facilities  
are future-  
proofed  
and more  
attractive  
to investors

Governments and businesses that have taken steps to mitigate and adapt to the impacts of a changing climate will reduce their exposure to risk and rising insurance premiums. Assets with independent certification such as Green Star will become increasingly favoured by investors and this is an important consideration for governments looking to leverage private sector investment for social infrastructure.

Green Star verifies the kind of good design which will future proof buildings against the impacts of a changing climate and the rising costs of energy, water, waste and emissions. Rising temperatures can be mitigated with features like external shading and blinds designed to protect the building from the strongest sunshine and solar thermal gains. Water sensitive landscaping, well-designed stormwater systems and rainwater harvesting can help minimise the impact of storm events that are increasing in frequency and intensity.

The Royal Institution of Chartered Surveyors' report, *Green Value: Growing Buildings, Growing Assets*<sup>31</sup> found that assets employing green building practices that increase energy efficiency and reduce greenhouse gas emissions, are more likely to attract grants and subsidies.

Globally, more and more organisations are required to report on climate-related risk. The Taskforce on Climate-related Financial Disclosure (TCFD) was established to develop voluntary, consistent climate-related financial risk disclosures for companies to use in reporting to investors, lenders, insurers and other stakeholders. The TCFD is supported by over 300 of the world's leading financial and insurance organisations.

New standards  
for investment

The Clean Energy Finance Corporation (CEFC) is aiming to kick start new standards in clean energy for healthcare by investing up to \$100 million in the new Dexus Healthcare Wholesale Property Fund (HWPF).

HWPF will own Australia's first portfolio of hospital and healthcare assets to focus on environmentally sustainable development. HWPF is targeting emissions reductions of 45% in both new and existing buildings when compared with the Council of Australian Government (COAG) Baseline Energy Consumption in commercial buildings. New HWPF buildings will target 5 Star Green Star – Design & As Built ratings, as well as Green Star – Performance ratings.<sup>32</sup>

Leading  
sustainable  
investment

GRESB is the global benchmark for environmental, social and governance (ESG) performance of real assets. In 2018, GRESB assessed 903 real estate companies and funds, representing more than 79,000 properties and AUD \$4.9 trillion in global assets under management.

The Australia/New Zealand regional score was 76, compared with a global average of 68. The Australia/NZ region continues to lead the world, although the gap with other regions is slowly closing. In 2017, Australia/NZ scored 73, compared with the global average of 63.

A record 73 Australian companies with AUD \$447 billion in assets reported to GRESB in 2018, up from 66 companies and \$205 billion the previous year. According to Ruben Langbroek, Head of Asia Pacific at GRESB, industry stakeholder collaboration and ambitious zero carbon goal setting is driving the region's leadership.

Unlocking the  
potential of  
Climate Bonds

The Climate Bonds Initiative is an international organisation that works to mobilise the \$100 trillion bond market for climate solutions. Certified green buildings provide assurance that a project or asset will meet the objectives and eligibility requirements of a bond issued under the Climate Bonds standard. There have been a number of hospitals around the world that have benefited from investment from climate bonds, including in Switzerland, Sweden, France and the US.

There have already been a number of green bonds issued in Australia and New Zealand which are intended to finance a range of projects and assets including green buildings, renewable energy generation and low carbon transport.





Green Star-  
certified  
healthcare  
facilities  
deliver  
accountability  
and credibility

Increasingly, leaders in both the public and private sector have a financial responsibility to deliver assets that are affordable and represent value for money over the long-term.

As an internationally-recognised, trusted mark of quality for the design, construction and operation of sustainable buildings, fitouts and communities, Green Star does just that by ensuring a commitment from all project stakeholders to deliver (and to prove they have delivered) a building that is designed and constructed to meet best practice benchmarks for sustainability and efficiency across the board.

Green Star provides certainty and independent verification that benchmarks have been met, unlike buildings which claim to be green, or claim to be 'designed to' Green Star standards without engaging in the certification process.

A study undertaken in the US to examine the costs and benefits of achieving LEED certification for hospitals concluded that considering the objectives of the healthcare organisations, along with the due diligence, accountability and third-party verification of the LEED process, certification was a sound investment delivering measurable economic, environmental and human health benefits.<sup>33</sup>



“  
Ultimately, we  
chose Green  
Star because it  
provides official  
recognition,  
and allowed our  
achievements to  
be independently  
assessed and  
benchmarked.

