Journal of Engineering, Design and Technology

The role of policies and regulations in promoting climate-friendly construction practices in New Zealand

Itohan Esther Aigwi, Ashok Ramji Patel, Tharaya Poorisat and Amarachukwu Nnadozie Nwadike
Department of Built Environment Engineering, School of Future Environments, Auckland University of Technology, Auckland, New Zealand

Received 27 February 2026
Revised 25 April 2026
23 May 2026
18 June 2026
Accepted 9 July 2026

Abstract

Purpose – This study aims to examine the role of policies and regulations in promoting climate-friendly construction practices in New Zealand, where the building sector contributes approximately 22% of national energy consumption and 20% of greenhouse gas emissions. This study evaluates the effectiveness of existing regulatory instruments in driving decarbonisation and sustainable construction.

Design/methodology/approach – A mixed-methods design was used, combining document analysis (n = 16), including the Building for Climate Change Programme and the Emissions Reduction Plan, with eight semi-structured interviews (n = 8) involving key stakeholders from government, industry and academia. Thematic analysis and data triangulation were used to enhance analytical reliability.

Findings – Current frameworks have improved energy efficiency standards, raised sustainability awareness and initiated low-carbon transitions. However, significant barriers remain, including financial constraints, slow regulatory updates, weak enforcement and fragmented stakeholder collaboration, limiting transformative change.

Research limitations/implications – This study is limited to the New Zealand context and a modest interview sample. Future research could incorporate quantitative performance data and comparative international analyses to strengthen generalisability and policy evaluation.

Practical implications – The findings of this study highlight the need for stronger regulatory coherence, improved enforcement mechanisms, expanded financial incentives and integrated governance approaches to accelerate sector-wide decarbonisation.

Social implications – Strengthened climate-responsive construction policies can reduce emissions, improve building performance and enhance long-term environmental and societal resilience.

Originality/value – This study provides a comprehensive evaluation of New Zealand's climate-related construction policy landscape, offering transferable insights for similar regulatory contexts transitioning towards low-carbon development.

Keywords Climate-friendly construction, Policies and regulations, New Zealand, Sustainable development, Energy efficiency

Paper type Research paper

Funding: This research was supported by the Auckland University of Technology's DCT Faculty Postgraduate Summer Research Assistant Award 2024.

Journal of Engineering, Design and Technology
Emerald Publishing Limited
1726-0531
DOI 10.1108/JEDT-02-2026-0111

1. Introduction

The building and construction industry is a key driver of economic growth, but it is also a major contributor to climate change, responsible for 30%–40% of global energy use and 25% of CO_2 emissions (González-Torres *et al.*, 2022). To tackle the issues, Policies and Regulations are critical for enabling climate action, fostering systemic change and incentivising Sustainable Construction Practices (SCPs) globally. For example, Building Energy Codes (BECs), which establish minimum energy performance standards, have proven to be effective tools for decarbonising the built environment (Schwarz *et al.*, 2020). In response, governments worldwide have introduced policies to accelerate low-carbon transitions in the sector. Notably, the European Union implemented directives such as the EPBD 2010 and the Energy Efficiency Directive 2012 to improve Energy Efficiency – EE. The 2018 revision of the EPBD mandated that all new buildings comply with Nearly Zero-Energy Building (NZEB) standards from 2018, reinforcing the EU's commitment to sustainable development (Schwarz *et al.*, 2020). In other regions of the world, similar efforts are observed. Canada's R-2000 standards promote energy-efficient innovation (Abdeen *et al.*, 2020), while Vancouver's 2016 Zero Emissions Building Plan requires all new buildings to meet zero-emission targets by 2030 (City of Vancouver, 2023). These frameworks reflect the growing global recognition of the construction sector's role in reducing greenhouse gas (GHG) emissions and align with SDGs 7, 11 and 13 (United Nations, 2022).

In New Zealand, the building sector accounts for 22% of final energy use and 20% of emissions (IEA, 2022), making it a critical area for SCP intervention. Government efforts include the Net Zero Carbon Roadmap for Aotearoa's Buildings (NZGBC, 2019) and initiatives by the Energy Efficiency and Conservation Authority (EECA) to improve EE in non-residential buildings (Ministry for the Environment, 2017). The Climate Change Response Act 2002 set a target to reduce emissions to 50% below 1990 levels by 2050, establishing a legal foundation for New Zealand's Paris Agreement commitments (Doan, Wall, *et al.*, 2021). Despite this progress, challenges remain, such as the lack of a comprehensive building certification system and the slow adoption of NZEB-related codes, presenting opportunities for research and policy (Cielo and Subiantoro, 2021).

It is important to distinguish between SCPs and Climate-Friendly Construction Practices (CFCPs), as both concepts are relevant to this study. SCPs encompass a broad range of environmentally responsible approaches within the construction sector, including resource efficiency, waste minimisation, pollution reduction and lifecycle impact management (Poorisat *et al.*, 2024). CFCPs, by contrast, represent a more focused subset of SCPs that specifically target greenhouse gas mitigation and climate change adaptation throughout the design, construction and operational stages of buildings. While the two concepts substantially overlap, CFCPs are used in this study when referring specifically to carbon reduction and climate resilience measures, whereas SCPs denote the broader sustainability agenda within which such measures are embedded. This distinction is important because some policy instruments explicitly pursue climate outcomes, while others contribute indirectly through wider sustainability objectives (Aigwi *et al.*, 2026).

To address the gap in understanding the effectiveness of policies and regulations in promoting CFCPs, this study uses a mixed-methods approach, combining document analysis and key informant interviews. This approach enhances validity by contextualising findings and validating them through expert insights. To achieve this aim, the following objectives were adopted: to identify the existing policies and regulations that relate to CFCPs in New Zealand; to examine the benefits and barriers to the implementation of the identified policies and regulations in promoting CFCPs in New Zealand; and to provide recommendations to

relevant stakeholders with current best practices regarding the role of policies and regulations in promoting CFCPs in New Zealand. For clarity, a list of the abbreviations used throughout this manuscript is provided in Appendix 2.

2. Literature review

2.1 Existing policies and regulations, drivers and climate-friendly construction practices implementation

The shift towards CFCPs is supported by diverse regional policies and regulations, which reflect local priorities and environmental goals. Studies highlight the essential role these measures play in promoting SCPs. This section reviews existing policies addressing CFCPs across various continents, including Europe (Greenwood *et al.*, 2017; Warren *et al.*, 2024), Asia (Li *et al.*, 2022) and Oceania (Enker and Morrison, 2017; Isaacs, 2020), as these instruments are essential to promoting SCPs (H. X. Li *et al.*, 2022).

2.1.1 Europe. Europe's construction sector accounts for 40% of total energy use and 36% of GHG emissions (Kangas *et al.*, 2018; Magrini *et al.*, 2020). Reducing building energy demand through EE policy is, therefore, central to the EU climate strategy (Economidou *et al.*, 2020). This study focuses on the UK, Sweden, France, Denmark and Switzerland because of their varied sustainability measures (Schwarz *et al.*, 2020; Warren *et al.*, 2024). The UK built environment contributes 42% of national GHG emissions, prompting stronger mitigation efforts. The 2019 legislation made the UK the first major economy to commit to net zero emissions by 2050 (Warren *et al.*, 2024). In the UK and Switzerland, renewable energy growth linked to carbon metrics supported climate goals. In Sweden, measured compliance helped reduce the performance gap. Although performance-based metrics improved EE, gains diminished over time (Hafez *et al.*, 2023). These findings suggested that while performance-based metrics improve EE, there are diminishing returns on further gains (Schwarz *et al.*, 2020; Warren *et al.*, 2024).

2.1.2 Asia. Asia's building sector is a major source of carbon emissions because of rapid urbanisation, material demand and energy use (Zhang *et al.*, 2021). The APEC region accounts for around 60% of global energy demand (Zhang *et al.*, 2021). This study focuses on China, India and Singapore as major contributors to regional energy use. China's building energy consumption has risen by over 200% in two decades, making it the world's second-largest consumer (Li *et al.*, 2020; Liu *et al.*, 2020). Policies such as ECPB and retrofit programmes have reduced emissions, though non-compliance and regional design differences remain challenges (Li *et al.*, 2020; Liu *et al.*, 2020). India aims to reduce GHG emissions by 35% by 2030. Its ECBC supports energy savings and better performance, although enforcement remains weak (Mathur, 2019). Singapore has become a leader in SCPs through the Green Mark scheme and national plans such as the Singapore Green Plan and Mandatory Energy Improvement Regime (Li *et al.*, 2020; Liu *et al.*, 2020). Benefits include improved EE and resource management, but challenges include compliance costs and ongoing professional training. Cases from various Asian countries underscore the importance of integrating robust policies, technological innovation, education, awareness and stakeholder engagement (Li *et al.*, 2020; Liu *et al.*, 2020).

