



VICTORIA UNIVERSITY
MELBOURNE AUSTRALIA

Classifying Australian building practitioners' behaviour in beyond-compliance in residential energy efficiency

This is the Published version of the following publication

Lu, Yi, Karunasena, Gayani Inoka and Liu, Chunlu (2026) Classifying Australian building practitioners' behaviour in beyond-compliance in residential energy efficiency. Built Environment Project and Asset Management. pp. 1-17. ISSN 2044-124X (In Press)

The publisher's official version can be found at
<https://doi.org/10.1108/bepam-01-2025-0019>
Note that access to this version may require subscription.

Downloaded from VU Research Repository <https://vuir.vu.edu.au/49915/>

Classifying Australian building practitioners' behaviour in beyond-compliance in residential energy efficiency

Built Environment
Project and Asset
Management

Yi Lu

*School of Architecture and Built Environment, Deakin University,
Melbourne, Australia and*

*College of Sport, Health and Engineering, Institute for Sustainable Industries and
Liveable Cities, Victoria University, Melbourne, Australia, and*

Gayani Inoka Karunasena and Chunlu Liu

*School of Architecture and Built Environment, Deakin University,
Melbourne, Australia*

Received 20 February 2025
Revised 18 July 2025
3 November 2025
Accepted 27 November 2025

Abstract

Purpose – Achieving beyond-compliance in residential energy efficiency remains a persistent challenge in Australia, with only few building practitioners consistently doing so, undermining Sustainable Development Goals (SDG) progress. Despite varying beyond-compliance behaviour states in the compliance process, no study has classified them by integrating both intention and actual beyond-compliance outcomes. The study aims to classify Australian building practitioners' beyond-compliance behaviours, identifying differentiations in the underlying motivations and abilities that influence beyond-compliance decisions.

Design/methodology/approach – The study draws on survey responses from 73 residential building practitioners in Victoria (Australia), all of whom were actively involved in the design stage of projects. Frequency analysis was used to generate classification.

Findings – Australian building practitioners' beyond-compliance behaviours are classified into three states: State 1: not intended to achieve beyond-compliance (47%). State 2: intended but not always successful in achieving beyond-compliance (16%). State 3: intended and successful in achieving beyond-compliance (37%). In examining behaviour state's association with building practitioners' occupational characteristics, most builders and construction supervisors, as well as experienced building practitioners belong to State 3.

Originality/value – This study is the first to classify building practitioners' beyond-compliance behaviours considering both intention and actual outcomes. It highlights the diverse challenges and motivations influencing practitioners' actions. It provides a foundation for targeted interventions, empowering more practitioners to go beyond-compliance and supporting SDG progress.

Keywords Beyond-compliance, Behaviour states, Classification, Energy efficiency, Residential building, Sustainable development goals

Paper type Research article

1. Introduction

Australia has set a legally binding target to reduce greenhouse gas (GHG) emissions by 43% and achieve net-zero emissions by 2050 (Australian Parliament House, 2022). These commitments reinforce the nation's heightened focus on addressing climate change and underscore the urgency of cutting emissions to advance the SDGs, especially SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production) (Oduro *et al.*, 2024). Among the pathways toward sustainability, improving residential energy

© Yi Lu, Gayani Inoka Karunasena and Chunlu Liu. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at [Link to the terms of the CC BY 4.0 licence](#).



Built Environment Project and Asset
Management
Emerald Publishing Limited
e-ISSN: 2044-1258
p-ISSN: 2044-124X
DOI 10.1108/BEPAM-01-2025-0019

efficiency emerges as a fast-track solution (Tilde and Fernando, 2024). This prompts the introduction of numerous commitments and initiatives to support this effort (Siva *et al.*, 2024).

Building energy performance standards in the building codes have proved to be a central policy measure to increase energy efficiency of newly-constructed residential buildings. They not only elevate the energy performance of residential buildings but also foster a level playing field for achieving beyond-compliance (i.e. achieving performance that exceeds minimal compliance with residential energy performance standards) (Berry and Marker, 2015). In Australia, the Nationwide Energy Rating Scheme (NatHERS) is the primary method for compliance demonstration for assessing residential building energy performance, generating star scores from 0 (worst) to 10 (best). Over the last 2 decades, Australia has progressively raised minimum energy efficiency requirements. They increased from approximately 4 NatHERS stars in 2003, progressively to 7 stars in 2022. Transition periods for these upgrades vary across states and territories, with most states mandating the 7-star standard from 2023.

While the move to a 7-star minimum is a positive step, it is insufficient for achieving a zero-carbon residential building industry in 2050. While minimum compliance establishes a baseline, exceeding these standards is essential for driving the sector towards net-zero emissions and promotes long-term sustainability. Moore *et al.* (2019) suggest ratings of at least 7.5 stars are necessary for aligning with 2050 commitment. Yet, recent data shows that from January to April 2024, 76.88% of new Victorian housing achieved only the 6-star standard, while only 9.25% exceeded 7 stars and a mere 1.18% surpassed 7.5 stars (CSIRO, 2024), highlighting the urgency to address barriers in achieving beyond-compliance outcomes (Iyer-Raniga *et al.*, 2023).

Among the various factors for not reaching beyond-compliance such as the often-discussed lack of regulatory transition support and limited client request for higher-performing homes, a key factor is the behaviour of building practitioners (Enker and Morrison, 2019; Lu *et al.*, 2024c), which refers to their willingness and ability to adhere to or exceed regulatory requirements (Bozeman, 2022). Previous research indicates that regulated individuals are not homogeneous. Their compliance behaviours vary significantly based on motivations and abilities (van der Heijden and De Jong, 2009). This variation is particularly evident in beyond-compliance outcomes, where some building practitioners exceed minimum requirements while others do not. Despite extensive studies on distinguishing compliance and non-compliance, no research has focused on classifying the diverse beyond-compliance behaviours and understanding their implications. To address this gap, the study aims to classify Australian building practitioners' beyond-compliance behaviour when facing NatHERS, exploring the differentiations in the underlying motivations and abilities in influencing their decisions in going beyond-compliance. This study builds on a shared dataset used in prior publications (Lu *et al.*, 2025a, b). Unlike the earlier studies, one of which grouped practitioners by psychological traits through cluster analysis and another which simulated policy impacts using agent-based modelling, this paper introduces a classification based on practitioners' behavioural outcomes, specifically their intention and actual achievement of beyond-compliance.

2. Different behaviour states in the compliance process

A wealth of previous research has categorised regulated actors into distinct behavioural states based on their compliance intentions and outcomes. One earliest example is Ayres and Braithwaite's (1992) "compliance pyramid" which introduces a stratified model of compliance behaviours (Ayres and Braithwaite, 1992). Building on this, Braithwaite's compliance model (Braithwaite, 2003) is widely adopted by many government bodies in Australia such as Australian Taxation Office's compliance model for taxpayers (Australian Taxation Office, 2019) and Queensland's regulatory framework for businesses' non-compliance with Fair Trading Laws (Queensland Government, 2024).