-Frank Zotti, Redevelopment Project Manager,  
Flinders Medical Centre – New South Wing

Opportunities to deliver greener,  
more sustainable healthcare  
facilities

Green Star assesses the sustainable design, construction and operation of buildings, fitouts and communities. Choosing Green Star can help you save money, create a healthy place for people, minimise your environmental footprint and build a better future for us all.

Green Star is an internationally-recognised, independent, third-party certification system which currently operates in Australia, New Zealand and South Africa.

Green Star certification is awarded for projects which achieve 4 Star (Best Practice), 5 Star (Australian/New Zealand Excellence), or 6 Star (World Leadership) benchmarks. Green Star – Performance also recognises 0-3 Star achievements to assist facilities to benchmark and identify opportunities for improvement.

The Green Star rating tools for buildings assess sustainability across nine impact categories:

- Management
- Indoor Environment Quality (IEQ)
- Energy
- Transport
- Water
- Materials
- Land Use & Ecology
- Emissions
- Innovation



# Improving existing healthcare facilities

There are hundreds of existing healthcare facilities across Australia and New Zealand, from large, tertiary hospitals to regional hospitals, from private hospitals and specialist centres to aged-care facilities. These facilities generally use a lot of energy and water, generate high levels of waste and don't always have optimal indoor environment quality. While it can be challenging to make changes, these outcomes do not need to be 'locked in' forever.

**Green Star – Performance** assesses the operational performance of buildings across nine impact categories. Using Green Star – Performance for an existing building gives the operations team and building users an opportunity to assess current practices and make changes that will bring them closer to, or even exceed, best practice benchmarks. There are significant opportunities for reducing energy and water use, reducing emissions and waste, improving operational practices and improving the indoor environment for all occupants.

Green Star – Performance has been used extensively to measure and improve the operational performance of a range of buildings, including some that are large and complex.

**Green Star – Interiors** assesses the sustainability of interior fitouts across nine impact categories. As well as being used for fitouts in new buildings, Green Star – Interiors gives existing buildings the chance to deliver sustainable, healthy spaces and achieve a certification when tackling an upgrade, refurbishment or redevelopment. There have been many outstanding, sustainable fitouts achieved within older, existing buildings, providing the opportunity to deliver greater resource efficiency and a healthier environment for users of the space.



◆ Royal Adelaide Hospital





Sydney Opera House, NSW, Australia

CASE STUDY

▼ Sydney Opera House (by night)



As one of the world's busiest performing arts spaces, the Sydney Opera House is no stranger to the sound of applause. But this time, the accolades aren't for the actors, but for the building's sustainability achievements. In 2015, the Opera House was awarded a 4 Star Green Star – Performance rating, joining a handful of World Heritage-listed buildings to have achieved green certification globally.

When designing the Sydney Opera House more than 40 years ago, Jørn Utzon was inspired by nature and integrated many features now recognised as pioneering sustainable design.

This has provided a great foundation for the sustainability improvements that have followed, including a two-year program of lighting upgrades in the Concert Hall. Old fixtures have been replaced with energy-efficient LED alternatives managed by a sophisticated control system. This lighting upgrade project alone has reduced energy consumption within the Concert Hall by 75% and is saving the venue around \$70,000 per year in electricity costs.

The GBCA's Chief Executive Officer, Romilly Madew, says that the Opera House's certification sends a signal to the market that older buildings can go green. "The general consensus has been that it's 'too hard' to improve the sustainability of older buildings. The Sydney Opera House has laid down the gauntlet for the property industry with a pragmatic, practical approach which shows even the most iconic, historic and challenging buildings can be high-performing, energy efficient and sustainable. If you can green the Opera House, you can green anything," Ms Madew says.

The sustainability initiatives that have earned the Sydney Opera House its certification are certainly cause for celebration. One of the best things about the achievement of a 4 Star Green Star – Performance rating is, however, the opportunity it provides to do even better. In 2013, the Opera House launched into a Decade of Renewal to prepare it for future generations of audiences, artists and performers.

