Te Kāhui Whaihanga New Zealand Institute of Architects

He Korowai Tiaki

Sustainability in the 2025 New Zealand Regional and National Architecture Awards

2025 Awards Sustainability Criteria Analysis – Detailed Report

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Te Kāhui Whaihanga New Zealand Institute of Architects

Executive summary

The 2025 Te Kāhui Whaihanga New Zealand Institute of Architects (NZIA) Awards Programme marked the first year of mandatory sustainability data collection under the newly developed *He Korowai Tiaki* criteria. This framework aligns the Institute with international awards programmes, affirming a commitment to climate-responsive design and the principle of rangatiratanga.

The introduction of mandatory sustainability criteria was in response to an AGM motion passed in 2024 aimed at increasing architectural engagement with sustainable design and practice. It is critical to note that many projects entered in 2025 were potentially designed four to five years prior—before these criteria were formalised. Consequently, the data provided in this report reflects an industry in transition, establishing a baseline for future benchmarking rather than representing a mature low-carbon sector. The analysis focuses on four categories of questioning asked of awards entrants: *Kaitiakitanga, Protection of Papatūānuku and Ecological Systems*, *Whakapapa of Building Materials and Processes,* and *Measurements and Pūnaha Pungao Energy Systems, and Enhancing the Mauri and Wellbeing of People and Culture.*

Award entries overview and metrics

The analysis is based on 356 eligible projects submitted by 128 architecture practices. Housing was the most common category, accounting for 35.7% of all entries, followed by Housing – Alterations and Additions (11.8%) and Commercial Architecture (11.2%). Geographically, projects were concentrated in areas with major urban centres, with Auckland representing nearly a third of entries (32.6%), followed by Canterbury (16.3%) and Wellington (15.7%).

The projects represent a wide range of scales, with an average project area of 1,915m² and a median area of 343m². Cost-wise, the projects ranged significantly, though the median cost sat at $1.8 million. The majority of entries were designed for longevity; 86.5% were designed for a 50–90 year lifespan – 50 years being the standard in New Zealand -, with nearly all remaining projects intended to last more than 90 years.

Kaitiakitanga: Climate resilience and environmental stewardship

The *Kaitiakitanga, Protection of Papatūānuku and Ecological Systems* section required entrants to identify climate risks and detail mitigation strategies. Over four-fifths (80.1%) of entrants provided such information. The analysis reveals three primary climate concerns currently facing New Zealand's built environment:

- **Flooding and water management** (37.0%): this includes immediate risks from extreme rain events and concerns regarding aging infrastructure capacity.
- **Overheating and extreme temperatures** (34.0%): most concerning among the education and residential sectors, where overheating issues threaten thermal and occupant comfort.
- **Storms, cyclones, and high winds** (32.9%): focused on structural integrity and durability.

Mitigation strategies offered were largely passive. For flooding, common responses included raising structures and increasing site permeability. For temperature regulation, architects relied heavily on passive solar design such as eaves, overhangs, and louvres, as well as high-performance glazing and enhanced thermal envelopes. Mechanical solutions like HVAC were primarily described as secondary backups rather than primary cooling drivers. Further, the retention of existing site elements such as building structures, soil, and mature trees was commonly stated, with 65.7% of projects practicing some form of existing material reuse.

Mauri Ora: Enhancing social and cultural well-being

The *Enhancing the Mauri and Wellbeing of People and Culture* asked about the human experience: how design promotes community health, inclusivity, and the well-being of tamariki (children) and rangatahi (youth). Only projects entering in the Education, Public Architecture, Commercial, Planning and Urban Design and Multi-Unit Housing categories were asked this set of questions. The response rate for Education (96.4% response rate) and Public Architecture (89.5%) was positive.

The analysis identified five dominant themes in project narratives:

- Community and social interaction: architects prioritised the creation of "third spaces" such as cafes, foyers and plazas to transition between public and private realms and foster connection.
- Tamariki and rangatahi: especially prevalent in Education projects (89.3%), entries focused on creating learning hubs and youth spaces that empower young people through safety and inspiration.
- Health and well-being: themes included biophilic design, high-quality indoor air and contemplative spaces to support mental health.
- Delight and aesthetics: a focus on sensory experiences, using sculptural forms, colour and light to evoke curiosity.
- Nature and sustainability: integrating design, sustainable practices and nature with green roofs, stream revitalisation and native landscaping to provide an "uplifting" connection to the land.

An area for improvement is in the completion of cultural assessments; 37.0% of projects undertook a formal cultural assessment.

Whakapapa of materials: Embodied carbon and material specification

The *Whakapapa of Building Materials and Processes* segment of the report provides a technical analysis of building materials, specifically focusing on life cycle assessments (LCAs). Across the entries, LCA uptake remains low at 17.1%, with larger commercial and public builds (36.8%) significantly outperforming residential builds in this metric. One Click LCA and BRANZ LCA Quick were the most frequently cited tools.

Entrants who did perform an LCA were also asked about upfront embodied, whole-of-life embodied and sequestered biogenic carbon:

- Upfront embodied carbon: provided for 15% of projects with a median intensity of 249.5 $kgCO_2e/m^2$.
- Whole-of-life embodied carbon: provided for only 7.3% of projects with a median of 594.0 $kgCO_2e/m^2$.
- Sequestered biogenic carbon: provided for 8.1% of projects with a median of -93.0 $kgCO_2e/m^2$.

Reduction strategies were largely centred on material specification. Over half of the entrants identified the prioritisation of timber as a "carbon sink" to replace steel and concrete. Other strategies included designing concrete-free upper floors and sourcing local timber to minimise supply chain emissions. The selection of non-toxic materials was the most consistently high metric across all categories, with 78.4% of projects prioritising indoor air quality by reducing volatile organic compounds (VOCs).

Pūnaha Pungao: Energy systems and operational performance

In the *Measurements and Pūnaha Pungao Energy Systems* section, analysis reveals a significant data gap between design intent and realised building performance. Only 12.4% of projects provided predicted energy use figures, and even fewer (5.9%) provided actual usage data.

Thermal modelling was undertaken for 38.2% of the submitted projects. However, this was concentrated in high-occupancy categories like Commercial Architecture, Education and Public Architecture while smaller residential projects were much less likely to be modelled.

Such larger projects (Commercial Architecture, Education and Public Architecture) are also leading the shift to electricity, with 78.2% (across all three categories) being 100% electric. Residential projects (41.4%) lagged comparatively, likely due to a continued reliance on natural gas for cooking and heating.

On-site renewable energy generation is currently low, with the highest uptake across the Housing and Housing - Alterations and Additions categories (26.0%), suggesting scale-related barriers for larger builds.

Airtightness was a consideration for 50.3% of Housing and Housing - Alterations and Additions projects but dropped significantly in other categories.

Award winner analysis: Correlating excellence with sustainability

The report finds that award winners consistently outperformed non-winners across nearly all sustainability metrics. This suggests that "design excellence" is intertwined with sustainable practice.

The most significant discrepancy was in material retention and adaptive reuse, practiced by 67.1% of winners compared to 43.5% of non-winners. Winners were also significantly more likely to have 100% electric projects (59.3% vs 38.4%), capture and manage water on site (54.3% vs 35.2%) and utilise thermal modelling (41.4% vs 26.9%).

Carbon and energy sub-analysis: Commercial, education and public architecture

The *Carbon and energy use sub-analysis* section of the report provides a detailed look at the carbon and energy data provided in the *Whakapapa of Building Materials and Processes* section for the Commercial Architecture, Education, and Public Architecture categories, which together represent 87 projects.

The analysis examined how project size (area) and cost per square metre correlated with carbon and energy performance:

- There was a significant relationship found between the size of a project and its upfront or whole-of-life embodied carbon intensity.
- No significant relationship was identified between project area and total sequestered biogenic carbon or carbon benefits beyond the life cycle.
- No significant relationships were found between any of the four carbon datasets and project cost per square metre.
- No significant relationship was found between project area and either predicted or actual energy use.

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Context

Te Kāhui Whaihanga New Zealand Institute of Architects (NZIA) is strengthening the sustainability data requirements for the Regional and New Zealand Architecture Awards, aligning these with leading awards programmes in the UK and Australia, and affirming the Institute's commitment to climate-responsive design and the principle of rangatiratanga. Architects are called on to demonstrate leadership, responsibility, and informed decision-making in their entries, ensuring their work actively contributes to Aotearoa New Zealand's low-carbon future and responds to the escalating climate and biodiversity emergency - including embedding embodied and operational carbon assessments into design processes and making energy modelling standard practice.

The sustainability criteria – *He Korowai Tiaki* – were introduced in the 2025 Awards programme to support jurors in assessing how projects demonstrate ethical, environmentally responsible practice: minimising harm while strengthening interconnected ecological systems through design excellence. Grounded in the principle of kaitiakitanga, they reflect our collective responsibility to protect and restore the natural world in the face of climate change, biodiversity loss, and pollution. The 2025 cycle represents the first year of mandatory criteria, and this analysis marks the beginning of a data-gathering process that will grow in depth and rigour over time. Some limitations in the data are both expected and accepted at this stage - our goal is to build knowledge and analytical capability progressively, using each awards cycle to better understand and inform sustainable practice across the profession.

It is important to note several factors that shape how this data should be read. Many of the projects entered in 2025 were potentially designed four to five years ago, before sustainability criteria were a formal requirement of the Awards, meaning the data reflects a profession in transition rather than one with consistent, shared expectations around sustainability reporting. The introduction of the criteria also followed an AGM motion responding to the low percentage of entrants who had engaged with the original sustainability questions, underscoring why a more structured and consistently applied approach was needed. Finally, this analysis excludes responses to the Approach to Practice questions, as this section has been removed from the 2026 Awards programme on the basis that those questions related to architectural practice more broadly rather than to the specific project being entered.

Findings

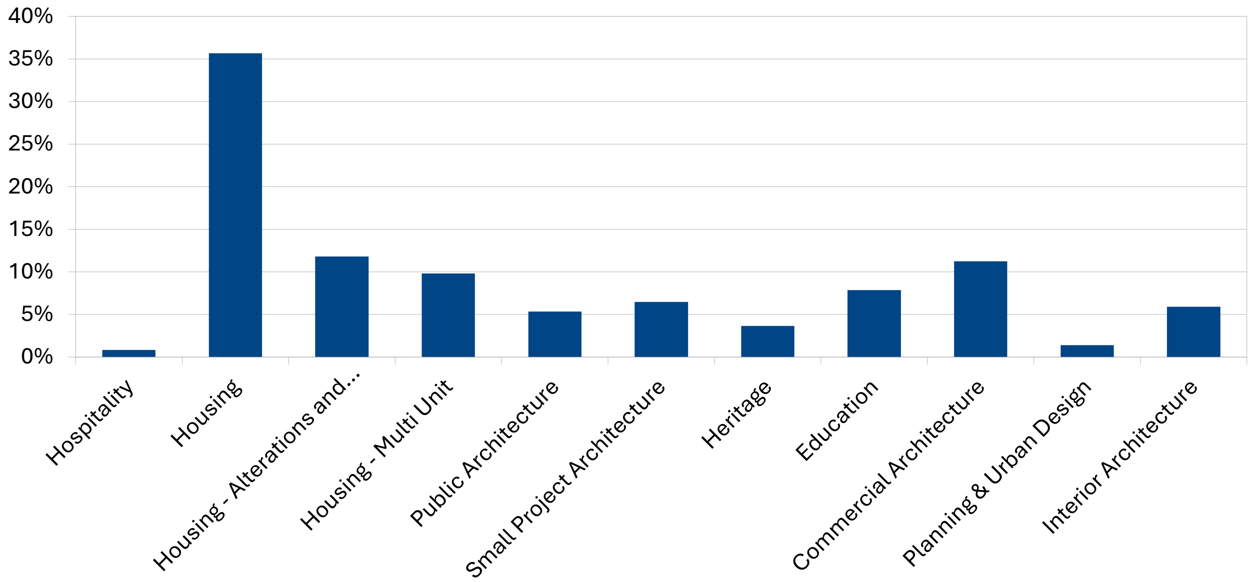
Project metrics

The Te Kāhui Whaihanga New Zealand Institute of Architects Regional and New Zealand Architecture Awards were entered by 128 architecture practices who submitted a total of 356 eligible projects for consideration[1]. The majority of entries were within the Housing category (35.7%), with the next largest categories being Housing – Alterations and Additions (11.8%) and Commercial Architecture (11.2%) (Table 1 & Figure 1).

Table 1: Awards projects by category

Project category	n	%
Hospitality	3	0.8%
Housing	127	35.7%
Housing - Alterations and Additions	42	11.8%
Housing - Multi Unit	35	9.8%
Public Architecture	19	5.3%
Small Project Architecture	23	6.5%
Heritage	13	3.7%
Education	28	7.9%
Commercial Architecture	40	11.2%
Planning & Urban Design	5	1.4%
Interior Architecture	21	5.9%

Figure 1: Awards projects by category



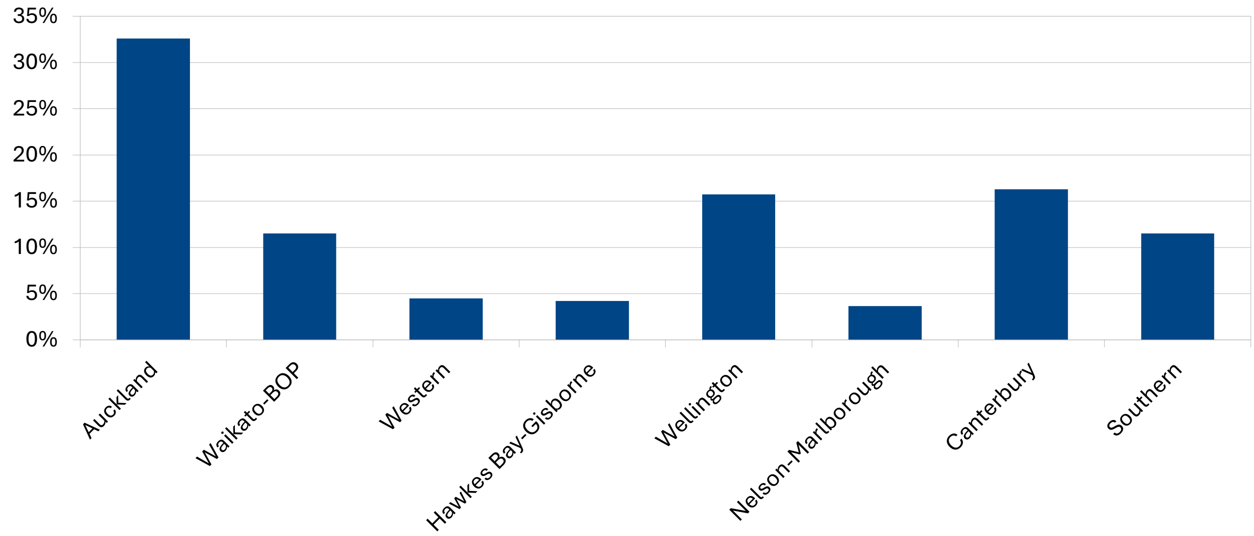
Projects were primarily located within the NZIA regions of Auckland (32.6%), Canterbury (16.3%) and Wellington (15.7%) (Figure 2).

[1] Six further entries for the Enduring Architecture award are not included in this analysis as they were not required to provide sustainability criteria as part of their entries.

Table 2: Awards projects by NZIA region

NZIA region	n	%
Auckland	116	32.6%
Waikato-BOP	41	11.5%
Western	16	4.5%
Hawkes Bay-Gisborne	15	4.2%
Wellington	56	15.7%
Nelson-Marlborough	13	3.7%
Canterbury	58	16.3%
Southern	41	11.5%

Figure 2: Awards projects by NZIA region



Across all entered projects, the average area was 1915m^2 and the median area was 343m^2. The average project cost was $10,634,850; the median cost was $1,800,000.

The majority of projects were designed to have a lifespan of 50-90 years (86.5%). With the exception of a single project, the remaining projects were designed to have a lifespan of more than 90 years.

Kaitiakitanga, Protection of Papatūānuku and Ecological Systems

When considering kaitiakitanga, protection of Papatūānuku and ecological systems, entrants were first asked whether their projects held any climate resilience risks, and if so, how they responded to these risks. Over four-fifths (80.1%) of entrants identified project climate risks and/or provided mitigation strategies. The remaining entrants either provided no answer to this question (15.2%) or stated that no climate risks were associated with their project (4.2%).

Table 3: Type and number of climate resilience risks, all projects

Risk category	Number of mentions	%
Flooding & water management (e.g. stormwater, inundation, heavy rain)	132	37.0%
Overheating & extreme temperatures	121	34.0%
Storms, cyclones & high winds	117	32.9%
Sea level rise & coastal hazards (e.g. surge, tsunami)	39	11.0%
Fire risks (bushfire, forest fire)	17	4.8%

Several recurring climate risks were identified by entrants, with many projects facing overlapping risks (e.g. both flooding and overheating). The most common risk categories were flooding and water management (37.0% of projects), overheating and extreme temperatures (34.0% of projects) and storms, cyclones and high winds (32.9% of projects). Fewer entrants (11.0%) cited sea level rise and coastal hazards as a project risk; however this is most probably due to the small number of projects in low-lying coastal areas (Table 3). Within these categories, flooding and water management risks include immediate, site-specific flooding from extreme rain events and longer-term concerns about the capacity of stormwater infrastructure. Overheating and extreme temperature concerns were prevalent among education and residential projects, with entrants describing risks such as "solar gain" and "extreme summer temperatures" which threaten indoor thermal comfort and building performance. Storms, cyclones and high winds were frequently considered to be of concern in terms of potential structural damage, while sea level rise and other coastal hazards are a specialised geographical risk but can require high-impact responses.

Risk mitigations for flooding and water management were typically characterised by ensuring that structures were raised to protect against flooding, and that the permeability of surfaces and drainage systems were able to handle high rainfall events. For example, one entrant stated that their "building is raised above ground level to protect against potential sea level rise risks/flooding events," while another wrote: "the work incorporated a simple perimeter drainage solution of a scoria channel over reed matting... protecting the timber at low level from excess standing water caused by flooding."

Primarily, overheating and extreme temperature risks were addressed through passive cooling and ventilation solutions, such as optimised shading, and the incorporation of overhangs, eaves or louvres, as well as ventilation solutions (especially cross-ventilation) built into the building's design. For example, one entrant stated that their project had "large eaves and carefully positioned windows optimise solar gain in winter while minimising solar heat gain in summer," while another said they included "passive solar design strategies, such as eyebrows over windows and cross-ventilation, were implemented to minimise the need for mechanical cooling." A small number of entrants also mentioned active or mechanical solutions (typically as a backup), mostly specifying HVAC and other heat pump-based products. Other entrants cited specific considerations around the thermal envelope of the building, including the use of "high-performance glazing" and correctly specified R-value insulation.

Finally, to mitigate the risks of both storms, cyclones and high winds, as well as fire risks, entrants ensured that their buildings were constructed in a robust manner and made of durable cladding and materials, with concrete mentioned several times. For example, one entrant wrote that "the primary construction below the sand dune level is concrete construction that is more durable in the event of a flooding event," while another stated "the building was designed to withstand strong winds, with careful consideration given to the selection of robust materials and secure fixings."

Entrants were asked whether their project supports and interacts with the surrounding natural environment and ecological systems. A significant majority (69.7%) did not feel that this was applicable to their project. Of the remainder, 23.3 per cent agreed with the statement and 7.0 per cent disagreed.

The majority of projects (65.7%) retained and adapted existing elements such as building fabrics or structures, materials, infrastructure, trees and soil in their development. Approximately one quarter (23.3%) of projects did not reuse any existing elements found at the site. Just over half (51.1%) of the projects were designed to capture stormwater, wastewater and/or drinking water on site; 42.7 per cent were not designed with this in mind.

Enhancing the Mauri and Wellbeing of People and Culture

Entrants from five categories (Education, Public Architecture, Commercial, Planning and Urban Design and Multi-Unit Housing) were asked to describe how their projects enhanced the mauri and wellbeing of people and culture. First, they were asked to describe how "the project promote[s] mauri ora and community health, foster[s] human delight and inclusivity, and benefit[s] tamariki/children and rangatahi/youth." Just under one-third (31.2%, n=111) of entrants provided valid answers to this question and were mostly within large project categories such as Planning and Urban Design (100.0%), Education (96.4%), Public Architecture (89.5%) and Commercial Architecture (80.0%). 60.0 per cent of Housing – Multi Unit projects responded to this question[2].

Analysing the 111 responses to this question, five major themes can be found: community and social interaction; tamariki and rangatahi; health, well-being and mauri ora; delight and aesthetics; nature and sustainability. Important but less common were themes of inclusivity and accessibility and cultural and spiritual connection.

