Te Kāhui Whaihanga
New Zealand Institute
of Architects

Energy Modelling Practices for Design and Compliance

Survey Analysis Report

May 2025

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Executive Summary

This report reviews energy modelling practices among Te Kāhui Whaihanga New Zealand Institute of Architects members, using survey data to identify trends, barriers, and opportunities in performance-based design and thermal compliance.

With New Zealand targeting Net-Zero carbon by 2050 and ongoing updates to Building Code Clause H1, the findings highlight where upskilling is needed to support industry transformation. The survey explores how architects demonstrate thermal compliance, the tools they use, how they assess energy and comfort outcomes, and their in-house expertise.

The insights aim to inform policy, improve tools and services, close knowledge gaps, and guide targeted support for our members to drive innovation and enable our members to achieve better design decisions for improved building performance and occupant wellbeing.

Summary of Key Findings

1. Small Practices Dominate the Field

A majority of respondents (59%) come from small practices with five or fewer staff, reflecting the broader membership profile. Mid-sized practices (6–20 staff) account for 24%, while larger ones (21+ staff) make up only 17% of the sample. This suggests that support for energy modelling must be accessible and scalable to suit smaller teams with limited resources.

2. Compliance Pathways Still Rely on Traditional Methods

The most commonly used method for demonstrating compliance is the Calculation Method (56% residential, 48% non-residential), followed by the Schedule Method (28% residential, 25% non-residential), with the Modelling Method used by only 26% (residential and non-residential) of respondents. These figures suggest an opportunity to expand the adoption of performance-based modelling to align with international best practice.

3. Energy Modelling Adoption is Still Limited

Only 38% of respondents report using energy modelling in the design process. While some firms have in-house capabilities or use hybrid approaches, some continue to rely on external consultants or simpler compliance tools. Tool preference varies: PHPP (Passive House Planning Package) and ECCHO (Energy and Carbon Calculator for Homes) dominate in residential work, while Speckel and Design Navigator are more common in early-stage design. Larger practices are generally more well equipped to undertake energy modelling in the design process.

4. Need for Energy Modelling Upskilling in the Profession

The survey shows that most respondents are in the early stages of their energy modelling journey, with 63% reporting minimal or no experience. While 24% have moderate experience, only 13% consider themselves highly experienced or experts, highlighting a skills gap in energy modelling across the profession.

5. Performance Risk Assessment is Rare

Detailed methods for assessing thermal bridging, heat loss and moisture risk are underused. Only 30–33% of respondents report applying these techniques. This points to a wider gap in the integration of whole-of-building performance thinking into the design process, with potential consequences for building durability and occupant health.

Conclusions

The findings underscore that while awareness of energy modelling is growing, actual adoption remains low, particularly among the small and mid-sized practices that constitute the majority of NZIA membership. There is a clear need for upskilling and targeted support to enable wider uptake. The gap in performance-based compliance has implications for long-term building quality, occupant comfort and health, energy costs, and the country's target to reach Net-Zero Carbon by 2050.

1. Introduction and Context

In New Zealand, energy modelling is not a mandatory compliance pathway for new building projects; prescriptive and calculation methods are also accepted. However, the drive toward energy-efficient and low-carbon design is gaining momentum.

Clause H1 now requires energy performance verification only for specific projects — namely, those using the Verification Method for compliance or where an Alternative Solution is proposed that relies on energy modelling. It is not a universal requirement for all building projects under the Code.

A range of tools are in use, including ECCHO and PHPP, among others. Despite this, adoption of energy modelling is hindered by several barriers, such as limited training and uncertainty around ROI (return on investment).

A significant challenge within the sector is the misunderstanding between compliance outcomes and actual building performance for occupants. H1 energy modelling, primarily used for code compliance, is simplified and indicative as it does not reliably predict real energy use and often overlooks critical thermal elements. Consequently, buildings that meet compliance standards on paper frequently under-perform in practice. In contrast, predictive energy modelling offers more accurate forecasts of real-world performance. The current compliance-driven approach can lead to suboptimal design decisions and reduced building quality. To bridge this gap, the industry should be making a shift towards predictive modelling, supported by enhanced education and training, to deliver better occupant outcomes.

Internationally, energy modelling is a standard requirement for new residential buildings in countries like the United Kingdom and Australia. Approximately 90% of new Australian homes undergo energy assessment under the Nationwide House Energy Rating Scheme (NatHERS), which enforces minimum thermal performance standards aligned with the National Construction Code. This integration ensures nearly all new residential builds incorporate energy modelling in the regulatory process.

Although energy modelling adds some upfront design costs, research shows that improving energy efficiency through design optimisation typically has minimal impact on overall construction costs. One notable study in Australia found that raising energy ratings from 5.9 to 7.1 stars increased costs by only about $37 on average, with most designs remaining within $500 of typical build costs.[1]

In the United Kingdom, energy modelling is legally required for all new residential developments and is central to compliance with current (Part L) and forthcoming building regulations. The launch of the Home Energy Model in 2025 will enhance assessment accuracy and detail. For existing homes, mandatory energy modelling applies to specific projects and major renovations.

The primary financial benefit of energy modelling lies in long-term operational savings. By enabling optimisation of building orientation, insulation, ventilation, and materials, energy modelling results in homes that are more energy-efficient to heat and cool, thereby reducing occupants' ongoing energy bills.[2]

Modelling can also save construction and material costs, as it ensures only the required amount of insulation is used, and in the right places — not too much, not too little. It can utilise the performance savings from increased airtightness to reduce the amount of insulation required, and can also drive simpler and more optimised design

In its recent H1 submission, the Institute called for urgent upgrades to design standards to address overheating and better manage internal moisture alongside Clause E3.