In this model, regulated actors are not regarded as a homogeneous group. Instead, they have different underlying motivational postures. Braithwaite (2003) distinguished compliance behaviour by measuring entities' both "intention" and "actual behaviour", resulting in four

behavioural types: (1) Have decided not to comply: These entities fully understand the regulatory requirements yet consciously ignore them. This stance may reflect a lack of respect for regulatory authority. (2) Don't want to comply: Regulated entities recognise the content of regulation but resist compliance due to perceived costs, limited perceived benefits, or scepticism about regulatory fairness. Constraints such as limited capability, insufficient knowledge, or negative experiences with regulators may exacerbate this unwillingness. (3) Try to but don't always succeed: These entities intend to follow rules and make genuine effort to do so, yet do not always achieve compliance. Ambiguous requirements, resource limitations, or inadequate guidance can undermine implementation. This highlights the possibility that intended behaviour may not translate into actual behaviour, consistent with the intention-behaviour gap described in Ajzen's Theory of Planned Behaviour (TPB) (Ajzen, 1991). (4) Willing to do the right thing: Entities in this category actively view regulatory compliance as aligned with organisational values and beneficial to their operations. They proactively embed compliance into practice and support the regulatory goals beyond mere rule-following. The categorisation emphasises the heterogeneity of responses among regulated parties, from those who willingly uphold regulatory standards for ethical or strategic reasons to those constrained by capacity or resistant to regulatory authority.

However, this traditional compliance classification focuses specifically on non-compliance. It may not be entirely suitable for the context of beyond-compliance (Burton, 2008). To the best of the author's knowledge, there exists no study to classify the building practitioners' beyond-compliance behaviour, necessitating an adaptation of the traditional compliance classification to account for these unique challenges. The first in Braithwaite's framework state "Have decided not to comply" highlights that these regulated actors disregard regulatory authority. However, in the context of beyond-compliance, this classification does not apply since beyond-compliance is voluntary and not mandated by regulatory frameworks; thus, it is not influenced by a fear of regulatory authority. Consequently, it is more appropriate to remove this first state in the context of beyond-compliance. The remaining three states of the traditional model are more relevant and can be adapted. Adapting the remaining three states not only reflects the complexity of practitioner behaviours in the context of beyond-compliance but also underscores the nuanced motivations and challenges that drive their engagement with higher standards. Based on the above thinking, the author established three states for depicting building practitioners' beyond-compliance behaviour with residential energy performance standards:

State 1: Not intended to achieve beyond-compliance – Comparable to traditional compliance model's second category of non-compliance, building practitioners in this group exhibit a clear reluctance or inability to engage with beyond-compliance goals. Their attitudes reflect a fundamental decision not to comply with higher standards, whether due to ethical concerns or simply a lack of motivation.

State 2: Intended but not always successful in achieving beyond-compliance – This state aligns closely with the third category of the Braithwaite's compliance model, where building practitioners attempt to meet higher standards but face barriers that impede their success.

State 3: Intended and always successful in achieving beyond-compliance – Building practitioners in this group correspond with the fourth category of the traditional compliance model, where entities are committed to compliance and actively pursue higher standards. Similar to those who are "willing to do the right thing," these practitioners possess not only the intention but also the capability to achieve beyond-compliance outcomes.

The examination of the beyond-compliance behaviour states further intrigues one to understand the underlying reasons behind these differences. Based on recent research (Lu *et al.*, 2024a, b), a beyond-compliance behaviour assessment model with energy performance standards was established, that reveals a wide range of behavioural constructs that affect building practitioner's beyond-compliance outcomes. As the model was relevant to the current study, it was applied by the authors. According to this model, the achievement of beyond-compliance

outcomes is largely driven by three factors: the building practitioner's attitudes, personal norms, and behavioural intention to achieve beyond-compliance. This intention is itself shaped by four predictive behavioural constructs. [Table 1](#) summarises these constructs.

Table 1. Constructs influencing building practitioners' behaviour in beyond-compliance in Australia

| Construct | Indicator |
|---|---|
| Attitudes (ATT) [An evaluative predisposition towards compliant behaviour as a function of its determinant personal consequences] | ATT1: Perceived economic benefits [The perceived advantages of adopting beyond-compliance measures, which may include financial incentives, increased marketability, or enhanced project differentiation] ATT2: Perceived economic costs [Reflects the increased upfront investments required for materials, technologies, and design processes associated with beyond-compliance efforts] |
| Subjective norms (SN) [Perceived pressure or motivation from those significant referents] | SN1: Requests from clients [Clients' demand] SN2: Expectations from building industry colleagues and peers [The social pressure exerted by colleagues and other stakeholders within the building industry] |
| Perceived behavioural control (PBC) [A person's "understanding of their capacity to achieve a compliant behaviour"] | PBC1: Self-efficacy in terms of confidence to go 7 stars and higher [Confidence in their ability to navigate compliance regulations and apply their knowledge and skills to deliver projects that exceed minimal standards] PBC2: Self-efficacy in terms of perceived easiness to go 7 stars and higher [Perceptions of the effort required to achieve beyond-compliance] PBC3: Perceived controllability in going 7 stars and higher [Feelings of control in achieving beyond-compliance] |
| Personal norms (PN) [Self-expectations based on people's internalised values, deriving either from internalised moral agreement with the policy objective or the policy content] | PN1: Moral agreement with environmental protection [The extent to which building practitioners morally align with the goals of environmental protection] PN2: Moral agreement with carbon emissions reduction [Commitment to reducing carbon emissions] PN3: Agreement regarding whether going beyond 7 stars is correct [Belief in the ethical validity of pursuing practices that exceed minimum compliance standards] PN4: Agreement regarding whether going beyond 7 stars can lead to emissions reduction [Recognition of the potential for beyond-compliance practices to contribute to significant emissions reductions] PN5: Agreement regarding whether going beyond 7 stars can lead to energy consumption reduction [Beliefs regarding the effectiveness of beyond-compliance measures in reducing energy consumption] |
| Intention to go beyond minimal compliance (INT) [The extent to which practitioners are willing to try, and the extent of efforts practitioners are planning to deploy for compliance] | INT: Willingness and efforts devoted to executing compliance |
| Actual compliance (COM) [The extent to which practitioners are willing to try, and the extent of efforts practitioners are planning to deploy for compliance.] | COM: Actual compliance outcome delivered since 2010 |

Source(s): [Lu et al. \(2024a, b\)](#)

Policy interventions such as incentivisation and training are widely used to encourage building practitioners to go beyond-compliance with residential energy standards. Examples include financial incentives like Germany's KfW program, the Netherlands' BREEAM certification, and Australia's 7 Star Homes Program, which offer rebates, loans, or public recognition to promote higher performance. Training programs, such as the European Commission's BUILD UP Skills initiative and Australia's National Construction Code Continuing Professional Development courses, aim to boost practitioners' knowledge and confidence in applying energy-efficient design practices. Despite these efforts, their long-term effectiveness remains unclear, as some practitioners may only engage superficially to gain immediate benefits. This uncertainty reveals an important research gap that this study addresses by examining Australian building practitioners' perceptions of these interventions and how these influence their intentions and actual beyond-compliance behaviours. By classifying practitioners into distinct behavioural states, this paper lays the groundwork for more tailored and effective policies and training that better support sustained beyond-compliance outcomes.

3. Methods

The study used questionnaire survey for data collection. A questionnaire survey enables the collection of large-scale data that, first, captures various factors influencing building practitioners' beyond-compliance behaviours, and second, gathers information on their occupational characteristics (Nielsen and Parker, 2012).