Community and social interaction were the most commonly occurring theme within entrants' responses, and was especially mentioned within the Commercial, Housing – Multi Unit and Education categories. Here, entrants emphasised the creation of socially inclusive "third spaces" and "community projects" such as cafes, foyers and plazas that focus on the transition between private and public space, foster social connection and support community activities. This is exemplified by one entrant who wrote: "the ground floor foyer, located behind the building's glazed perimeter, features a public café designed to draw visitors into the building," while another wrote that their "project creates a space that nurtures a sense of community, welcoming people of all ages to gather, learn, and connect." Describing a multi-unit housing project, one entrant stated that "as social housing, it supports vulnerable families, tamariki, and rangatahi with its central community spaces including vegetable gardens."

Tamariki and rangatahi was the second most common theme, and was mentioned primarily within Education projects, with 89.3 per cent of projects addressing it. It was also a primary theme within Public Architecture projects, with 65.0 per cent of projects addressing it. These entrants highlighted their priorities to create dedicated spaces for tamariki and rangatahi, including play areas, learning hubs and youth centres designed to empower young people while fostering intergenerational connections. These entrants emphasised agency, safety and inspiration within youth-specific spaces that feel distinct from traditional institutional settings. For example, one entrant wrote that "by co-locating services like the AA centre... youth who wouldn't normally visit a library get to experience the space… the space fosters intergenerational interaction." Another said that within their project, "the Education Room is dedicated to tamariki, providing a space for school trips and classroom visits, fostering creativity with pin-up areas for art and other child-friendly features."

The third recurrent theme was health, well-being and mauri ora. This theme was mostly seen among Education (53.6%), Commercial (50.0%) and Housing – Multi Unit (50.0%) projects. Here, entrants have highlighted the integration of medical and social facilities, spaces for physical activity and the specific design of environments to be both physically healthy, such as though high-quality indoor air, and support mental health and mauri ora. One entrant said of their project: "the Thousand Stars Room offers a peaceful and contemplative environment, encouraging mindfulness and well-being," while another noted that "the project promotes inclusivity, exercise and health of all its residents by providing a community around them that is supportive and meaningful… the Common House has shared facilities as well as a combined space to gather which promotes mauri ora in the residents."

Fourth was the theme of delight and aesthetics which focuses on the sensory experience of the project's architecture. This theme was most common among projects within the Education (39.3%), Housing – Multi Unit (37.1%) and Commercial (32.5%) categories. Entrants considered the project's form, such as the artistic nature of the architecture, and the use of art, colour, light and views to evoke desired experiences and curiosity. One entrant noted that "the external architecture [of their project] is sculptural and playful and fosters a sense of intrigue." Another stated that "the design intends to provide uplifting spaces for occupants, with biophilic principles, offering connectedness to nature, light and the broader community."

[2] Providing answers for this section was optional for the following categories: Housing, Housing – Alterations and Additions, Small Project Architecture, Heritage, Hospitality and Interior Architecture.

The fifth theme was that of nature and sustainability. This was most commonly found among projects in the categories of Housing – Multi Unit (45.7%), Public Architecture (42.1%) and Planning and Urban Design (40.0%). Here, biophilic design practices were prioritised and implemented, as well as the greening of buildings (such as through green roofs) and the surrounding landscape (such as the revitalisation of streams and native planting). Further, entrants stressed the visual and physical connection to the natural environment and land as an "uplifting experience". For example, one entrant noted of their project: "the development site features native landscaping, a revitalised stream, and community gardens, fostering biodiversity and community wellbeing." Another wrote that their project had a "focus on sustainability and environmental stewardship, which positively impacts the community's overall health. For example, [the project] has implemented energy-efficient systems and supports local biodiversity projects... help[ing] create a better future for the younger generation."

Thirty-seven per cent of all entered projects included a cultural assessment.

The majority of projects stated that walking, cycling and mixed mobility over motorised modes of transport was prioritised (67.7%).

The Whakapapa of Building Materials and Processes

17.1 per cent of projects had a Life Cycle Assessment (LCA) undertaken. The majority, 74.7 per cent, had not, and for the remaining 8.1 per cent of projects, the entrant selected not applicable. While the figure of 17.1% appears low, expert advice suggests that the result is better than expected and that this is a meaningful and positive starting point. It shows that a cohort of first adopter practices are already leading the profession into whole-of-life embodied carbon measurement, using evidence to inform design decisions even without legislative requirements or national benchmarks. This is impressive given the short history of Life Cycle Assessments in the construction sector.

Of the 61 projects where an LCA was undertaken, 12 different systems were used[3]. The four most commonly used LCA systems were One Click LCA (29.5%), BRANZ LCAQuick (16.4%), eTool Software (9.8%) and HECC (Homestar Embodied Carbon Calculator) (9.8%).

Entrants were asked to provide upfront and whole-of-life embodied carbon intensity for their projects, as well as total sequestered biogenic carbon and benefits beyond the project lifecycle, if any. The following table details the number and percentage of projects in each category that provided the requested carbon data (Table 4).

Table 4: Count and percentage of projects provided with carbon data, by category

	Upfront embodied carbon intensity (Stages A1-A5)	%	Whole-of-life embodied carbon intensity (Modules A, B & C)	%	Total sequestered biogenic carbon	%	Carbon benefits beyond the life cycle (Module D)	%
Housing	12	9%	0	0%	6	5%	4	3%
Housing - Alterations and Additions	4	10%	0	0%	1	2%	0	0%
Public Architecture	6	32%	5	26%	5	26%	3	16%

[3] See Appendix B for full table of LCA systems specified.

Small Project Architecture	4	17%	0	0%	2	9%	2	9%
Housing - Multi Unit	2	6%	0	0%	0	0%	1	3%
Education	9	32%	10	36%	8	29%	6	21%
Commercial Architecture	13	33%	11	28%	7	18%	6	15%
Heritage	1	8%	0	0%	1	8%	1	8%
Planning & Urban Design	0	0%	0	0%	0	0%	0	0%
Interior Architecture	2	10%	1	5%	2	10%	2	10%
Hospitality	0	0%	0	0%	0	0%	0	0%
Total	53	15%	27	8%	32	9%	25	7%

As can be seen, across all categories very few projects were provided with carbon data. These data were more commonly provided for larger build categories such as Public Architecture, Education and Commercial Architecture. However, in most cases, less than one-third of the projects within these categories provided the requested carbon data. Just 13 (3.7%) projects provided all four of these pieces of information. Due to inconsistencies in data collection, the data for the following analysis has been sign-standardised to ensure consistency with typical module reporting[4]

Table 5: Upfront embodied carbon ($kgCO_2e/m^2$)

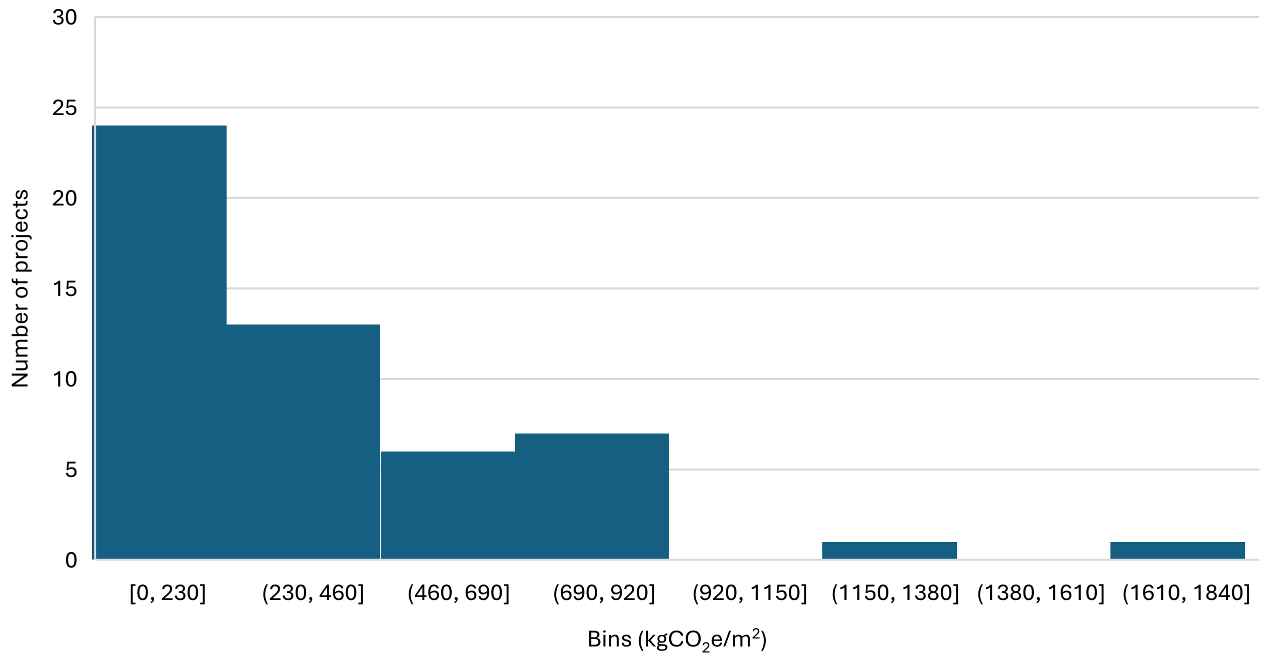
	carbon ($kgCO_2e/m^2$)
	n=53
mean	362.4
median	249.5
min	0.0
max	1836.0

Upfront embodied carbon intensity was provided for 53 projects (14.9%)[5], representing nine of the 11 project categories (Table 5). Of these projects, the average embodied carbon intensity was 362.4 ($kgCO_2e/m^2$) and the median was 249.5 $kgCO_2e/m^2$. The minimum provided value was 0 $kgCO_2e/m^2$ while the maximum was 1836.0 $kgCO_2e/m^2$ (excluding the outlier).

[4] E.g. Two entrants provided negative values for upfront embodied carbon, which is typically reported as a positive figure. These data points have been swapped from negative to positive.

5 One project was excluded from embodied carbon intensity analysis due to what appears to be an outlier in the data (8195 $kgCO_2e/m^2$ – almost 4x higher than the next highest data point).

Figure 3: Histogram showing upfront embodied carbon intensity of projects ($kgCO_2e/m^2$)



The histogram above (Figure 3) shows a distribution skewed towards lower levels of upfront embodied carbon intensity with 50 per cent of projects under 250 $kgCO_2e/m^2$, reflecting a standard-to-good industry performance.

Figure 4: Box and whisker plot showing upfront embodied carbon intensity of projects ($kgCO_2e/m^2$)

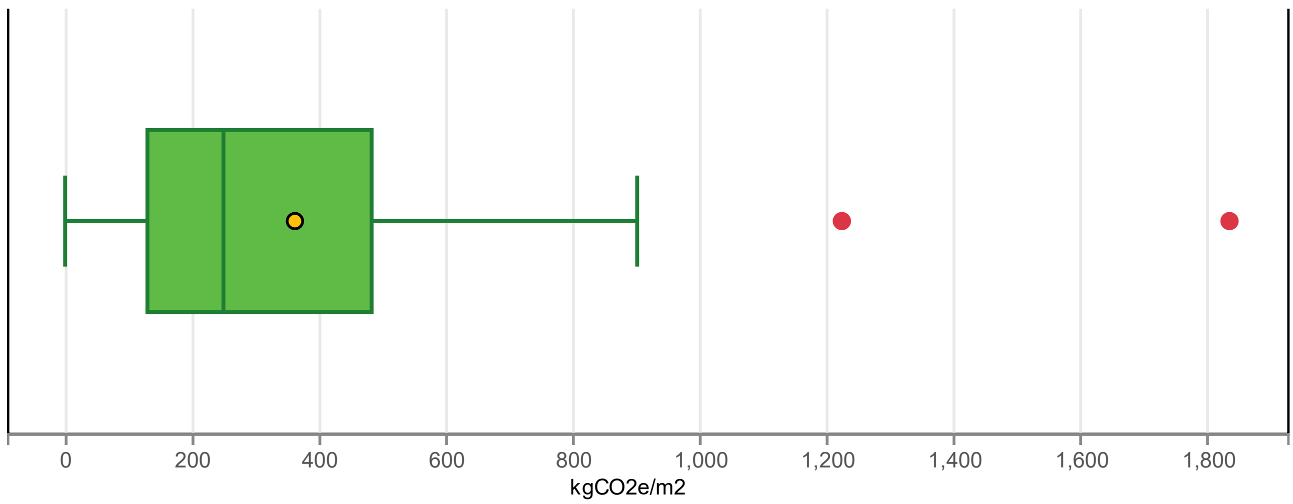


Figure 4 shows that the interquartile range of projects' whole-of-life carbon intensity was between 129.7 and 483.5 $kgCO_2e/m^2$; the median was 249.5 $kgCO_2e/m^2$.

Table 6: Whole-of-life embodied carbon intensity *($kgCO_2e/m^2$)*

	carbon ($kgCO_2e/m^2$)
	n=26
mean	792.3
median	594.0
min	0.0
max	3477.0

Whole-of-life embodied carbon intensity ($kgCO_2e/m^2$) was provided for 26 projects (7.3%), representing four of the 11 awards categories. The mean whole-of-life carbon intensity was 792.4 $kgCO_2e/m^2$ and the median was 594.0 $kgCO_2e/m^2$ (

Table *6*).

Figure 5: Box and whisker plot showing whole-of-life embodied carbon intensity of projects ($kgCO_2e/m^2$)

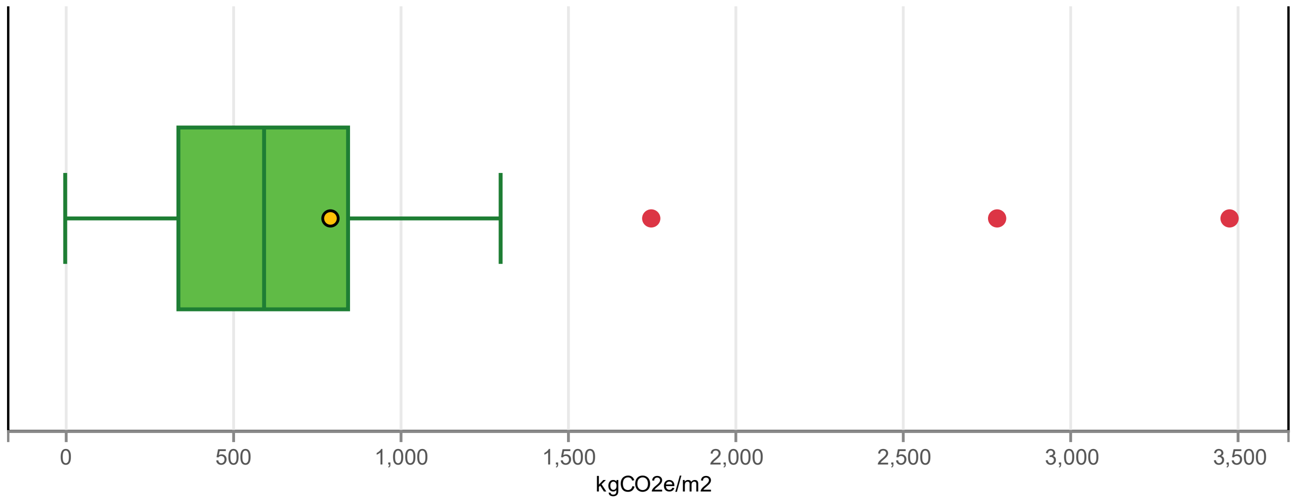
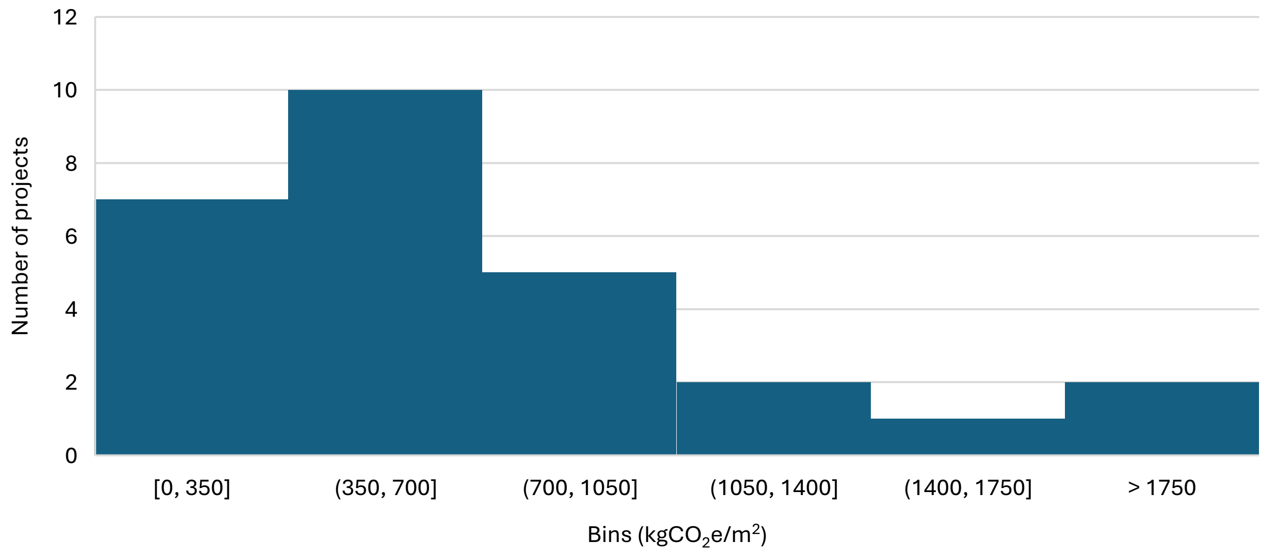


Figure 5 shows that the interquartile range of projects' whole-of-life carbon intensity was between 338.0 and 845.0 $kgCO_2e/m^2$.

Figure 6: Histogram showing whole-of-life embodied carbon intensity of projects ($kgCO_2e/m^2$)



The histogram in Figure 6 , like that in Figure 3, is skewed towards lower levels of whole-of-life carbon intensity and shows that over 50 per cent of projects supplying this data had a whole-of-life carbon intensity of under 700 $kgCO_2e/m^2$.

Table 7: Total sequestered biogenic carbon ($kgCO_2e/m^2$)

	carbon ($kgCO_2e/m^2$)
	n=29
mean	-151.4
median	-93.0
min	-613.0
max	-3.0

Figures for total sequestered biogenic carbon were provided for 29 (8.1%) projects across eight categories and ranged from -3.0 kgCO2e/m^2 to -613 kgCO_2e/m2. The mean figure was -151.4 kgCO_2e/m^2 and the median was -93.0 kgCO_2e/m^2 (Table 7).

Figure 7: Box and whisker plot showing total sequestered biogenic carbon (kgCO_2e/m^2)

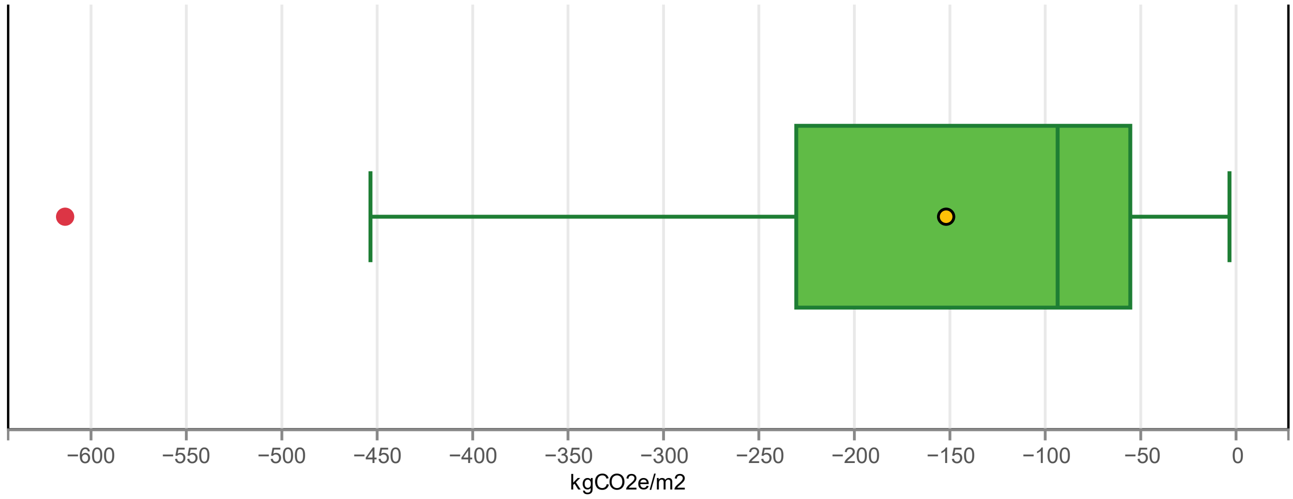


Figure 7 shows that the interquartile range for total sequestered biogenic carbon was between -230.0 and -55.0 kgCO_2e/m^2.