Key recommendations included:

- Removing the schedule method (except for minor buildings) and phasing out the calculation method for multi-unit housing
- Mandating modelling for townhouses and apartments as a first step; and stand-alone houses and commercial projects as a second step
- Making predictive energy modelling the default and removing the reference building approach
- Introducing absolute performance targets (e.g., kWh/m²/year)

1 Identifying Cost Savings through Building Redesign for Achieving Residential Building Energy Efficiency Standards: Part Two, Sustainability House, Department of Climate Change and Energy Efficiency, June 2012

2 Cost Benefits of Net-Zero Energy Homes in Australia, Moncef Krarti and Ali Karrech, 15 April 2024

- Standardising software tools across the industry
- Upskilling architects in predictive modelling

The Institute's current survey explores how members use energy modelling, demonstrate compliance, and assess performance and comfort. These insights will directly support advocacy for healthier, more energy-efficient buildings through improved standards and design practices.

2. Survey Methodology and Practice Profile

2.1 Survey Overview and Methodology

The Energy Modelling Practices for Design and Compliance Survey was conducted to gather insights from members on thermal performance compliance pathways. The survey explored:

- The use of modelling, schedule, or calculation methods
- Approaches to assessing building performance and occupant comfort
- The tools and skills currently used in energy modelling across the industry

As architects, we are responsible for designing buildings that safeguard occupants, promote health and wellbeing, and respond to the challenges of climate change. Predictive energy modelling is a proven and powerful tool that supports these goals by enabling informed, performance-driven design decisions.

The survey was administered online via SurveyMonkey. An electronic direct mail (EDM) invitation was sent to all members on Tuesday, April 1, 2025 and the survey remained open until 5:00 p.m. on Friday, April 11, 2025.

A total of 205 responses were received. However, some responses were incomplete, resulting in a variation in the number of responses per question. Data analysis was conducted using Excel-based tools for quantitative responses, with support from Microsoft Copilot to assist in analysing open-ended, text-based responses.

2.2 Overview of Practice Size

Key Insights

1. Small Practices Dominate

- 59% of respondents come from practices with 5 or fewer employees (including sole practitioners).

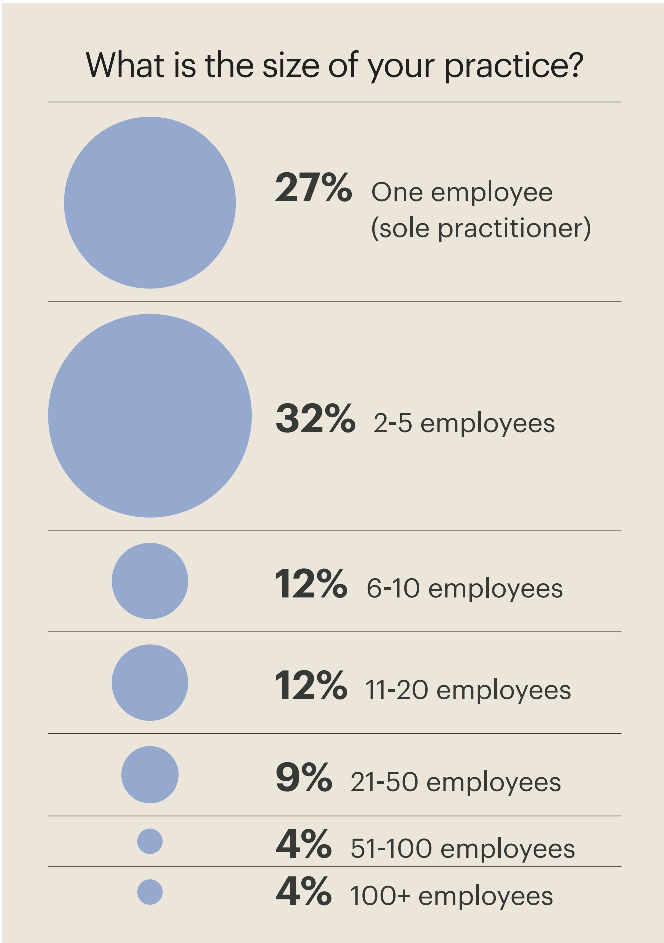
2. Mid-sized Practices (6–20 employees)

- Represent 24% of responses. These practices may have more resources than sole practitioners but may still face challenges implementing energy modelling.

3. Larger Practices (21+ employees)

- Make up only 17% of the sample.
- While smaller in representation, these firms are more likely to have dedicated staff or resources to handle energy modelling and performance assessments.

Answered: 205, **No Response:** 0



3. Compliance Pathways Analysis

3.1 Which pathway/s do you use to show compliance for thermal performance of your residential and non-residential projects?