3.1 Data collection

This study uses data based on a 2023 questionnaire survey of Victorian residential building practitioners, previously examined in the authors' previous research (Lu *et al.*, 2025a, b). (Ethics approval No. SEBE-2022–54). Out of the 600 questionnaires distributed, participants were invited through industrial professional bodies. To ensure relevant representation, cluster sampling was applied, allocating 80% to architects and designers/draftspersons due to their primary involvement during the design phase, and the rest to builders, project managers, and thermal performance assessors. The final sample comprised 73 responses, yielding a 12.17% response rate. Though this response rate is considered reliable for large-scale surveys (Fosnacht *et al.*, 2017), the potential for low-response bias cannot be fully eliminated. Nevertheless, the study mitigated by employing cluster sampling to ensure diverse practitioner representation, and focussing on those with over two years of experience to enhance the relevance and quality of responses.

Earlier studies have demonstrated that beyond-compliance behaviours among Australian residential building practitioners can vary widely, shaped by factors like their professional background, years of experience, the type of their projects (e.g. volume homes or custom homes), and whether their work is situated in urban or regional areas (Lu *et al.*, 2022, 2025a; Martek *et al.*, 2019). To explore the possible relationship between States and practitioners' occupational characteristics, the initial part of the questionnaire collected data on their occupation-related information, as presented in Figure 1.

The subsequent section of the questionnaire was designed to obtain each respondent's beyond-compliance behaviour constructs based on the authors' established model, as outlined in Table 1. Each variable was assessed using specific indicators rated on a 5-point Likert scale, with 1 representing the minimum level and 5 the maximum. The indicators were tailored to reflect practitioners' engagement with beyond-compliance under the NatHERS framework, defined as achieving a 7-star energy rating or higher. For instance, perceived behavioural control was measured through three items: PBC1 and PBC2 measured self-efficacy by exploring practitioners' confidence and perceived ease in reaching 7 stars or more, while PBC3 examined perceived controllability by asking whether they believed achieving such outcomes was within their influence.

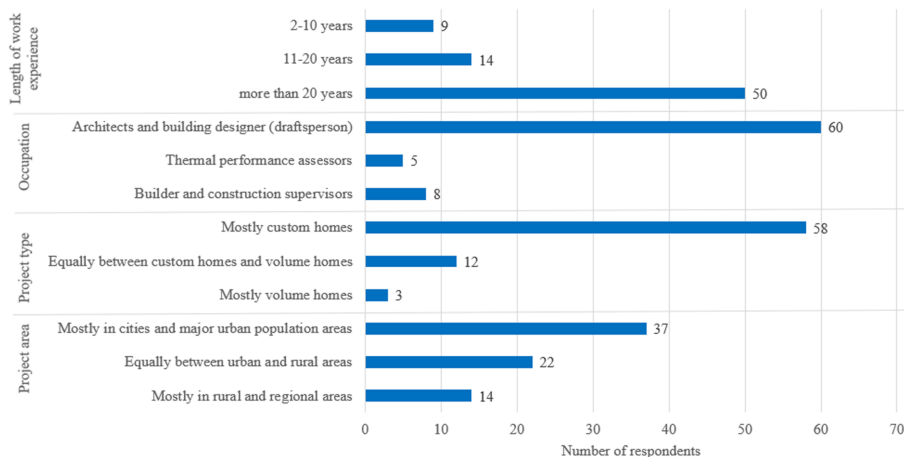


Figure 1. Occupational characteristics of the respondents. Source: Authors' own work

3.2 Data analysis

Before analysing the collected data, data reliability must be tested to confirm the reliability of empirical data for computation and analysis. Cronbach's α value of above 0.58 is deemed satisfactory for data reliability (Taber, 2018).

The analysis intended to reveal Australian building practitioners' compliance behaviour in beyond-compliance with residential energy performance standards. Building on previous studies that used cluster analysis and simulation methods to explore practitioner behaviours and policy impacts, this simple classification method was chosen to clearly separate practitioners based on their intention and actual behaviour in going beyond compliance. This approach offers a straightforward and practical framework that complements earlier work by providing clear categories easily understood and applied by policymakers and industry practitioners.

To classify the behaviour states, the authors categorised building practitioners based on their self-reported "intention to achieve beyond-compliance" and their "actual beyond-compliance." The criteria for this classification follows Braithwaite (2003):

- (1) State 1:
 - (1) Intention to achieve beyond-compliance: Below 5
 - (2) Actual beyond-compliance: Below 5
- (2) State 2:
 - (1) Intention to achieve beyond-compliance: 5
 - (2) Actual beyond-compliance: Below 5
- (3) State 3:
 - (1) Intention to achieve beyond-compliance: 5
 - (2) Actual beyond-compliance: 5

A frequency analysis classified the 73 participants into three distinct behaviour states based on their self-reported values of intention and actual beyond-compliance, highlighting differences among the 73 participants.

To ensure conceptual consistency across the three behavioural states, a score of 5 was used as the threshold for both intention and actual compliance. This highest rating represents a clear and consistent commitment (“extremely likely”/“always”), which aligns with the definition of State 3, where practitioners both fully intend and reliably achieve beyond-compliance outcomes. Lower scores (e.g. 3 or 4) were not used as cutoffs to avoid classifying partial or uncertain behaviours as fully committed or successful. After classifying the building practitioners, the next step was to identify the characteristics of each behaviour state and determine how they differed. This was done by comparing the mean values of the behavioural constructs across the states. Subsequently, pairwise comparisons of the construct scores between each state were conducted, and the significance of these differences was tested using the Post Hoc Bonferroni-test. This test also enabled the authors to determine which behavioural predictor most clearly differentiated one behaviour state from another (Nielsen and Parker, 2012).

Subsequently, the relationship between state membership and practitioners’ occupational characteristics was examined using crosstab analysis to determine any associations, followed by a detailed description using mean values of each predictor construct within each occupational sub-group (Nielsen and Parker, 2012).

4. Results

4.1 Classification of building practitioners’ beyond-compliance behaviour states

As indicated in the previous Section, data reliability is checked by computing Cronbach’s α . Cronbach’s α values for the empirical data in this study are all above 0.580, demonstrating that the data’s reliability is acceptable. With data reliability tested, the result of classification is presented in Table 2.

Table 2. Three behaviour states of building practitioners

| Construct | Indicator | State information | | | Between-state difference | | |
|-----------|-----------|---|------------------|------------------|---|----------------|----------------|
| | | Constructs and indicators of beyond-compliance behaviour ^a | | | The mean difference of constructs and their significance ^b | | |
| | | State 1 (47%) | State 2 (16%) | State 3 (37%) | States 1 and 2 | States 1 and 3 | States 2 and 3 |
| ATT | | 2.29 | 1.92 | 3.80 | 0.38 | 1.50* | 1.88* |
| | ATT1 | 2.26 | 1.67 | 3.63 | | | |
| | ATT2 | 2.32 | 2.17 | 3.96 | | | |
| SN | | 3.53 | 4.54 | 4.70 | 1.01* | 1.17* | 0.16 |
| | SN1 | 3.38 | 4.25 | 4.63 | | | |
| | SN2 | 3.65 | 4.83 | 4.78 | | | |
| PBC | | 3.11 | 3.92 | 4.15 | 0.81* | 1.04* | 0.23 |
| | PBC1 | 3.68 | 4.50 | 4.56 | | | |
| | PBC2 | 3.03 | 3.75 | 4.00 | | | |
| PN | | 2.62 | 3.50 | 3.89 | 0.66* | 0.87* | 0.20 |
| | PBC3 | 3.84 | 4.50 | 4.70 | | | |
| | PN1 | 4.00 | 4.67 | 4.81 | | | |
| | PN2 | 3.76 | 4.58 | 4.52 | | | |
| | PN3 | 3.88 | 4.75 | 4.81 | | | |
| | PN4 | 3.50 | 4.08 | 4.56 | | | |
| | PN5 | 4.12 | 4.42 | 4.70 | | | |