2.1.3 Africa. Africa faces rapid urbanisation, expected to continue for decades (Emere *et al.*, 2023). This section focuses on South Africa, Nigeria and Ghana. South Africa is among the top 12 global CO_2 emitters because of coal-based electricity (Shikwambana *et al.*, 2021). Studies in South Africa stress the need for mandatory regulations and stakeholder incentives (Emere *et al.*, 2023). In Nigeria, rapid growth has driven policies such as the National Building EE Code and Climate Change Policy. Research indicates these measures reduce electricity use and emissions, although mandatory enforcement is limited

(Ebekozien *et al.*, 2024). Ghana has also introduced codes and action plans. Osei-Poku *et al.* (2022) emphasised the need for culturally and climatically suitable legal frameworks and stronger quality assurance. Collectively, these efforts across the selected countries highlight the growing recognition of CFCPs as critical tools for managing urbanisation-related emissions; however, their success ultimately depends on the enforcement of mandatory standards, cultural and climatic contextualisation and sustained stakeholder engagement (Shikwambana *et al.*, 2021).

2.1.4 Oceania. Oceania, including Australia, New Zealand and Pacific Island nations, has a diverse emissions profile. This study focuses on Australia and New Zealand because of their significant emissions and commitments to the Paris Agreement and SDGs (Chandrakumar *et al.*, 2020; Enker and Morrison, 2017). In Australia, building operations account for 45% of total energy use (Brown *et al.*, 2024). Key frameworks include the National Construction Code and NatHERS. For example, Enker and Morrison (2017) found these regulations effective and cost-efficient for improving EE and reducing GHG emissions. In New Zealand, major policies include the NZ Building Code, National Adaptation Plan, Healthy Homes Standards and the Climate Change Response (Zero Carbon) Amendment Act. Together, these measures support CFCPs, reduce environmental impacts and improve occupant well-being. Jalali *et al.* (2023) found that BECs improve EE and lower costs. However, Isaacs (2020) noted that political and industry resistance delayed EE clauses.

A review of existing literature reveals a significant research gap at the intersection of policies, regulations and CFCPs in New Zealand. Prior studies have examined individual aspects, such as building EE standards (Cielo and Subiantoro, 2021), green building certification drivers (Doan, GhaffarianHoseini, *et al.*, 2021) or construction waste management policies (Albsoul *et al.*, 2024). To date, no study has comprehensively evaluated the combined effectiveness of New Zealand's climate-related construction regulatory instruments. Unlike studies in Europe and Asia that have assessed the impact of integrated policy frameworks on construction sector decarbonisation, New Zealand's policy landscape remains under-examined (Li *et al.*, 2022; Schwarz *et al.*, 2020). This study addresses this gap by providing the first integrated assessment of how New Zealand's regulatory instruments collectively influence the adoption of CFCPs, drawing on both documentary evidence and stakeholder perspectives to offer a nuanced understanding that extends beyond individual policy evaluations.

3. Materials and methods

This study used a qualitative approach to achieve its research objectives, combining document analysis with key informant interviews for data collection. The aim was to identify existing policies and regulations related to CFCPs in New Zealand. Document analysis was used to collect data because it provides detailed and comprehensive information, encompassing both historical and contemporary contexts (Kutsyuruba, 2023). Additionally, this approach is cost-effective, as documents are often readily accessible. It also proves to be time-efficient, allowing researchers to analyse existing data without the need for extensive fieldwork or ethical concerns (Morgan, 2022). Key informant interviews complemented the document analysis by offering valuable high-level perspectives, comparative insights into the research questions and aiding in data triangulation (Creswell and Creswell, 2018).

3.1 Document analysis

This study used document analysis to identify existing policies and regulations related to CFCPs in New Zealand. Document analysis was selected as an appropriate qualitative method for examining policy content, institutional priorities and regulatory mechanisms

relevant to SCPs. To ensure comprehensive coverage of current and relevant sources, a structured search strategy was adopted. Data collection was undertaken through official government websites, policy repositories, regulations, research reports and publications from relevant organisations such as the Ministry for the Environment – MfE (Ministry for the Environment, 2022a, 2024c), the Building Research Association of New Zealand – BRANZ, the Ministry of Business, Innovation and Employment – MBIE, the Auckland Council, the Ministry of Conservation – DOC (Department of Conservation, 2010) and Ministry of Housing and Urban Development – HUD (Ministry of Housing and Urban Development, 2024). Documents were selected based on their relevance to CFCPs, with a focus on policy objectives, implementation strategies and impact assessments.

The final set of 16 documents was determined through purposive selection, consistent with applied construction management research approaches (Umar, 2020), using three inclusion criteria: direct relevance to CFCPs in New Zealand; regulatory significance, prioritising documents issued by statutory agencies or nationally recognised institutions; and credibility and currency, with preference given to recently updated documents reflecting current decarbonisation and sustainability priorities. Documents that were duplicated, outdated or only indirectly related to construction-sector climate outcomes were excluded. The final sample of 16 documents was considered sufficient, as recurring regulatory themes, implementation mechanisms and policy priorities became evident across the data set, indicating adequate coverage of the contemporary policy landscape. The selected documents were subsequently analysed for key interpretative constructs, thematic patterns and significant findings. By using this method, the research provides a comprehensive understanding of the regulatory framework governing CFCPs and sustainability within the New Zealand context.

3.2 Key informant interviews

Key informant interviews were conducted to examine the benefits and challenges of implementing the identified Policies and regulations (see Appendix 1 for interview protocol). Participants were purposively sampled to ensure relevant expertise and knowledge (Mweshi and Sakyi, 2020). Interviewees were recruited from leading organisations within New Zealand's construction and sustainability sectors. A total of eight semi-structured interviews, each lasting 25–30 min, were conducted face-to-face or via Microsoft Teams. The sample size aligns with qualitative guidance, indicating that thematic saturation in expert studies is often reached within 6–12 interviews involving specialised participants (Hennink and Kaiser, 2022). Similar sample sizes were reported by Umar and Egbu (2018) in construction research. Saturation was assessed iteratively; by the sixth interview, no new themes had emerged, while the final two interviews confirmed and refined the framework (Braun *et al.*, 2019).

The interviews were designed to explore two primary themes: the key benefits of existing policies and regulations in promoting CFCPs in New Zealand; and the significant barriers posed by current policies and regulations that hinder wider adoption. Data were transcribed and analysed using thematic analysis to identify common patterns (Byrne, 2022). NVivo software supported efficient and transparent coding (Allsop *et al.*, 2022). Findings were synthesised to generate practical recommendations. The coding process followed a hybrid inductive-deductive approach (Braun *et al.*, 2019). Initial codes were derived from the research objectives and document analysis framework, covering policy effectiveness, regulatory barriers, stakeholder perspectives and implementation challenges. These were complemented by inductive codes emerging from the interviews. The lead researcher coded all transcripts, while a second researcher reviewed the transcripts for consistency.

Differences were resolved through discussion, and the framework was refined until alignment was achieved. The research team comprised academics with expertise in construction management and sustainable built environment studies in New Zealand. While this supported rapport and informed analysis, it also created potential confirmation bias. To minimise this risk, researchers used a reflexive journal to record assumptions, decisions and interpretations (Braun *et al.*, 2019). Member checking with selected participants and triangulation between documentary and interview evidence further enhanced credibility (Creswell and Creswell, 2018).

4. Results and discussion

This section presents the key findings from document analysis and semi-structured interviews, together with an integrated discussion. Findings are organised thematically, with each subsection first outlining the principal empirical insights, followed by analytical interpretation in relation to prior literature, stakeholder perspectives and policy implications.

4.1 Findings and discussion from document analysis

In all, 16 documents were analysed through document analysis, which involved examining materials from various sources, including the MfE, the MBIE, BRANZ, the Department of Conservation (DOC), the HUD and the Auckland Council. The policies and regulations extracted from these documents were categorised into two categories: Government-Led Policies and Environmental Frameworks for SCPs and Technical Standards, Research and Regional Implementation for SCPs.

4.1.1 National leadership in climate policy and environmental stewardship for sustainable construction practices: the roles of the New Zealand Government. In New Zealand, several government agencies lead sustainability, conservation and environmental protection. Key authorities include the MfE, the HUD and the DOC. Moreover, MfE leads environmental policy and oversees legislation such as the Climate Change Response Act and Emissions Reduction Plan (ERP), which set national targets and reduce construction emissions (Ministry for the Environment, 2024b). HUD promotes sustainable housing and urban planning through energy-efficient, affordable development policies. DOC protects biodiversity and supports sustainable land use linked to urban and infrastructure growth (Department of Conservation, 2024). These agencies are grouped because they share responsibility for national frameworks, policies and legal structures guiding SCPs in New Zealand. Table 1 summarises their policies supporting climate mitigation, adaptation, energy efficiency and ecosystem protection, forming an integrated framework aligned with New Zealand's SDG commitments.