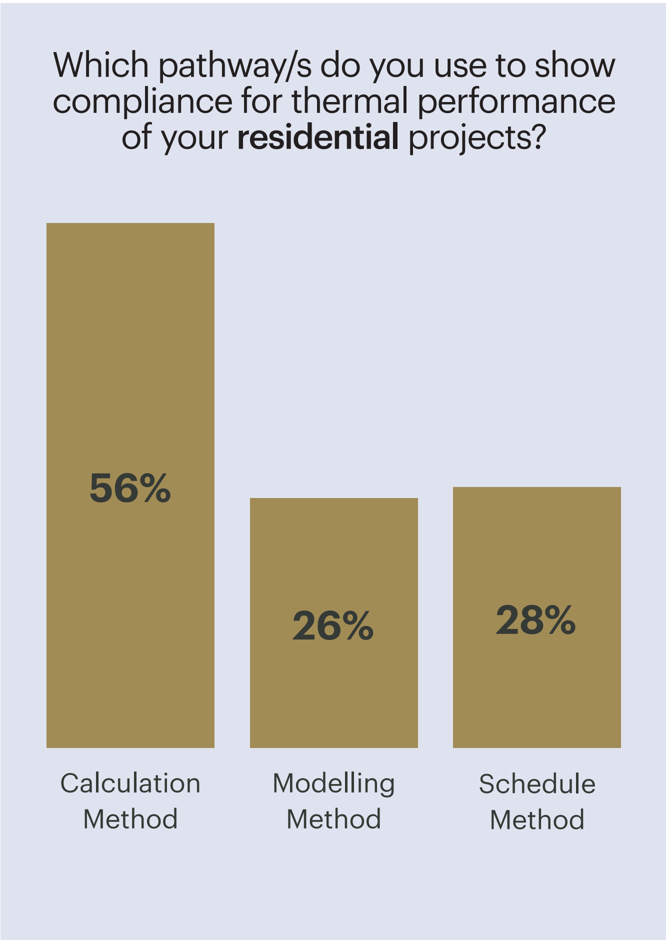
Key Insights

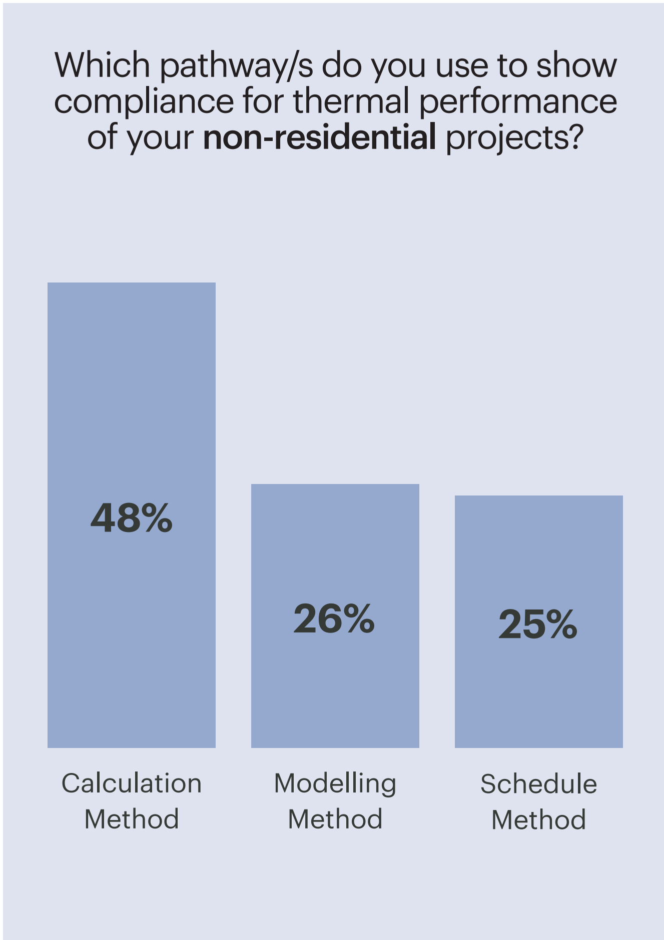
i. Calculation Method is Most Commonly Used
The Calculation Method is the dominant compliance pathway, used by 56% (residential) and 48% (non-residential) of respondents overall. This method appears to be the preferred approach due to its relative simplicity, familiarity and that is known to provide more accurate building performance results than the Schedule Method.

ii. Moderate Use of Schedule Method
The Schedule Method is used by 28% (residential) and 25% (non-residential) of respondents respectively, indicating a moderate level of adoption. Its continued use may reflect its simplicity and lower technical requirements, though it may not provide the same level of accuracy or flexibility as calculation or modelling-based approaches.

iii. Limited Adoption of Modelling Method
Only 26% (residential) and 26% (non-residential) of respondents reported using the Modelling Method. This method, while offering more accurate, flexible, and site-specific insights into energy performance, remains the least utilised pathway.

Residential: **Answered:** 168, **No Response:** 37
Non-residential: **Answered:** 153, **No Response:** 52





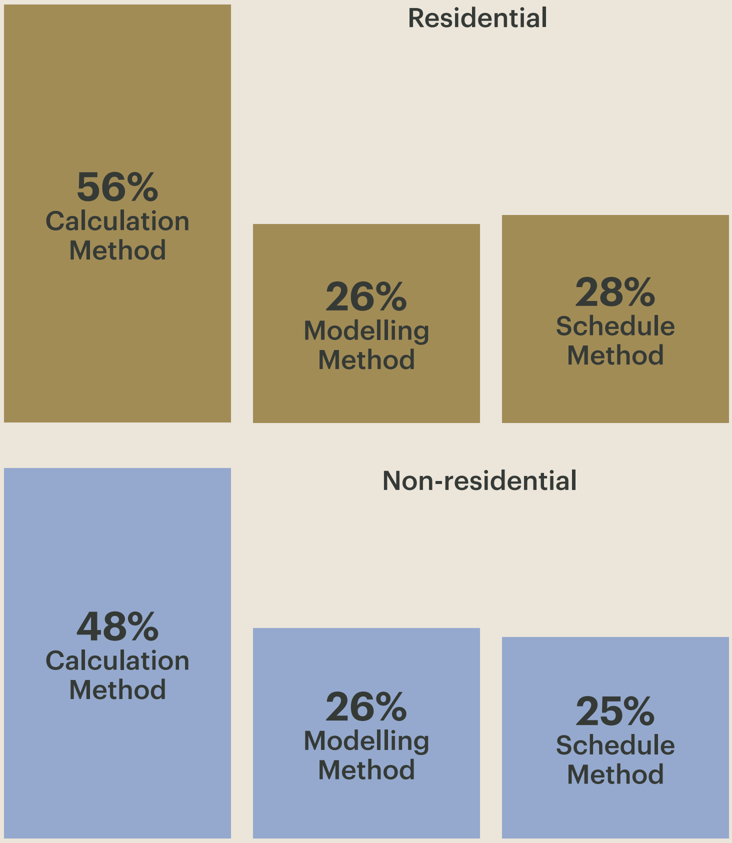
3.2 Comparison of the use of Modelling, Schedule, and Calculation methods between residential and non-residential projects.

