Slattery embodied carbon series: Retrofitting reimagined

HIHANIT

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Embodied carbon: Retrofitting reimagined

Every building has an embodied carbon footprint. As Australia's development industry begins to measure embodied carbon emissions, the scales are tipping in favour of retrofits. Slattery, with Australia's first carbon planning service, is releasing our data and knowledge so the industry can move further and faster together.

Overview

Key highlights

According to Slattery's most recent data:

- Retaining the structure and envelope of an existing commercial office building can save 300-500 kilograms of greenhouse gas emissions per square metre of gross floor area.
- Extending the life of existing structures through retrofitting and reuse is the most effective strategy to minimise upfront embodied carbon and meet sustainability targets.

Cover image credit: Pat Whelen via Pexels

be manufacture, construction, maintenance and demolition of buildings – accounts for 35-45% of a standard building's lifecycle carbon emissions.

These emissions are 'locked in' before a building's first occupants step through the front door.

Embodied carbon - the greenhouse gas emissions generated during the

We have measured the embodied carbon from real-world projects to quantify the savings that are possible when we retain existing buildings.

We find almost **half a tonne of upfront embodied carbon** can be saved for every square metre retained from an existing commercial office, when compared to an equivalent new-build project.

Retaining a structure and envelope – the substructure, upper floors, columns, external walls, roof, stairs and internal structural walls – allows us to **preserve nearly three quarters, or 74%, of a building's upfront embodied carbon.**

We hope, by putting 'concrete' data behind a concept, Slattery can contribute to the evidence base and elevate the essential conversation about embodied carbon.

Slattery embodied carbon methodology

To dive into the detail of how Slattery's Carbon Planning Service measures the upfront embodied carbon, read our methodology report.

> Image credit: Urlaubstracker via Unsplash

Our industry needs rapid change and creative solutions to addressing emissions in the built environment. With early adopters and ambitious projects guided by benchmarked data, we can expedite Australia's net zero carbon target."

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Retrofitting is rising up the development agenda

Retrofitting, refurbishment, adaptive reuse, upgrade, uplift...

All these terms capture the same idea of enhancing an existing structure or system to improve its performance, efficiency and functionality, and to achieve its highest and best use.

Human beings have always retrofitted older buildings. But a host of drivers are pushing Australia's property industry towards retrofitting. In the office sector, for instance, the national vacancy rate is. at its highest level since 1995 especially among lower-grade building stock, as tenants rethink their space requirements and shift to higher quality stock. Many building owners are also looking to upgrade their buildings to improve their energy efficiency.

In 2018, the Green Building Council of Australia estimated that around 80,000. 'mid-tier' office buildings were 'ripe for retrofit'. These buildings, below Premium or A Grade, were typically constructed before the year 2000 with outdated and inefficient technologies that make them energy guzzlers. And that's just offices.

Retrofit is also growing in appeal as construction costs escalate, as higher interest rates increase holding costs, and as the planning process becomes more difficult to navigate.

The net zero agenda adds a new value dimension to all building projects, as retrofitting an existing building is the most efficient way to reduce the upfront embodied carbon emissions of any development project. Our data confirms that retaining the structure and envelope of an existing commercial office building can save 300-500 kilograms of greenhouse gas emissions per square metre of gross floor area.

Figure 1 illustrates why retrofitting is so important in the embodied carbon discussion.

This graph shows the percentage of global warming potential (GWP) – which assesses the impact of different greenhouse gases on global warming, not just carbon dioxide – from the upfront embodied carbon emissions of a typical commercial building. This graph covers materials, transport and construction, and shows that the 'cold shell' – the basic structural elements – is responsible for nearly three quarters of a building's upfront embodied carbon emissions.

Figure 1

projects

Average elemental percentage

breakdown of GWP in Slattery

commercial benchmarked

Figure 2 shows that, by retaining the structure and envelope building elements – the substructure, upper floors, columns, external walls, roof, stairs and internal structural walls – we can preserve 74% of a building's upfront embodied carbon, as represented by the grey elements in the graph.

This means we avoid using highcarbon materials to construct a new superstructure, such as concrete, steel, aluminium and glass. When we remove these elements from the dataset, our focus changes. Rather than thinking about how to reduce the embodied carbon in concrete and steel, we begin to consider how to specify low-embodied carbon finishes and plasterboard for internal walls, for example.

Not all buildings are right for retrofit; but by assessing the embodied carbon that will be saved through retrofitting, developers can make informed decisions.





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Retaining the structure and envelope of an existing commercial office building can save 300-500 kilograms of greenhouse gas emissions per square metre of gross floor area."

Figure 2

Percentage breakdown as shown in Figure 1, but depicting the potential 74% of preserved upfront embodied carbon from retrofitting.



Case studies

The embodied carbon savings can be a powerful story to tell potential tenant customers when repositioning an existing asset.

Queen & Collins, Melbourne

Slattery was engaged by The GPT Group to provide carbon planning on the refurbishment of buildings known as the 'Gothic Bank Complex' at the corner of Queen Street and Collins Street in Melbourne's CBD. This included three 19th century neo-gothic architectural landmarks and a 1990s office tower.