Figure 8: Histogram showing total sequestered biogenic carbon of projects kgCO_2e/m^2)

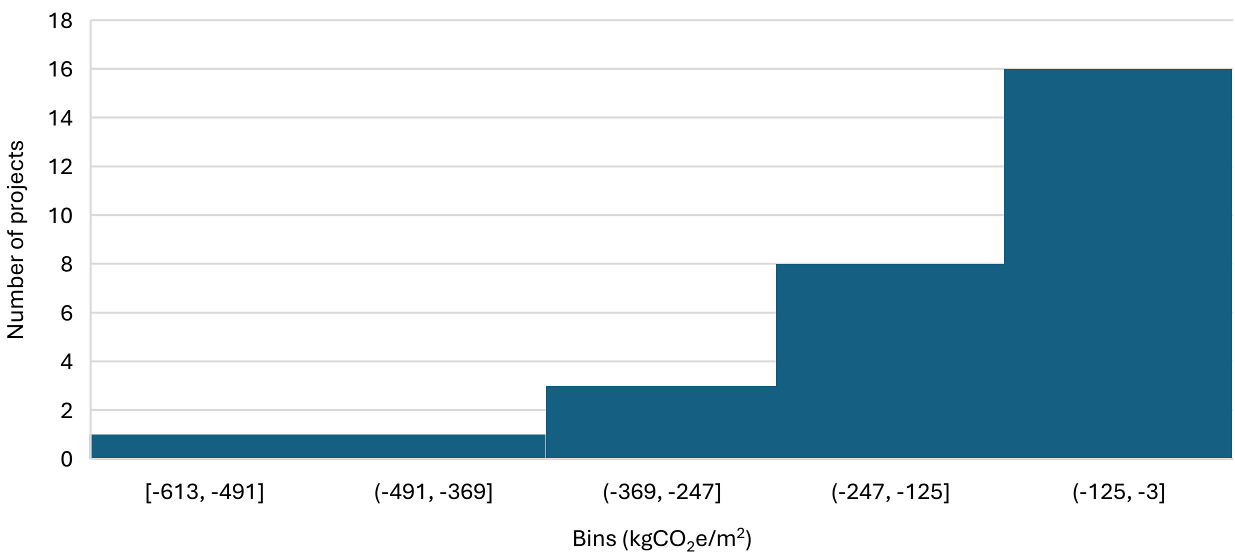


Figure 8 provides a histogram showing the distribution of projects' total sequestered biogenic carbon. It skews right (towards less sequestered biogenic carbon), with carbon figures primarily falling within bins covering -247.0 to -3.0 kgCO_2e/m^2.

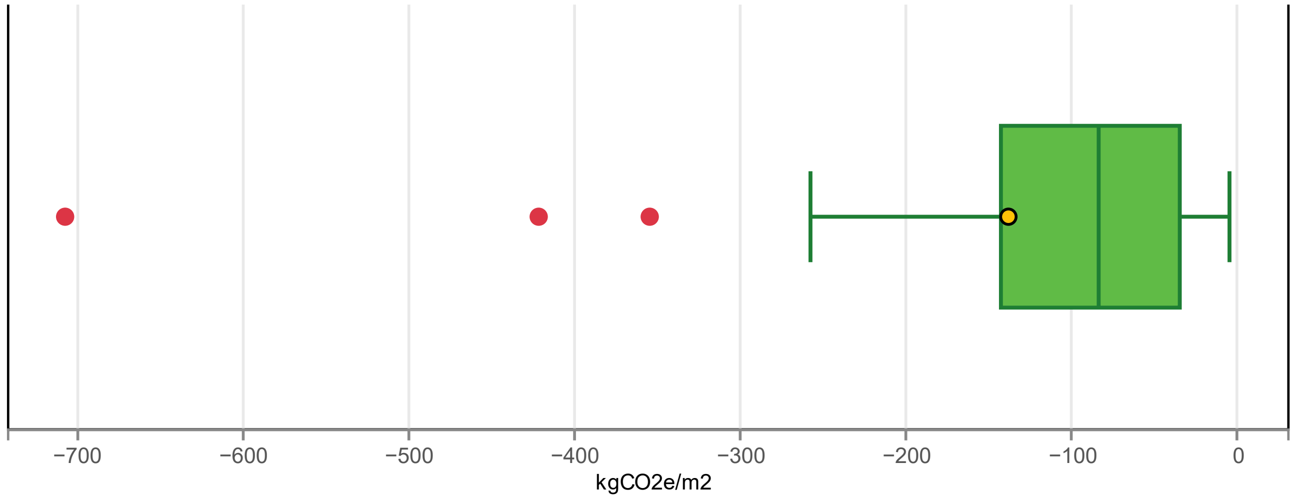
Table 8: Carbon benefits beyond lifecycle (kgCO_2e/m^2)

	carbon (kgCO_2e/m^2)
	n=24

mean	-137.4
median	-83.0
min	-707.0
max	-4.0

Carbon benefits beyond the lifecycle were provided for 24 (6.7%) projects across seven categories. These figures ranged from -4.0 kgCO2e/m2 to -707.0 kgCO2e/m2. The mean figure was -137.4.

Figure 9: Box and whisker plot showing carbon benefits beyond project life cycle (kgCO_2e/m^2)



The carbon benefit beyond the life cycle estimated for the middle 50 percent of projects fell between -142.0 and -34.0 kgCO_2e/m^2 (
Figure 9).

Figure 10: Histogram showing carbon benefit beyond the life cycle for projects (kgCO_2e/m^2)

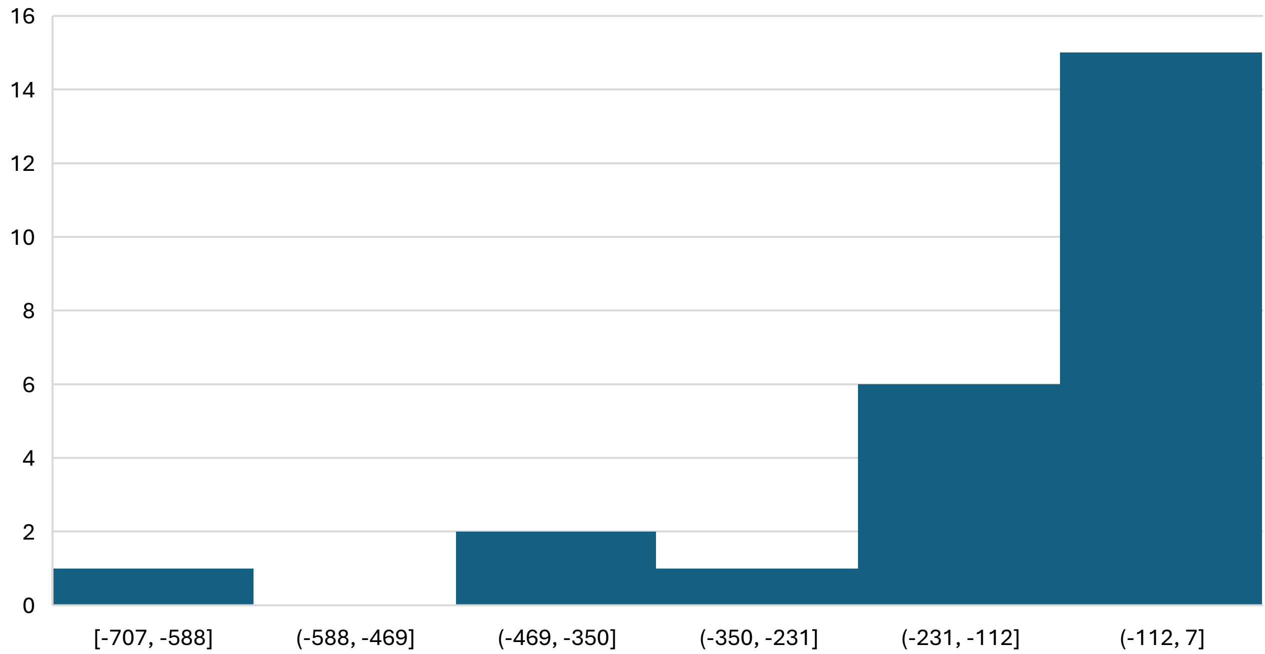


Figure 10 shows a histogram of carbon benefits beyond the life cycle for the 24 projects that this data was provided for. As can be seen, the distribution is skewed right (towards fewer carbon benefits beyond the life cycle), with the majority of projects sitting in the two bins between -231.0 and -4.0 $kgCO_2e/m^2$ bin.

Entrants were also asked to detail how their project design reduced embodied carbon (upfront or whole-of-life). This question was answered by 180 entrants with responses typically upfront carbon reductions through choices in material use, building reuse, efficiency in design and local sourcing

The specification of materials was the most common embodied carbon reduction tool cited by entrants. Over half of the entrants mentioned the prioritisation of timber (and other wood products) because it acts as a "carbon sink", sequestering CO_2 during growth. At the same time, entrants also focused on reducing the use of steel and concrete by "designing them out" or using them more sparingly, for example, limiting concrete to ground floors only. One entrant wrote that "wood is a renewable and carbon-storing material, offering a significant reduction in embodied carbon compared to concrete or steel." Another stated that the "two storied construction meant that half of the floor area was able to be constructed out of timber floor framing and thus confined the concrete use to just the ground floor," while a third outlined that their "efficient diagrid structure reduced embodied carbon by 27%... [we sourced] steel from responsible suppliers, [and] alternative fuels [were] used for cement production."

Furthermore, some entrants implemented circular-economy principles such as reusing salvaged material or specifying products made from waste or through recycling processes. For example, three entrants noted that their projects utilised "reclaimed hardwood cladding, saveboard (recycled tetrapack) lining, and SIPs," that "all the timber used was salvaged from the owners' recently completed house build on the same site... [and] steel [was] salvaged from site fencing," and "the insulation that has been installed is made using recycled products." Beyond material reuse, other entrants mentioned the retention and reuse of foundations, roofs and structures, allowing them to avoid the carbon "debt" that accompanies new construction as well as the demolition of old buildings. For example, one entrant stated that "the key carbon reduction strategy was to retain as much of the original building as possible... extending its life by another 50 years." Another wrote that their project included the "re-use of existing roof steel structure and base slab, together with core structure and linings in timber."
To further reduce upfront embodied carbon, some entrants prioritised sourcing local materials, especially timber, which enables them to reduce supply chains. For example, one entrant wrote that their project used "locally sourced timber [that] minimised transportation distances and associated emissions." Another stated that "locally sourced, these aluminium extrusions comprise up to 80% recycled content... [this] results in an embodied carbon footprint of just 11% of the international average."

Whole-of-life embodied carbon reduction was achieved by designing for thermal performance and choosing materials and construction methods that require less maintenance and/or repair. Approximately one-third of entrants mentioned carbon reduction via thermal performance such as investing in better insulation and building for airtightness to ensure less energy requirements for heating and cooling. For example, one entrant noted that their project's "warm roof system that achieves very high R-values, contributing to less demand for cooling and heating," while another stated that their project was "oriented south and east, preventing overheating from the high solar gain... combined with high-performance glass, this design achieves optimal comfort and energy efficiency." Other entrants designed their projects to ensure the longevity of material quality and project against unnecessary repair or replacement. This is exemplified by one entrant who wrote that the "selection of materials and construction techniques [will] ensure long-term durability, minimising the need for future alterations," while another specifically noted that they had "avoid[ed] painted exterior surfaces: by eliminating the need for painted exterior surfaces, the design minimises ongoing maintenance and repainting."

Over half (53.7%) of the entered projects were stated to have implemented circular economy principles and specified construction waste minimisation plans. Further, over three-quarters (78.4%) of projects had specified non-toxic materials in order to improve indoor air quality and reduce off-gassing (VOCs).

Measurements and Pūnaha Pungao Energy Systems

Across all entered projects, 19.7 per cent had adhered to established sustainability benchmarking tools, certification and/or relevant standards. Of these projects, the majority (44.3%) did not state what certification system they had implemented. Of those named, different versions of Homestar (17.1%) and Passivhaus (14.3%) were the most common.

Table 9: Predicted and actual energy use, and difference, all projects

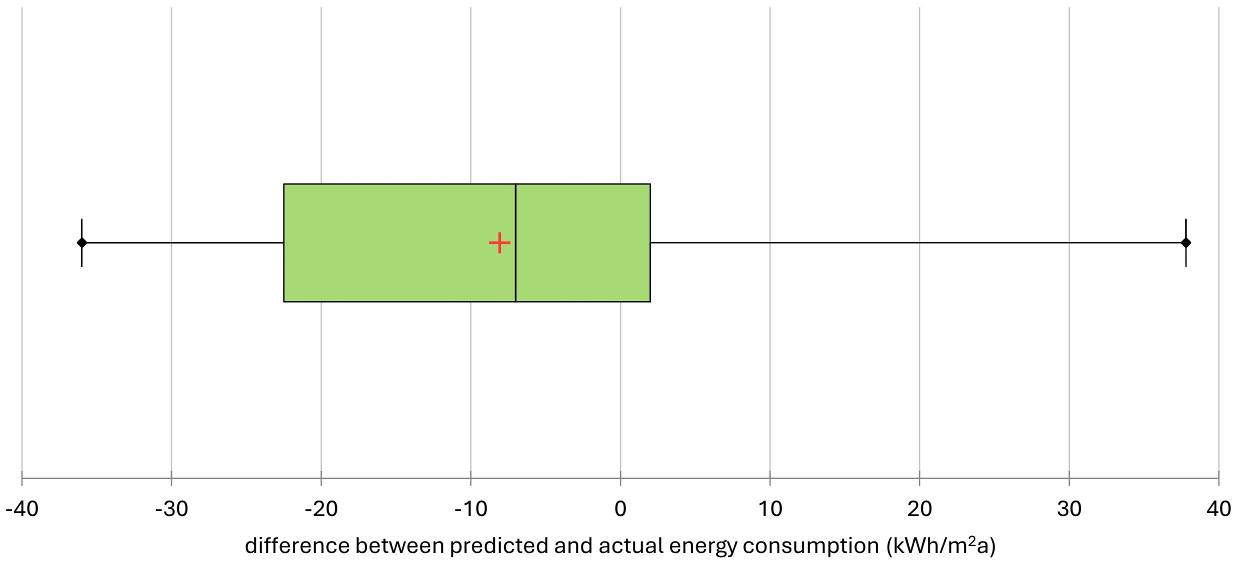
	predicted (kWh/m^{2}a)	actual (kWh/m^{2}a)	difference (kWh/m^{2}a)
	n=44	n=21	n=16
mean	113.0	116.7	-7.6
median	62.5	63.0	-5.5
maximum	950.0	314.0	-36.0
minimum	15.0	14.5	37.8

Overall, 44 (12.4%) projects were supplied with predicted energy use calculations and 21 (5.9%) were supplied with actual energy use calculations. Just 16 (4.5%) projects were provided with both figures (Table 9).

Across the 44 projects that did provide predicted energy use, the mean was 113.0 kWh/m2/yr and the median was 62.5 kWh/m2/yr. The minimum prediction was 15.0 kWh/m2/yr while the maximum was 965.0 kWh/m2/yr. For the 21 projects that provided actual energy use data, the mean was 116.7 kWh/m2/yr and the median was 63.0 kWh/m2/yr. The minimum actual figure was 14.5 kWh/m2/yr while the maximum was 314.0 kWh/m2/yr (Table 9).

Further, 16 projects provided calculations for both predicted and actual energy consumption. From these data, the difference can be calculated to determine how accurately entrants were able to predict the energy consumption of their completed projects. For these projects, the mean difference in predicted vs actual energy consumption was -7.6 kWh/m^{2}a while the median was -5.5 kWh/m^{2}a. These figures suggest that awards entrants were able to predict the energy consumption of their completed projects to a very accurate degree.

Figure 11: Box and whisker plot showing difference between predicted and actual energy consumption (kWh/m²a)



Further, Figure 11 shows that the majority of data points fall below 0 kWh/m²a, suggesting that awards entrants were more likely to over-estimate the energy consumption of their project than they were to under-estimate it.

However, the data provided in Table 9 and Figure 11 may not be especially useful as both expected and actual energy consumption can be significantly different between different types of architectural projects.

Table 10: Count and percentage of projects with energy modelling figures, by group

	Predicted energy use	%	Actual energy use	%	Both	%
Housing Housing - Alterations and Additions Housing - Multi Unit	25	12%	12	6%	9	4%
Commercial Architecture Education Public Architecture	8	9%	9	10%	7	8%
Hospitality Interior Architecture	0	0%	0	0%	0	0%
Small Project Architecture	2	9%	0	0%	0	0%
Heritage	0	0%	0	0%	0	0%
Planning & Urban Design	0	0%	0	0%	0	0%
Total	35	12.4%	21	5.9%	16	4.5%

Table 10 groups projects by similar typologies and architectural intent and gives the count and percent (within each group) of projects that were provided with predicted and actual energy use, as well as those provided with both figures. As can be seen, sample sizes at a combined subgroup level become relatively sparse, with only 9 projects within Housing, Housing – Alterations and

Additions & Housing Multi Unit and 7 projects within Commercial Architecture, Education & Public Architecture having offered both predicted and actual energy use calculations, while just 2 projects within Small Project Architecture provide data for predicted energy use. Such small sample sizes significantly diminish analytical robustness and may not produce any useful commentary on energy modelling practices.

Table 11: Predicted and actual energy use, by combined subgroup

	Predicted energy use (kWh/m^2a)					Actual energy use (kWh/m^2a)				
	n	mean	median	min	max	n	mean	median	min	max
Housing Housing - Alterations and Additions Housing - Multi Unit	25	76.9	56.6	15	284	12	78.6	50.5	14.5	284
Commercial Architecture Education Public Architecture	8	171.7	80.5	20.9	965	9	167.4	174	32	314

Despite the sampling complications mentioned above, Table 11 provides the mean, median, minimum and maximum predicted and actual energy use figures for projects within the Housing, Housing – Alterations and Additions & Housing Multi Unit and Commercial Architecture, Education & Public Architecture groups. As can be seen, within the Housing, Housing – Alterations and Additions & Housing Multi Unit group, both the mean and median figures remained relatively stable between the predicted and actual energy use calculations. This shows that predicted energy use calculations within this group were relatively accurate. Conversely, while the mean remained relatively stable within the Commercial Architecture, Education & Public Architecture group, the median actual energy use calculation was more than double that of the predicted figure. This suggests significant underestimation of energy use for the majority of projects within this group.

Table 12: Difference between predicted and actual energy use, matched projects, by combined subgroup (kWh/m^2a)

	Housing, Housing – Alterations & Additions Housing - Multi Unit	Commercial Architecture, Education & Public Architecture
	n=9	n=7
mean	-5.8	-9.9
median	0	-14.13

Further analysis can be undertaken on matched projects only. Table 12 provides the mean and median difference between predicted and actual energy consumption calculations for matched projects. While this sample is objectively small (n= 9 for the Housing, Housing – Alterations and Additions & Housing Multi Unit group; n=7 for the Commercial Architecture, Education & Public Architecture group), it does provide further evidence for the accuracy of energy consumption estimates for Housing, Housing – Alterations and Additions & Housing Multi Unit projects. This is evidenced by the median difference of 0 kWh/m^2a and the relatively low mean difference of -5.8 kWh/m^2a. Interestingly, this analysis for Commercial Architecture, Education & Public Architecture projects produces a different outcome of that outlined in Table 11 above. Rather than significantly underestimating energy consumption, the analysis of matched differences finds that these entrants typically overestimated consumption. However, the contrasting outcome of this analysis when compared with the non-matched data suggests there may be a selection bias among entrants reporting this information – for example, it may be that the actual energy consumption figure was more likely to be reported by entrants who had produced positive calculations, while those whose calculations fell short of their predictions chose to withhold this information.

Energy modelling was undertaken for 38.2 per cent of projects. Almost half (49.7%) of the entered projects were not thermally modelled; 12.1% entrants noted not applicable[6].

Just 14.6 per cent of projects were considered to have a 'net zero' operational energy expenditure or included some form of on-site energy generation from renewable energy sources such as solar or wind in their completed form.

Over half (52.8%) of the projects were stated to be 100 per cent electric and just under half (44.4%) had taken airtightness into consideration. Ventilation strategies were split evenly between active (49.7%) and passive (50.3%). Further, 82.0% of projects included energy efficient fittings for hot water heating and space heating and/or cooling.

The predicted heat demand and/or load was calculated for 37.1 per cent (n=132) of projects. This was not calculated for 48.0 per cent of projects, while it was considered to not be applicable for 14.9 per cent.

Of the projects where heat demand and/or load was confirmed to have been calculated, just 45 (34.1%) entrants provided figures for this calculation: 28 (21.2%) projects were attributed heat demand calculations, 22 (16.7%) were attributed heat load calculations and only 5 (0.3%) were attributed both.