The data shows that:

- The Calculation Method is the most used in both sets.

Utilisation of the Modelling Method and the Schedule Method are similar for both residential and non-residential

Comparison of the use of Modelling, Schedule, and Calculation methods between **residential** and **non-residential** projects.



3.3 Do you have a separate approach for assessing the building performance and comfort for the end users, or do you rely on the outcomes of the selected compliance pathway?

Summary of Approaches

	Approach Type	Frequency	Notes
1	Rely on Compliance Pathway (Schedule/Calculation)	Very High	Default strategy for most
2	Use of PHPP	Moderate	Often only if required (e.g. Passive House)
3	Modelling for Comfort/Performance	Low-Mod	Done occasionally, usually by consultants
4	Passive Design Principles	High	Widely used, though not quantified
5	External Consultant Reliance	High	Especially for larger/ commercial work
6	Frustration or Resistance to Modelling	Moderate	Concern about cost, value, usability

Key Themes from Responses

i. Heavy Reliance on Compliance Pathways

A significant number of practitioners rely heavily on the selected compliance pathway to demonstrate code compliance, often without incorporating thermal performance modelling meaningfully into the design process. Common responses referenced a general dependence on compliance outcomes, with recurring mentions of using the compliance path only or relying solely on it.

ii. Limited Use of Thermal Modelling for Design

When modelling is used, it is outsourced to consultants, carried out in-house, or applied only when necessary—such as for complex projects, or where certification systems like Passive House or Green Star are pursued. Modelling is frequently seen as costly, difficult to interpret, and used more for ticking compliance boxes than for informing or improving design. One respondent noted that the modelling method adds unnecessary financial cost for the client, and that they avoid using it whenever possible.

iii. Emphasis on Experience and Passive Design and Experience

Many architects prefer to rely on established design principles, professional experience, and intuition rather than formal modelling tools. They emphasise passive strategies such as building orientation, shading, cross ventilation, thermal mass, and minimising thermal bridges. Respondents often stressed designing intelligently from the outset—avoiding western glazing, using eaves, and relying on cross-ventilation.

iv. Outsourcing and Consultant Reliance

It is common to engage engineers, façade specialists and thermal consultants especially for HVAC, dew point analysis and advanced envelope design.

v. Use of Passive House Planning Package (PHPP)

A minority of firms consistently use PHPP—some as a design tool, others only for compliance or client-driven performance goals. The challenge is that councils often don't understand PHPP, leading to dual methods (PHPP + Schedule or Calculation) being used to satisfy compliance documentation.

vi. Frustration with Modelling Requirements and Tools

Concerns include:

- Increased project costs
- Time burden
- Lack of accessible, user-friendly software
- Perceived low value for smaller projects

vii. Tiered Approach Based on Project Type

- Standalone homes: Basic compliance methods
- Townhouses/commercial: More advanced modelling
- Sustainability focused clients: Homestar/Green Star assessments

viii. Comfort and Performance as Separate from Compliance

- Comfort strategies (e.g. ventilation, solar gain, materials) often treated as distinct from H1 compliance.
- Achieved through qualitative design rather than quantitative modelling.