Note(s): ^aCell entries are the mean values of constructs for building practitioners comprising the designated behaviour states, ^bFor each comparison the difference of means, the Post Hoc Bonferroni test is: * = $p < .05$. (A “*” means that a particular difference in the construct between two states is statistically significant, indicating a meaningful difference in behaviour constructs between those groups of building practitioners)

Source(s): Authors’ own work

4.1.1 State 1: not intended to achieve beyond-compliance (47%). Building practitioners in State 1 have a general reluctance or inability to engage with beyond-compliance goals, which could impede broader efforts to raise energy efficiency across the industry. They stood out from the other two states due to their drastically lower scores in subjective norms (SN), perceived behavioural control (PBC), and personal norms (PN), as highlighted through the asterisks in [Table 2](#).

In terms of SN, building practitioners in State 1 indicated that their clients rarely requested high-energy performance homes (SN1 = 3.38), and their peers did not expect them to deliver high-performing projects (SN2 = 3.65). With respect to PBC, these practitioners exhibited low score over delivering beyond-minimum compliance projects (PBC3 = 2.62), often due to various constraints. Existing research suggests that such limitations can include shortages of specific materials ([Pitt and Sherry, 2014](#)).

Conversely, an increase in the supply of these materials reduced difficulties and facilitated the achievement of beyond-compliance.

Furthermore, the notably low score on personal norms, particularly PN4 at 3.50, suggests that practitioners in State 1 generally do not believe that constructing homes rated at 7 stars or higher meaningfully contributes to the building sector's transition to net-zero emissions. This reflects a broader sense of scepticism or dissatisfaction with the NatHERS framework. Similar concerns have been echoed in prior studies. For instance, [Daniel et al. \(2017\)](#) questioned the framework's suitability for evaluating low-energy dwellings designed to function with minimal heating and cooling.

In summary, State 1 building practitioners face a combination of low SN, PBC and PN. The interplay of these constructs results in their reluctance or inability to move towards beyond-compliance projects.

4.1.2 State 2: intended but not always successful in achieving beyond-compliance (16%). In State 2, building practitioners were highly motivated to go beyond-compliance with residential energy performance standards, but they encountered obstacles that prevented them from translating that intention into action every time.

One of the key factors contributing to this disconnect is their low attitude (ATT) score of 1.92, which was the lowest across the three states and closer to that of State 1 (2.29), indicating a generally negative or indifferent attitude toward achieving beyond-compliance. The low ATT score reveals that State 2 building practitioners perceive the pursuit of beyond-compliance as burdensome or costly, particularly when considering projects designed to meet the 7-star NatHERS rating.

This highlights the industry's concern that going beyond minimum compliance requires substantial investments, leading building practitioners to weigh economic considerations heavily. Even though State 2 building practitioners may recognise the technical and environmental value of energy-efficient projects, they are likely to view the additional requirements for higher compliance as a financial strain, decreasing their enthusiasm for pursuing higher standards.

However, State 2 building practitioners do exhibit high scores in SN, PBC, and PN, which aligns closely with State 3. Their high SN and PBC indicate that they possess a strong awareness of societal expectations, feel confident in their ability to meet these standards, and recognise the moral or ethical importance of achieving higher energy performance. Additionally, the relatively high PN score (4.27) indicates that many State 2 practitioners feel a moral obligation to contribute to the industry's shift toward lower carbon emissions and higher energy standards.

Despite the strong SN, PBC, and PN, their low ATT holds State 2 building practitioners back from fully achieving beyond-compliance.

In summary, the key feature of State 2 building practitioners is their strong technical knowledge and capability to meet energy standards, paired with high external and moral pressure to comply. However, their low attitude toward beyond-compliance, driven by perceptions of high costs, limits their ability to always successfully act on these intentions.

4.1.3 *State 3: intended and successful in achieving beyond-compliance (37%).* Building practitioners in State 3 were more successful in transitioning towards 7-star standards, positioning themselves as leaders within the group of 73 participants in the 6 to 7-star compliance range.

Building practitioners in this state are characterised by their significantly higher scores in key behaviour constructs, particularly ATT, which scored at 3.80, the highest among the states. These elevated attitudes reflect a favourable opinion towards the material and competitive benefits of delivering 7-star projects. Building practitioners in this group recognise that achieving beyond-compliance outcomes can provide them with a competitive advantage, attracting more clients and generating higher revenues. Their positive outlook indicates that they perceive energy-efficient building practices not just as a compliance obligation but as a strategic business opportunity.

Further, State 3 building practitioners indicated that their clients showed a strong preference for owning energy-efficient homes, with SN1 scoring 4.63. This highlights the role of client demand as a significant motivator for achieving beyond-compliance. Additionally, these practitioners highly valued the perceptions within the building industry regarding high-performing buildings, with SN2 scoring an impressive 4.78. This reflects their desire to have a good reputation and gain recognition from the building industry for delivering top-tier energy-efficient projects. Their alignment with industry norms also suggests that these building practitioners are leaders who set the standard for others, enhancing both their standing and their business prospects. In terms of PBC, State 3 building practitioners were confident in their ability to deliver beyond-compliance projects, as indicated by PBC1 scoring at 4.56. This confidence suggests they possess both the knowledge and resources necessary to overcome typical challenges, such as material shortages or additional costs, and consistently meet high performance standards.

Finally, building practitioners in State 3 also scored highly on PN, with an overall score of 4.70. This indicates that they intrinsically agree with the goals of the NatHERS framework, specifically its aim to guide the building industry toward net zero emissions. Their alignment with NatHERS suggests that they not only understand the technical requirements but also view the transition towards a more sustainable industry as both an ethical responsibility and a business imperative. The high PN scores reflect a strong personal commitment to delivering projects that exceed minimum standards and contribute meaningfully to the industry's environmental goals.

In summary, State 3 building practitioners are leaders in adopting beyond-compliance standards, motivated by a mix of financial, client-driven, and personal factors. They view energy-efficient projects as a way to gain a competitive edge, maintain industry leadership, and contribute to the broader goal of net zero within the building sector.

Looking at the overall compliance status, while State 3 building practitioners are leading the way, they only represent 37% of the sampling building practitioners. The majority is in State 2 and State 1, who are still struggling to move towards beyond-compliance. This insight aligns with the report [ASBEC \(2018\)](#), which argued that merely a limited group of market leaders have reached the 7-star level or higher.

4.2 *Beyond-compliance behaviour states associated with occupational characteristics*

Subsequently, the authors depicted different beyond-compliance behaviours of building practitioners associated with occupationally varying characteristics, summarised in [Table 3](#).