Table 13: Heat demand and load

	demand (kWh/m^2a)	load (W/m^2)
	n=28	n=22
mean	37.3	57.4
median	26.6	50.5
maximum	152.0	162.2
minimum	5.0	0.1

For projects where heat demand and load calculations were provided (Table 13), the mean demand was 37.3 kWh/m^2a and the median demand was 25.6 kWh/m^2a. The maximum provided heating demand was 152.0 kWh/m^2a and the minimum was 5.0 kWh/m^2a. The mean heating load was 57.2 W/m^2 and the median load was 50.5 W/m^2. The maximum provided load was 162.2 W/m^2 while the minimum was 0.1 W/m^2.

The regions where projects were most likely to have had their heat demand and/or load calculated were Hawkes Bay-Gisborne, Western and Wellington, with figures provided for approximately 25 per cent of submitted projects within each of these regions.

[6] An answer of "not applicable" does not necessarily mean that thermal modelling was not applicable to the project. It could mean that it was not a consideration at the time of designing the project

Within the 11 awards categories, Education projects were most likely to have had heat demand and/or load calculated, with this data accompanying 42.9 per cent of submitted Education projects. This figure is significantly higher than that of other categories. The second and third highest project categories that were attributed heat calculations were Commercial Architecture (17.5%) and Housing (17.3%).

The predicted cooling demand and/or load was calculated for 30.6 per cent of all submitted projects. It was not calculated for 52.5 per cent of projects and was considered to not be applicable for 16.9 per cent. Of the 109 projects stated to have had cooling demand and/or load calculations undertaken, just 28 (25.7%) provided one or more of these figures: 16 (14.7%) were attributed cooling demand calculations and 12 (11.0%) were attributed cooling load calculations. No projects were attributed both calculations.

Table 14: Cooling demand and load

	demand (kWh/m^2a)	load (W/m^2)
	n=16	n=12
mean	28.6	71.7
median	8.0	73.0
maximum	186.5	150
minimum	0.0	0.1

For projects where cooling demand and load calculations were provided (Table 14), the mean demand was 28.6 kWh/m^2a; the median demand was 8 kWh/m^2a. The maximum provided cooling demand was 186.5 kWh/m^2a and the minimum was 0 kWh/m^2a. The mean cooling load was 71.7 W/m^2; the median cooling load was 73 W/m^2. The maximum cooling load was 150 W/m^2 while the minimum was 0.1 W/m^2.

The regions where projects were most likely to have had their cooling demand and/or load calculated were Hawkes Bay-Gisborne (20.0%), Southern (19.5%) and Nelson-Marlborough (15.4%).

Projects submitted within the Education category were considerably more likely than those submitted in other categories to have had their cooling demand and/or load calculated: this was provided for 32.1 per cent of submitted projects in this category. The second and third most common categories within which projects were attributed cooling calculations were Public Architecture (15.8%) and Heritage (15.4%).

Estimation of potable water usage and water saving initiatives were employed in 37.9 per cent of projects. Half (50.0%) did not undertake these, while 12.1 per cent found them to be not applicable.

Award winner analysis

This section analyses the differences and similarities in answers between projects that won awards and those that did not.

Except for the calculation of predicted and actual energy use, award winners were more likely than non-winners to have included sustainable practices in their project. A full table is available in Appendix A.

Figure 12: Responses, winners and non-winners

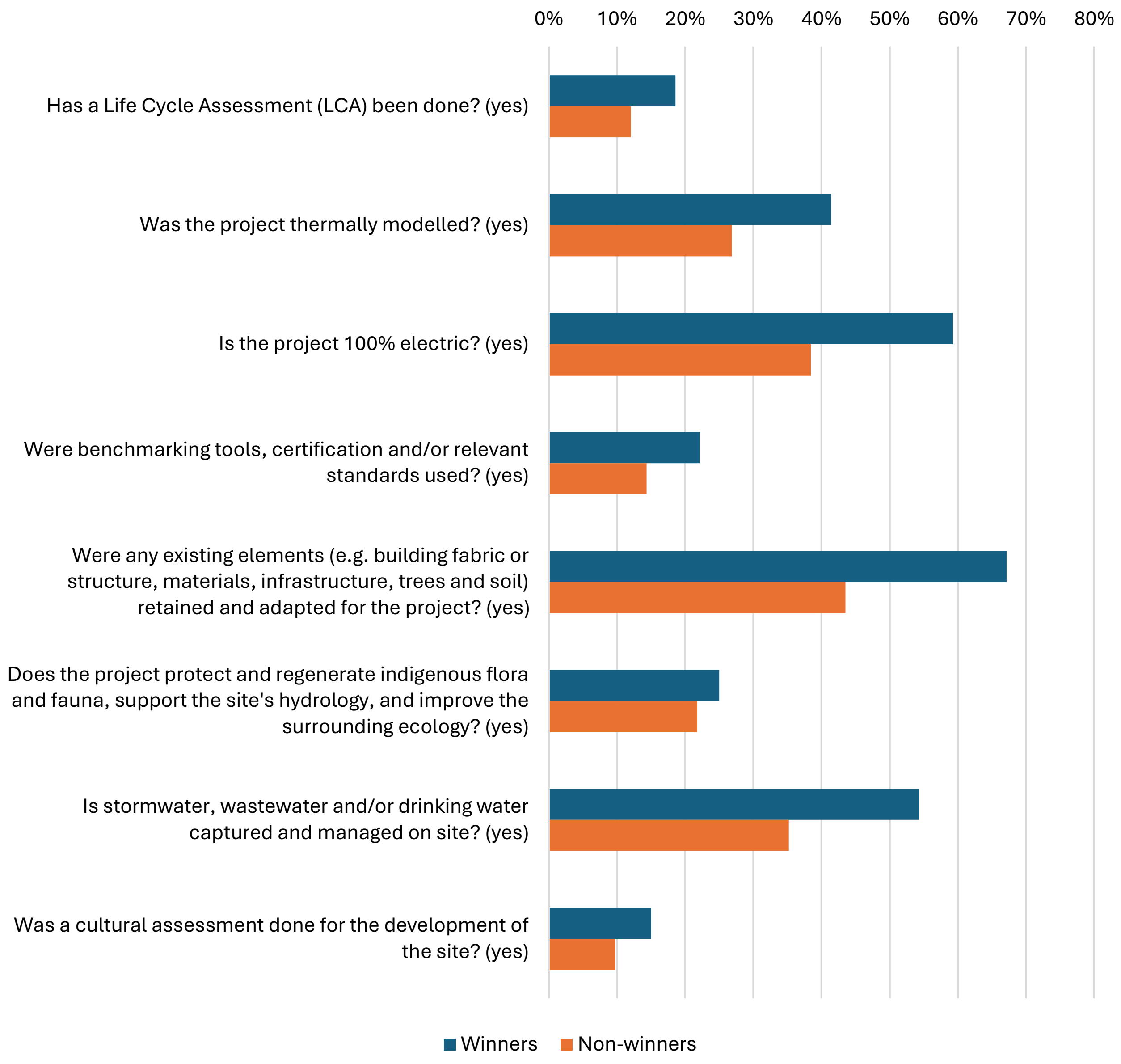


Figure 12 shows the differences between the entry responses of award winners and non-winners for a selection of significant questions. As can be seen, across all questions, award winners were more likely to have undertaken sustainability practices. The largest discrepancy between the sustainability practices of award winners and non-winners shown in Figure 12 was the retention and reuse of existing materials, where this was done by 67.1 per cent of winners and 43.5 per cent of non-winners[7].

Winners were also more likely to have 100 per cent electric projects (59.3% vs 38.4% for non-winners), capture and manage water on site (54.3% vs 35.2% for non-winners) and undertake thermal modelling for their project (41.4% vs 26.9% for non-winners).

Carbon and energy use sub-analysis

The following section investigates the embodied carbon, carbon sequestration and energy expenditure figures for the categories of Commercial Architecture, Education and Public Architecture, combined. Together, this represents 87 projects entered in the awards.

Table 15: Percentage of projects that provided carbon and energy data (Commercial Architecture, Education and Public Architecture)

Data category	% of projects
Upfront embodied carbon intensity (kgCO2e/m2)	31.0%
Whole-of-life embodied carbon intensity (kgCO2e/m2)	28.7%
Total sequestered biogenic carbon (kgCO2e/m2)	23.0%
Carbon benefits beyond the life cycle (kgCO2e/m2)	17.2%
Predicted energy use (kWh/m2/yr)	19.5%
Actual energy use (kWh/m2/yr)	10.3%

As a caveat for this section, Table 15 shows the percentage of projects within the categories of Commercial Architecture, Education and Public Architecture for which carbon and energy use data was supplied. Because the figures are relatively low, the robustness of the following analysis may be questioned.

Across the three categories, the average area of a project was 4518m^2; the median area was 1709m^2. The average cost was $27,623,964; the median cost was $11,750,000. The average cost per square metre was $10,636; the median cost per square metre was $7,151.

Table 16: Summary statistics for carbon data (Commercial Architecture, Education and Public Architecture)

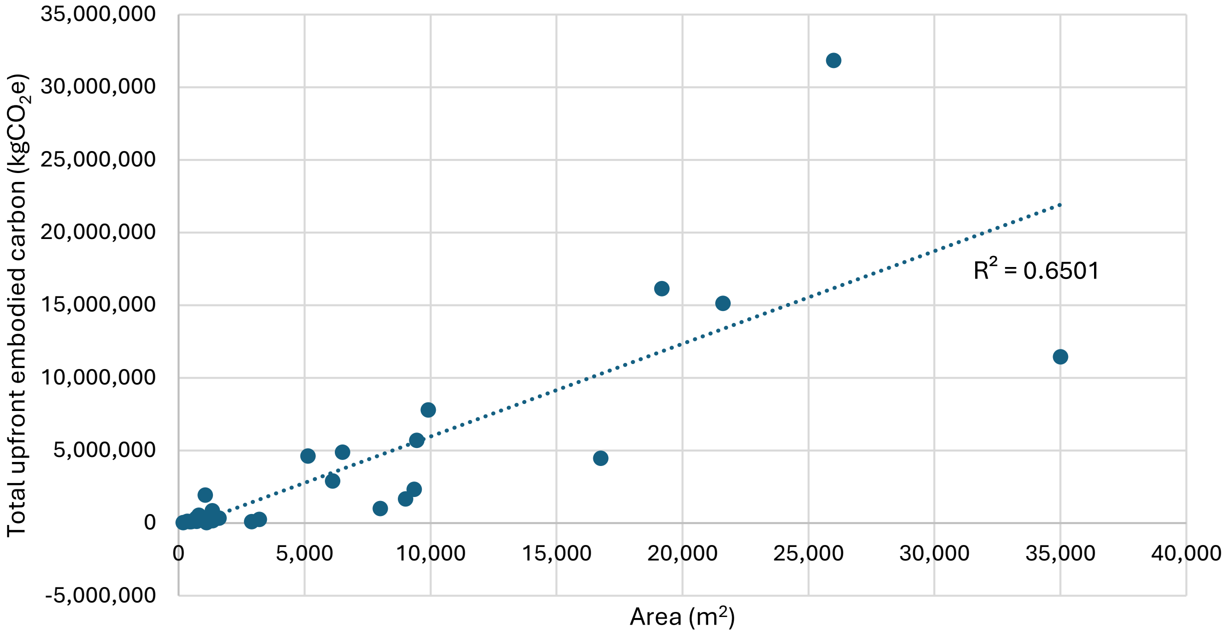
Data category	n	mean	median	min	max
Upfront embodied carbon ($kgCO_2e/m^2$)	27	473.5	327.0	30.0	1836.0
Whole-of-life embodied carbon intensity ($kgCO_2e/m^2$)	25	826.2	594.0	35.0	3477.0
Total sequestered biogenic carbon ($kgCO_2e/m^2$)	20	103.2	71.5	3.0	307.0
Carbon benefits beyond the life cycle ($kgCO2e/m^2$)	15	180.0	106.0	15.0	707.0

Table 16 provides project summary statistics for carbon data across the Commercial Architecture, Education and Public Architecture categories. As shown, the mean upfront embodied carbon was 473.5 $kgCO_2e/m^2$ and the median was 327.0 $kgCO_2e/m^2$. The mean whole-of-life embodied carbon intensity was 826.2 $kgCO_2e/m^2$ and the median was 594.0 $kgCO_2e/m^2$. The mean total sequestered

[7] Larger discrepancies are seen within questions not listed in Figure 12. These were purposely not included – see Appendix A for full table.

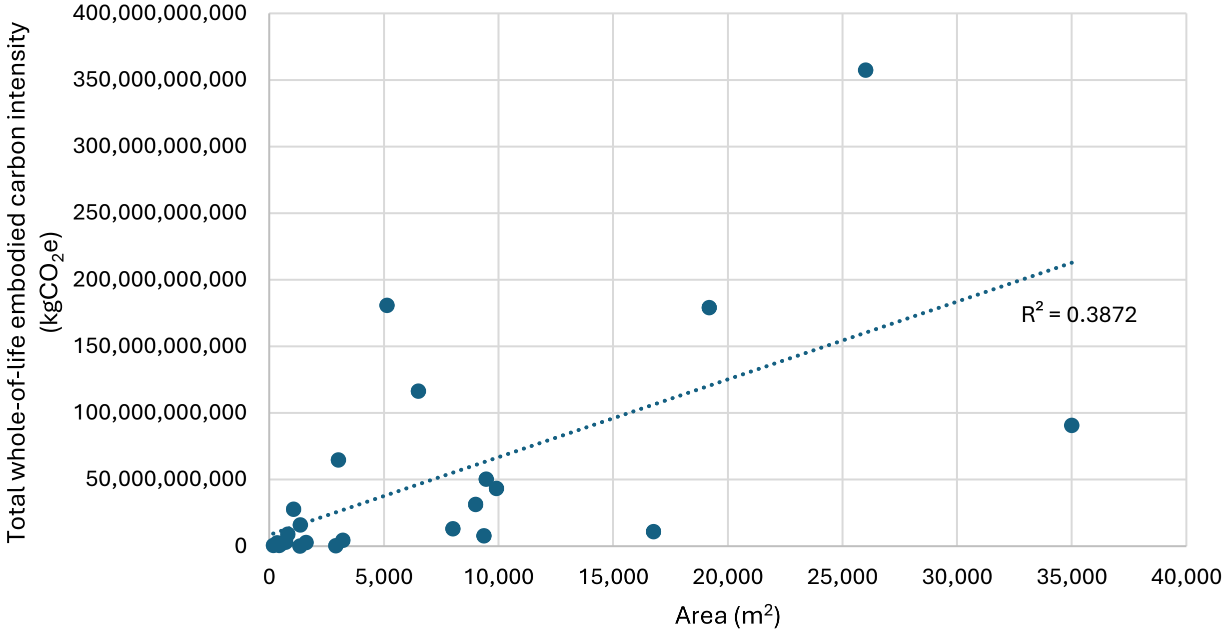
biogenic carbon was 103.2 $kgCO_2e/m^2$ and the median was 71.5 $kgCO_2e/m^2$. The mean carbon benefits beyond the lifecycle were 180.0 $kgCO_2e/m^2$ and the median was 106.0 $kgCO_2e/m^2$.

Figure 13: Relationship between project area (m^2) and total upfront embodied carbon ($kgCO_2e$) for Commercial Architecture, Education and Public Architecture projects



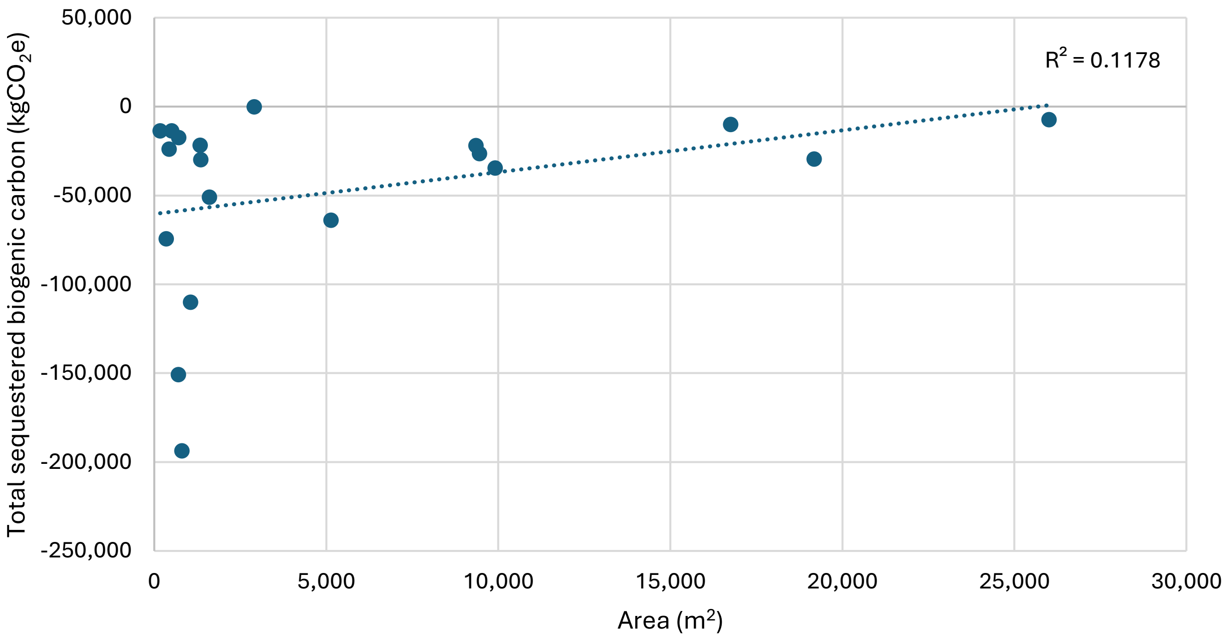
Project data confirms that larger projects typically have higher upfront emissions during manufacturing and construction. Figure 13 shows the relationship between building area and total upfront embodied carbon (Modules A1-A5) and indicates a strong, positive linear correlation ($r = 0.8063$, $p < 0.00001$). Floor area accounts for 65.0 per cent ($R^2 = 0.6501$) of day-one emissions, showing that the physical scale of a project has a relatively large impact on its initial environmental baseline. This is most likely because heavy structural elements like concrete foundations, floor slabs, and framing scale directly with spatial footprint.

Figure 14: Relationship between project area (m^2) and total whole-of-life embodied carbon intensity ($kgCO_2e$) for Commercial Architecture, Education and Public Architecture projects



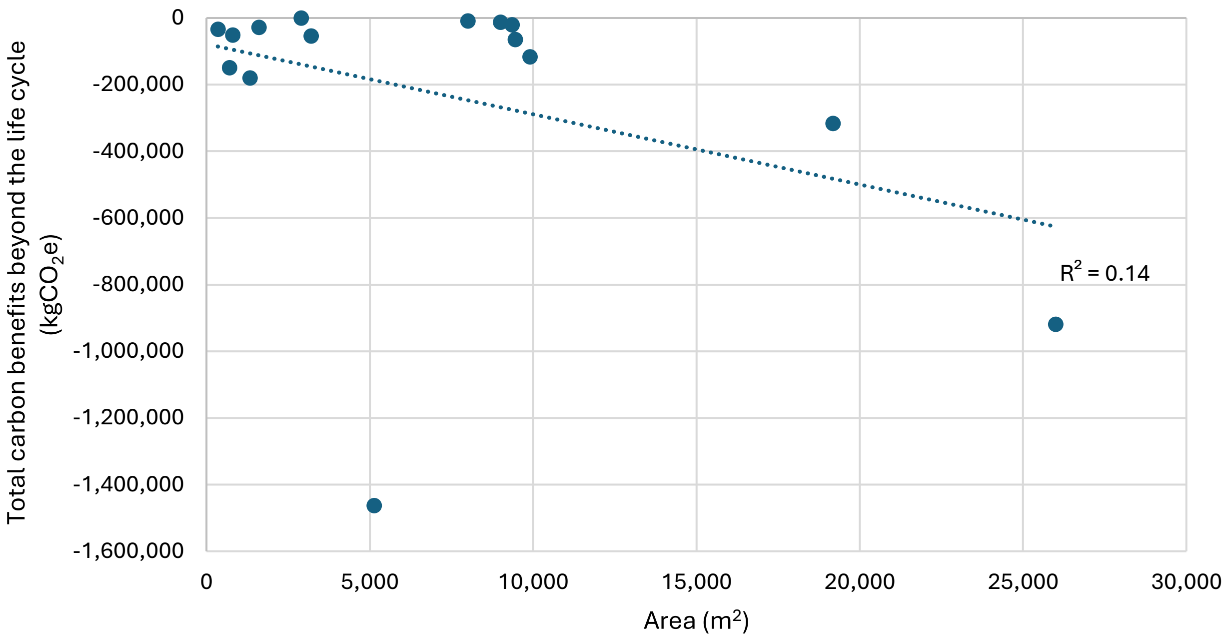
In contrast, while project building area (m^2) remains a statistically significant driver of total whole-of-life embodied carbon ($p = 0.000896$) with a positive linear trend ($r = 0.6222$), its predictive capacity decreases over the full life cycle (Figure 14). Floor area explains 38.7 per cent of the total embodied carbon ($R^2 = 0.3872$) across the complete building lifespan. Because the remaining 61.3 per cent of the variance is driven by other factors, a building's total lifetime carbon footprint is not solely determined by its scale. The remaining variance may be dictated by other factors, such as design-stage interventions including material specification or structural framing efficiency, as well as long-term building maintenance cycles.