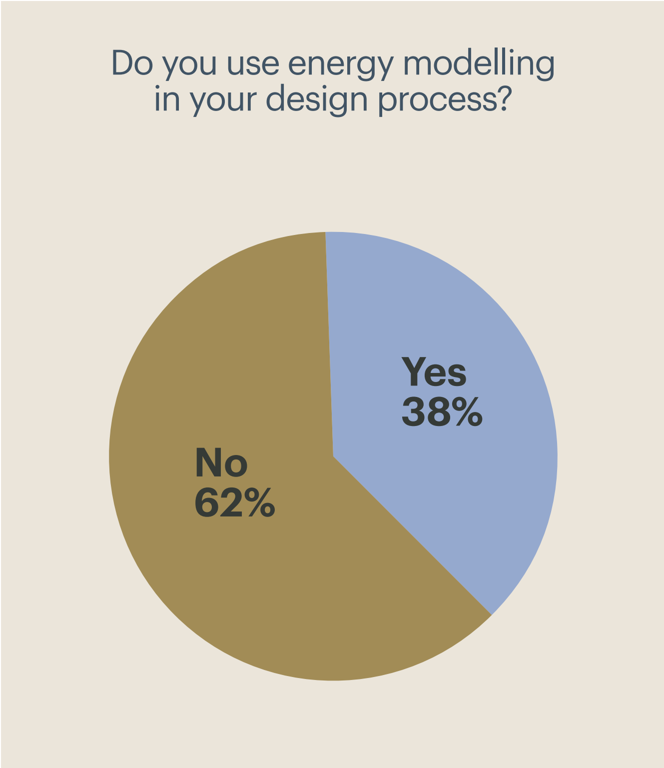
Answered: 143, **No Response:** 62

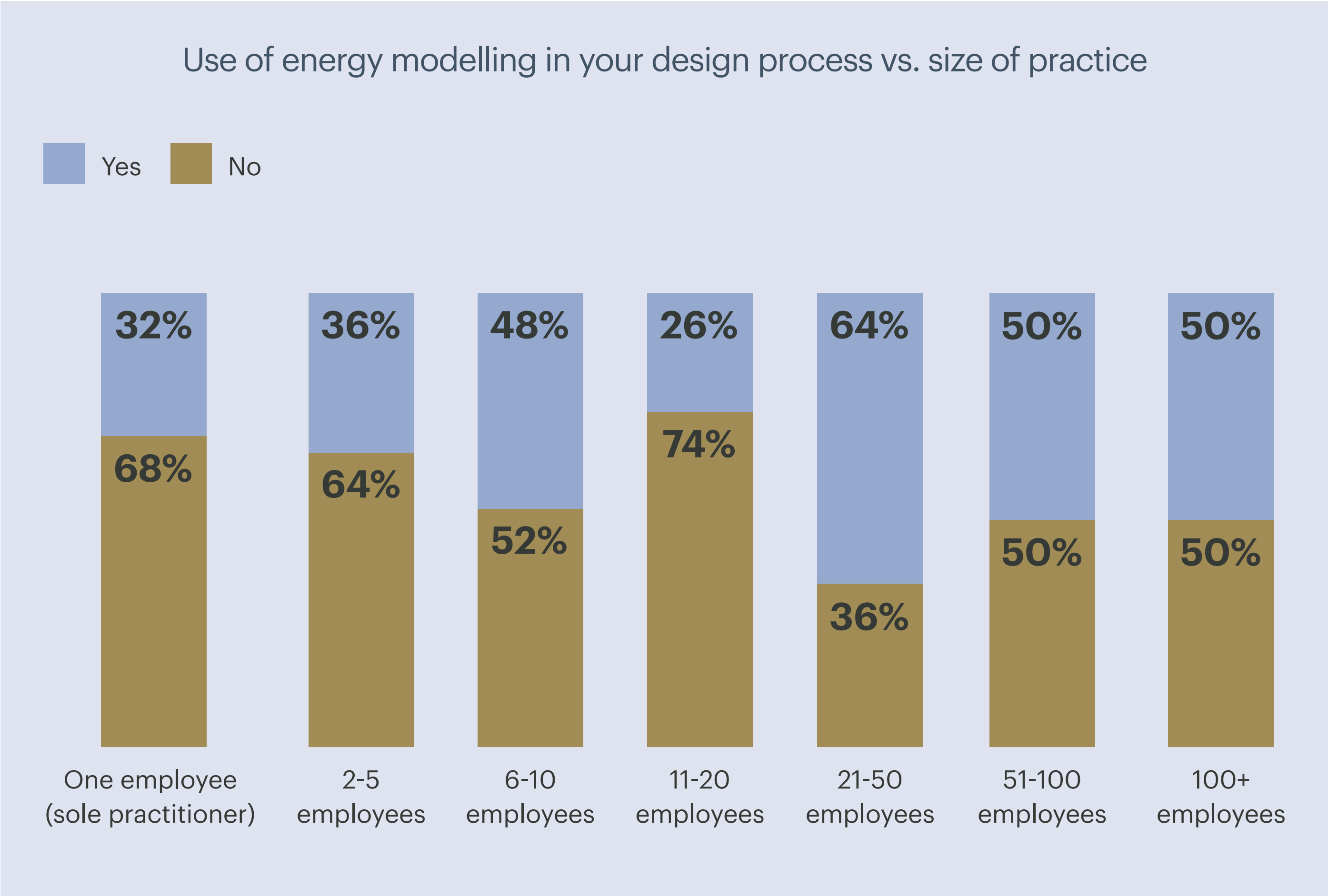
4. Energy Modelling Practices

4.1 Do you use energy modelling in your design process?

Out of the 172 who answered, over one-third of respondents use energy modelling as part of their design process, which is positive, but it also highlights that there is significant amount of education required to enable members to include energy modelling as part of their design process.
Answered: 172, **No Response:** 33

The graph below highlights that larger practices are generally better equipped to undertake energy modelling in the design process, with practices over 50 people showing an even split between those that use energy modelling in the design process than those that do not.



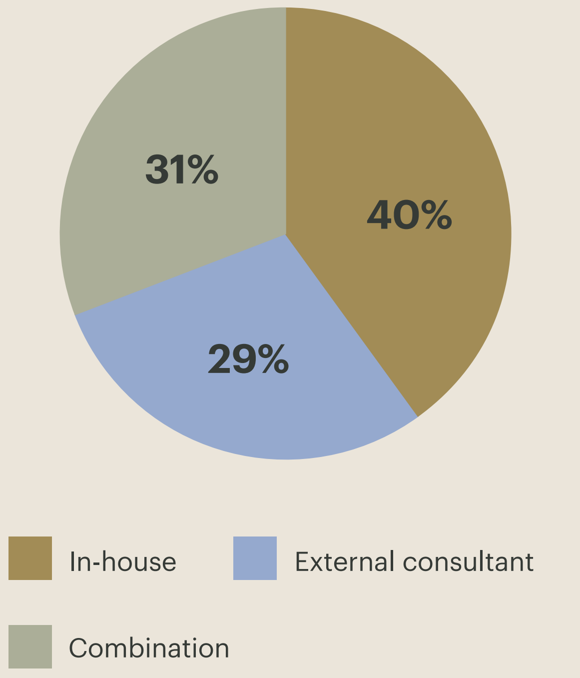


4.2 Do you do your energy modelling in-house, or do you use a consultant?

Among the 65 respondents who provided answers, 40% reported using in-house energy modelling, while 31% use a combination of in-house and external support. Only 29% rely solely on external consultants. The trend among engaged respondents suggests that internal capacity is valued in energy modelling practices.

The low response rate to this question is likely due to its dependency on the previous one — only respondents who answered 'Yes' to 'Do you use energy modelling in your design process?' would have proceeded to answer it.
Answered: 65, **No Response:** 140

Do you do your energy modelling in-house, or do you use a consultant?