4.2.1 *Occupation.* In the overall data ([Table 2](#)), the majority of building practitioners fall into State 1, followed by State 3 and State 2. However, as [Table 3](#) shows, within the subgroup of builders and construction supervisors, the pattern is notably different: the majority are in State 3 (50.00%), followed by State 1 (37.50%), and a very small portion in State 2 (12.50%). This suggests that builders and construction supervisors have a stronger representation in the group that is successfully achieving beyond-compliance, contrasting with the overall trend,

Table 3. State percentage and mean values of behaviour constructs per occupational characteristics

| Occupational characteristics and behaviour constructs | | | State 1 | State 2 | State 3 |
|---|---|------------------|---------|---------|---------|
| Occupation | Architect and building designer | State percentage | 46.67% | 18.33% | 35.00% |
| | | ATT | 2.23 | 1.82 | 3.71 |
| | | SN | 3.54 | 4.50 | 4.67 |
| | | PBC | 3.16 | 3.94 | 4.06 |
| | | PN | 3.89 | 4.51 | 4.68 |
| | Thermal performance assessor | State percentage | 60.00% | 0.00% | 40.00% |
| | | ATT | 3.17 | na | 4.00 |
| | | SN | 3.67 | na | 5.00 |
| | | PBC | 2.78 | na | 4.50 |
| | | PN | 4.40 | na | 5.00 |
| | Builder and construction supervisor | State percentage | 37.50% | 12.50% | 50.00% |
| | | ATT | 2.00 | 3.00 | 4.13 |
| | | SN | 3.33 | 5.00 | 4.75 |
| | | PBC | 3.00 | 3.67 | 4.42 |
| | | PN | 2.73 | 4.40 | 4.70 |
| Length of work experience | 2–10 years | State percentage | 55.56% | 11.11% | 33.33% |
| | | ATT | 2.70 | 2.00 | 4.17 |
| | | SN | 3.20 | 4.50 | 4.83 |
| | | PBC | 3.07 | 2.67 | 3.56 |
| | | PN | 4.56 | 4.60 | 4.67 |
| | 11–20 years | State percentage | 57.14% | 28.57% | 14.29% |
| | | ATT | 2.25 | 2.13 | 3.50 |
| | | SN | 3.63 | 4.75 | 4.25 |
| | | PBC | 3.09 | 4.00 | 4.50 |
| | | PN | 4.13 | 4.45 | 4.50 |
| | More than 20 years | State percentage | 42.00% | 14.00% | 44.00% |
| | | ATT | 2.21 | 1.79 | 3.77 |
| | | SN | 3.57 | 4.43 | 4.73 |
| | | PBC | 3.13 | 4.05 | 4.20 |
| | | PN | 3.55 | 4.51 | 4.73 |
| Project area | Mostly in cities and major urban population areas | State percentage | 51.35% | 10.81% | 37.84% |
| | | ATT | 2.11 | 2.13 | 3.64 |
| | | SN | 3.47 | 4.75 | 4.71 |
| | | PBC | 3.09 | 4.00 | 4.26 |
| | | PN | 3.81 | 4.45 | 4.71 |
| | Equally between urban and rural areas | State percentage | 40.91% | 22.73% | 36.36% |
| | | ATT | 2.50 | 1.90 | 4.00 |
| | | SN | 3.44 | 4.40 | 4.63 |
| | | PBC | 3.26 | 3.87 | 3.71 |
| | | PN | 3.91 | 4.60 | 4.78 |
| | Mostly in rural and regional areas | State percentage | 42.86% | 21.43% | 35.71% |
| | | ATT | 2.58 | 1.67 | 3.90 |
| | | SN | 3.83 | 4.50 | 4.80 |
| | | PBC | 2.94 | 3.89 | 4.53 |
| | | PN | 3.80 | 4.40 | 4.56 |

(continued)

Table 3. Continued

| Occupational characteristics and behaviour constructs | | | State 1 | State 2 | State 3 | Built Environment Project and Asset Management |
|---|--|------------------|---------|---------|---------|--|
| Project type | Mostly custom homes | State percentage | 44.83% | 18.97% | 36.21% | |
| | | ATT | 2.35 | 2.00 | 3.81 | |
| | | SN | 3.58 | 4.59 | 4.67 | |
| | | PBC | 3.04 | 3.94 | 4.22 | |
| | | PN | 3.86 | 4.47 | 4.68 | |
| | Equally between custom homes and project homes | State percentage | 50.00% | 8.33% | 41.67% | |
| | | ATT | 2.08 | 1.00 | 3.90 | |
| | | SN | 3.17 | 4.00 | 4.80 | |
| | | PBC | 3.45 | 3.67 | 3.87 | |
| | | PN | 3.53 | 4.80 | 4.92 | |
| | Mostly volume homes | State percentage | 66.67% | 0.00% | 33.33% | |
| | | ATT | 2.25 | na | 3.00 | |
| | | SN | 4.00 | na | 5.00 | |
| | | PBC | 3.00 | na | 4.00 | |
| | | PN | 4.40 | na | 4.20 | |

Source(s): Authors' own work

where fewer practitioners are leading in compliance outcomes. This distinct distribution pattern suggests that builders and construction supervisors may have greater influence or control over project outcomes, potentially due to their desire to stand out of the market as reflected by their relatively high SN score (4.75) in State 3. In a similar vein, [Hurlimann et al. \(2018\)](#) concluded that societal intangibles such as social reputation stimulated compliance intention in the Australian building industry.

The occupation-specific behaviour constructs' mean values reveal variations in building practitioners' behaviour states and constructs based on their roles. Builders and construction supervisors lead in achieving beyond-compliance in State 3, driven by high client demand, technical capabilities, and strong personal norms, as evidenced by their high scores in SN, PBC and PN. In contrast, architects and building designers show a mix of resistance and acceptance, with State 1 practitioners facing client constraints yet still feeling pressure to pursue beyond-compliance projects. Thermal performance assessors exhibit exceptional commitment in State 3, marked by high SN and PN scores, reflecting their technical capacity and ethical commitment to sustainability. These findings highlight the importance of tailored strategies aligning with the unique motivations and challenges faced by each occupational group to enhance overall beyond-compliance behaviour within the Australian residential building industry.

4.2.2 Length of work experience. As [Table 3](#) indicates, building practitioners with more than 20 years of work experience were slightly more likely to fall into State 3, representing those who both intended and successfully achieved beyond-compliance. This state distribution is different from the overall distribution pattern as shown in [Table 2](#). This distribution suggests that experience may play significant role in shaping beyond-compliance behaviour. Building practitioners with more than 2 decades of experience are likely to have greater familiarity with evolving energy performance standards and an enhanced understanding of the benefits of exceeding minimum compliance. They may also have developed a stronger network of industry connections, allowing them to access the necessary resources, tools, and materials required for successful high-performance projects.

Mean values of each subgroup's behaviour constructs in each state show that the length of work experience can significantly influence practitioners' approaches to beyond-compliance.

Younger professionals (2–10 years) show strong societal and personal motivations but are more likely to remain in State 1 due to their inexperience. Mid-career professionals (11–20 years) face the greatest challenges, with the highest proportion in State 1 and the lowest success rate in State 3, despite external pressures and perceived capabilities. Experienced professionals (more than 20 years) are the most successful in achieving beyond-compliance, motivated by a combination of societal expectations, personal ethics, and a deep understanding of the industry's long-term sustainability goals.

4.2.3 Project area. As depicted in [Table 3](#), the trends observed in the various project areas, whether they are primarily urban, a mix of urban and rural, or rural, align with the broader distribution trends across all groups. Such consistency may indicate that the challenges and motivations driving beyond-compliance behaviour are not significantly affected by the project area's characteristics, highlighting a commonality in how these professionals approach their work across different contexts.