## Designing and building new healthcare facilities

Designing and building green hospitals and aged-care facilities has a range of benefits for operators, staff, patients and visitors as well as the environment. In Australia, the **Green Star – Design & As Built** rating tool provides the opportunity to integrate sustainability into the design and construction of a project from its inception, culminating in a certification upon the building's completion. In New Zealand, **Green Star – Design** rates the sustainability of a project's design, while a separate certification, **Green Star – Built**, rates the sustainability of a completed building.

There are now more than a dozen healthcare facilities which have achieved Green Star certification, delivering significant reductions in emissions, waste and resource use, savings in energy and water costs and providing a higher quality environment for patients and staff.

▼ Lyell McEwen Hospital Redevelopment Stage C





# Innovation in Green Star projects

Since Green Star was first introduced to the market in 2003, the sustainable building industry has made significant progress in designing and delivering innovative buildings, fitouts and communities that meet and exceed best practice sustainability benchmarks. Innovation has played a large role in our industry's growth and success, and Green Star has endeavoured to recognise these innovations and achievements as much as possible through the Innovation category.

While the Green Star rating system is rigorous and comprehensive, there will always be emerging sustainability issues that are not addressed by the Green Star rating tools. Innovation Challenges attempt to capture these issues and encourage project teams to invest in solutions. Some recent examples of projects going above and beyond to innovate include:

◆ **Contractor education and Reconciliation Action Plan**

– At Barangaroo, a world-leading urban development project in Sydney, Australia, the project developer, Lendlease, has partnered with training institution, TAFE NSW, to deliver the Barangaroo Skills Exchange. This program has directly employed 212 Aboriginal and Torres Strait Islander workers, including apprentices. These workers not only learn their chosen trade and gain opportunities to achieve further qualifications, but also get valuable training in sustainable building practices.

◆ **Sustainable procurement** – When the Auckland City Council developed its new Green Star office at 135 Albert Street in Auckland, NZ, it took a sustainable approach to procurement. The design team, project management team and contractor were all required to demonstrate an understanding of, and commitment to, sustainability during the tender process and ISO14001 was used in procuring furniture.

Since completing this project, the Auckland City Council has become a founding member of the Global Lead City Network on Sustainable Procurement and has contributed learnings from the project to the Circular Economy Office Guide produced by the Sustainable Business Network. The council has also established a range of targets for sustainable procurement and a sustainable procurement strategy to inform all capital and operational expenditure.

◆ **Employment creation** – While leading the Sunshine Coast University Hospital project, Lendlease partnered with the Sunshine Coast Council and The Hornery Institute who was responsible for an initiative called The Workshop. The Workshop was responsible for placing 807 jobseekers into employment on the project - 82% were local people, 19% were previously unemployed, and 13% were young people.

Healthcare and aged-care projects are encouraged to tackle any of the Innovation Challenges available, or to suggest something new to further drive innovation in the sector.