4.1.2 Advancing sustainable construction practices through research and regulation: the roles of Building Research Association of New Zealand and the Ministry of Business, Innovation and Employment. In New Zealand, MBIE regulates the building and construction sector, oversees the Building Codes, ensures compliance and develops policies to promote safe, healthy and sustainable buildings (Nwadike and Wilkinson, 2022). BRANZ, an independent non-profit, supports these goals through research that enhances building performance and sustainability. It provides evidence-based insights, practical tools and best practices via publications and workshops (BRANZ, 2025). MBIE and BRANZ are examined jointly because of their collaboration, with MBIE regularly drawing on BRANZ's research to inform updates to the Building Codes (BRANZ, 2024; MBIE, 2024b). While BRANZ focuses on research and knowledge transfer, MBIE leads regulatory and policy development. Both aim to improve building quality, safety and sustainability in New Zealand

Table 1. Summary of existing policies and regulations by Ministry for the Environment, Ministry of Conservation and Ministry of Housing and Urban Development

			Existing policies and regulations by MfE, DOC and HUD			
No.	Policies/Regulations	Year	Policy direction (purpose)	Organisation	Recommendations	Contribution to CFCPs
1	National Adaptation Plan (Ministry for the Environment, 2022a)	2022	- Support resilient homes, buildings and workforce readiness	MfE	- Coordinate workforce planning; support climate-resilient construction training; ensure equitable adaptation	- Promotes climate-resilient construction, skills development and equitable adaptation
2	Emission Reduction Plan – ERP (Ministry for the Environment, 2024c)	2020	- Reduce emissions and support sustainable development		- Promote sustainable urban development; enhance forestry carbon sequestration; align urban policies with emissions targets	- Reduces construction emissions while supporting low-carbon growth
3	National Policy Statement on Urban Development (Ministry for the Environment, 2022b)	2020	- Guide sustainable urban development and housing affordability		- Establish regional housing standards; promote sustainable development; align urban policy with emissions targets	- Supports affordable, low-emission urban development
4	Climate Change Response (Zero Carbon) Amendment Act (Ministry for the Environment, 2019)	2019	- Set emissions targets and an adaptation framework		- Establish clear emissions targets; support the climate change commission; adopt climate-risk adaptation strategies	- Strengthen carbon reduction, resilience and construction-sector adaptation
5	Emissions Trading Scheme - ETS (Ministry for the Environment, 2023)	2008	- Support emissions reporting and trading		- Expand coverage to construction emissions; incentivise low-carbon materials; support innovation research	- Encourages low-carbon materials and reduces the sector's carbon footprint
6	Carbon Neutral Programme (Ministry for the Environment, 2024a)	2020	- Make government operations carbon neutral by 2025		- Set 2025 and 2030 targets; phase out coal boilers; transition to EVs; report emissions across all scopes	- Promotes EE, low-carbon public buildings and carbon-neutral operations
7	Transitioning to a Low-emissions and Climate-resilient Future Plan (Ministry for the Environment, 2021)	2021	- Guide transition to a low-emissions, resilient future		- Integrate emissions reduction with industry, infrastructure, housing, urban development, finance and resilience planning	- Promotes low-carbon materials, SCPs and human-centred urban design
8	Healthy Home Standards (Ministry of Housing and Urban Development, 2024)	2019	- Improve rental housing warmth, dryness and health	HUD	- Meet heating standards; install insulation; improve ventilation; address moisture issues	- Improves EE, indoor health and sustainable rental housing
9	New Zealand Coastal Policy Statement (Department of Conservation, 2010)	2010	- Protect coastal resources and manage coastal hazards	DOC	- Assess coastal hazard risks; promote sustainable development; protect and restore natural defences	- Supports resilient coastal development and sustainable land-use planning

Source(s): Authors' own work

(BRANZ, 2020; MBIE, 2022). Table 2 outlines the key policy contributions from both organisations to sustainable development.

4.1.3 Local governance for sustainable development: the role of Auckland council. Auckland is one of the largest cities in New Zealand, with a current population of 1.8 million (Asquith *et al.*, 2021; StatsNZ, 2024). The Auckland Council plays a pivotal role in the region's building and construction activities, focusing on regulatory compliance, promoting sustainable urban development and aligning projects with Auckland's strategic growth plans (Auckland Council, 2024). Unlike BRANZ and MBIE, which operate on a national level (BRANZ, 2025), the Auckland Council enforces regulations at a regional level and tailors them to address the unique needs of its population and environment (Auckland Council, 2019). Therefore, analysing Auckland Council policies is essential because of the city's unique position as New Zealand's largest urban area, housing a diverse and growing population. Table 3 presents a summary of the key policies introduced by the Auckland Council, underscoring their contributions to sustainable development on a regional scale.

The document analysis reveals that New Zealand's framework for CFCPs is situated within a multi-level governance system in which national sustainability and climate-policy direction are set primarily by the MfE. At the same time, implementation is distributed across agencies such as the DOC, the MBIE, HUD and local authorities, including Auckland Council (Auckland Council, 2018b). Within this institutional arrangement, MBIE, supported by BRANZ and HUD, contributes to building-performance regulation through research, technical guidance and regulatory development; DOC embeds biodiversity and environmental protection considerations into planning; and Auckland Council translates national objectives into local planning, procurement, growth management, housing delivery and emissions-reduction initiatives. Although this governance network demonstrates extensive policy engagement with sustainability and climate objectives, the analysis indicates that policy ambition has not been matched by equivalent implementation capacity.

Furthermore, this implementation gap is evident in fragmented institutional responsibilities, slow building-code updates, uneven enforcement, skills and capability shortages and cost-related barriers (Nwadike and Wilkinson, 2022). These constraints suggest that New Zealand's challenge is not the absence of sustainability-oriented policy activity, but the limited capacity of existing governance arrangements to convert high-level climate commitments into enforceable and measurable construction-sector outcomes. This interpretation is consistent with Cielo and Subiantoro (2021) and Poorisat *et al.* (2026a) findings that New Zealand lags behind several developed countries in legislative effectiveness. Accordingly, stronger CFCP outcomes require not only improved coordination among responsible agencies but also faster regulatory updates, more robust compliance mechanisms, targeted incentives for low-carbon construction, workforce development and clearer technical guidance. First, the policy mix is dominated by strategic, aspirational and guidance-oriented instruments rather than binding performance requirements. Among the instruments reviewed, only the Healthy Homes Standards and the Emissions Trading Scheme impose enforceable obligations with direct or indirect relevance to construction-sector stakeholders (New Zealand Legislation, 2008). This produces an enforcement asymmetry: strong national climate ambition is articulated through instruments such as the Climate Change Response (Zero Carbon) Amendment Act, the ERP and Auckland's Climate Plan, yet these commitments are not consistently translated into mandatory project-level requirements or measurable construction-sector performance outcomes (Auckland Council, 2020).

Building on the individual policy instruments summarised in Tables 1–3, the comparative synthesis assesses the 16 selected policy and regulatory instruments in terms of their

Table 2. Summary of existing policies and regulations by Ministry of Business, Innovation and Employment and Building Research Association of New Zealand

			Existing policies and regulations by MBIE and BRANZ			
No.	Policies/Regulations	Year	Policy direction (purpose)	Organisation	Recommendations	Contribution to CFCPs
10	Building for Climate Change Programme (MBIE, 2020)	2020	- Reduce sector emissions and improve resilience towards net zero by 2050	MBIE	- Improve efficiency; cut embodied carbon; set targets; train stakeholders; improve transparency	- Lowers carbon footprint and strengthens climate-resilient buildings
11	Building System Regulatory Strategy (MBIE, 2024a)	2020	- Ensure safe, healthy, durable and accessible buildings	MBIE	- Improve performance; support innovation; develop workforce skills; protect consumers	- Supports EE, resilience and sustainable building outcomes
12	Resource Efficiency in the Building and Related Industries (REBRI) guidelines (BRANZ, 1995)	1995	- Reduce construction and demolition waste	BRANZ	- Promote waste minimisation, recycling and environmental awareness	- Encourages sustainable design, recycled materials and resource efficiency

Source(s): Authors' own work

Table 3. Summary of existing policies and regulations by the Auckland council

Existing policies and regulations by the Auckland council						
No.	Name of policies/regulations	Year	Policy direction (purpose)	Organisation	Recommendations	Contribution to CFCPs
13	Auckland Unitary Plan RMA Section 35 Monitoring – B2.3A quality-built environment (Auckland Council, 2022)	2022	- Assess the effectiveness of the unitary plan in delivering quality urban environments	Auckland council	- Further climate research; require landscape plans; prioritise maintenance	- Supports innovative design, sustainable landscaping and CFCP integration in development
14	Auckland's Climate Plan (Auckland Council, 2020)	2020	- Integrated approach to emissions reduction and climate resilience		- Redirect investment to sustainability; accelerate innovation; improve infrastructure and public spaces	- Reduces embodied emissions and strengthens resilient urban infrastructure
15	Auckland Plan 2050 (Auckland Council, 2018b)	2018	- Guide long-term urban growth, connectivity and environmental protection		- Assess future risks; minimise emissions; embed adaptive planning	- Promotes resilience, low emissions and sustainability in urban development
16	Auckland Council Group Sustainable Procurement Framework (Auckland Council, 2018a)	2018	- Promote sustainable procurement and supplier innovation		- Engage suppliers early; provide staff resources; drive innovation	- Supports climate-conscious purchasing and sustainable project delivery

Source(s): Authors' own work

regulatory strength, implementation mechanisms and contribution to CFCP outcomes. Three structural patterns emerge. First, the policy mix is dominated by strategic, aspirational and guidance-oriented instruments rather than binding performance requirements. Among the instruments reviewed, only the Healthy Homes Standards and the Emissions Trading Scheme impose enforceable obligations with direct or indirect relevance to construction-sector stakeholders (New Zealand Legislation, 2008). This produces an enforcement asymmetry: strong national climate ambition is articulated through instruments such as the Climate Change Response (Zero Carbon) Amendment Act, the ERP and Auckland's Climate Plan, yet these commitments are not consistently translated into mandatory project-level requirements or measurable construction-sector performance outcomes (Auckland Council, 2020).