The analysis of beyond-compliance behaviour across different project areas shows consistent trends in ATT, SN, PBC and PN. Building practitioners in urban areas tend to have limited motivation for beyond-compliance, although those achieving this in State 3 demonstrate strong societal expectations and a high sense of control. In mixed urban and rural areas, attitudes toward compliance are slightly better, with State 3 practitioners showing a strong commitment to achieving beyond-compliance driven by personal and societal expectations. In most rural areas, attitudes are somewhat more positive compared to urban counterparts, but perceived control is notably lower. However, those in State 3 exhibit strong confidence in their ability to achieve beyond compliance.

4.2.4 Project type. As shown in [Table 3](#), the state distribution of each subgroup associated with project type exhibits a similar pattern to the overall distribution. This indicates that the trends and proportions observed across the various project types, whether in custom homes, a mix of custom and project homes, or volume homes, are consistent with the broader findings. Such similarities suggest that the factors influencing beyond-compliance behaviours in these subgroups are interconnected, reinforcing the notion that project type plays a significant role in shaping outcomes across the different states.

The analysis of beyond-compliance behaviour by project type reveals consistent patterns across custom homes, mixed project types, and volume homes, suggesting interconnected factors influencing compliance outcomes. In custom homes, practitioners exhibit low personal motivation despite higher awareness of societal expectations. Those in State 2 acknowledge the importance of compliance but struggle to achieve it, while successful practitioners in State 3 demonstrate strong motivation and personal norms, indicating that intrinsic motivation plays a crucial role. In mixed project types, attitudes are similarly low, with practitioners facing barriers to compliance, especially in State 2, where motivation is particularly weak. A small number of responses from volume home practitioners suggest a potential disconnect between high social norms and lower motivation, particularly among those in State 2 who reported limited attempts to achieve beyond-compliance. However, it is noted that given the small sample size, this should be viewed as a preliminary insight rather than a general trend.

In conclusion, by classifying building practitioners according to their reported values of “intention to achieve beyond-compliance” and “actual beyond-compliance,” a fine-tuned understanding of each state's beyond-compliance behaviours is achieved, both in general terms and concerning their specific occupational traits.

5. Discussion

To our knowledge, no prior research has systematically identified and analysed distinct beyond-compliance behaviour states within the context of building energy efficiency requirements by capturing both intention and actual behaviour. The three-state classification offers a better understanding of practitioners' engagement beyond the minimum regulatory threshold. Importantly, it reveals meaningful variation between those who do not intend to go

beyond compliance, those who aspire to but struggle with consistent implementation, and those who demonstrate both commitment and follow-through. By linking these states with psychological constructs such as ATT, SN, PBC and PN, the study also provides insight into the underlying motivations and barriers influencing each state.

In contrast, the authors' previous study (Lu *et al.*, 2025a) employed k-means cluster analysis on the same questionnaire survey to segment practitioners. They differed the segmentation based solely on predictive behavioural constructs (ATT, SN, PBC, and PN), resulting in three clusters: lingerers, close-followers, and leaders. While both studies identify a tripartite grouping, the present study introduces a novel classification method incorporating both behavioural intention and actual beyond-compliance action. This allows for greater analytical precision in distinguishing those with strong normative and moral drivers but low ATT (State 2) from those with both intention and demonstrated action (State 3). For example, although the close-followers in Lu *et al.* (2025a) and State 2 in the current study both show high SN, PBC, and PN, only the current study reveals that it is a low ATT score that holds these practitioners back, which is an insight enabled by including actual behavioural outcome in the classification. Moreover, while leaders in Lu *et al.* (2025a) exhibit high intention in achieving beyond-compliance, State 3 practitioners in the current study are distinguished not just by strong psychological constructs, but also by consistent delivery of high-performance outcomes. By directly aligning internal motivations with real-world behaviour, the present study offers more practice-relevant implications for targeted interventions.

Having discussed the added value over earlier clustering-based segmentation in Australia, the following section situates its findings within the broader international literature on beyond-compliance behaviour.

State 1 building practitioners show the lowest ATT toward compliance with energy performance standards, reflecting a general lack of interest to surpass the minimum requirements. Their SN and PBC scores are also comparatively low, suggesting that these practitioners experience minimal external pressure and have limited confidence in achieving beyond-compliance outcomes. This trend is consistent with research from Sweden and the UK, where some practitioners have likewise shown limited motivation to surpass minimum energy requirements, often citing financial burdens, implementation challenges, and the absence of compelling economic drivers as key deterrents. For instance, Persson and Grönkvist (2015) note that some Swedish practitioners resist adopting advanced energy standards due to the perceived high upfront costs and insufficient demand from clients. This is further compounded by limited access to Swedish government's financial support, and traditional Swedish banking practices that overlook life-cycle cost savings, challenges that echo the economic concerns of Australian State 1 building practitioners. In England and Wales, research on building regulation compliance (Pan and Garmston, 2012b) also found that a portion of the construction industry tends to follow only the minimum regulations, often due to a "tick-box" approach where compliance is seen as a necessary but burdensome step rather than an opportunity for innovation or long-term savings. That study further argued that, this sub-optimal situation may be shaped by broader UK government's policy communication issues, including the lower prioritisation of energy standards in regulatory messaging and a fragmented, piecemeal approach to updating building regulations, which has contributed to industry confusion and weakened commitment to ambitious energy targets. This differs from the cost-driven disengagement seen in State 1 in Australia.

State 2 building practitioners in Australia display strong social and ethical commitment to going beyond compliance, reflected in their high scores in SN, PBC, and PN. However, their efforts are undermined by low ATT scores, which act as a key barrier. This indicates that, despite acknowledging the significance of energy efficiency, especially from an environmental standpoint, they are discouraged by perceived financial burdens and practical obstacles, which prevent consistent follow-through. Similar behaviour has been observed in Swedish studies (Blomqvist *et al.*, 2022), where many practitioners recognise the advantages of low-energy buildings but face financial limitations or insufficient demand from

clients, which impede their ability to consistently deliver projects that exceed minimum standards. In addition, the comparatively low attitude score observed in State 2 presents an intriguing finding. Especially the results show that practitioners with over 20 years of work experience report the lowest ATT scores across all groups. A likely explanation is that these experienced practitioners have a more realistic and detailed understanding of the cost–benefit trade-offs involved in achieving beyond-compliance outcomes. Unlike less experienced counterparts, they are more aware of the financial implications associated with higher energy performance targets. This pragmatic awareness may temper their attitude, even when they personally intend to deliver it where possible. In this case, low attitude scores do not reflect scepticism or lack of belief in the importance of energy efficiency, but rather a cautious, cost-informed stance grounded in long-term industry experience. This insight suggests that engagement strategies for experienced practitioners should focus less on awareness-raising and more on addressing cost-related barriers.

State 3 Australian building practitioners are leaders in achieving beyond-compliance, exhibiting high scores across ATT, SN, PBC, and PN scores that reflect strong motivation and confidence in delivering energy-efficient homes. They recognise the business advantages of high-performing projects and are positively influenced by industry norms and client demand for sustainability. This state mirrors findings in Botswana (Ngowi, 2001). As Ngowi (2001) argued, environment-friendly building practices can offer firms a competitive advantage, especially when energy efficiency consideration is embedded at the design stage. While Ngowi (2001) discussed at the firm level, it is reasonable to infer that building practitioners in decision-making roles, such as architects, builders, and senior designers, can internalise these strategic benefits, especially when their practices align with business outcomes. State 3 practitioners' strong performance and motivation may reflect such alignment between sustainability goals and perceived competitive value. State 3 practitioners recognised that the most successful building professionals regard exceeding energy efficiency standards as a competitive advantage. They also observed that those who have effectively implemented energy-efficient practices are often motivated by clear financial stimulus or the opportunity to become market leaders, reflecting the profile of State 3 practitioners in Australia. Moreover, across England and Wales, research shows that a select group of top-performing practitioners recognise the financial and reputational gains from surpassing regulatory standards, often promoting energy efficiency to draw clients (Pan and Garmston, 2012a). Similar to State 3 practitioners in Australia, this group frequently leads the industry in achieving beyond-compliance outcomes.