# References

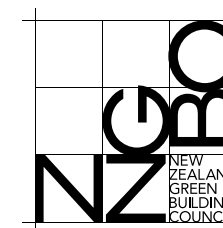
- <sup>1</sup> Australian Institute of Health and Welfare. 2017. *Health and welfare expenditure*. Retrieved from <https://www.aihw.gov.au/reports-statistics/health-welfare-overview/health-welfare-expenditure/overview> (p.1)
- <sup>2</sup> The Treasury. 2016. *Health*. Retrieved from <https://treasury.govt.nz/information-and-services/interest-areas/health> (p.2)
- <sup>3</sup> Clark, Hon Dr David, NZ Minister of Health. 2018. *Letter of expectations for District Health Boards and subsidiary entities for 2018/19*. Retrieved from <https://nsfl.health.govt.nz/dhb-planning-package/201819-planning-package/supplementary-information-201819-planning-guidelines-0> (p.2)
- <sup>4</sup> Davis Langdon. *Health sector joins green ratings era*. Retrieved from <https://www.gbca.org.au/docs/Davis%20Langdon%20Research%20Report%20-%20Health%20Sector%20Joins%20Green%20Ratings%20Era.pdf> (p.4)
- <sup>5</sup> ClimateWorks, & Australian Sustainable Built Environment Council. 2018. *Built to perform... An industry led pathway to a zero carbon ready building code*. Retrieved from <https://www.asbec.asn.au/wordpress/wp-content/uploads/2018/07/180703-ASBEC-CWA-Built-to-Perform-Zero-Carbon-Ready-Building-Code-web.pdf> (p.4)
- <sup>6</sup> Green Building Council of Australia. 2013. *The value of Green Star: A decade of environmental benefits*. Retrieved from [https://www.gbca.org.au/uploads/194/34754/The\\_Value\\_of\\_Green\\_Star\\_A\\_Decade\\_of\\_Environmental\\_Benefits.pdf](https://www.gbca.org.au/uploads/194/34754/The_Value_of_Green_Star_A_Decade_of_Environmental_Benefits.pdf) (p.4)
- <sup>7</sup> New Zealand Productivity Commission. 2018. *Low-emissions economy: Final report*. Retrieved from [www.productivity.govt.nz/low-emissions](http://www.productivity.govt.nz/low-emissions) (p.5)
- <sup>8</sup> Leadership in Energy and Environmental Design (LEED) is a green building rating system developed by the US Green Building Council. Available for virtually all building, community and home project types, LEED provides a framework to create healthy, highly efficient and cost-saving green buildings. See <https://new.usgbc.org/leed> (p.6)
- <sup>9</sup> Guenther, R., & Vittori, G. 2013. *Sustainable Healthcare Architecture*. Hoboken, New Jersey
- <sup>10</sup> World Green Building Council, 2013, *The business case for green buildings – A review of the costs and benefits for developers, investors and occupants*. Retrieved from [http://www.worldgbc.org/sites/default/files/Business\\_Case\\_For\\_Green\\_Building\\_Report\\_WEB\\_2013-04-11-2.pdf](http://www.worldgbc.org/sites/default/files/Business_Case_For_Green_Building_Report_WEB_2013-04-11-2.pdf) (p.6)
- <sup>11</sup> Davis Langdon. Davis Langdon. *Health sector joins green ratings era*. (p.6)
- <sup>12</sup> Laski, J., World Green Building Council, 2018, *Doing right by planet and people – The business case for health and wellbeing in green building*. Retrieved from <http://www.worldgbc.org/better-places-people/green-healthy-work-spaces> (p.8)
- <sup>13</sup> Beauchemin, K.M., & Hays, P. 1996. Sunny hospital rooms expedite recovery from severe and refractory depressions. *Journal of Affective Disorders*, 40 (1-2) 49-51. [https://doi.org/10.1016/0165-0327\(96\)00040-7](https://doi.org/10.1016/0165-0327(96)00040-7) (p.10)
- <sup>14</sup> Joon, H.C. 2005. *Study of the relationship between indoor daylight environments and patient average length of stay (ALOS) in healthcare facilities* (Masters thesis, Texas A&M University, USA). Retrieved from [https://research.arch.tamu.edu/media/cms\\_page\\_media/6078/etd-tamu-2005C-ARCH-Choi.pdf](https://research.arch.tamu.edu/media/cms_page_media/6078/etd-tamu-2005C-ARCH-Choi.pdf) (p.10)
- <sup>15</sup> Robert Wood Johnson Foundation. 2004. *Evidence-based hospital design improves healthcare outcomes for patients, families and staff*. Retrieved from <https://www.rwjf.org/en/library/articles-and-news/2004/06/evidence-based-hospital-design-improves-healthcare-outcomes-for-.html> (p.10)
- <sup>16</sup> Ulrich, R.S. 1984. View through a window may influence recovery from surgery. *Science*, 224 (4647), 420-421. DOI: 10.1126/science.6143402 (p.10)
- <sup>17</sup> McNaughton, P., Cao, X., Buonocore, J., Cedenro-Laurent, J., Spengler, J., Berstein, A., & Allen, J. 2018. Energy savings, emission reductions, and health co-benefits of the green building movement. *Journal of Exposure, Science and Environmental Epidemiology*, 28, 307-318. Retrieved from <https://www.nature.com/articles/s41370-017-0014-9> (p.15)