Our team reviewed the existing buildings and calculated the carbon savings achieved by retaining and refurbishing the structures, rather than building new.

As you can see from Figure 3, by refurbishing the existing Queen and Collins buildings, an indicative saving of 22,086,000 GWP (kgCO2-eq) was achieved. This saving excludes the carbon savings made by not demolishing the existing building.

The main difference between the hypothetical new build (scenario 1) and the refurbishment (scenario 2) is the large carbon savings in the superstructure, specifically the upper floors, external walls (including the envelope), and the internal core walls. The upper floors consist of reinforced concrete slabs, while the external walls contain a mixture of steel, glass and aluminium. All these materials are very carbon intensive. By refurbishing the corner of Queen Street and Collins Street, the quantity of carbonintensive materials was reduced, leading to a significant saving of more than 22,000 tonnes of greenhouse gas emissions. This saving is equivalent to removing 4,800 fossil-fuel powered cars from our roads for 12 months, or the annual carbon footprint of 1,100 standard homes. This underscores the size of the saving that just

one retrofitting project can deliver.



...the quantity of carbon-intensive materials was reduced, leading to a significant saving of more than 22,000 tonnes of greenhouse gas emissions. ??

Queen & Collins Image credit: Sharyn Cairns

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150 Lonsdale Street, Melbourne

Wesley Place, home to a complex of mid to late-19th century and early-20th century ecclesiastical buildings, has been transformed by Charter Hall. Construction on the \$60 million repositioning of 150 Lonsdale Street was completed in 2022.

Slattery measured the upfront embodied carbon of the refurbishment and compared this to the estimated upfront embodied carbon of knocking down the asset and rebuilding. By using the documentation provided, Slattery calculated the carbon associated with demolition and then built a hypothetical carbon model using our extensive benchmark data.

As Figure 4 illustrates, refurbishing the existing asset achieved an indicative saving of 25,813,000 GWP.

Like the Queen and Collins building, the main differences between the hypothetical new build (scenario 1) and the refurbishment works (scenario 2) are the GWP savings achieved across the carbon-intensive areas of the upper floors, the external walls and the internal walls. These building elements contain carbon-intensive materials such as reinforced concrete, structural steel, glass and aluminium. When the upper floors, external walls, and internal walls and partitions are combined, they account for 72% of the total GWP within the hypothetical new build. This, once again, emphasises the potential of retrofitting.

By refurbishing the existing asset, more than 25,800 tonnes of carbon emissions was avoided, which is the equivalent to removing 5,611 fossil-fuel powered cars from the road for 12 months, or the annual emissions of 1,290 standard homes. 35,000,000.00 30,000,000.00 25,000,000.00 20,000,000.00

15,000,000.00

10,000,000.00

5,000,000.00

Figure 4

Difference in GWP of 150 Lonsdale Street new build versus refurbishment



150 Lonsdale Street Image credit: Tommy Miller

Figure 3

Difference in GWP of Queen and Collins new build versus refurbishment

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Regulation, standards and tools are driving transformation

The question of how to address embodied carbon is complex and challenging to answer.

However, several regulatory developments in 2023 are sparking new conversations across Australia's construction industry. We provide some examples below to illustrate the direction of travel.

International

The state of California has adopted. changes to its building code that will limit embodied carbon emissions in commercial and school buildings. The whole building embodied carbon policy, which will be effective 1 July 2024, sets an historic precedent for building codes across the United States.

National

The Australian Government is proposing to mandate climate reporting, based on the International Sustainability Standards Board's new framework, from 1 July 2024. ASIC chairman Joe Longo has said it will be the "biggest change to corporate reporting in a generation". This will require Australia's biggest companies to disclose their carbon emissions across a range of categories, including the Scope 3 emissions generated in their supply chains. This will have cascading implications for the construction industry, as embodied carbon emissions are Scope 3 emission.

NABERS, the National Australian Built Environment Rating System, is currently developing a framework to measure, benchmark and certify embodied carbon emissions. Informed by industry expertise, including from Slattery, NABERS expects to release the framework in 2024.

The Property Council of Australia and Green **Building Council of** Australia released a suite of policy recommendations in 2023 under the banner of Every Building Counts. This urges the federal government to adopt the NABERS framework for embodied carbon, set new minimum reporting requirements within the National Construction Code, and create a national embodied carbon database for products and materials.

State

The NSW Government's State Environmental Planning Policy (Sustainable Buildings) 2022 came into force on 1 October 2023. This requires developers to disclose embodied carbon emissions generated on large projects, including offices, hotels and serviced apartments, and state-significant developments like health, education and cultural buildings. Other sectors, like retail and industrial, are expected to be included in future stages.

Local

The City of Melbourne launched its Retrofit Melbourne Plan in October 2023 with a determination to reach its target of netzero emissions by 2040. This includes a goal that all mid-tier commercial buildings are 'zero carbon ready' by 2040, with a plan to tackle embodied carbon. More than 80 buildings will need upgrades each year to reach this target; currently, the Council averages just seven.