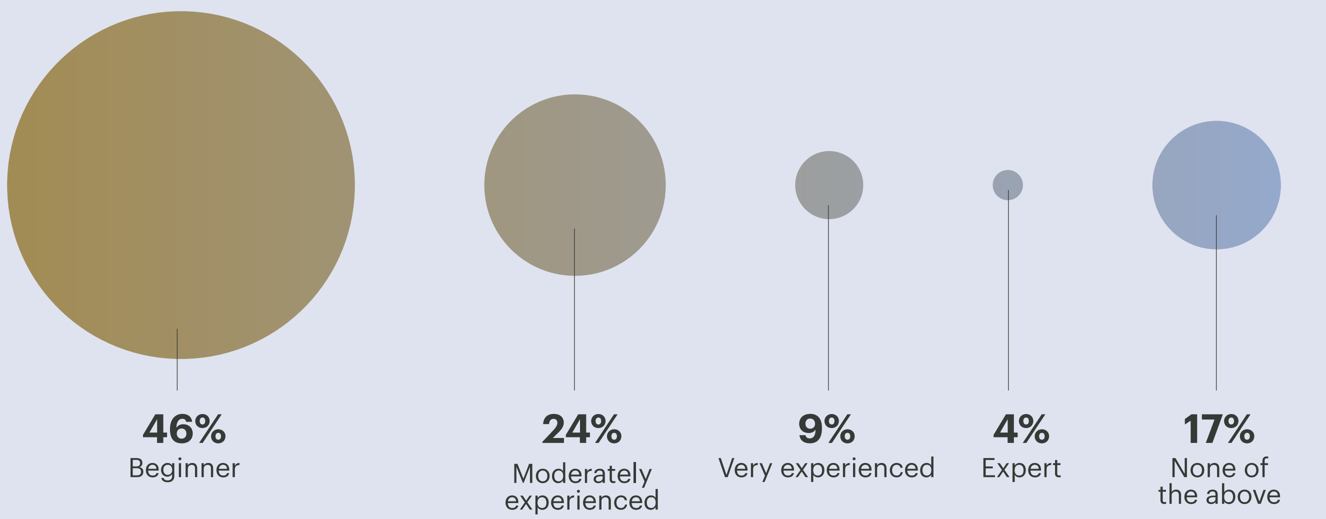


4.3 What do you consider your skill base in energy modelling to be?

The survey results reveal that most respondents are at an early stage in their energy modelling journey. Beginners make up the largest group, accounting for 46% of respondents, indicating a foundational level of familiarity with energy modelling practices. When combined with the 17% who selected "None of the above," a total of 63% of respondents reported having minimal or no experience. Those with moderate experience represent 24%, suggesting a relatively small group with some practical exposure but likely lacking in-depth proficiency or confidence.

Advanced expertise sits at 9% identifying as very experienced and 4% considering themselves experts. This identifies a skills gap at higher experience levels across the profession.
Answered: 163, **No Response:** 42

What do you consider your skill base in energy modelling to be?



4.4 Which energy modelling tool/s do you use?

The survey indicates a diverse range of energy modelling tools in use across the profession. PHPP and ECCHO are the most commonly used, particularly in residential projects and Passive House design. Tools such as Design Navigator and Speckel are also popular, especially during early design stages, due to their accessibility and ease of use. However, many architects choose to outsource energy modelling tasks, often due to internal resource constraints or limited expertise. A small number of firms demonstrate strong technical capability, employing parametric and simulation tools such as EnergyPlus via Grasshopper, highlighting a segment of highly skilled practices. Refer to **Appendix A** for further detail.

5. Calculating Thermal Bridging, Heat Loss and Moisture Risk

5.1 Do you calculate thermal bridging to assess heat loss in projects?

Key Insights

- 32% of respondents calculate thermal bridging to assess heat loss in projects.
- 68% do not use this method.

This highlights that the majority of practitioners are not currently assessing heat loss through thermal bridging, highlighting a potential gap in common design practices.
Answered: 170, **No Response:** 35

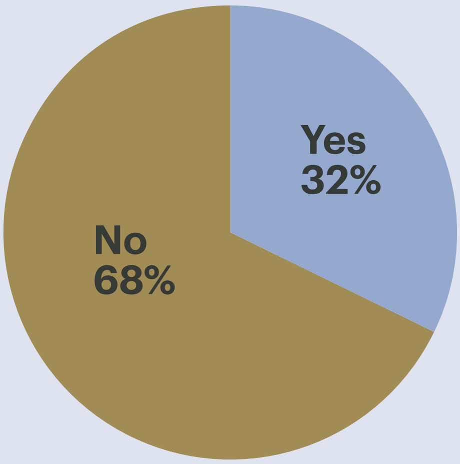
5.2 Do you calculate thermal bridging and construction buildups to assess interstitial and interior moisture risk in projects?

Key Insights

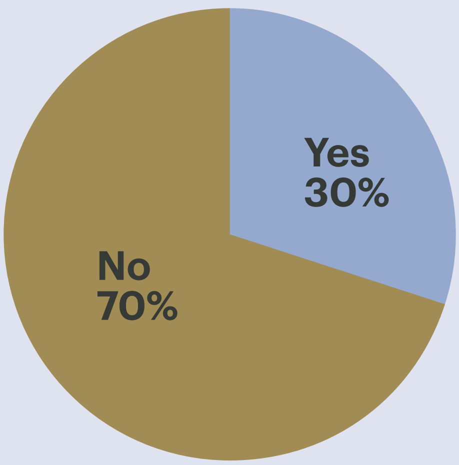
- 30% of respondents assess interstitial and interior moisture risk using thermal bridging and construction buildup calculations.
- 70% do not use this method.

This mirrors trends seen in previous datasets, confirming that the majority of practitioners do not currently incorporate detailed thermal bridging analysis when assessing moisture risks — pointing to a key area for industry education and practice improvement.
Answered: 172, **No Response:** 33

Do you calculate thermal bridging to assess heat loss in projects?