Figure 15: Relationship between project area (m^2) and total sequestered biogenic carbon ($kgCO_2e$) for Commercial Architecture, Education and Public Architecture projects



When evaluating projects' total sequestered biogenic carbon, the data shows no statistically significant relationship with building area ($p = 0.1503$). The weak negative correlation ($r = -0.3432$) is not statistically reliable, while floor area explains just 11.8 per cent of the variance ($R^2 = 0.1178$) on the scatter plot. This indicates that biogenic carbon storage does not automatically scale with building size. Instead, it is a function of material specification. For example, a large concrete structure will sequester minimal carbon, whereas a smaller mass-timber building can capture a significant amount. This leaves 88.2 percent of this metric to be determined by material choices rather than project size.

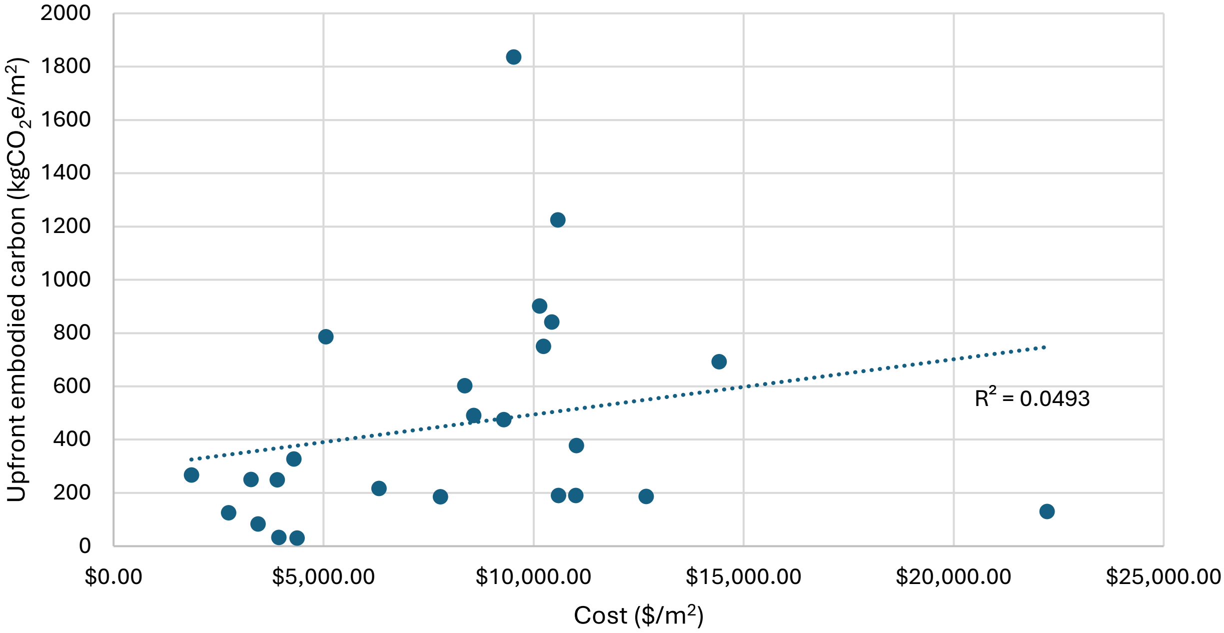
Figure 16: Relationship between project area (m^2) and total carbon benefits beyond the life cycle ($kgCO_2e$) for Commercial Architecture, Education and Public Architecture projects



Similarly, total carbon benefits beyond the life cycle (Module D) shows no statistically reliable connection to building size ($p = 0.1695$). While a weak positive lean exists ($r = 0.3741$), building area accounts for just 14.0 per cent of the carbon benefits ($R^2 = 0.1400$), meaning 86.0 per cent of the benefits are driven by other variables. This lack of predictability indicates that the expectation of circular economy advantages, such as future steel recycling or concrete recovery do not automatically increase with a larger project footprint.

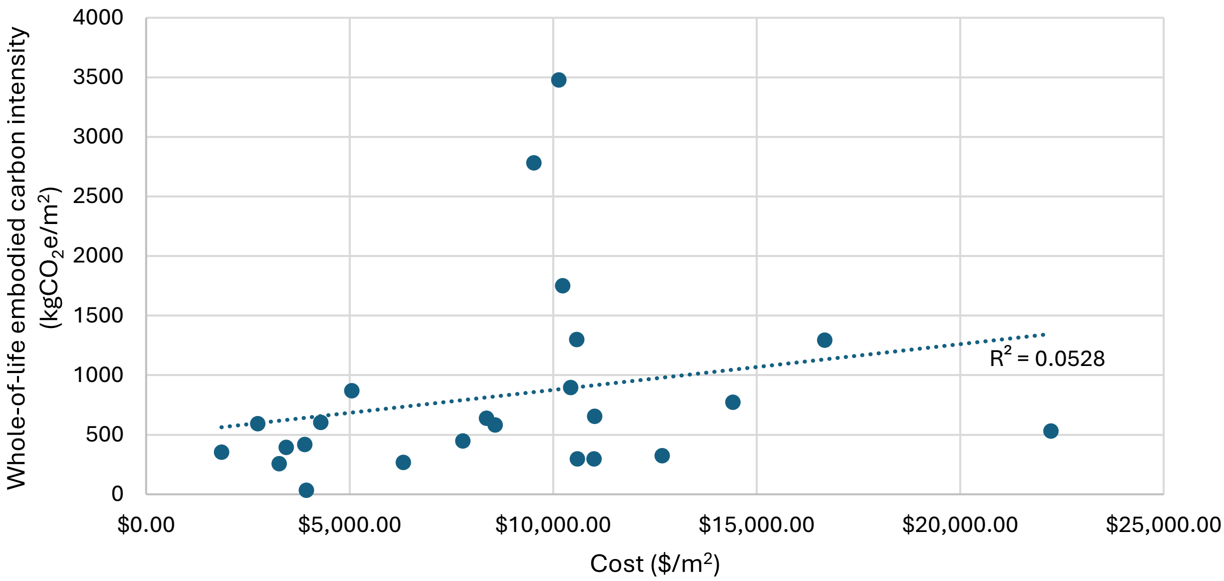
Together, these four datasets show that project area affects carbon metrics differently depending on the life cycle stage. Physical building area acts as a clear baseline predictor early on, explaining nearly two-thirds of all upfront carbon emissions. However, as the scope expands across time and subsequent life cycle stages, the predictive power of building size decreases. It drops for whole-of-life carbon ($R^2 = 38.7\%$) and is non-significant for Biogenic Sequestration ($R^2 = 11.8\%$) and End-of-Life Circularity ($R^2 = 14.0\%$).

Figure 17: Relationship between project cost ($/m²) and upfront embodied carbon ($kgCO_2e/m^2$) for Commercial Architecture, Education and Public Architecture projects



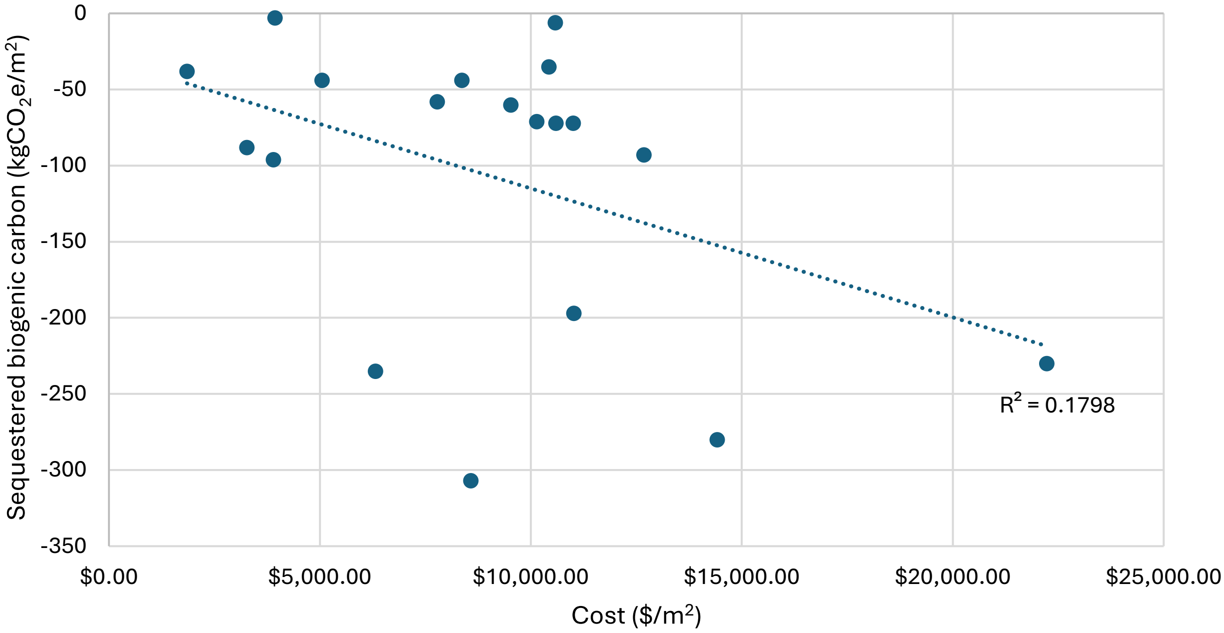
The scatterplot in Figure 17 above shows the relationship between project cost intensity ($/m²) and upfront embodied carbon intensity (kgCO2e/m²) for Commercial Architecture, Education and Public Architecture projects (n=25), finding that it is not statistically significant ($p = 0.2959$). There is a weak positive correlation ($r = 0.2221$) which is statistically unreliable, and project cost per square metre explains only 4.9 per cent of the reasons ($R^2 = 0.0493$) for upfront embodied carbon (Modules A1-A5). This relatively flat trend indicates that spending more money per square metre during construction does not inherently result in a higher or lower carbon footprint. Upfront carbon intensity is independent of project cost per square metre, meaning low-carbon and high-carbon buildings can exist at identical budget thresholds.

Figure 18: Relationship between project cost ($/m²) and total whole-of-life embodied carbon intensity ($kgCO_2e/m^2$) for Commercial Architecture, Education and Public Architecture projects



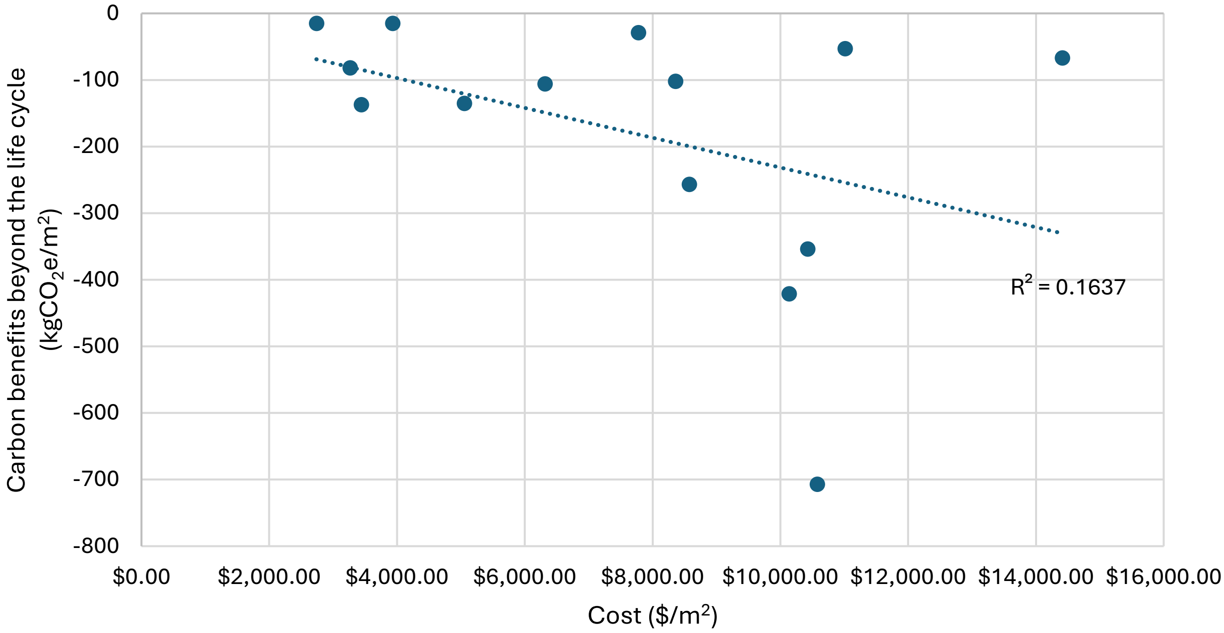
Similarly, analysing whole-of-life embodied carbon against project cost (Figure 18) intensity yields no statistically significant relationship ($p = 0.2803$). Cost per square metre accounts for just 5.3% of the reason ($R^2 = 0.0528$) for lifecycle emissions intensity, with a weak linear correlation ($r = 0.2297$). This finds that a higher project cost per square metre does not guarantee better or worse embodied carbon across a project's lifetime. This data shows that the majority of whole-of-life embodied carbon (94.7%) is driven by variables outside of cost metrics.

Figure 19: Relationship between project cost ($/$m^2$) and total sequestered biogenic carbon ($kgCO_2e/m^2$) for Commercial Architecture, Education and Public Architecture projects



When evaluating total sequestered biogenic carbon intensity, the data shows a moderate positive correlation ($r = 0.4240$), but it remains statistically non-significant ($p = 0.0739$). Cost per square metre explains 18.0 per cent of the factors ($R^2 = 0.1798$) for project biogenic carbon sequestration. While the lower p-value hints at a slight downward trend, suggesting that higher cost projects might use higher sequestering materials, the relationship is too noisy to be reliable. The remaining 82.0 per cent of the variance indicates that biogenic carbon sequestration is dictated by other factors rather than project expenditure.

Figure 20: Relationship between project cost ($/m²) and carbon benefits beyond the life cycle ($kgCO_2e/m^2$) for Commercial Architecture, Education and Public Architecture projects



Finally, carbon benefits beyond the life cycle (Module D) shows no statistically reliable connection to project cost ($p = 0.1513$). While a moderate positive lean is visible ($r = 0.4046$), cost per square metre explains only 16.4 per cent of the reason ($R^2 = 0.1637$) for end-of-life circular economy metrics. This lack of significance means that building a more expensive project per square metre does not automatically ensure higher recycling or reuse potential at decommissioning.

When looked at collectively, these four datasets demonstrate that project cost ($/m²) has no statistically significant relationship with any of the carbon metrics. The predictive power of cost is consistently low, ranging from a 3.2 per cent for upfront carbon to a maximum of 18.0 per cent for biogenic sequestration, with all p-values failing to meet the standard significance threshold ($p > 0.05$). This suggests that for the projects providing carbon and cost metrics, carbon performance is entirely decoupled from project costs.

Table 17: Summary statistics for energy use data (Commercial Architecture, Education and Public Architecture projects)

	n	mean	median	min	max
Predicted energy use (kWh/m²/yr)	17	171.8	80.5	20.9	965.0
Actual energy use (kWh/m²/yr)	9	167.5	174.0	32.0	314.0

Table 17 provides the summary statistics for energy use data across the Commercial Architecture, Education and Public Architecture categories. As shown, the mean predicted energy use figure was 171.8 kWh/m²/yr and the median was 80.5 kWh/m²/yr. For actual energy use, the mean figure was 167.5 kWh/m²/yr and the median was 174.0 kWh/m²/yr. The average difference between predicted and actual energy use values was -9.9 kWh/m²/yr (i.e. the actual energy use was 9.9 kWh/m²/yr lower than the predicted energy use). This is because among projects where both predicted and actual energy use figures were provided (n=7), four projects overestimated their energy use and three underestimated it.

Figure 21: Relationship between project area (m^2) and energy use data (kWh/m^2/yr) for Commercial Architecture, Education and Public Architecture projects

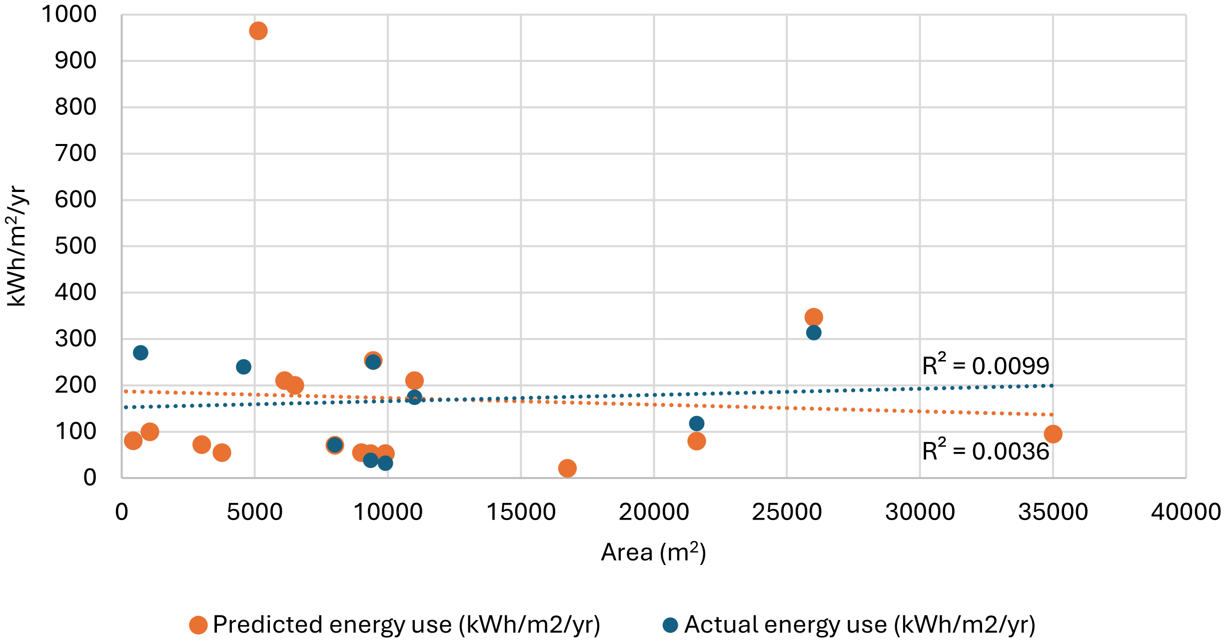


Figure 21 shows the relationship between project area (m^2) and predicted and actual energy use values (kWh/m^2/yr). The relationship between building area and predicted energy use is non-significant ($p = 0.8196$). The Pearson correlation is nearly zero ($r = -0.0598$) and building size accounts for a just 0.36 per cent of the variance in predicted energy use.

Similarly, the relationship between building area and actual energy use shows no statistical significance ($p = 0.7991$). The correlation is near zero ($r = 0.0994$) with floor area explaining just 0.99 per cent of the variance in real-world energy use. This indicates that across these projects, their physical footprints do not dictate their actual operational energy efficiency.

Figure 22: Relationship between project cost per square metre ($\$/m^2$) and energy use data ($kWh/m^2/yr$) for Commercial Architecture, Education and Public Architecture

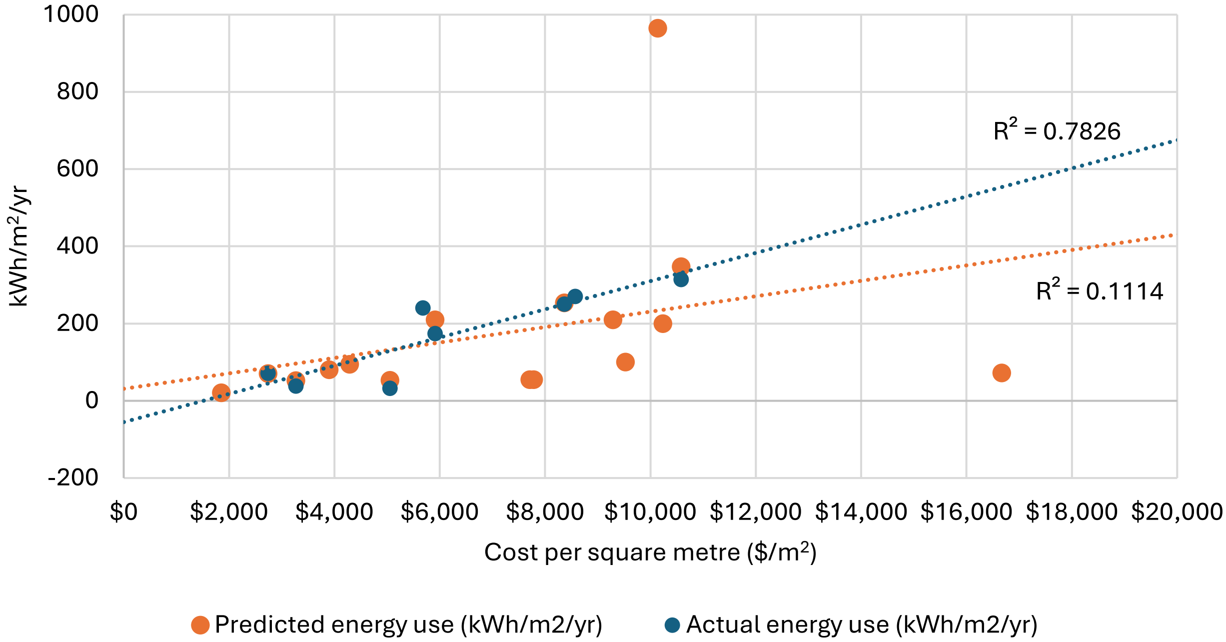


Figure 22 shows the relationship between project cost per square metre ($\$/m^2$) and predicted and actual energy use values ($kWh/m^2/yr$). The relationship between project cost ($\$/m^2$) and predicted energy use is not statistically significant ($p = 0.2065$). While a mild positive trend is visible ($r = 0.3337$), project cost per square metre explains only 11.1 per cent of the difference ($R^2 = 0.1114$) in modelled energy targets. This indicates that costs per square metre do not serve as a reliable predictor for how energy-efficient a building is expected to be on paper.