- <sup>18</sup> Laski, J., World Green Building Council, 2018, *Doing right by planet and people... The business case for health and wellbeing in green building*. Retrieved from <http://www.worldgbc.org/better-places-people/green-healthy-work-spaces> (p.17)
- <sup>19</sup> Allen, J.G., MacNaughton, P., Satish, U., Santanam, S., Vallarino, J., & Spengler, J.D. 2016. Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments. *Environmental Health Perspectives*, 124. Retrieved from <https://ehp.niehs.nih.gov/15-10037/> (p.17)
- <sup>20</sup> Buckley, J., Schneider, M., & Shang, Y. 2004. The Effects of School Facility Quality on Teacher Retention in Urban School Districts. Washington, DC: *National Clearinghouse for Educational Facilities*. Retrieved from <http://www.mfe.govt.nz/climate-change/why-climate-change-matters/global-response/paris-agreement> (p.17)
- <sup>21</sup> Robert Wood Johnson Foundation. 2004. *Evidence-based hospital design improves healthcare outcomes for patients, families and staff*. Retrieved from <https://www.rwjf.org/en/library/articles-and-news/2004/06/evidence-based-hospital-design-improves-healthcare-outcomes-for-.html> (p.17)
- <sup>22</sup> Allen, J.G., MacNaughton, P., Satish, U., Santanam, S., Vallarino, J., & Spengler, J.D. 2016. Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments. *Environmental Health Perspectives*, 124. Retrieved from <https://ehp.niehs.nih.gov/15-10037/> (p.17)
- <sup>23</sup> Ministry for the Environment. 2018. *About the Paris Agreement*. Retrieved from <http://www.mfe.govt.nz/climate-change/why-climate-change-matters/global-response/paris-agreement> (p.23)
- <sup>24</sup> Department of Environment and Energy. *Paris Agreement*. Retrieved from <http://www.environment.gov.au/climate-change/government/international/paris-agreement> (p.23)
- <sup>25</sup> European Commission. *Buildings*. Retrieved from <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings> (p.23)
- <sup>26</sup> BREEAM. 2013. *BREEAM Healthcare FAQs*. Retrieved from [https://tools.breeam.com/filelibrary/KN5253\\_BREEAM\\_Healthcare\\_FAQs.pdf](https://tools.breeam.com/filelibrary/KN5253_BREEAM_Healthcare_FAQs.pdf). BREEAM is the UK-based sustainability assessment method for masterplanning projects, infrastructure and buildings. (p.23)
- <sup>27</sup> Office of Environment and Heritage. *NSW Government action on climate change*. Retrieved from <https://climatechange.environment.nsw.gov.au/About-climate-change-in-NSW/NSW-Government-action-on-climate-change/> (p.23)
- <sup>28</sup> Office of Environment and Heritage. *NSW Government Resource Policy*. Retrieved from <http://www.environment.nsw.gov.au/resources> (p.23)
- <sup>29</sup> Environment, Planning and Sustainable Development Directorate. 2018. *Energy*. Retrieved from <http://www.environment.nsw.gov.au/resources> (p.23)
- <sup>30</sup> Ministry for the Environment. 2018. *The transition to a low-emissions and climate-resilient Aotearoa New Zealand*. Retrieved from <http://www.mfe.govt.nz/climate-change/what-government-doing/new-zealands-climate-change-programme> (p.23)
- <sup>31</sup> Davis, R. 2005. *Green Value: Growing buildings, growing assets: Report*. Retrieved from <http://www.rics.org/NR/rdonlyres/93B20864-E89E-4641-AB11-028387737058/0/GreenValueReport.pdf> (p.25)
- <sup>32</sup> Clean Energy Finance Corporation. 2017. *CEFC and Dexu to deliver Australian-first clean energy makeover for healthcare sector*. Retrieved from <https://www.cefc.com.au/media/files/cefc-and-dexu-to-deliver-australian-first-clean-energy-makeover-for-healthcare-sector/> (p.25)
- <sup>33</sup> Guenther, R., & Vittori, G. 2013. *Sustainable Healthcare Architecture*. Hoboken, New Jersey (p.27)

## GBCA and NZGBC can help you achieve a Green Star rating

The GBCA and NZGBC have supported hundreds of projects through the registration and certification process. If you are interested in finding out more about how Green Star can assist your project to achieve a high level of sustainability, quality and accountability, please get in contact with us. You can talk with one of our team, register your project online, or register for any of our events and training courses created to help you understand the Green Star rating tools, as well as issues and advancements within the industry.



Visit: [gbca.org.au](http://gbca.org.au)  
Call: +61 2 8239 6200  
Email: [info@gbca.org.au](mailto:info@gbca.org.au)



Visit: [nzgbc.org.nz](http://nzgbc.org.nz)  
Call: +64 9 379 3996  
Email: [info@nzgbc.org.nz](mailto:info@nzgbc.org.nz)