Do you calculate thermal bridging and construction buildups to assess interstitial and interior moisture risk in projects?



5.3 Comparison of use of moisture risk and heat loss assessments, and use of energy modelling in the design process

Key Insights

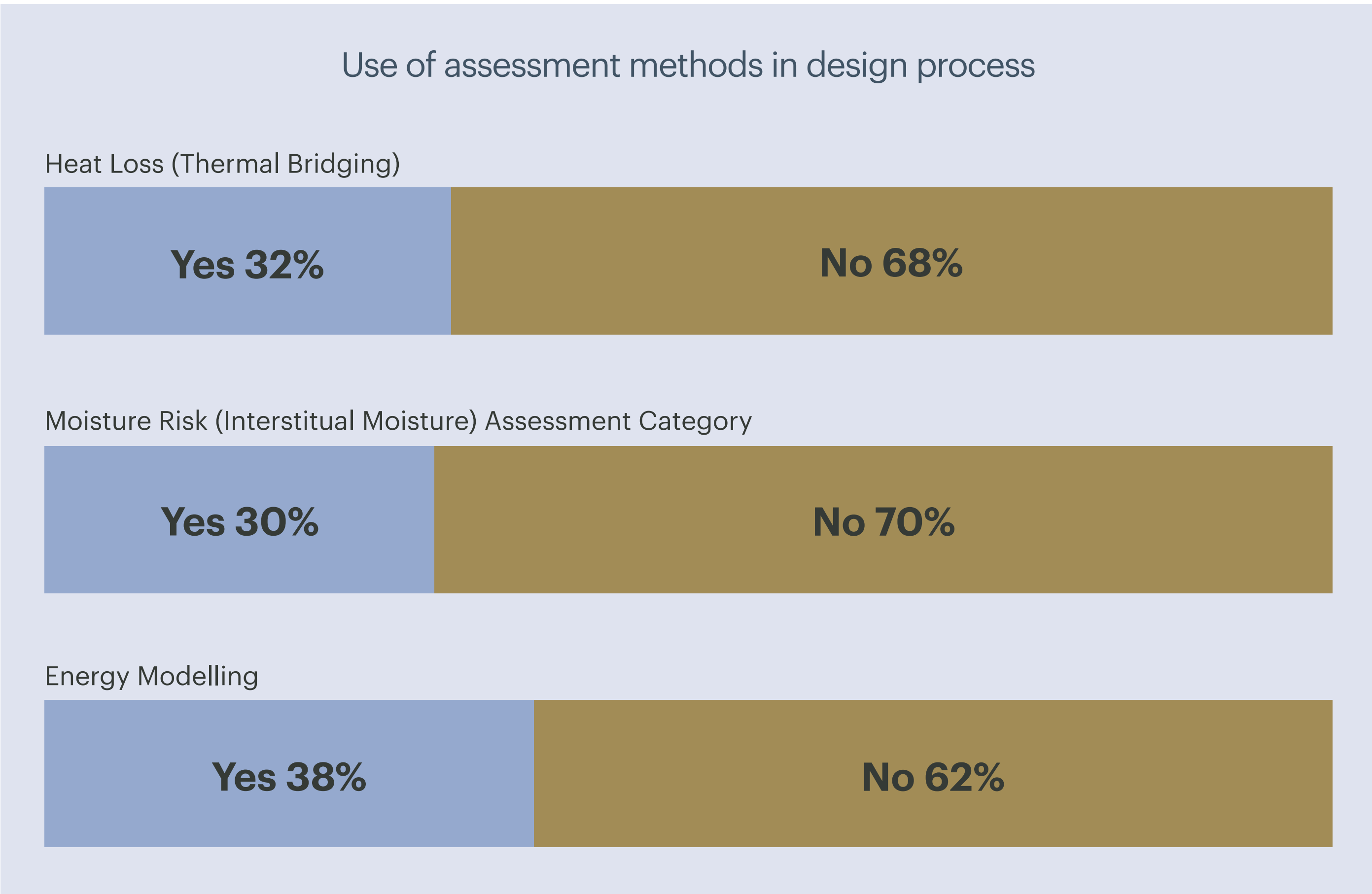
- **Low Adoption Overall:** Generally, a third of respondents use assessment methods across energy modelling, thermal bridging, and moisture risk, indicating limited integration of detailed technical performance analysis in design workflows.
- **Energy Modelling Leads Slightly:** With 38% uptake, energy modelling is the most commonly used method, though it remains far from widespread practice.
- **Thermal Bridging and Moisture Risk Undervalued:** Thermal bridging (32%) and moisture risk assessment (30%) trail closely, despite their critical role in preventing heat loss and moisture-related issues.
- **Implications for Practice:** These findings point to a clear gap in design-stage performance analysis. There is good potential for targeted training, improved tools, and policy support to boost adoption, ultimately improving building quality, energy efficiency, and occupant comfort.

6. Limitations

Non-Response Consideration

The survey questions were answered by the majority of participants, with response counts ranging from 143 to 172 out of 205. Which indicates a non-response rate of between 16% and 20%. Except for question 4.2 where the question is dependent on question 4.1 and therefore has a lower response rate.

Therefore, the findings still offer a valuable snapshot of current energy modelling practices.



7. Recommendations

To accelerate the adoption of energy modelling and support better design outcomes, the Institute will investigate the following focus areas:

1. Awareness and Advocacy

Promote the value and return on investment (ROI) of energy modelling across the architectural profession.

2. Education and Training

Investigate the best learning pathways for members, especially those that cater to small practices.

3. Tool Access and Resources

Identify and address barriers related to the cost, usability, and accessibility of energy modelling software and tools, especially for smaller practices.