In contrast, the relationship between project cost and actual energy use is highly statistically significant ($p = 0.0035$) and has a strong positive correlation ($r = 0.8847$). Cost per square metre accounts for 78.3 per cent of the variance ($R^2 = 0.7826$) in actual energy consumption. This alignment reveals that projects with higher per square metre costs consistently result in higher energy usage in practice.

Project category cross-analysis

The following section provides a cross-analysis of the quantitative data provided by sustainability awards entrants. Following steering group advice, award categories have been aggregated into five groups: Housing / Housing – Alterations and Additions; Housing – Multi Unit; Small Project Architecture / Heritage / Hospitality / Interior Architecture; Commercial Architecture / Public Architecture / Education; and Planning and Urban Design.

Project metrics

First, project metrics are outlined by project category.

Figure 23: Project lifespan, by grouped category

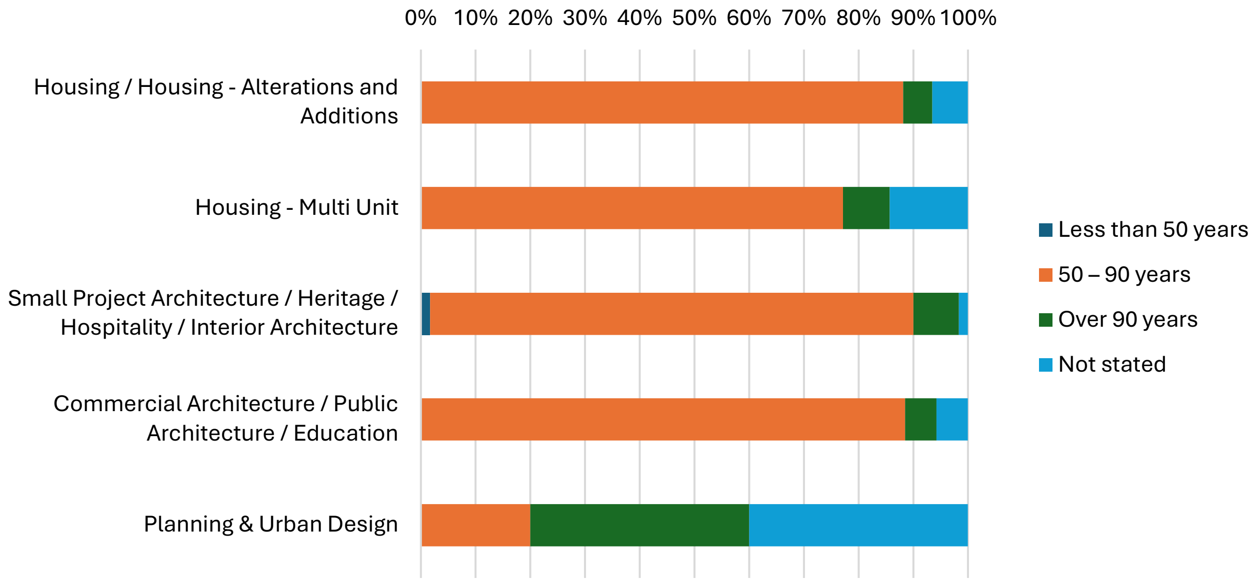


Figure 23 shows the intended project lifespan within each grouped category. As is shown, the majority of projects across all categories (typically 75-90 per cent) are designed for a 50–90 year lifespan. The only real outlier is Planning and Urban Design, with 40.0 per cent of projects intended to last over 90 years, which may reflect the longer-term nature of urban infrastructure.

Figure 24: Climate zone distribution, by grouped category

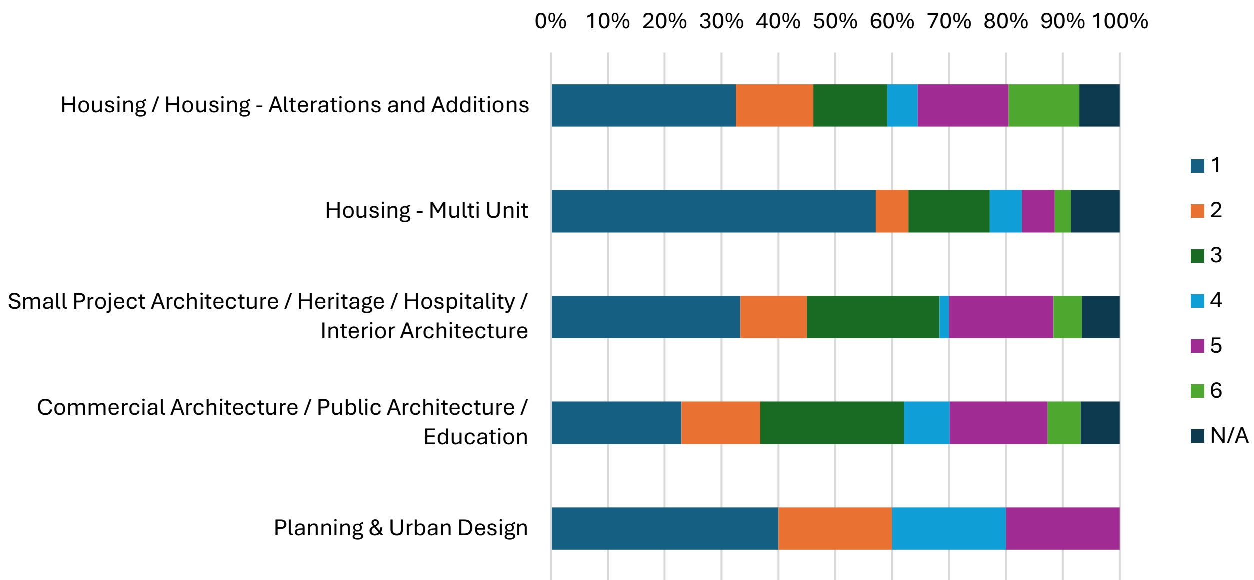


Figure 24 **Error! Reference source not found.** shows the percentage of projects within each climate zone, by grouped category. The data shows a broad distribution within most categories, however, with the exception of
Commercial Architecture / Public Architecture / Education, the largest number of projects are located in climate zone 1.

Kaitiakitanga, Protection of Papatūānuku and Ecological Systems

The following describes the quantitative responses within the Kaitiakitanga, Protection of Papatūānuku and Ecological Systems section of the sustainability awards entry form, by category.

Figure 25: Does the project protect and regenerate indigenous flora and fauna, support the site's hydrology, and improve the surrounding ecology? (by grouped category)

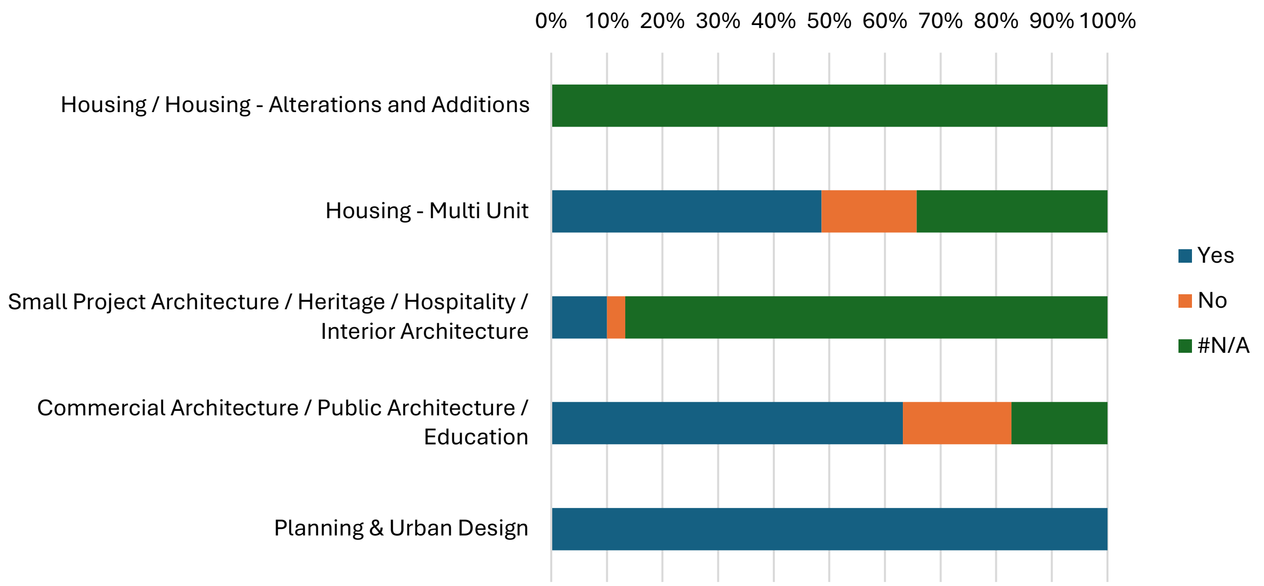


Figure 25 shows a large discrepancy between commercial/public/urban and residential architecture when considering the protection and regenerations of indigenous flora and fauna, hydrological support at the site and improvement of the surrounding ecology. Here, significant positive responses are seen among Planning and Urban Design (100.0%), Commercial Architecture / Public Architecture / Education (63.2%) and Housing – Multi Unit (48.6%). In contrast, 100 per cent of projects withing the categories of Housing / Housing – Alterations and Additions and 86.7 per cent within Small Project Architecture / Heritage / Hospitality / Interior Architecture were provided with "not applicable" responses. While it is difficult to know whether ecological protection and regeneration were truly "not applicable" for any projects within these categories, or the "no" response should have instead been selected, that "yes" was not selected for the majority of projects suggests that this is not a priority within these architectural categories.

Figure 26: Were any existing elements (e.g. building fabric or structure, materials, infrastructure, trees and soil) retained and adapted for the project? (by grouped category)

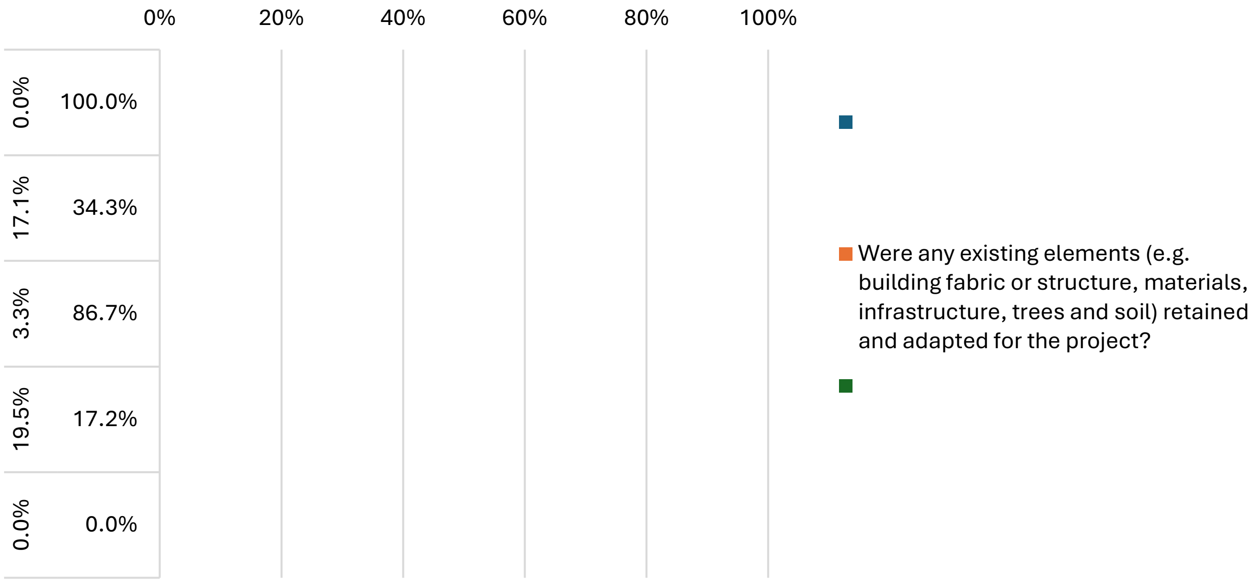
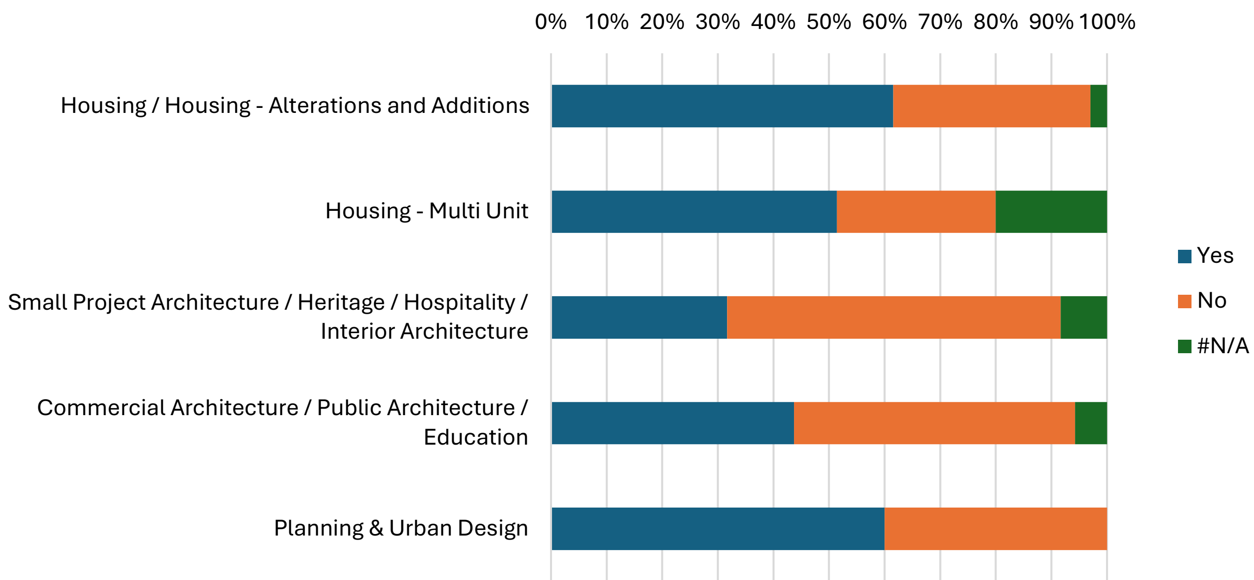


Figure 26 shows, by grouped category, the percentage of projects where elements of the existing site, such as building structures or materials and trees or soil, were retained and adapted for the project. As can be seen, reuse and adaptation was relatively high across all grouped categories, with over 50 per cent of projects in all categories but Housing – Multi Unit selecting a "yes" response. Reuse and adaptation was highest among Small Project Architecture, Heritage, Hospitality and Interior Architecture (80.0%) and Planning and Urban Design (80%) projects - categories where projects are often redesigns or updates to existing architecture or infrastructure. Housing and Housing – Alterations and Additions (70%) were similarly likely to include such practices.

Figure 27: Is stormwater, wastewater and/or drinking water captured and managed on site? (by grouped category)



The on-site capture and management of stormwater, wastewater and/or drinking water is shown in Figure 27. While water management does not appear to be a significant feature of projects within any one category, Figure 27 shows it to be most common among projects within the Housing / Housing – Alterations and Additions (66.4%) and Planning and Urban Design (60.0%) categories; perhaps due to water management requirements set out by the local authorities commissioning projects, as well as the potential for residential projects entered into the awards to commonly be holiday homes located in more rural locations.

Enhancing the Mauri and Wellbeing of People and Culture

The following analysis the awards entrant responses within the Enhancing the Mauri and Wellbeing of People and Culture section of the entry form, by category.

Figure 28: Was a cultural assessment done for the development of the site? (by grouped category)

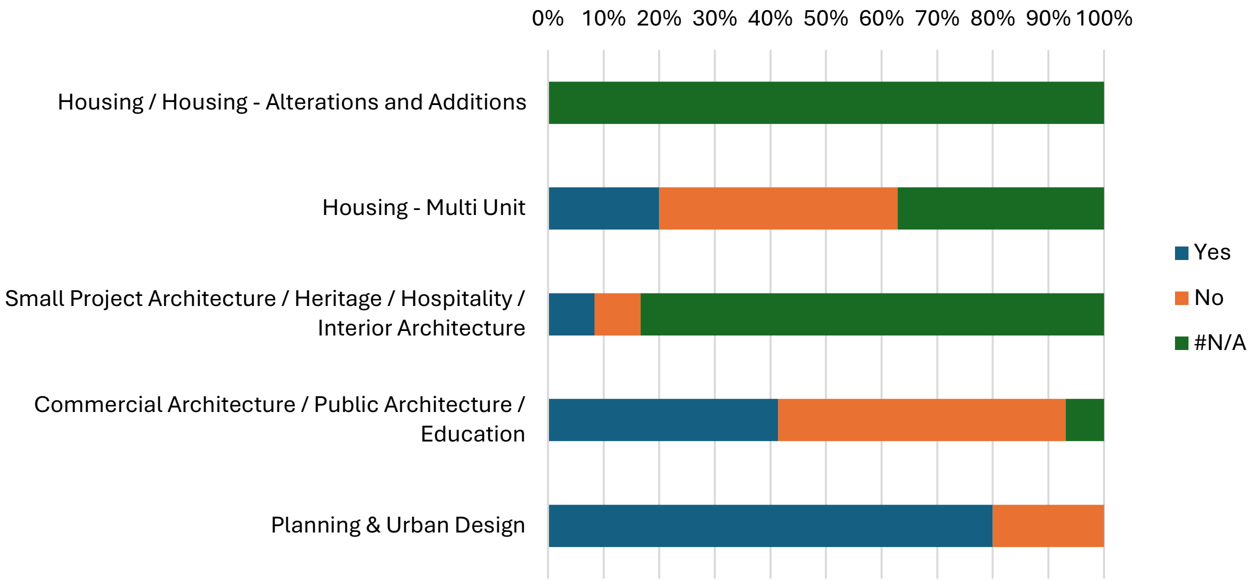


Figure 28 shows the percentage of projects within each grouped category where a cultural assessment was completed. As shown, there is a significant divide between public and private projects, with the former being more likely to undertake a cultural assessment and the latter less likely. Thus, considerably more projects within the Planning and Urban Design category (80.0%) are shown to have undertook a cultural assessment, followed by 41.4 per cent of Commercial Architecture / Public Architecture / Education projects. In contrast, a cultural assessment was not considered to be applicable for 100 per cent of Housing / Housing – Alterations and Additions and just 83.3 per cent of projects within the category Small Project Architecture / Heritage / Hospitality / Interior Architecture. These contrasting findings may be the outcome of development triggers such as iwi consultation as a condition of funding or specific resource consent constraints.