Second, the policy landscape reflects a layered and incremental architecture. Earlier instruments, including the Emissions Trading Scheme and the New Zealand Coastal Policy Statement, were not designed specifically to advance CFCPs, while newer climate-oriented instruments remain at relatively early stages of implementation. This has created overlaps, gaps and an unclear hierarchy between established sustainability instruments and more recent climate-led frameworks (Schwarz *et al.*, 2020). Third, a vertical coherence gap persists between national target-setting and local delivery. Although MfE, MBIE, HUD and DOC establish broad policy objectives, their implementation depends heavily on local planning, procurement, consenting and development-control processes. However, none of the reviewed instruments explicitly mandates project-level carbon accounting, embodied-carbon thresholds, whole-of-life carbon assessment or carbon disclosure. This limits the ability of the current policy framework to generate consistent, verifiable and sector-specific CFCP outcomes.

Taken together, these findings indicate that the 16 instruments do not yet constitute a coherent or mutually reinforcing policy mix. Rather, they operate as a loosely coupled assemblage distributed unevenly across a continuum of regulatory strength. At the binding end are the Healthy Homes Standards and the Emissions Trading Scheme (Ministry of Housing and Urban Development, 2024). In the intermediate position are performance-oriented mechanisms, including the Building Code pathway and the Building for Climate Change Programme, which signal regulatory direction but do not yet impose comprehensive or measurable carbon-performance obligations. At the discretionary end are strategic and guidance-based instruments, such as the ERP, the National Adaptation Plan, Auckland's Climate Plan and the Auckland Plan 2050, which express climate ambition while largely devolving implementation to actors who may lack the mandate, resources or capacity to deliver the intended outcomes.

The key contribution of this document analysis is, therefore, to demonstrate that New Zealand's CFCP policy weakness lies less in the number of instruments than in the way those instruments are configured. The instruments carrying the strongest climate and sustainability aspirations tend to be the weakest in enforceability, while the few binding instruments were not designed primarily to drive construction-sector decarbonisation and, therefore, affect CFCP outcomes only indirectly. This ambition–obligation mismatch helps explain why an extensive policy landscape coexists with limited mandatory project-level carbon requirements. Addressing this gap requires more than adding further policy documents.

Accordingly, the existing guidance-based mechanisms need to be progressively strengthened into enforceable standards by embedding embodied-carbon thresholds, whole-of-life carbon assessment, project-level carbon disclosure and compliance requirements within the Building Code and related regulatory pathways. A sequenced schedule of increasing stringency should support these measures, targeted economic incentives,

workforce training and technical guidance. Such an approach would better align climate ambition, regulatory obligation, market signals and industry capability, thereby strengthening New Zealand's capacity to deliver measurable CFCP outcomes and contribute to the SDGs (Schwarz *et al.*, 2020; Warren *et al.*, 2024).

4.2 Findings and discussion from key informant interviews

This section presents findings from interviews with eight key informants with expertise in strategy, regulations, EE, infrastructure, climate mitigation, quality management and sustainability. The interviews were digitally recorded and transcribed to support consistent analysis. To maintain confidentiality, participants were anonymised as *P1–P8*. Table 4 summarises their job titles and expertise, reflecting the diverse stakeholder perspectives gathered on the implementation of CFCPs in New Zealand.

4.2.1 Benefits of the implementation of the existing policies and regulations in promoting climate-friendly construction practices in New Zealand. Participants generally agreed that existing policies and regulations have played a constructive role in advancing CFCPs in New Zealand. However, the perceived benefits extended beyond direct environmental outcomes, encompassing market transformation, improved governance, consumer protection and strategic sector direction.

4.2.1.1 Consumer and market focus. A key perceived benefit of regulation was the establishment of minimum market standards that protect consumers while improving product quality. *P1* noted that minimum standards help "propel the market forward", indicating that regulation can act as a competitive driver rather than merely a compliance burden. Similarly, *P8* highlighted that appliance energy-efficiency programmes prevent low-quality products from entering the market. These findings suggest that well-designed standards can simultaneously improve environmental performance and market confidence, aligning with prior work by Hafez *et al.* (2023), who mentioned that regulatory minimums often stimulate innovation by removing inefficient products and encouraging firms to compete through higher performance.

4.2.1.2 Environmental and sustainability goals. Participants strongly associated existing frameworks with emissions reduction, resource efficiency and long-term sustainability. *P3* described the Building for Climate Change Programme as a framework addressing "whole-of-life carbon and climate resilience", highlighting growing recognition that both operational and embodied emissions must be addressed. *P2* also linked waste reduction with competitiveness, noting that firms adopting waste-conscious practices may gain a strategic advantage. This indicates that sustainability regulation is increasingly perceived as an

Table 4. Participants' profiles

Participants ID	Job title	Area of expertise
P1	Group manager	Strategy, regulations and EE
P2	Director	Infrastructure and environmental services
P3	Lead advisor	Climate mitigation
P4	Manager	Quality and environment
P5	Scientist	Private organisation for building research in New Zealand
P6	Co-manager	Healthy homes and environmental policy
P7	Lead advisor	Environmental sustainability
P8	Senior advisor	EE and policy analysis

Source(s): Authors' own work

economic opportunity rather than solely an environmental obligation. Similar trends have been observed internationally, where low-carbon standards enhance innovation capacity and long-term resilience (Bui *et al.*, 2021).

4.2.1.3 Implementation and practical approaches. Participants discussed the practical aspects of implementing these Policies and regulations. *P1* pointed out that "the system operates efficiently with low visibility to consumers", meaning that they are unaware of the regulatory status of the products they purchase, resulting in minimal resistance from consumers, allowing for smooth market intervention and influence. In addition, *P5* emphasised the proactive role that individuals must play by claiming, "It is the sector's role to drive the change". Ghisellini *et al.* (2018) supported this by stating that proactive measures are crucial because they contribute to waste reduction, cost savings and alignment with SDGs. Findings highlight the importance of non-disruptive implementation and proactive industry engagement to ensure effective regulation and a smooth transition towards CFCPs.

4.2.1.4 Planning and best practices. Strategic planning and regulatory alignment emerged as important enablers of CFCPs in New Zealand. Participants highlighted the value of coordinated standards and cross-jurisdictional frameworks in improving efficiency and supporting knowledge transfer. *P1* referred to the Trans-Tasman Mutual Recognition Agreement, which enables products compliant with New Zealand standards to be accepted in Australia and vice versa, thereby promoting regulatory harmonisation and market integration. As *P1* noted, "Products manufactured to New Zealand standards can be sold in the Australian market without issues". This suggests that regulatory alignment can reduce duplication, enhance competitiveness and accelerate the uptake of best practices. These benefits are consistent with Epps (2024), who identified the Trans-Tasman Mutual Recognition Agreement as a model for regulatory cooperation and knowledge exchange. Similarly, Durdyev *et al.* (2023) emphasised that sustainability integrated into planning frameworks can improve public health, productivity and well-being. However, participants also noted limitations in current policy progress. *P4* stated that "New Zealand remains in the early stages of developing a comprehensive CFCP", indicating that existing efforts are still evolving, supporting earlier findings that New Zealand lags behind leading jurisdictions in the pace of building code development and implementation (Doan, GhaffarianHoseini, *et al.*, 2021). Overall, while New Zealand has established useful foundations for strategic planning and regulatory coordination, a more comprehensive and forward-looking policy roadmap is still needed to accelerate the transition towards sustainable construction.

4.2.1.5 Policy and regulatory framework. The policy and regulatory framework was identified as a major enabler of CFCPs in New Zealand. Participants highlighted the importance of building codes, climate targets and performance-based standards in influencing design, construction and operational decisions. *P5* noted that "the performance of the building is at the forefront in the design and construction processes", suggesting that outcome-based regulation can encourage more efficient practices. Participants expressed contrasting views on long-term climate targets. *P4* warned against complacency associated with the 2050 goal, stating that "If everyone keeps working towards 2050, we are in trouble", and emphasised the need for immediate action and stronger interim milestones. This supports Poorisat *et al.* (2024), who found that framing climate change as urgent can increase support for timely mitigation and adaptation. In contrast, *P7* supported the 2050 net-zero target, stating that "having those regulations is extremely advantageous", as they provide direction and motivation for industry stakeholders. This is consistent with Hafez *et al.* (2023), who highlighted the role of updated Building Codes in improving EE and reducing costs. Collectively, the findings emphasise the need for modernised legislation, continual

refinement of standards and stronger government leadership to support resilient and equitable sustainability outcomes.

4.3 Challenges of the implementation of the identified policies and regulations in promoting climate-friendly construction practices in New Zealand

The transition towards CFCPs in New Zealand is hindered by multiple challenges that affect the effective implementation of Policies and regulations. Participants identified key challenges, including Construction and Waste Management, Financial and Resource Constraints, Industry and Political Influences, Regulatory and Compliance Issues and Social and Operational Barriers. These themes reflect the complex interaction between regulatory structures, industry practices and societal attitudes, highlighting the difficulty of achieving SCPs. Addressing these barriers is crucial to narrowing the gap between policy intent and real-world outcomes. This section analyses the key challenges raised by participants, supported by relevant literature, to offer a comprehensive perspective on overcoming them.