4. Integration into Design Practice

Encourage earlier adoption of modelling in the design process to inform key design decisions and improve performance outcomes.

5. Policy Engagement and Industry Collaboration

Advocate for architects to play a central and continued role in shaping energy efficiency policies and standards.

6. Tertiary Education Engagement

The NZIA will engage with higher education institutions to assess why design courses currently don't include building science, measurable building performance, occupant health and comfort and techniques to assess these issues such as energy modelling, thermal bridge modelling and hygrothermal assessment.

Initial Actions the Institute will take to support the profession

To support these strategic aims, the Institute will begin with the following steps:

- Create targeted learning resources and CPD opportunities to build practitioner capability in energy modelling.
- Develop case studies and communications that highlight the tangible cost and performance benefits of energy modelling.
- Initiate a dialogue on embedding energy modelling earlier in design workflows.
- Engage with existing educational providers such as NZGBC and PHINZ to explore options for improving access and affordability to energy modelling options.
- Engage with tertiary education to discuss incorporation of best practice building performance into architectural curricula.
- Collaborate with policymakers and industry partners to ensure architects' perspectives continue to be represented in energy performance regulations.

Through these initiatives, the Institute aims to empower architects with the tools, knowledge, and support necessary upskilling to make energy modelling a standard and valued part of the design process — driving both improved building performance and greater professional impact.

8. Conclusion

Communicating the Value of Energy Modelling to Members

The Institute recognises the need to upskill our members in energy modelling and to clearly communicate the cost-benefit of energy modelling to its members. Despite some reservations within the profession and the knowledge gap, evidence — particularly from Australia — demonstrates that energy modelling has minimal impact on upfront construction costs for residential projects and can even reduce them through design optimisation.

The true value of energy modelling lies in its long-term benefits. By enabling more efficient building design, energy modelling reduces ongoing energy costs while improving occupant comfort. It also offers savings during construction by ensuring insulation is used precisely where needed — avoiding both excess and insufficiency.

Modelling can capitalise on performance gains from increased airtightness to reduce insulation requirements, and it supports simpler, more streamlined, and optimised design solutions.

When considered over the full lifecycle of a building, energy modelling proves to be a cost-effective strategy for both new builds and retrofits. Beyond financial savings, energy-efficient buildings contribute to broader social and environmental outcomes, including improved health, reduced emissions, and enhanced resilience.

Appendix A:

Detailed Breakdown of Responses to “Which energy modelling tool/s do you use?”

	Tool/System	Mentions (approx.)	Notes
Most Frequently Used Tools	PHPP	30+	Widely used, often with designPH or ECCHO
	ECCHO	20+	Common in NZ, Homestar compliance
	Design Navigator	~10–12	Popular for early design
Other Notable Tools	Speckel	~5–6	Being explored or trialed
	EnergyPlus (via various tools)	~5	For advanced modelling; consultants use it
	Sefaira	~3–4	Concept-stage modelling
	designPH	~3–4	Companion to PHPP
	Climate Studio / OpenStudio	~2–3	Advanced workflows
	Cove.Tool	1–2	Newer, early-stage focus
	DesignBuilder	1–2	Less common
	ArchiCAD EcoDesigner STAR	1–2	BIM-integrated option
	Wufi	1	Niche use
	Rhino to Grasshopper to Ladybug to Open Studio to Energy Plus, Passive House Calculator.	1	Niche use
	AccuRateNZ	1	Niche use
	Actually App	1	Niche use
	Custom/Other (e.g., Mammoth service, internal tools)	Several	Varied approaches

Below is a detailed analysis and breakdown of the tools mentioned in Section 3.4, unwrapping patterns in usage, and broader themes:

i. Most Frequently Mentioned Tools

The following tools stand out for frequent use:

PHPP (Passive House Planning Package)

- Most frequently cited tool.
- Often used alone or with complementary tools (e.g., designPH, ECCHO).
- Reflects strong adoption of Passive House standards and detailed energy analysis.

ECCHO

- Also widely cited, often alongside PHPP.
- Commonly used in New Zealand (linked to NZGBC's Homestar tool).
- Seen as a standard or default among local practices and consultants.

Design Navigator

- Another frequently mentioned tool.
- Valued for its accessibility and simplicity in early-stage design decisions.

ii. Other Notable Tools

These tools are mentioned less frequently but indicate a broader ecosystem:

- **Speckel/Spekel**: Emerging or trial usage.
- **Sefaira**: Some references, likely tied to early design phases.
- **EnergyPlus (via Climate Studio, OpenStudio, Ladybug/Honeybee)**: Indicates high technical capability and integration with parametric tools like Rhino/Grasshopper.
- **designPH**: A plugin for SketchUp, used alongside PHPP.
- **Cove.Tool**: Mentioned occasionally, suggesting exploration of newer platforms.
- **DesignBuilder**: Used but not widely cited.
- **Wufi**: Noted once, for hygrothermal simulation.

iii. Consultant-Led Modelling

A significant number of respondents indicate they do not carry out energy modelling in-house, instead:

- Rely on **ESD** or **mechanical consultants**.
- **Outsource** modelling to experts using tools like PHPP or ECCHO.
- A few noted **plans to adopt ECCHO internally** in future.

iv. Mixed Methods and Custom Workflows

Some practices report **complex** or **hybrid workflows**, including:

- Grasshopper → Honeybee/Ladybug → OpenStudio → EnergyPlus.
- Use of **internal tools** or **custom applications**.
- Varied engagement depending on **project scale** or **client goals**.

v. Notable Attitudes and Observations

- Several responses reflect frustration or misalignment with survey assumptions (e.g., commercial practices or architects not typically modelling themselves).
- Some note exploration of tools but haven't adopted them fully.
- Cost and complexity are cited reasons for outsourcing.