The identification of distinct beyond-compliance behaviour states among building practitioners provides a valuable foundation for designing targeted interventions aligned with SDGs. For practitioners in State 1, where intention is limited, norm-shifting campaigns and enhanced regulatory engagement can foster motivation and cultural change, advancing SDG 12 by encouraging responsible production practices across the building industry. Industry associations such as the Australian Building Sustainability Association plays a role in this space by promoting sustainability values across the industry, accrediting professionals, engaging with policy development, and raising awareness of the long-term benefits of energy performance. While its services support a wide range of practitioners, the industry-wide advocacy and educational efforts can help address motivational and attitudinal gaps in State 1, influencing those currently disengaged from beyond-compliance practices. Practitioners in State 2, who intend but encounter barriers, would benefit from capacity-building initiatives including tailored training, mentorship, and technical support programs. These programs enhance practitioner capabilities, directly contributing to SDG 12 by promoting responsible and efficient resource use. A practical avenue for such support is through Continuing Professional Development (CPD) programs offered by industry registration bodies such as the “Designing for 7 stars and Beyond Series” by the Australian Institute of Architects. These programs increasingly include sustainability-focused modules that introduce the latest energy-efficient design practices, regulatory updates, and case studies of high-performance buildings. Embedding beyond-compliance content into CPD frameworks ensures that practitioners,

particularly those with longer careers, have access to relevant, up-to-date knowledge that supports the transition from intention to successful implementation. Meanwhile for practitioners in State 3, recognition programs and performance-based incentives can reinforce these positive practices, directly contributing to SDG 11 by encouraging sustainable building design and construction. For instance, the Green Star certification system, managed by the Green Building Council of Australia, serves as a voluntary sustainability rating system that provides third-party recognition of high-performing projects and practitioners. Publicly showcasing these leaders within the industry not only supports their continued efforts but also helps set aspirational benchmarks for others to follow. By aligning these interventions with practitioners' motivational and behavioural profiles, the study contributes actionable insights for policymakers and industry stakeholders to accelerate progress toward energy-efficient residential buildings and broader sustainability targets. Although regulatory contexts vary internationally, the behavioural patterns observed here suggest broader applicability of the three-state framework and indicate avenues for future cross-country research on energy-efficient building practices.

6. Conclusions

This study provides a novel classification of Australian building practitioners' beyond-compliance behaviours into three distinct states: State 1 (47%). Building practitioners in this state show reluctance or inability to pursue beyond-compliance goals, which hinders broader energy efficiency efforts in the industry. State 2 (16%). Building practitioners in State 2 show a strong intention to comply but face obstacles that hinder action. State 3 (37%). It includes practitioners who consistently intend and succeed in achieving beyond-compliance.

This study makes a novel contribution to the literature on beyond-compliance behaviour in residential energy efficiency based on intention and outcome. It offers a new theoretical foundation for examining voluntary, sustainability-driven practices in the building sector. For building practitioners, the classification guides the development of targeted support measures, such as specialised training, and formal recognition, to enhance their capacity and motivation to achieve beyond-compliance outcomes. For policymakers, it offers a basis for designing targeted interventions that align with SDG 11 and 12. The classification framework serves as a valuable step towards bridging future collaboration among industry professionals and policymakers, enabling more effective alignment of strategies with behavioural realities.

However, this study is confined to the Victorian context, which may not fully reflect the broader complexities of beyond-compliance behaviours across Australia. Future research could extend to other states and territories to provide a more comprehensive understanding. In addition, future research can also explore external drivers of behaviour change, such as economic incentives and social influences, to deepen understanding and further refine intervention strategies. By incorporating these external factors, this study lays a strong foundation for developing effective solutions that enhance energy efficiency, reduce environmental impact, and drive progress towards a residential building industry that supports the achievement of the SDGs 11 and 12.

References

- Ajzen, I. (1991), "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol. 50 No. 2, pp. 179-211, doi: [10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T).
- ASBEC (2018), "Built to perform - an industry led pathway to a zero carbon ready building code", Cooperative Research Centre for Low Carbon Living, available at: <https://apo.org.au/node/199346> (accessed 2 May 2022).
- Australian Parliament House (2022), "Climate change bill 2022", available at: https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r6885 (accessed 13 December 2023).