4.3.1 Construction and waste management. Construction and waste management emerged as significant challenges to implementing CFCPs in New Zealand. Participants highlighted the persistent volume of construction waste sent to landfill, indicating a gap between sustainability ambitions and on-site waste outcomes. *P2* pointed to "the substantial amount of rubbish waste from construction sites that ends up in landfills", suggesting that existing controls may be insufficient to drive meaningful waste reduction. Although waste management plans are commonly required as part of building consent applications, their effectiveness depends on enforcement, monitoring and industry commitment. This concern aligns with Greenwood *et al.* (2017), who noted that regulatory approaches often face resistance where they are perceived to reduce economic competitiveness. However, structured waste management plans can help narrow the gap between policy intent and environmental performance by improving accountability and material recovery practices (Abdallah *et al.*, 2021). Participants also highlighted the need for a broader systems perspective. *P3* emphasised the interconnections between green space, climate resilience, EE, WE and waste management, stating that "We should consider the carbon footprint and look at the wider benefits". This indicates that construction waste should not be treated as an isolated issue, but as part of a wider sustainability framework involving resource efficiency, emissions reduction and urban resilience. Overall, the findings suggest that construction waste remains a major implementation challenge requiring stronger enforcement, integrated planning and more ambitious managerial strategies. This supports earlier work calling for broader environmental standards and more effective management approaches to address climate-related challenges in the construction industry (Albsoul *et al.*, 2024).

4.3.2 Financial and resource constraints. Financial and resource constraints emerged as major barriers to implementing CFCPs in New Zealand. Participants highlighted the tension between higher upfront costs and delayed returns from sustainable technologies and upgrades. *P2* described funding availability as a "big challenge", showing that access to capital remains a key constraint. This aligns with Rita *et al.* (2023), who identified high initial costs and long payback periods as barriers to sustainable construction. *P3* challenged the view that "energy-efficient designs are more expensive", noting that although upfront costs may rise, lower operation and maintenance costs can create long-term savings. This suggests barriers are shaped by not only actual costs but also limited awareness of lifecycle value. Technology readiness was also a challenge. *P4* stated that "many technologies are insufficient and also prohibitively expensive", highlighting cost and market maturity concerns. This supports Ebekozien *et al.* (2024), who found that limited access to mature technologies and reliable information can hinder adoption. Administrative delays further

worsen these issues. *P7* noted that "cost and design complexity remain major concerns", while *P8* explained that some EE equipment regulations require cabinet approval, causing delays. *P8* also noted that New Zealand requires broad legislation similar to that of larger nations, increasing complexity. Overall, financial barriers are multidimensional, involving capital access, cost perceptions, technology availability and regulatory delays. Addressing these issues requires targeted incentives, green finance tools and stronger promotion of lifecycle-cost thinking.

4.3.3 Industry and political influences. Industry and political influences were identified as major barriers to implementing CFCPs. Participants suggested policy reform may slow when dominant market actors resist changes that challenge existing business models. *P1* noted that many regulations are developed with industry and may progress slowly, adding that "these drivers and attitudes must be acknowledged, as they may not always prioritise improvement". This aligns with Ebekozien *et al.* (2024), who identified cultural resistance and conservatism in the building sector as barriers to innovation. It also suggests that collaborative policy development, while valuable, can reinforce existing interests if not balanced by stronger public-interest leadership. Participants also highlighted split incentives in the housing market. *P3* stated that "property developers often focus on building and selling houses without considering the long-term operating costs". This supports Poorisat *et al.* (2024), who found that clients often prioritise short-term gains over future operation and maintenance benefits. As a result, developers may have limited motivation to invest in measures benefiting future occupants. Political resistance was also identified as a constraint. *P6* noted that "political resistance can significantly hinder the progress of implementing CFCPs". Overall, these findings indicate that stronger alignment between policy ambition, market incentives and political commitment is needed to accelerate sector transformation.

4.3.4 Regulatory and compliance. Participants frequently cited regulatory and compliance barriers. *P1* described the current system as "very slow", noting that outdated regulations are causing the market to lag and emphasising the need for "more modern regulations". A further challenge lies in regulatory enforcement, as many are unaware that certain products are subject to regulation, which aligns with Greenwood *et al.* (2017), who advocate for cultivating a culture of innovation to support wellness-focused infrastructure. Similarly, *P2* noted the slow pace of behavioural change, particularly among older generations, but was optimistic about younger people's stronger sustainability awareness. These insights underscore the need for practical solutions, stronger regulatory frameworks and improved public education to drive meaningful progress.

4.3.5 Social and operational. Participants identified several social and operational challenges in implementing SCPs. *P2* noted the difficulty of changing public behaviour in SCPs, stating, "They want others to do it, but not themselves", reflecting a tendency to defer responsibility. This observation aligns with Poorisat *et al.* (2024), who highlight the importance of considering human factors, resistance to change and consumer preferences to promote SCPs effectively. Moreover, *P4* criticised the delay in addressing climate obligations, stating that aiming to meet goals by 2050 is "kind of the wrong call" and suggesting that efforts should be aimed at achieving these goals by 2040. Furthermore, *P5* mentioned that "the lack of skills is the main barrier", which stressed the importance of embedding these competencies throughout the sector. These findings align with Poorisat *et al.* (2024), who reported that deficiencies in expertise and training exacerbate challenges in promoting SCPs. Furthermore, *P7* linked sustainability and climate change outcomes to cost savings, highlighting their alignment as drivers of operational changes (Greenwood *et al.*, 2017). The findings represent the social and organisational aspects of concerns regarding the

integration of CFCPs, as well as the consideration of cost-effectiveness as a mandatory objective.

4.3.6 Cross-cutting tensions and stakeholder dynamics. A cross-cutting analysis of interview and documentary data reveals several notable tensions and contradictions that merit discussion. First, there is a fundamental tension between the industry's call for regulatory certainty and the government's incremental approach to policy reform. While participants from industry backgrounds (*P1*, *P3* and *P7*) emphasised the need for clear, ambitious targets and stable long-term frameworks, government-aligned participants (*P6* and *P8*) highlighted political constraints and the risk of imposing disproportionate compliance costs on smaller firms. This asymmetry reflects a broader power dynamic in which industry stakeholders with greater lobbying capacity can influence the pace and stringency of regulatory change, potentially delaying more ambitious climate action (Greenwood *et al.*, 2017).

Second, a contradiction emerged between participants' acknowledgement of the urgency of climate action and their pragmatic acceptance of delayed timelines. *P4*'s critique that the 2050 target is inadequate stands in contrast to the general acquiescence among other participants to existing timeframes, suggesting a disconnect between stated ambitions and institutional willingness to pursue accelerated reform. Third, the data reveal a gap between national policy aspirations and local implementation capacity. While central government frameworks such as the Building for Climate Change Programme set broad objectives, local authorities lack the resources and technical expertise for effective enforcement, creating an implementation deficit (Nwadike and Wilkinson, 2022). These tensions underscore the need for more nuanced policy design that accounts for divergent stakeholder interests and power structures within the construction sector (Poorisat *et al.*, 2026b).

Additionally, these tensions can be interpreted through stakeholder disagreement, policy trade-offs and institutional power dynamics. The regulatory–industry interface may reflect partial regulatory capture, where established industry actors influence rule-making ambition (Greenwood *et al.*, 2017). Larger firms are better positioned to participate in consultation, while SMEs, occupants and future-generation interests remain less represented. This may partly explain the slow progress of the Building for Climate Change Programme and incremental Building Code updates (Nwadike and Wilkinson, 2022). The findings also reveal key trade-offs, including regulatory ambition versus SME challenge, policy stability versus technological change and national consistency versus regional responsiveness (Poorisat *et al.*, 2026a). These are distributive policy choices concerning whose costs, risks and benefits are prioritised (Akomea-Frimpong *et al.*, 2022). Institutionally, MfE and MBIE set strategic direction, but implementation depends on territorial authorities and the private sector, creating accountability gaps. Fragmentation among MBIE, BRANZ, HUD and DOC further weakens delivery. Accordingly, future reform should, therefore, strengthen both regulatory content and the institutional arrangements through which climate-related construction policy is designed and enforced.

Synthesising the document analysis and key informant interview evidence indicates that New Zealand's implementation gap in advancing SCPs is primarily a governance and policy-instrument problem rather than a failure of any single actor or initiative. The document analysis reveals an instrument mix that is rich in ambition but weak in obligation, while the interviews demonstrate how this policy configuration is experienced in practice through slow and outdated regulation, limited enforcement, split incentives between developers and occupants, skills and capability constraints and an over-reliance on the distant 2050 target. The recurrence of these concerns across different stakeholder groups, including industry stakeholders seeking regulatory certainty, policymakers balancing political and cost

constraints and technical experts identifying delivery-capacity deficits, suggests that the gap is structural.