Figure 29: Have walking, cycling and mixed mobility been prioritised over motorised modes of transport? (by grouped category)

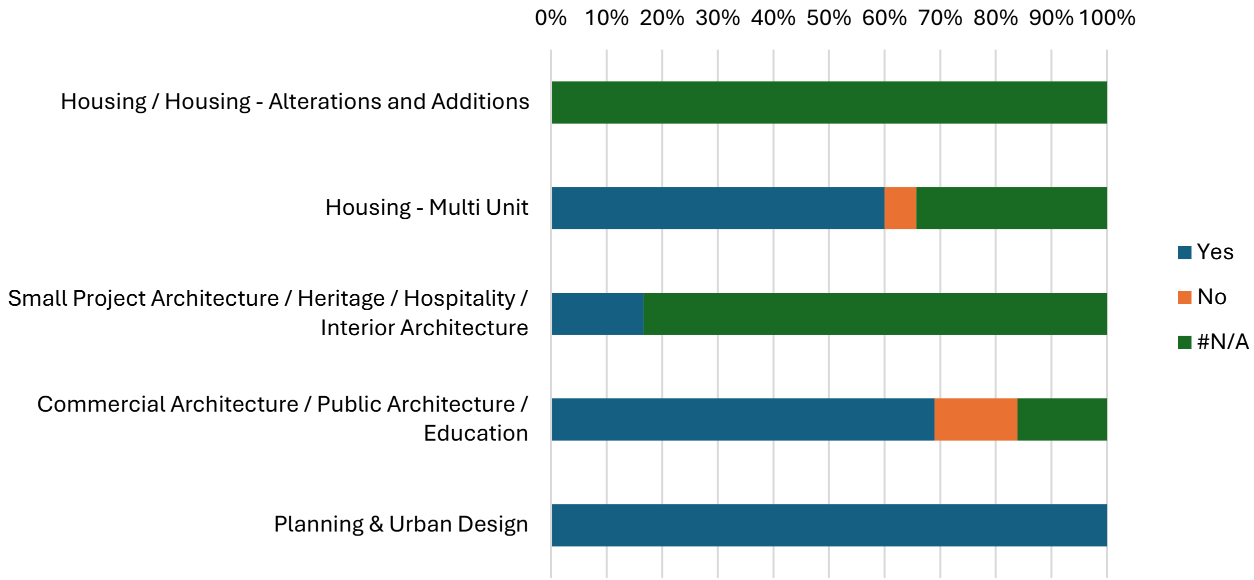
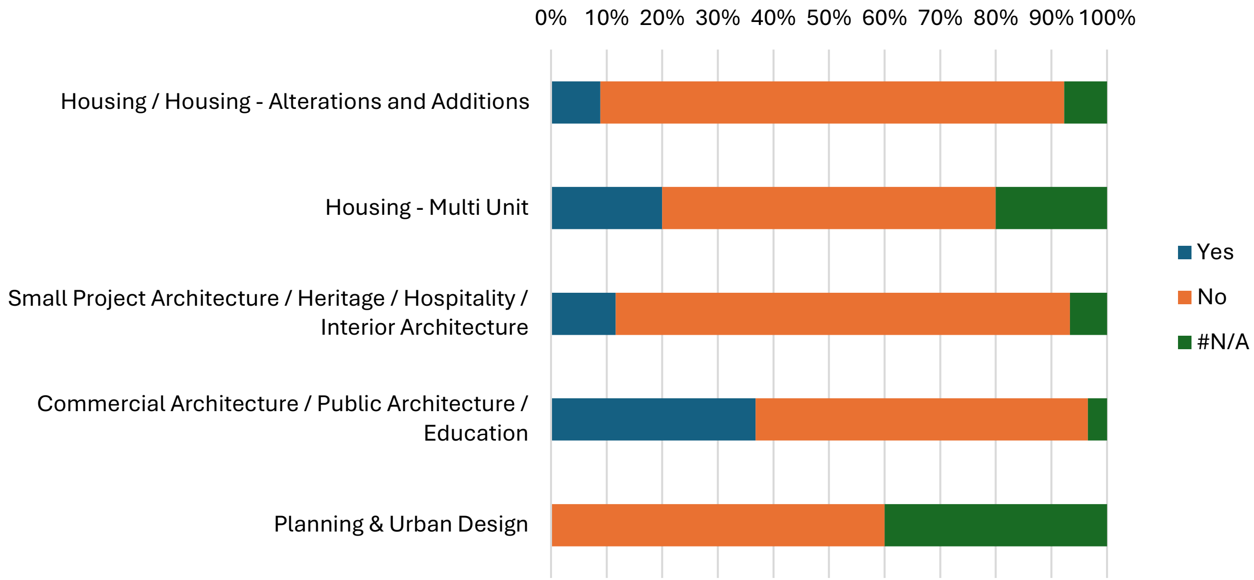


Figure 29 shows the percentage of projects where walking, cycling and mixed mobility have been prioritised over motorised modes of transport, by grouped category. As can be seen, awards entrants working on residential and smaller projects typically do not consider the prioritisation of walking, cycling and mixed mobilities. For example, 100.0 per cent of projects within Housing and Housing – Alterations / Additions stated that such transport concerns were not applicable. In contrast, alternatives to car dependence have been considered for larger projects, those likely to be located in urban centres and those that are public facing. As can be seen, walking, cycling and mixed mobilities have been prioritised for 100.0 per cent of Planning and Urban Design projects and 69.0 per cent of Commercial Architecture / Public Architecture / Education projects. Interestingly, alternative mobilities were prioritised among 60.0 per cent of Housing – Multi Unit projects, suggesting a shift in the way architects and developers are considering urban habitation.

The Whakapapa of Building Materials and Processes

The following describes the quantitative responses within the Whakapapa of Building Materials and Processes section of the sustainability awards entry form, by grouped category.

Figure 30: Has a Life Cycle Assessment (LCA) been done? (by grouped category)



As was shown earlier in this report, just 17.1 per cent of projects entered into the awards had completed an LCA. Breaking this into grouped categories, Figure 30 shows that projects most likely to have undertaken an LCA were in Commercial Architecture / Public Architecture / Education (36.8%) and Housing – Multi Unit (20.0%). Despite this, across all categories, the majority answer was that an LCA was not completed.

Figure 31: Were circular economy principles implemented and construction waste minimisation specified? (by grouped category)

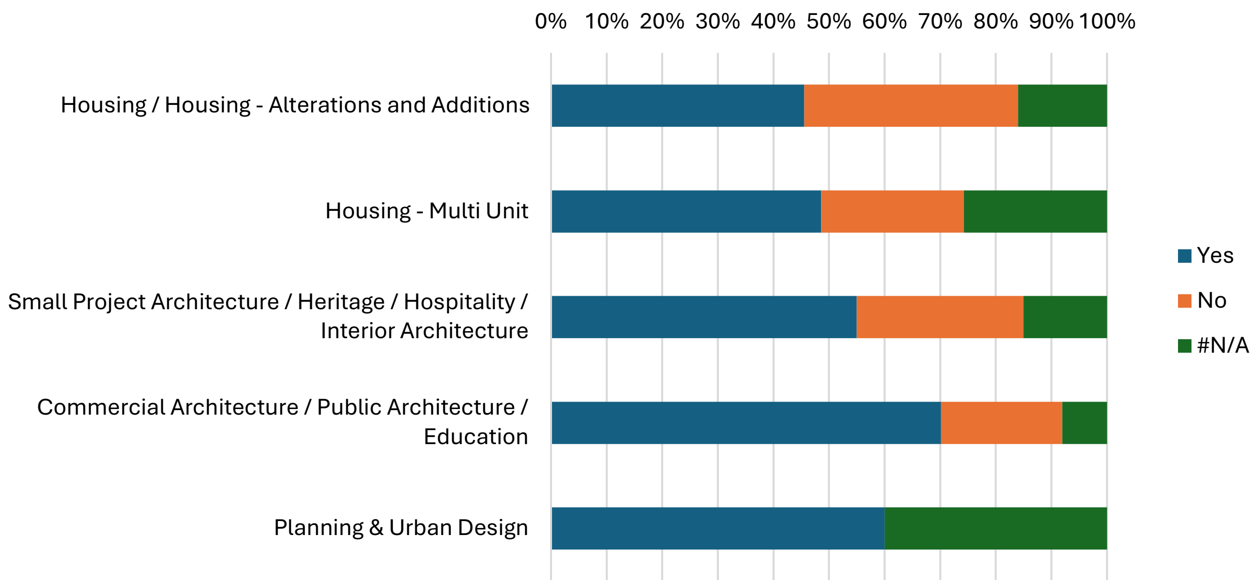
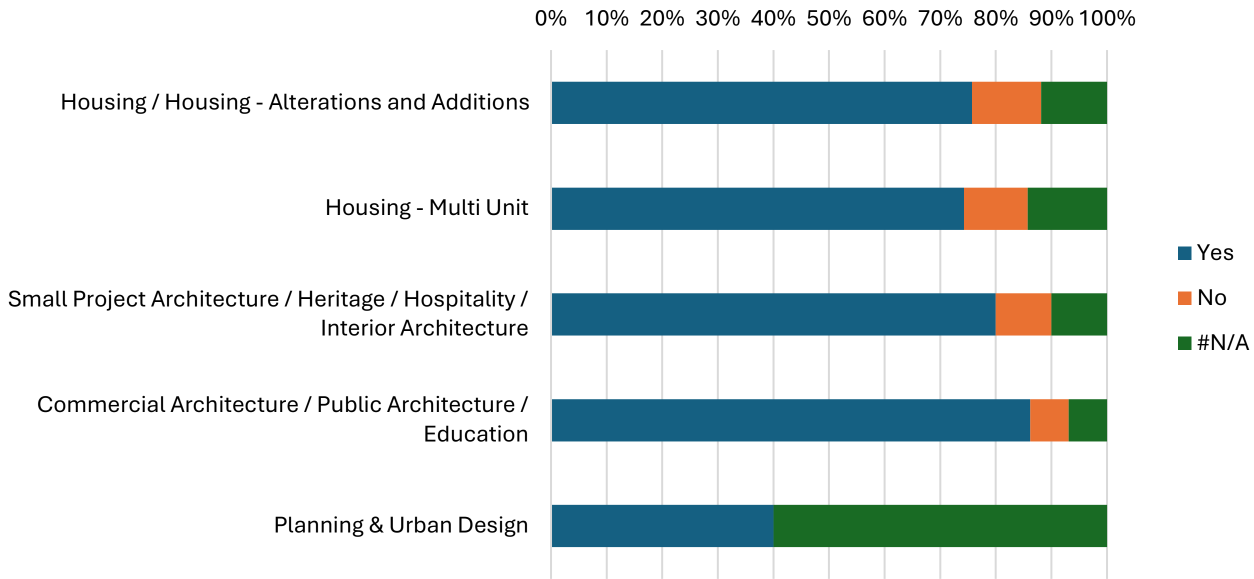


Figure 31 shows the percentage of projects in each category where circular economy principles implemented, and construction waste minimisation was specified. As can be seen, larger, urban and public projects are more likely to have implemented circular economy principles. For example, implementation was affirmed by 70.1 per cent of Commercial Architecture / Public Architecture / Education projects and 60.0 per cent of Public and Urban Design projects. This may be because large-scale construction contracts may require waste minimisation strategies. However, small project categories were also more likely to state that they did implement circular economy principles and waste minimisation, with 55.0 per cent of Small Project Architecture / Heritage / Hospitality / Interior Architecture projects confirming such strategies, as well as 48.6 per cent of Housing – Multi Unit projects and 45.6 per cent of Housing / Housing – Alterations and Additions projects.

Figure 32: Have non-toxic materials selections been made to improve indoor air quality and reduce off-gassing (VOCs)? (by grouped category)

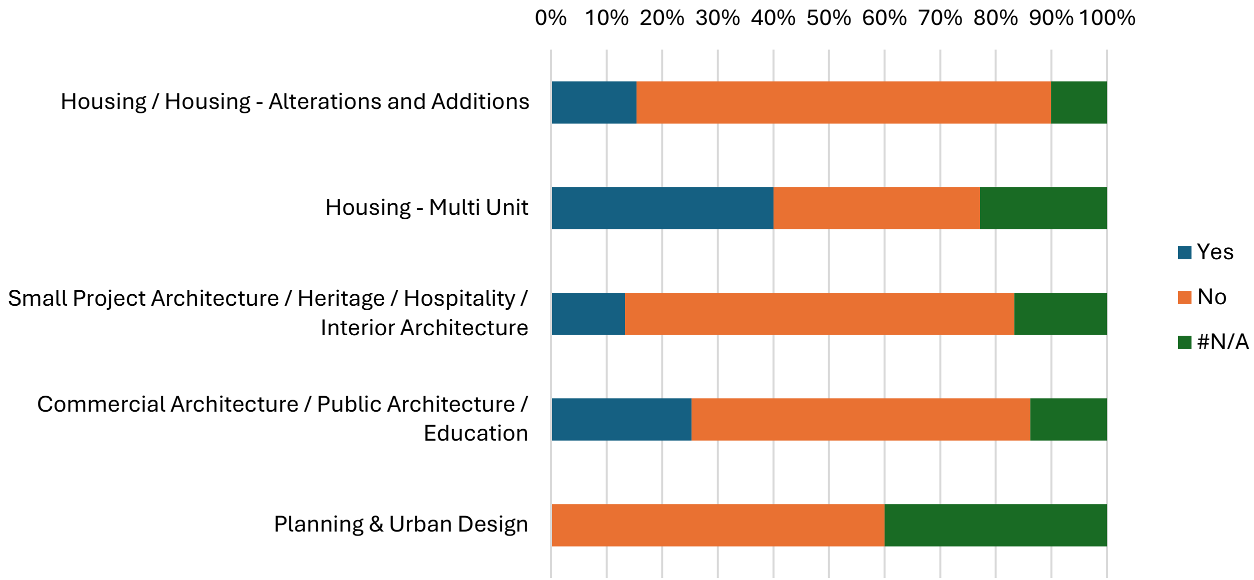


Noted above, 78.4 per cent of all projects had made use of non-toxic materials to improve indoor air quality and reduce off-gassing. As Figure 32 shows, this was high across all projects categories, with 86.2 per cent of Commercial Architecture / Public Architecture / Education projects, and 80.0 per cent of Small Project Architecture / Heritage / Hospitality / Interior Architecture projects being stated as making such material selections. Even the lowest figure remains relatively high compared with other sustainability metrics: 40.0 per cent of Planning and Urban Design projects confirmed the use of non-toxic materials. This is the most consistently high sustainability metric across all categories.

Measurements and Pūnaha Pungao Energy Systems

The following describes the quantitative responses within the Measurements and Pūnaha Pungao Energy Systems section of the sustainability awards entry form, by project category.

Figure 33: Were benchmarking tools, certification and/or relevant standards used? (by grouped category)



As noted earlier, just 19.7 per cent of projects had used a benchmarking tool, certification and/or relevant standards. Breaking this down by grouped category, Figure 33 shows that implementation of these tools and standards remains low across all project categories, with the highest rate of implementation being among Housing – Multi Unit projects (40.0%), followed by Commercial Architecture / Public Architecture / Education (25.3%). For those projects that did implement a tool, certification or standard, this again may be due to expectations built into construction contracts for larger or public projects. With low numbers across all categories, it is not useful to dig deeper into which certification systems were used within grouped categories. However, it may be worth noting that three of the four category groups where at least one project did specify a certification system, “Not stated” was the most common answer.

Figure 34: Was the project thermally modelled? (by grouped category)

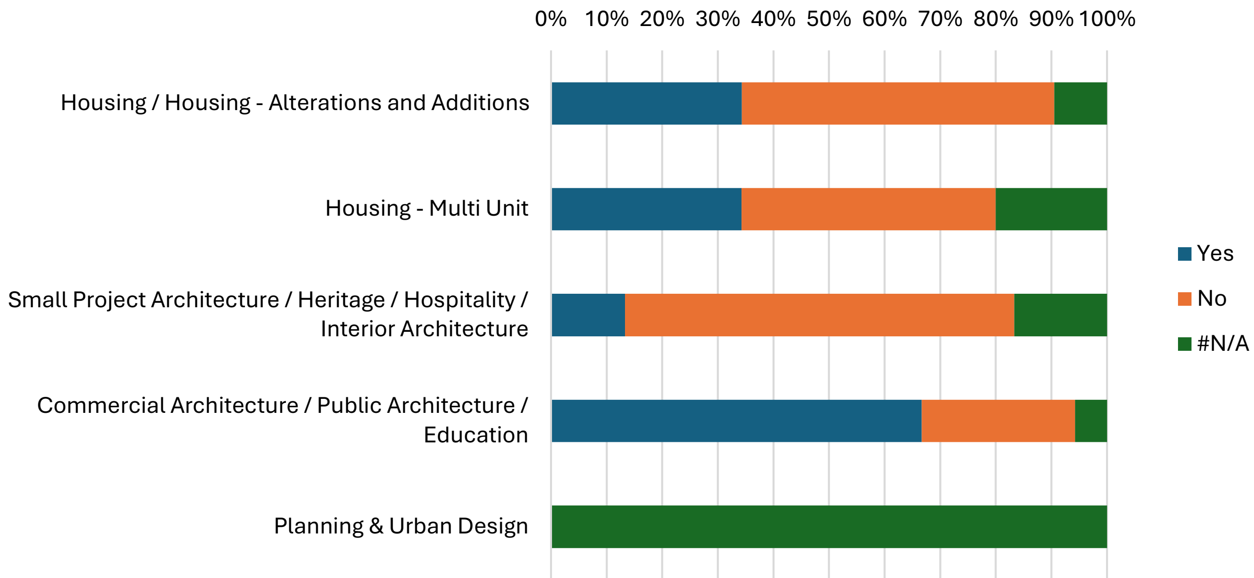


Figure 34 shows the percentage of projects within grouped category that were thermally modelled. As can be seen, thermal modelling was most commonly undertaken within Commercial Architecture / Public Architecture / Education (66.7%) projects. Modelling was less likely among Planning and Urban Design (0.0%), and very unlikely among Small Project Architecture / Heritage / Hospitality / Interior Architecture projects (13.3%). This suggests that high occupancy and public buildings are more likely to be modelled, while low occupancy, private buildings are less likely to be modelled.

Figure 35: Is there any on-site energy generation or is the project 'net zero' for operational energy use, utilizing renewable energy sources (e.g. PV, wind) to minimize its carbon footprint? (by category)

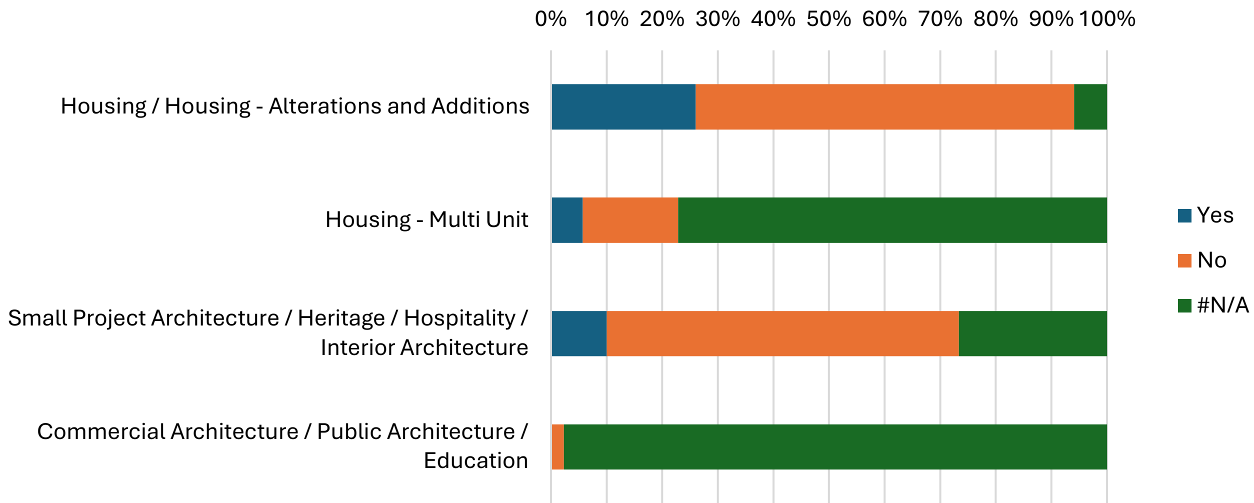
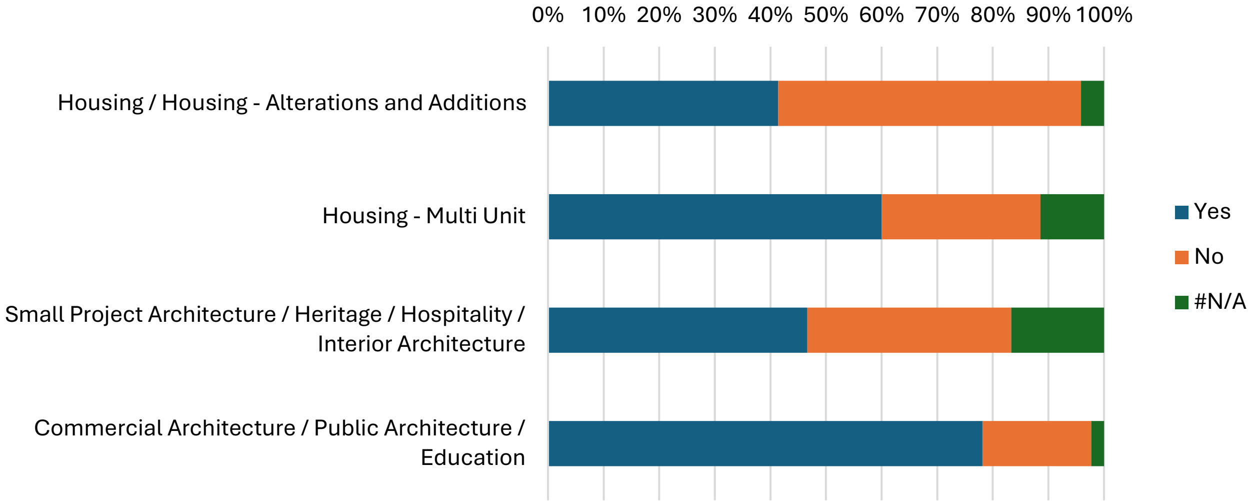


Figure 36 shows that on-site energy generation, use of renewable energy and/or net zero operational energy use is significantly low across grouped categories[8]. The highest rate of uptake is among residential projects in Housing / Housing – Alterations and Additions (26.0%). This may suggest that as the size of a project increases, implementation of renewable energy solutions becomes impractical or overly expensive.