Image credit: L God Picture via Pexels R Lara Jameson via Pexels

Embodied carbon data changes fitout decisions

When undertaking a new build project, the key building elements with the highest upfront embodied carbon are the building structure and envelope.

However, when the decision is made to retrofit, refurbish and fit out an existing building, these embodied carbon intensive building elements are generally preserved and the embodied carbon emissions associated with these works eliminated.

In fitout works, therefore, the key building elements are:

- Fitments such as loose furniture, workstations and joinery
- Finishes, for ceilings, floors and internal wall
- Internal partitions and screens
- Building services.

Case study: GPT Design Suites, Melbourne

Slattery was engaged by The GPT Group to provide carbon planning on various office fitouts in Melbourne.

Slattery data demonstrated the most carbon-intensive elements of the new commercial office fitouts were the internal walls, fitments and finishes. Identifying the priority upfront embodied carbon elements was the first step towards targeted action.

Slattery provided alternative design and specification strategies to reduce the upfront embodied carbon of these elements and quantified the indicative carbon savings and the financial costs and savings.

Following this work, one site achieved a 43% reduction in upfront embodied carbon when compared to the reference project.

Some of the strategies implemented on these projects included:

- Incorporating re-used or refurbished loose office furniture items
- Redesigning workstations and joinery to minimise the use of carbon intensive materials
- Specifying lower or carbon neutral floor, wall and ceiling finishes
- Reducing areas and heights of internal partition walls.

This case study highlights the importance of project specific, databacked advice to guide design decision making. When existing structures and envelopes are retained, project teams still need to consider how their decisions impact embodied carbon outcomes because there are significant carbon savings possible.

Building services, 11.8% Internal partitions / screens, 14.7% Special equipment, 1.8% nal doors, 3.8% Wall finishes, 2.5% finishes, 7.9% Ceiling finishes, 7.2% Fitments, 49.3%

Stairs, 1.1%

How Slattery can help Good decisions are made with high-quality data – and Slattery is **Retrofit opportunities** amassing that data. overwhelm the obstacles As the first quantity surveying company in Australia to introduce a service which measures upfront embodied carbon, Slattery has a As the focus on carbon intensifies, many growing database of projects to support better design decisions. companies are taking positive steps to Slattery's team has been engaged by clients at the master-planning address operational carbon. The next stage when the big decisions around retrofitting can be made and natural step is to address embodied implemented. carbon. As our team continues to work on refurbishment projects There are many reasons why building throughout Australia, we are helping our clients to measure their owners choose to rebuild rather than carbon savings and identify broader 'brown to green' benefits. retrofit. This may be because the existing

building has structural integrity issues or insurmountable site constraints.

It is true that retrofitting an existing building may reveal hidden costs - like asbestos - or require some creative design to meet current building codes or leasing preferences.

But often the obstacles are based on the misconception that newer is a better product.

When we retain older buildings, we preserve future heritage and history, strengthen community connections and maintain the distinct character of our cities.

We minimise waste sent to landfill and the disruption that comes with demolition. We often accelerate project timelines, reducing risks associated with time costs.

When weighing up these benefits alongside the embodied carbon emissions and costs associated with offsetting prevented, the scales tip in favour of retrofitting.

Average elemental percentage break down of GWP in Slattery commercial workplace fitout benchmarked projects

Figure 5



We can help you use embodied carbon data to tell a powerful sustainability story, whether that's to explain the value of the carbon saved to attract tenants or inspire your employees, or to underscore the benefits of future proofing to investors and fund managers. As we work together to tackle built environment emissions and accelerate Australia to net zero, Slattery is here to help.

GPT Design Suite, 550 Bourke St Image credit: Lynton Crabb

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About Slattery and Kaizen

Slattery is a property and construction advisory firm specialising in quantity surveying, cost management and early phase project advisory, with an outstanding history spanning more than 40 years.

We work hand-in-hand with governments, institutions and organisations as well as planners, developers, architects and design teams on a broad range of property and construction projects.

A commitment to excellence and innovation, and an ability to become an integral part of the project team, has earned Slattery the trust and respect of clients and project teams alike. Slattery adds value by taking control and ownership of the cost management process from the outset.

Slattery's Kaizen papers share knowledge, ideas and pertinent cost information related to our industry. Kaizen is the Japanese word for improvement, and a business philosophy that strives for continuous improvement in process. We produce papers across the sectors we work with, which are shared with our clients and made available on our website for all to view.

Explore our knowledge sharing further at www.slattery.com.au/thought-leadership

Slattery Carbon Planning

Slattery is proud to be the first quantity surveying firm in Australia to launch a carbon planning service.

Our service is available in conjunction with cost planning to assist our clients to address upfront embodied carbon on current and future developments, and to achieve their net zero and sustainability targets.

Read more about Slattery's carbon planning offering at www.slattery.com.au/carbon-planning.

Slattery operates as a carbon neutral business by conducting annual assessments of our carbon footprint and offsetting our greenhouse gas emissions, as detailed in our Public Disclosure Statement.

Our team is pleased to hold memberships to the following industry groups:



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