Viewed through a policy-instruments lens, New Zealand reflects the limitations of a fragmented, guidance-led regime operating within a small, performance-based regulatory system. Dispersed authority weakens accountability; voluntary signalling often substitutes for enforceable requirements; and incremental code revisions struggle to keep pace with climate and sustainability needs (Cielo and Subiantoro, 2021; Nwadike and Wilkinson, 2022). This has an important distributive implication. Because the binding edge of the current instrument mix remains thin, the costs of delayed action are shifted onto future occupants and the wider public realm, while better-resourced actors are more able to shape and respond to discretionary guidance and consultation processes. This asymmetry helps explain the slow trajectory of the Building for Climate Change Programme and the uneven translation of sustainability ambition into practice (Greenwood *et al.*, 2017; Poorisat *et al.*, 2026a). Therefore, the combined evidence suggests that marginal refinements to individual instruments are unlikely to close the implementation gap. Instead, New Zealand requires a more deliberately integrated instrument mix in which binding standards, economic incentives and capability-building measures are sequenced to reinforce one another (Nwadike and Wilkinson, 2022). For example, embodied-carbon disclosure should be coupled with green-finance mechanisms and targeted workforce training so that regulatory ambition, market signals and delivery capacity progress together rather than in isolation (Akomea-Frimpong *et al.*, 2022).

5. Recommendations from document analysis and key informant interviews

Based on the insights gathered from document analysis and key informant interviews, several key recommendations have been provided to enhance the role of policies and regulations in promoting CFCPs in New Zealand. These recommendations aim to address existing gaps while leveraging best practices and insights obtained from the research findings.

5.1 Strengthening regulatory frameworks and providing financial incentives

To enhance CFCPs in New Zealand, strengthening and modernising regulatory frameworks is a key recommendation (Cielo and Subiantoro, 2021). The current system is often criticised as slow and outdated, with product and code updates taking years, leaving the market behind other countries (Cielo and Subiantoro, 2021). Improving compliance and enforcement is, therefore, critical. Regular audits, inspections and stronger penalties can increase adherence to updated standards. Financial rewards for stakeholders exceeding minimum codes can further encourage SCP adoption (Durdyev *et al.*, 2023).

These measures highlight the important role of government in steering the construction sector towards SCPs. Tax rebates, grants and low-interest loans can offset upfront costs and make sustainable projects more attractive (Akomea-Frimpong *et al.*, 2022). Also, Simpeh and Smallwood (2023) mentioned that incentives are essential for wider uptake. Strong leadership is needed through updated Building Codes aligned with current sustainability standards (Durdyev *et al.*, 2023). Governments should also provide clear guidance and improve collaboration across agencies and industry stakeholders (Poorisat *et al.*, 2026b). Collectively, these reforms and incentives can accelerate New Zealand's transition to SCPs.

5.2 Promoting education and training

Addressing skill shortages in the construction sector is vital for implementing SCPs effectively (Ebekozien *et al.*, 2024). Targeted training programs tailored for architects,

engineers and construction workers can equip them with the knowledge and skills necessary to adopt CFCPs. Furthermore, continuous professional development and certification programs can strengthen workforce competency and ensure up-to-date expertise in SCPs. Public awareness campaigns that highlight the benefits of CFCPs are crucial. These recommendations align with prior research by Addy *et al.* (2020), which emphasises the significant influence of education and awareness on the knowledge and engagement levels of clients and the general public regarding SCPs.

5.3 Enhancing coordination and collaboration between relevant stakeholders

Collaboration between government agencies, industry stakeholders, academic institutions and community groups is essential for developing and implementing effective CFCPs (Poorisat *et al.*, 2024). This collaborative approach ensures that policies are comprehensive, inclusive and reflective of the needs and perspectives of relevant stakeholders. A more decisive direction from the central government, even when administrations change, is needed to maintain consistency in policy implementation (Poorisat *et al.*, 2026b). The recommendations are aligned with Ebekozien *et al.* (2024), who highlighted the importance of early stakeholder involvement and frequent stakeholder meetings for the success of project development.

5.4 Promoting best practices and innovation

Promoting and recognising successful CFCPs can effectively motivate other developers and foster a competitive market for sustainable building innovations (Poorisat *et al.*, 2024). The implementation of awards, certifications and public acknowledgment of exemplary projects can inspire industry stakeholders to adopt and even surpass existing sustainability standards (Blackburn *et al.*, 2020), which is consistent with Poorisat *et al.* (2024), underscoring the importance of advocating for SCPs through the dissemination of successful case studies. By adopting these strategies, New Zealand can significantly enhance the effectiveness of its policies and regulations in promoting CFCPs, thereby ensuring that New Zealand's built environment is adequately equipped to address the challenges posed by climate change.

5.5 Technological and strategic approaches

Adopting and integrating advanced technological solutions is a key strategy for promoting CFCPs. This includes the transition to digital construction techniques, such as Building Information Modelling and automated construction processes, which can significantly enhance efficiency and reduce construction waste. Establishing a clear framework for technological adoption, supported by strong policies and incentives, can accelerate this transition by enabling the construction industry to achieve its environmental goals. These strategies will reduce the sector's carbon footprint, ensure climate-resilient constructions and position New Zealand as a global leader in SCPs. The findings align with Albsoul *et al.* (2024), who demonstrated that adopting advanced technologies to support circular design concepts within the construction sector can improve material recycling rates and significantly reduce unnecessary construction waste.

6. Implications of the findings

The findings of this study provide important implications for advancing CFCPs in New Zealand. First, they highlight the need for a more robust and agile regulatory framework to address slow updates and inconsistent enforcement. Strengthening regulations through clear guidance and modern standards, such as whole-of-life carbon assessments, can improve

governance of SCPs. Second, the findings emphasise the importance of financial incentives. Tax rebates, grants and low-interest loans can help offset higher upfront costs and encourage wider adoption of CFCPs while supporting SDGs (Akomea-Frimpong *et al.*, 2022). Third, the study underscores the need for education and workforce development to address skill gaps and improve public awareness. Targeted training and public campaigns can increase adoption and demand for sustainable solutions. Finally, the findings reinforce the value of stakeholder collaboration among government, industry, academia and communities to support effective policy design, innovation and sustainability goals (Poorisat *et al.*, 2026b).

Together, these measures can accelerate New Zealand's transition towards a resilient and sustainable built environment. The findings also offer transferable insights for countries with comparable regulatory systems and construction sectors. New Zealand's experience with performance-based building codes, mixed regulatory–voluntary approaches and enforcement challenges within a small open economy reflects conditions in jurisdictions such as Australia, Ireland and the Nordic countries (Schwarz *et al.*, 2020). Likewise, barriers such as slow regulatory updates, fragmented collaboration and limited incentives are common across sectors transitioning to low-carbon development (Nwadike and Wilkinson, 2022). Therefore, the policy recommendations of stronger regulatory coherence, improved enforcement and integrated governance may inform decision-making in similar contexts. Furthermore, the mixed-methods design, combining document analysis with expert interviews, offers a practical framework for evaluating construction policy effectiveness internationally. Accordingly, this study contributes to the wider international discourse on sustainable construction governance and the role of policy in accelerating decarbonisation.

Compared with leading international frameworks, New Zealand's policy mix remains ambition-heavy but enforcement-light. The EU's EPBD provides a mandatory performance pathway through nearly zero-energy and zero-emission building requirements, while the UK Future Homes and Future Buildings Standards illustrate phased mandatory operational-performance uplifts (Warren *et al.*, 2024). Singapore's Green Mark scheme further demonstrates a more integrated model linking regulation, rating systems, procurement and investment (Liu *et al.*, 2019). By contrast, New Zealand lacks binding project-level carbon metrics, embodied-carbon thresholds, whole-of-life carbon assessment requirements and a pre-announced schedule for increasing regulatory stringency. This comparison shows that New Zealand's broader contribution lies in illustrating the governance risks of fragmented, guidance-oriented climate policy in small performance-based regulatory systems.

7. Conclusion

This research addresses the pressing need for SCPs within the construction industry, a major contributor to GHG emissions. By evaluating the existing regulatory framework, this study provides important insights into how policies and regulations can mitigate the environmental impacts of construction activities. The research also supports New Zealand's broader SDGs by emphasising the role of cohesive policy approaches in strengthening climate resilience and reducing the carbon footprint of the built environment. The findings offer practical recommendations for policymakers, industry stakeholders and researchers to help bridge the gap between policy intent and implementation. Key beneficiaries include policymakers, construction professionals, environmental organisations, investors and academics seeking to improve regulatory frameworks, adopt best practices and drive innovation in CFCPs.

Despite its comprehensive approach, the research has limitations. This study relied on qualitative methods, including document analysis (n = 16) and key informant interviews (n = 8), which may introduce subjectivity and limit the generalisability of findings. In addition, the interview sample may not fully capture the diversity of perspectives across the

construction sector. The rapidly evolving nature of policies, regulations and technologies also means some findings may become outdated over time. Therefore, future research should integrate qualitative and quantitative approaches to enable data triangulation and strengthen robustness. Expanding the sample to include a broader range of stakeholders, such as policymakers, industry professionals, investors and end-users, would provide more comprehensive insights into SCPs. Longitudinal studies are also needed to assess the long-term effects of policies and regulations on sector sustainability. Comparative studies across countries or regions could identify transferable best practices, while research on emerging technologies, innovative materials and public awareness can further support the transition to a sustainable built environment.

References

Abdallah, M., Hamdan, S. and Shabib, A. (2021), "A multi-objective optimization model for strategic waste management master plans", *Journal of Cleaner Production*, Vol. 284, p. 124714, doi: 10.1016/j.jclepro.2020.124714.