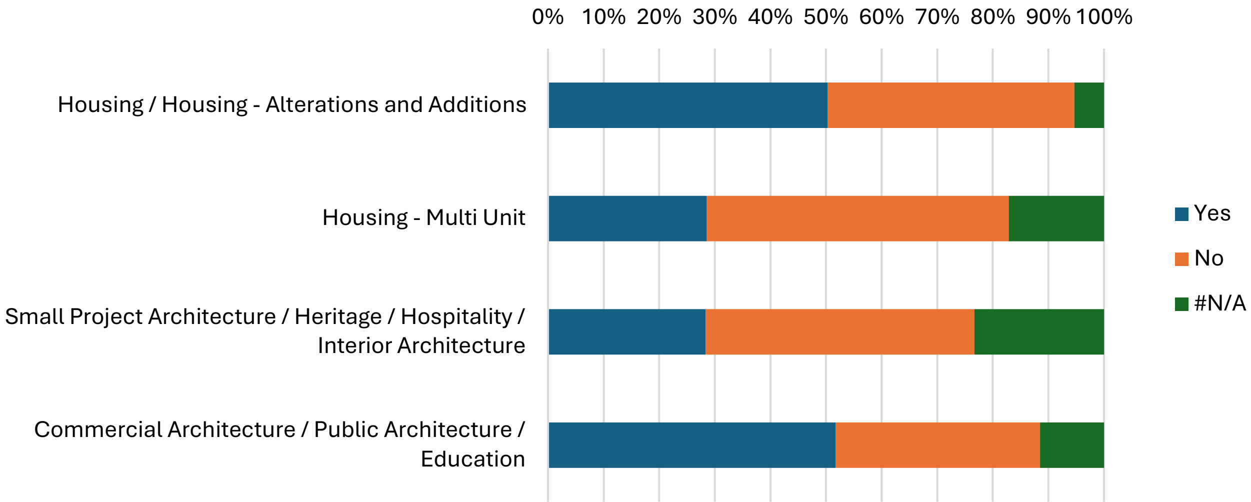
[8] This and the following questions were not answered by any Planning and Urban Design project entrants. The category has been removed from the analysis.

Figure 36: Is the project 100% electric? (by grouped category)



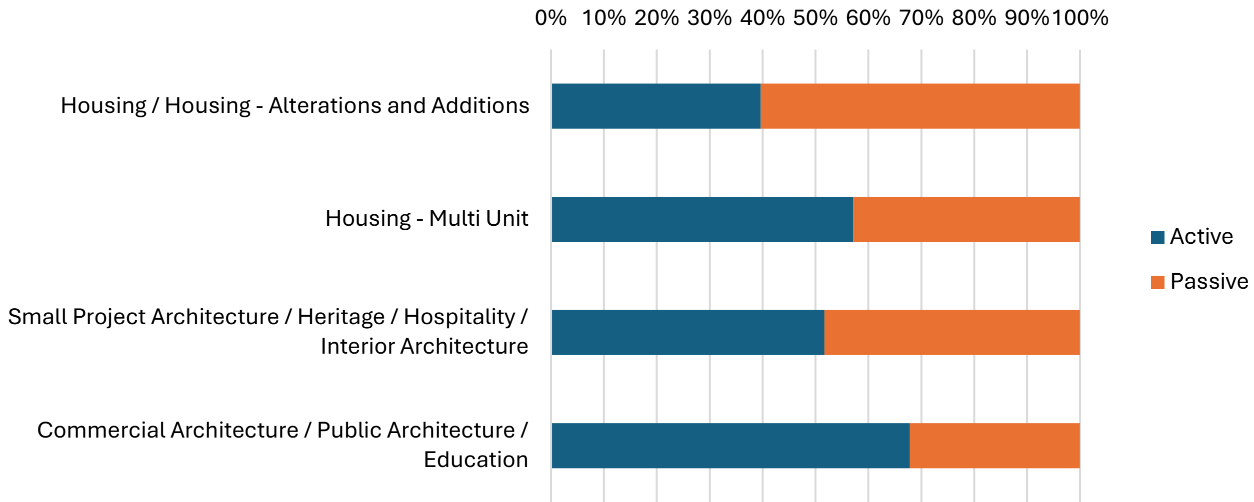
Entrants were asked if their projects were fully electric (Figure 36). Despite high renewable uptake among residential projects, Commercial Architecture / Public Architecture / Education projects were the most likely to be 100 per cent electric (78.2%). It is likely that categories with fewer fully electric projects, such as Housing / Housing – Alterations and Additions (41.4%) still rely on alternative energy sources like natural gas for activities such as cooking.

Figure 37: Was airtightness a consideration for this project? (by grouped category)



Across two of the four grouped categories shown above, airtightness was a consideration for less than 50 per cent of projects (Figure 37). Only within Housing / Housing – Alterations and Additions (50.3%) and Commercial Architecture / Public Architecture / Education (51.7%) categories did more than half of the projects consider the airtightness of their structures. Despite this, it appears that (except for Housing / Housing – Alterations and Additions projects) considerations around airtightness tend to once again be more common among projects that serve public interests or where larger numbers of people may congregate.

Figure 38: Were active or passive ventilation strategies used? (by grouped category)



Entrants were asked whether their projects used active or passive ventilation strategies. Figure 38 shows the results by grouped category. As can be seen, higher occupancy spaces and those with potentially larger open-plan floor areas tend to use active strategies, while smaller spaces default to passive strategies. For example, higher implementation of active strategies area seen among categories such as Commercial Architecture / Public Architecture / Education (67.8%), and to a lesser extent, Housing – Multi Unit (57.1%).

Figure 39: Were energy efficient fittings used for space heating and/or cooling and/or hot water heating? (by grouped category)

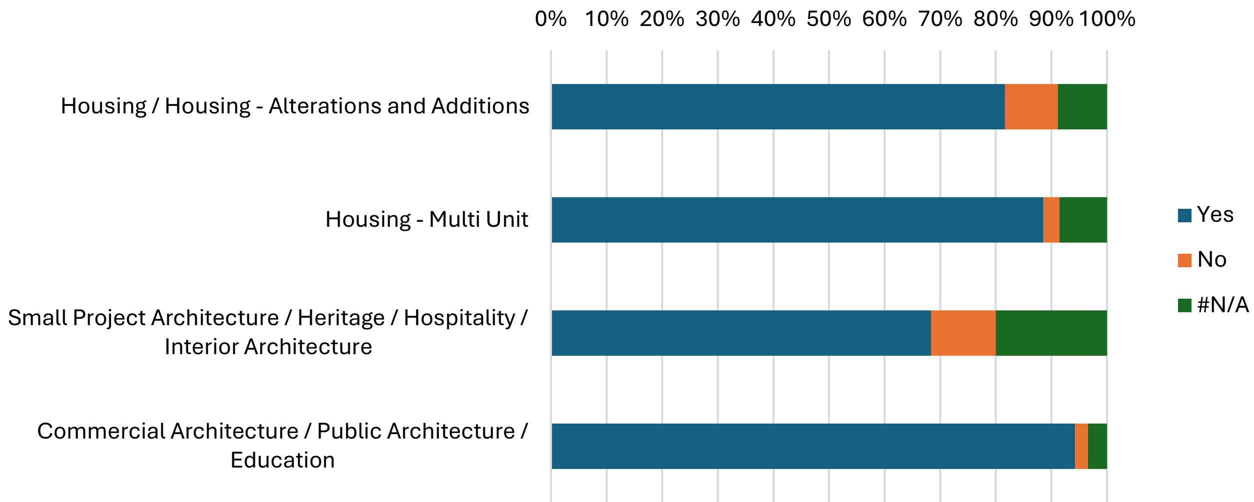


Figure 39 shows the use of energy efficient fittings for space heating and cooling, and hot water heating. Over 65 per cent of projects in all grouped categories implemented energy efficient fittings. While the affirmative response is high across the board, standout categories include Commercial Architecture / Public Architecture / Education, with 94.3 per cent of all projects within this grouped category noting the use of energy efficient fittings. Of all sustainable energy systems considered as part of the awards structure, the use of energy efficient fittings is the most common across all projects.

Figure 40: Did you calculate the predicted heat demand or heat load for this project? (by grouped category)

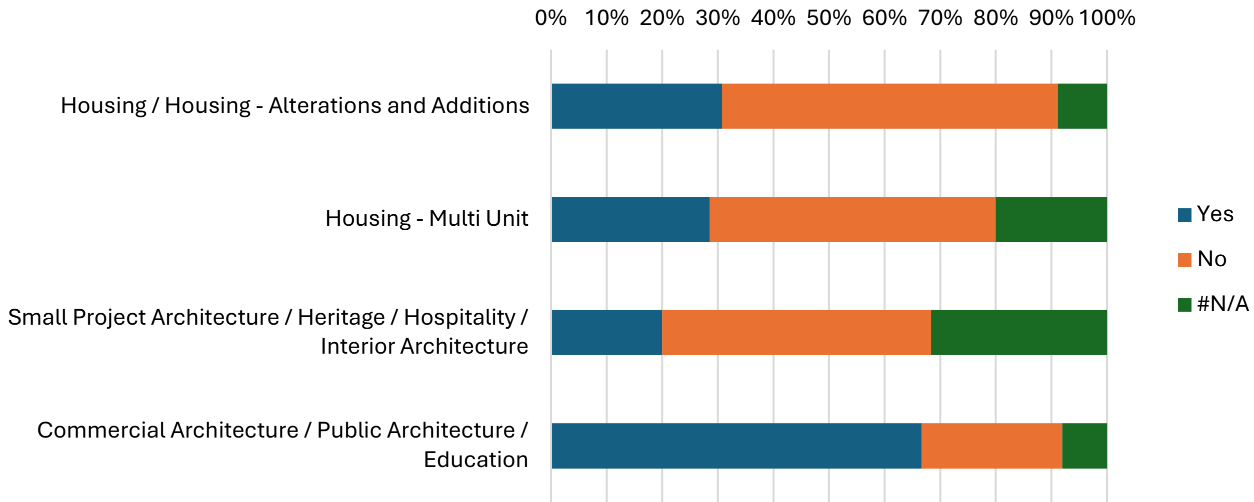


Figure 41: Did you calculate the predicted cooling demand or cooling load for this project? (by grouped category)

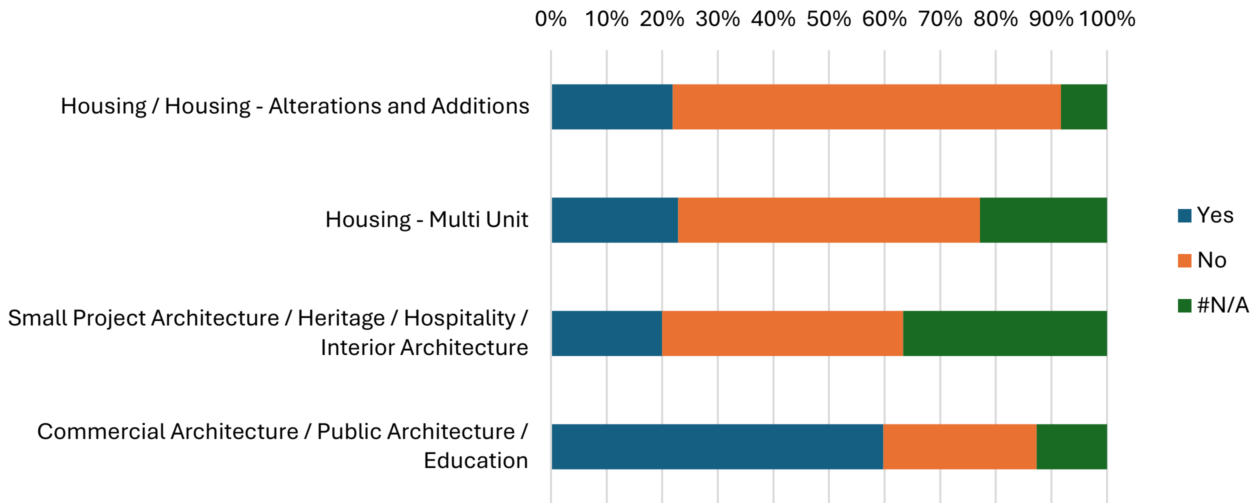
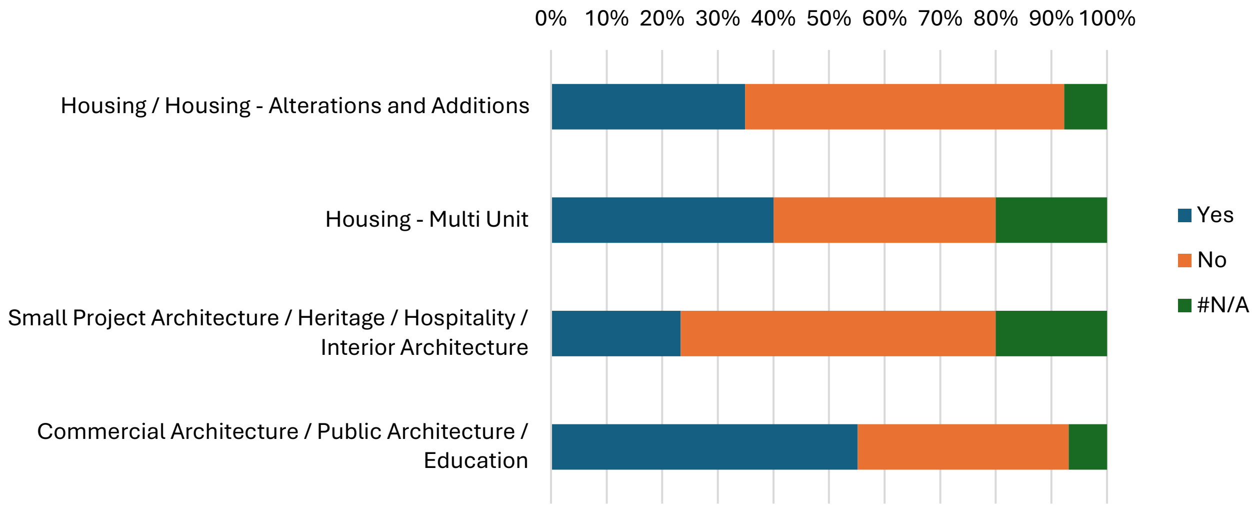


Figure 40 and Figure 41 show whether predicted heat and cooling demand or load were calculated for projects, by grouped category. As can be seen, there is little difference between the two charts, meaning that those entrants who calculated predicted cooling demand or load were very likely to have calculated predicted heating demand or load (or vice-versa). As with the above, such complex calculations are mostly undertaken for larger projects such as those within Commercial Architecture / Public Architecture / Education (66.7% heating; 59.8% cooling). These figures, however, may still be considered relatively low and even fewer projects within the remaining categories have made heating and cooling calculations.

Interestingly, contrasting Figure 40 and Figure 41 with Figure 34 finds a correlation between thermal modelling and heating/cooling demand/load calculations. For example, within the Commercial Architecture / Public Architecture / Education grouped category, 66.7 per cent of projects conducted thermal modelling, 66.7 per cent made heating calculations and 59.8 per cent made cooling calculations. Conversely, within the Small Project Architecture / Heritage / Hospitality / Interior Architecture grouped category, just 13.3 per cent of projects conducted thermal modelling, while 20.0 per cent made both heating and cooling. This suggests that the modelling and calculations were undertaken as part of the same process.

Figure 42: Was potable water use estimated, and were water saving initiatives employed in this project? (by grouped category)



The final question asks entrants whether their project estimated potable water use and whether water saving initiatives were employed (Figure 42). As shown, in only one grouped category did more than 50 per cent of entrants confirm that their project included such an initiative: Commercial Architecture / Public Architecture / Education (55.2%). In general, it appears that water use estimation and water saving initiatives were not a priority for entrants' projects.

Notes

Box and whisker graphs

A box and whisker plot is used to show the "shape" of a dataset. Instead of plotting every single value, it summarises the data into five key numbers, allowing you to see at a glance where most of the values fall and how much they vary.

To read the graph, look at these five specific points from left to right:

- The whiskers: the lines extending from the box reach out to the minimum and maximum values. These show the total spread (range) of the data.

- The box: the central box represents the middle 50 per cent of the data. The "start" of the box is the 1st Quartile (Q1), and the "end" is the 3rd Quartile (Q3). If the box is short, the data is consistent; if it's long, the data is more varied.

- The median: the line inside the box marks the Median, or the exact middle value.

- Outliers: if you see individual dots or asterisks sitting alone past the whiskers, these are outliers. They represent unusual data points that fall far outside the expected range.

Appendix A

Question responses, award winners vs non-winners. Questions specify if the question was answered in the affirmative or if the requisite calculation was undertaken.

Question	Winners	Non-winners	Difference
Does the project protect and regenerate indigenous flora and fauna, support the site's hydrology, and improve the surrounding ecology? (yes)	25.0%	21.8%	3.2%
Were any existing elements (e.g. building fabric or structure, materials, infrastructure, trees and soil) retained and adapted for the project? (yes)	67.1%	43.5%	23.6%
Is stormwater, wastewater and/or drinking water captured and managed on site? (yes)	54.3%	35.2%	19.1%
Was a cultural assessment done for the development of the site? (yes)	15.0%	9.7%	5.3%
Have walking, cycling and mixed mobility been prioritised over motorised modes of transport? (yes)	26.4%	17.1%	9.3%
Has a Life Cycle Assessment (LCA) been done? (yes)	18.6%	12.0%	6.5%
What is the upfront embodied carbon (Modules A1-A5) intensity of the project? (kgCO2e/m2) (calculated)	20.7%	13.9%	6.8%
What is the whole-of-life embodied carbon intensity (Modules A, B, C) of the project? (kgCO2e/m2)? (calculated)	9.3%	7.9%	1.4%
What is the total sequestered biogenic carbon of the project, if calculated? (kgCO2e/m2) (calculated)	11.4%	8.8%	2.6%
Are there carbon benefits beyond the life cycle (module D)? (yes)	10.7%	7.4%	3.3%
Were circular economy principles implemented and construction waste minimisation specified? (yes)	55.7%	36.1%	19.6%
Have non-toxic materials selections been made to improve indoor air quality and reduce off-gassing (VOCs)? (yes)	82.9%	53.7%	29.2%
Were benchmarking tools, certification and/or relevant standards used? (yes)	22.1%	14.4%	7.8%
What is the predicted energy use (kWh/m2/yr) (calculated)	14.3%	18.6%	-4.3%
What is the actual energy use (kWh/m2/yr) (calculated)	7.9%	10.0%	-2.1%
Was the project thermally modelled? (yes)	41.4%	26.9%	14.6%
Is there any on-site energy generation or is the project 'net zero' for operational energy use, utilizing renewable energy sources (e.g. PV, wind) to minimize its carbon footprint? (yes)	13.6%	8.8%	4.8%
Is the project 100% electric? (yes)	59.3%	38.4%	20.9%
Was airtightness a consideration for this project? (yes)	40.7%	26.4%	14.3%
Were energy efficient fittings used for space heating and/or cooling and/or hot water heating? (yes)	84.3%	54.6%	29.7%
Is the project 'net zero' for operational energy use, utilizing renewable energy sources (e.g. PV, wind) to minimize its carbon footprint? (yes)	8.6%	5.6%	3.0%
Did you calculate the predicted heat demand or heat load for this project? (yes)	37.1%	24.1%	13.1%
Did you calculate the predicted cooling demand or cooling load for this project? (yes)	34.3%	22.2%	12.1%

Was potable water use estimated, and were water saving initiatives employed in this project? (yes)	41.4%	26.9%	14.6%

Appendix B

LCA system response raw data.

LCA system	n	%
BRANZ LCAQuick	10	16.4%
DesignLCA	1	1.6%
eTool Software	6	9.8%
Green Star Embodied Carbon Calculator	1	1.6%
HECC (Homestar Embodied Carbon Calculator)	6	9.8%
LCA Link	1	1.6%
LETI	1	1.6%
Not stated	8	13.1%
NZGBC Embodied Carbon Calculator	3	4.9%
One Click LCA	18	29.5%
Proprietary software	2	3.3%
The Carbonator	1	1.6%
WSP Carb0nise	3	4.9%