- Australian Taxation Office (2019), "Compliance model", available at: <https://www.ato.gov.au/about-ato/managing-the-tax-and-super-system/strategic-direction/how-we-help-and-influence-taxpayers/compliance-model> (accessed 12 November 2023).
- Ayres, I. and Braithwaite, J. (1992), *Responsive Regulation: Transcending the Deregulation Debate*, Oxford University Press, USA.
- Berry, S. and Marker, T. (2015), "Residential energy efficiency standards in Australia: where to next?", *Energy Efficiency*, Vol. 8 No. 5, pp. 963-974, doi: [10.1007/s12053-015-9336-4](https://doi.org/10.1007/s12053-015-9336-4).
- Blomqvist, S., Ödlund, L. and Rohdin, P. (2022), "Understanding energy efficiency decisions in the building sector—A survey of barriers and drivers in Sweden", *Cleaner Engineering and Technology*, Vol. 9, 100527, doi: [10.1016/j.clet.2022.100527](https://doi.org/10.1016/j.clet.2022.100527).
- Bozeman, B. (2022), "Rules compliance behavior: a heuristic model", *Perspectives on Public Management and Governance*, Vol. 5 No. 1, pp. 36-49, doi: [10.1093/ppmgov/gvab028](https://doi.org/10.1093/ppmgov/gvab028).
- Braithwaite, V. (2003), "Dancing with tax authorities: motivational postures and non-compliant actions", in *Taxing Democracy: Understanding Tax Avoidance and Evasion*, pp. 15-39, doi: [10.4324/9781315241746](https://doi.org/10.4324/9781315241746).
- Burton, M. (2008), "The Commissioner's compliance strategy: compliance pyramid to compliance diamond to compliance cube".
- CSIRO (2024), "Australian housing data", available at: <https://ahd.csiro.au/dashboards/energy-rating/states/> (accessed 1 September 2024).
- Daniel, L., Williamson, T. and Soebarto, V. (2017), "Comfort-based performance assessment methodology for low energy residential buildings in Australia", *Building and Environment*, Vol. 111, pp. 169-179, doi: [10.1016/j.buildenv.2016.10.023](https://doi.org/10.1016/j.buildenv.2016.10.023).
- Enker, R.A. and Morrison, G.M. (2019), "Behavioral facilitation of a transition to energy efficient and low-carbon residential buildings", *Buildings*, Vol. 9 No. 11, p. 226, doi: [10.3390/buildings9110226](https://doi.org/10.3390/buildings9110226).
- Fosnacht, K., Sarraf, S., Howe, E. and Peck, L.K. (2017), "How important are high response rates for college surveys?", *The Review of Higher Education*, Vol. 40 No. 2, pp. 245-265, doi: [10.1353/rhe.2017.0003](https://doi.org/10.1353/rhe.2017.0003).
- Hurlimann, A.C., Browne, G.R., Warren-Myers, G. and Francis, V. (2018), "Barriers to climate change adaptation in the Australian construction industry—Impetus for regulatory reform", *Building and Environment*, Vol. 137, pp. 235-245, doi: [10.1016/j.buildenv.2018.04.015](https://doi.org/10.1016/j.buildenv.2018.04.015).
- Iyer-Raniga, U., Moore, T. and Ho, O. (2023), "Residential building sustainability rating tools in Australia", available at: https://www.oneplanetnetwork.org/sites/default/files/from-crm/Issue%252002_July%25202023.pdf (accessed 20 November 2023).
- Lu, Y., Karunasena, G. and Liu, C. (2022), "Issues in compliance with low-carbon requirements in the Australian residential building industry", *45th Australasian Universities Building Education Association (AUBEA) Conference*, Penrith, Australia.
- Lu, Y., Karunasena, G. and Liu, C. (2024a), "Conceptual cross-theoretical assessment model for practitioners' compliance behavior with building energy codes", *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, Vol. 16 No. 1, 04523039, doi: [10.1061/JLADAH.LADR-1019](https://doi.org/10.1061/JLADAH.LADR-1019).
- Lu, Y., Karunasena, G. and Liu, C. (2024b), "Influence of behavioural constructs on building practitioner's minimal compliance with residential building energy performance standards in Australia", in Sandanayake, Y.G., Waidyasekara, K.G.A.S., Ranadewa, K.A.T.O. and Chandanie, H. (Eds), *12th World Construction Symposium*, Sri Lanka.
- Lu, Y., Karunasena, G. and Liu, C. (2024c), "Preliminary study on building practitioners' compliance behaviour with 7-star house energy ratings in Australia: perceptions of industry experts", *Smart and Sustainable Built Environment*, Vol. ahead-of-print No. ahead-of-print, doi: [10.1108/SASBE-09-2023-0279](https://doi.org/10.1108/SASBE-09-2023-0279).
- Lu, Y., Karunasena, G. and Liu, C. (2025a), "Exploring beyond-compliance behaviors of Australian building practitioners: a cluster analysis", *Energy Research and Social Science*, Vol. 121, 103969, doi: [10.1016/j.erss.2025.103969](https://doi.org/10.1016/j.erss.2025.103969).

- Lu, Y., Karunasena, G. and Liu, C. (2025b), "Influence of interventions on building practitioners' beyond-compliance with residential energy performance standards", *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, Vol. 17 No. 3, 04525017, doi: [10.1061/JLADAH.LADR-1296](https://doi.org/10.1061/JLADAH.LADR-1296).
- Martek, I., Hosseini, M.R., Shrestha, A., Edwards, D.J. and Durdyev, S. (2019), "Barriers inhibiting the transition to sustainability within the Australian construction industry: an investigation of technical and social interactions", *Journal of Cleaner Production*, Vol. 211, pp. 281-292, doi: [10.1016/j.jclepro.2018.11.166](https://doi.org/10.1016/j.jclepro.2018.11.166).
- Moore, T., Berry, S. and Ambrose, M. (2019), "Aiming for mediocrity: the case of Australian housing thermal performance", *Energy Policy*, Vol. 132, pp. 602-610, doi: [10.1016/j.enpol.2019.06.017](https://doi.org/10.1016/j.enpol.2019.06.017).
- Ngowi, A. (2001), "Creating competitive advantage by using environment-friendly building processes", *Building and Environment*, Vol. 36 No. 3, pp. 291-298, doi: [10.1016/s0360-1323\(00\)00006-8](https://doi.org/10.1016/s0360-1323(00)00006-8).
- Nielsen, V.L. and Parker, C. (2012), "Mixed motives: economic, social, and normative motivations in business compliance", *Law and Policy*, Vol. 34 No. 4, pp. 428-462, doi: [10.1111/j.1467-9930.2012.00369.x](https://doi.org/10.1111/j.1467-9930.2012.00369.x).
- Oduro, S., Pittri, H., Simons, B., Baah, B., Anteh, E.D. and Oduro, J.A. (2024), "Awareness of net zero energy buildings among construction professionals in the Ghanaian construction industry", *Built Environment Project and Asset Management*, Vol. 15 No. 5, pp. 988-1003, doi: [10.1108/bepam-01-2024-0001](https://doi.org/10.1108/bepam-01-2024-0001).
- Pan, W. and Garmston, H. (2012a), "Building regulations in energy efficiency: compliance in England and Wales", *Energy Policy*, Vol. 45, pp. 594-605, doi: [10.1016/j.enpol.2012.03.010](https://doi.org/10.1016/j.enpol.2012.03.010).
- Pan, W. and Garmston, H. (2012b), "Compliance with building energy regulations for new-build dwellings", *Energy*, Vol. 48 No. 1, pp. 11-22, doi: [10.1016/j.energy.2012.06.048](https://doi.org/10.1016/j.energy.2012.06.048).
- Persson, J. and Grönkvist, S. (2015), "Drivers for and barriers to low-energy buildings in Sweden", *Journal of Cleaner Production*, Vol. 109, pp. 296-304, doi: [10.1016/j.jclepro.2014.09.094](https://doi.org/10.1016/j.jclepro.2014.09.094).
- Pitt and Sherry (2014), "National energy efficient building project report, prepared for the State of South Australia", available at: https://energymining.sa.gov.au/__data/assets/pdf_file/0019/315415/NEEBP-final-report-November-2014.pdf (accessed 12 March 2022).
- Queensland Government (2024), "Fair trading compliance", available at: <https://www.qld.gov.au/law/laws-regulated-industries-and-accountability/queensland-laws-and-regulations/regulated-industries-and-licensing/fair-trading-enforcement/compliance> (accessed 12 July 2024).
- Siva, J., Gajendran, T., Toindre, O. and Vaughan, J. (2024), "Driving the zero-carbon construction strategy: key barriers and enablers", *Built Environment Project and Asset Management*, Vol. 15 No. 3, pp. 380-398, doi: [10.1108/bepam-12-2023-0245](https://doi.org/10.1108/bepam-12-2023-0245).
- Taber, K.S. (2018), "The use of Cronbach's alpha when developing and reporting research instruments in science education", *Research in Science Education*, Vol. 48 No. 6, pp. 1273-1296, doi: [10.1007/s11165-016-9602-2](https://doi.org/10.1007/s11165-016-9602-2).
- Tilde, A.I. and Fernando, N.G. (2024), "Knowledge, attitude and practices of energy utilisation behaviours: a study of residential building occupants", *Built Environment Project and Asset Management*, Vol. 14 No. 3, pp. 349-365, doi: [10.1108/bepam-01-2023-0008](https://doi.org/10.1108/bepam-01-2023-0008).
- van der Heijden, J. and De Jong, J. (2009), "Towards a better understanding of building regulation", *Environment and Planning B: Planning and Design*, Vol. 36 No. 6, pp. 1038-1052, doi: [10.1068/b34120](https://doi.org/10.1068/b34120).

Corresponding author

Gayani Inoka Karunasena can be contacted at: gayani.karunasena@deakin.edu.au

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgrouppublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com