Abdeen, A., O'Brien, W., Gunay, B., Newsham, G. and Knudsen, H. (2020), "Comparative review of occupant-related energy aspects of the national building code of Canada", *Building and Environment*, Vol. 183, p. 107136, doi: 10.1016/j.buildenv.2020.107136.

Addy, M., Adinyira, E., Danku, J.C. and Dadzoe, F. (2020), "Impediments to the development of the green building market in Sub-Saharan Africa: the case of Ghana", *Smart and Sustainable Built Environment*, Vol. 10 No. 2, pp. 193-207, doi: 10.1108/SASBE-12-2019-0170.

Aigwi, I.E., Mendoza, L., Poorisat, T. and Nwadike, A.N. (2026), "Transforming spaces: the role of adaptive reuse in strengthening urban resilience in Auckland, New Zealand", *Cities*, Vol. 169, p. Article 106472, doi: 10.1016/j.cities.2025.106472.

Akomea-Frimpong, I., Kukah, A.S., Jin, X., Osei-Kyei, R. and Pariafsai, F. (2022), "Green finance for green buildings: a systematic review and conceptual foundation", *Journal of Cleaner Production*, Vol. 356, p. Article 131869, doi: 10.1016/j.jclepro.2022.131869.

Albsoul, H., Doan, D.T., Aigwi, I.E. and Ghaffarianhoseini, A. (2024), "A review of extant literature and recent trends in residential construction waste reduction", *Waste Management and Research: The Journal for a Sustainable Circular Economy*, Vol. 43 No. 3, pp. 322-338, doi: 10.1177/0734242X241241607.

Allsop, D.B., Chelladurai, J.M., Kimball, E.R., Marks, L.D. and Hendricks, J.J. (2022), "Qualitative methods with NVivo software: a practical guide for analyzing qualitative data", *Psych*, Vol. 4 No. 2, pp. 142-159, doi: 10.3390/psych4020013.

Asquith, A., McNeill, J. and Stockley, E. (2021), "Amalgamation and Auckland city: a New Zealand success story?", *Australian Journal of Public Administration*, Vol. 80 No. 4, pp. 977-986, doi: 10.1111/1467-8500.12457.

Auckland Council (2018a), "Auckland council group sustainable procurement framework", available at: www.aucklandcouncil.govt.nz/about-auckland-council/how-we-buy-products-and-services/sustainable-procurement/Documents/procurement-sustainable-framework.pdf

Auckland Council (2018b), "Auckland plan 2050", available at: www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/auckland-plan/about-the-auckland-plan/docsprintdocuments/auckland-plan-2050-print-document.pdf

Auckland Council (2019), "Auckland council regulatory compliance unit: Compliance and enforcement policy", available at: www.aucklandcity.govt.nz/council/documents/regionalplans/aucklandcouncilregionalpolicystatement/ACRPS%20Policy.pdf

Auckland Council (2020), "Auckland's climate plan", available at: www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/environmental-plans-strategies/aucklands-climate-plan/Documents/auckland-climate-plan.pdf

Auckland Council (2022), "Auckland unitary plan RMA section 35 monitoring – B2.3 a quality-built environment", available at: www.aucklandcouncil.govt.nz/UnitaryPlanDocuments/pc-79-att-5-section-35-monitoring-b2-3-a-quailty-built-environment.pdf

Auckland Council (2024), "Role of Auckland council", available at: www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/environmental-plans-strategies/aucklands-climate-plan/implementation/Pages/role-of-auckland-councilaspx#:~:text=The%20Auckland%20Council%20group%20plays,control%2C%20revegetation%20and%20supporting%20biodiversity

Blackburn, C.J., Flowers, M.E., Matisoff, D.C. and Moreno-Cruz, J. (2020), "Do pilot and demonstration projects work? Evidence from a green building program", *Journal of Policy Analysis and Management*, Vol. 39 No. 4, pp. 1100-1132, doi: 10.1002/pam.22218.

BRANZ (1995), "REBRI: Reducing building material waste", available at: www.branz.co.nz/reducing-building-material-waste/#:~:text=REBRI%20provides%20a%20toolbox%20for,reused%2C%20recycled%2C%20or%20recovered

BRANZ (2020), "Thermal, financial and carbon review of NZBC energy efficiency clause H1/AS1 thermal envelope requirements for residential and small buildings", available at: www.building.govt.nz/assets/Uploads/building-code-compliance/background-report-on-h1-energy-efficiency-branz.pdf#page=5.43

BRANZ (2024), "Building act changes removing barriers to using overseas products", available at: www.branz.co.nz/sector-leadership/building-act-changes-removing-barriers-to-using-overseas-products/

BRANZ (2025), "BRANZ research now", BRANZ, available at: www.branz.co.nz/pubs/research-now/

Braun, V., Clarke, V., Hayfield, N. and Terry, G. (2019), "Thematic analysis", in Liamputtong, P. (Ed.), *Handbook of Research Methods in Health Social Sciences*, Springer Singapore, pp. 843-860, doi: 10.1007/978-981-10-5251-4_103.

Brown, D., Tokede, O., Li, H.X. and Edwards, D. (2024), "A systematic review of barriers to implementing net zero energy buildings in Australia", *Journal of Cleaner Production*, Vol. 467, p. 142910, doi: 10.1016/j.jclepro.2024.142910.

Bui, T.T., Wilkinson, S., Domingo, N. and MacGregor, C. (2021), "Zero carbon building practices in Aotearoa New Zealand", *Energies*, Vol. 14 No. 15, p. Article 4455, doi: 10.3390/en14154455.

Byrne, D. (2022), "A worked example of Braun and Clarke's approach to reflexive thematic analysis", *Quality and Quantity*, Vol. 56 No. 3, pp. 1391-1412, doi: 10.1007/s11135-021-01182-y.

Chandrakumar, C., McLaren, S.J., Dowdell, D. and Jaques, R. (2020), "A science-based approach to setting climate targets for buildings: the case of a New Zealand detached house", *Building and Environment*, Vol. 169, p. 106560, doi: 10.1016/j.buildenv.2019.106560.

Cielo, D. and Subiantoro, A. (2021), "Net zero energy buildings in New Zealand: challenges and potentials reviewed against legislative, climatic, technological, and economic factors", *Journal of Building Engineering*, Vol. 44, p. 102970, doi: 10.1016/j.jobe.2021.102970.

City of Vancouver (2023), "Zero emissions buildings", available at: https://vancouver.ca/green-vancouver/zero-emissions-buildings.aspx#zero-emissions-building-plan

Creswell, J.W. and Creswell, J.D. (2018), *Research Design: qualitative, Quantitative, and Mixed Methods Approaches*, (5th ed.), SAGE.

Department of Conservation (2010), "New Zealand coastal policy statement", New Zealand Government, available at: www.doc.govt.nz/about-us/science-publications/conservation-publications/marine-and-coastal/new-zealand-coastal-policy-statement

Department of Conservation (2024), "Our role: how we manage New Zealand's natural and cultural heritage, legislation we work with, our history and corporate publications", New Zealand Government, available at: www.doc.govt.nz/about-us/our-role/

Doan, D.T., GhaffarianHoseini, A., Naismith, N., Ghaffarianhoseini, A., Zhang, T. and Tookey, J. (2021), "Examining critical perspectives on building information modelling (BIM) adoption in New Zealand", *Smart and Sustainable Built Environment*, Vol. 10 No. 4, pp. 594-615, doi: 10.1108/SASBE-04-2020-0043.

Doan, D.T., Wall, H., Ghaffarian Hoseini, A., GhaffarianHoseini, A. and Naismith, N. (2021), "Green building practice in the New Zealand construction industry: drivers and limitations", *International Journal of Technology*, Vol. 12 No. 5, pp. 291-319, doi: 10.14716/ijtech.v12i5.5209.

Durdyev, S., Koc, K., Karaca, F. and Gurgun, A.P. (2023), "Strategies for implementation of green roofs in developing countries", *Engineering, Construction and Architectural Management*, Vol. 30 No. 6, pp. 2481-2502, doi: 10.1108/ECAM-12-2021-1147.

Ebekozien, A., Aigbavboa, C., Thwala, W.D., Amadi, G.C., Aigbedion, M. and Ogbaini, I.F. (2024), "A systematic review of green building practices implementation in Africa", *Journal of Facilities Management*, Vol. 22 No. 1, pp. 91-107, doi: 10.1108/JFM-09-2021-0096.

Economidou, M., Todeschi, V., Bertoldi, P., D'Agostino, D., Zangheri, P. and Castellazzi, L. (2020), "Review of 50 years of EU energy efficiency policies for buildings", *Energy and Buildings*, Vol. 225, p. 110322, doi: 10.1016/j.enbuild.2020.110322.

Emere, C., Aigbavboa, C. and Thwala, D. (2023), "A principal component analysis of regulatory environment features for sustainable building construction in South Africa", *Journal of Construction Project Management and Innovation*, Vol. 13 No. 2, pp. 17-32, doi: 10.1108/JEDT-01-2024-0015.

Enker, R.A. and Morrison, G.M. (2017), "Analysis of the transition effects of building codes and regulations on the emergence of a low carbon residential building sector", *Energy and Buildings*, Vol. 156, pp. 40-50, doi: 10.1016/j.enbuild.2017.09.059.

Epps, T. (2024), "The Trans-Tasman mutual recognition arrangement (TTMRA): a model for others or a unique set of circumstances?", *Legal Issues of Economic Integration*, Vol. 51 No. Issue 3, pp. 233-262, doi: 10.54648/leie2024011.

Ghisellini, P., Ji, X., Liu, G. and Ulgiati, S. (2018), "Evaluating the transition towards cleaner production in the construction and demolition sector of China: a review", *Journal of Cleaner Production*, Vol. 195, pp. 418-434, doi: 10.1016/j.jclepro.2018.05.084.

González-Torres, M., Pérez-Lombard, L., Coronel, J.F., Maestre, I.R. and Yan, D. (2022), "A review on buildings energy information: trends, end-uses, fuels and drivers", *Energy Reports*, Vol. 8, pp. 626-637, doi: 10.1016/j.egyr.2021.11.280.

Greenwood, D., Congreve, A. and King, M. (2017), "Streamlining or watering down? Assessing the 'smartness' of policy and standards for the promotion of low and zero carbon homes in England 2010–15", *Energy Policy*, Vol. 110, pp. 490-499, doi: 10.1016/j.enpol.2017.08.033.

Hafez, F.S., Sa'di, B., Safa-Gamal, M., Taufiq-Yap, Y.H., Alrifaey, M., Seyedmahmoudian, M., Stojcevski, A., Horan, B. and Mekhilef, S. (2023), "Energy efficiency in sustainable buildings: a systematic review with taxonomy, challenges, motivations, methodological aspects, recommendations, and pathways for future research", *Energy Strategy Reviews*, Vol. 45, p. 101013, doi: 10.1016/j.esr.2022.101013.

Hennink, M. and Kaiser, B.N. (2022), "Sample sizes for saturation in qualitative research: a systematic review of empirical tests", *Social Science and Medicine*, Vol. 292, p. 114523, doi: 10.1016/j.socscimed.2021.114523.

IEA (2022), "World energy outlook 2022", available at: www.iea.org/reports/world-energy-outlook-2022

Isaacs, N. (2020), "Keeping cost effectively warm: the inclusion of thermal performance in the New Zealand building code", *Architectural History Aotearoa*, Vol. 17, doi: 10.26686/aha.v17.9572.

Jalali, Z., Shamseldin, A. and Mannakkara, S. (2023), "Evaluation of climate change effects on residential building cooling and heating demands in New Zealand: implications for energy

efficiency standards and building codes", *International Journal of Building Pathology and Adaptation*, Vol. 43 No. 5, pp. 1179-1196, doi: 10.1108/ijbpa-10-2022-0168.

Kangas, H.-L., Lazarevic, D. and Kivimaa, P. (2018), "Technical skills, disinterest and non-functional regulation: barriers to building energy efficiency in Finland viewed by energy service companies", *Energy Policy*, Vol. 114 No. 114, pp. 63-76, doi: 10.1016/j.enpol.2017.11.060.

Kutsyuruba, B. (2023), "Document analysis", In *Varieties of Qualitative Research Methods: Selected Contextual Perspectives*, Springer, pp. 139-146, doi: 10.1007/978-3-031-04394-9_23.

Li, B., Han, S., Wang, Y., Wang, Y., Li, J. and Wang, Y. (2020), "Feasibility assessment of the carbon emissions peak in China's construction industry: Factor decomposition and peak forecast", *Science of The Total Environment*, Vol. 706, p. 135716, doi: 10.1016/j.scitotenv.2019.135716.

Li, H.X., Moore, T., Huang, J., Zhang, P. and Costin, G. (2022), "Towards zero carbon housing in Victoria, Australia: a policy and incentive framework", *Energy Strategy Reviews*, Vol. 40, p. 100802, doi: 10.1016/j.esr.2022.100802.

Li, Y., Liu, Z. and Li, C. (2022), "Overview of government strategies on green building in Singapore", *Journal of Green Building*, Vol. 17 No. 4, pp. 219-241, doi: 10.3992/jgb.17.4.219.

Liu, G., Li, X., Tan, Y. and Zhang, G. (2020), "Building green retrofit in China: policies, barriers and recommendations", *Energy Policy*, Vol. 139, p. 111356, doi: 10.1016/j.enpol.2020.111356.

Liu, Y., Lu, Y., Hong, Z., Nian, V. and Loi, T.S.A. (2019), "The "START" framework to evaluate national progress in green buildings and its application in cases of Singapore and China", *Environmental Impact Assessment Review*, Vol. 75, pp. 67-78, doi: 10.1016/j.eiar.2018.12.007.

Magrini, A., Lentini, G., Cuman, S., Bodrato, A. and Marenco, L. (2020), "From nearly zero energy buildings (NZEB) to positive energy buildings (PEB): the next challenge – The most recent European trends with some notes on the energy analysis of a forerunner PEB example", *Developments in the Built Environment*, Vol. 3, p. 100019, doi: 10.1016/j.dibe.2020.100019.

Mathur, A. (2019), "Public costs and private benefits: the governance of energy efficiency in India", *Building Research and Information*, Vol. 47 No. 1, pp. 123-126, doi: 10.1080/09613218.2018.1514743.

MBIE (2020), "Building for climate change: transforming the building and construction sector to reduce emissions and improve climate resilience", New Zealand Government, available at: www.mbie.govt.nz/dmsdocument/11522-building-for-climate-change

MBIE (2022), "Building and construction sector trends: Annual report 2022", MBIE, available at: www.mbie.govt.nz/dmsdocument/25439-building-construction-sector-trends-annual-report-2022

MBIE (2024a), "Building system regulatory strategy: the building system regulatory strategy – building for the future – outlines MBIE's vision for the future of building regulation over the next 10 to 15 years", New Zealand Government, available at: www.building.govt.nz/about-building-performance/building-system-regulatory-strategy

MBIE (2024b), "National construction pipeline report: the national construction pipeline report provides the sector with a 6-year projection of national building and construction work", New Zealand Government, available at: www.mbie.govt.nz/building-and-energy/building/supporting-a-skilled-and-productive-workforce/national-construction-pipeline-report

Ministry for the Environment (2017), "New Zealand's seventh national communication: fulfilling reporting requirements under the united nations framework convention on climate change and the Kyoto protocol", New Zealand Government, available at: https://environment.govt.nz/assets/Publications/Files/21-12-17-Web-FINAL-Seventh-National-Communication-2017.pdf

Ministry for the Environment (2019), "Climate change response (zero carbon) amendment act 2019", New Zealand Government, available at: https://environment.govt.nz/acts-and-regulations/acts/climate-change-response-amendment-act-2019/

Ministry for the Environment (2021), "Transitioning to a low-emissions and climate-resilient future: emissions reduction plan", New Zealand Government, available at: https://environment.govt.nz/publications/emissions-reduction-plan-discussion-document/

Ministry for the Environment (2022a), "National adaptation plan", New Zealand Government, available at: https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/adapting-to-climate-change/national-adaptation-plan/

Ministry for the Environment (2022b), "National policy statement on urban development 2020", New Zealand Government, available at: https://environment.govt.nz/publications/national-policy-statement-on-urban-development-2020-updated-may-2022/

Ministry for the Environment (2023), "New Zealand emissions trading scheme", New Zealand Government, available at: https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/ets/about-nz-ets/

Ministry for the Environment (2024a), "About the carbon neutral government programme", New Zealand Government, available at: https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/carbon-neutral-government-programme/about-carbon-neutral-government-programme/#timeline-for-the-programme

Ministry for the Environment (2024b), "About the ministry for the environment", New Zealand Government, available at: https://environment.govt.nz/about-us/ministry-for-the-environment/#:~:text=Find%20out%20more-Our%20role%20and%20purpose,needs%20of%20future%20generations

Ministry for the Environment (2024c), "Emissions reductions plan", New Zealand Government, available at: https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/emissions-reductions/

Ministry of Housing and Urban Development (2024), "Healthy homes standards", New Zealand Government, available at: www.hud.govt.nz/our-work/healthy-homes-standards

Morgan, H. (2022), "Conducting a qualitative document analysis", *The Qualitative Report*, Vol. 27 No. 1, pp. 64-77, doi: 10.46743/2160-3715/2022.5044.

Mweshi, G.K. and Sakyi, K. (2020), "Application of sampling methods for the research design", *Archives of Business Research*, Vol. 8 No. 11, pp. 180-193, doi: 10.14738/abr.811.9042.

New Zealand Legislation (2008), "Climate change response (emissions trading) amendment act 2008", available at: www.legislation.govt.nz/act/public/2008/85/en/latest/#DLM1130932

Nwadike, A. and Wilkinson, S. (2022), "Challenges facing building code compliance in New Zealand", *International Journal of Construction Management*, Vol. 22 No. 13, pp. 2493-2503, doi: 10.1080/15623599.2020.1801336.

NZGBC (2019), "A zero carbon road map for Aotearoa's buildings", NZGBC Website: NZGBC, available at: www.nzgbc.org.nz/Attachment?Action=Download&Attachment_id=2528

Osei-Poku, G., Koranteng, C., Amos-Abanyie, S., Botchway, E. and Gyimah, K. (2022), "A review of frameworks for the energy performance certification of buildings and lessons for Ghana", *Applied Research Conference in Africa*, pp. 63-80, doi: 10.1007/978-3-031-25998-2_6.

Poorisat, T., Aigwi, I.E., Doan, D.T. and GhaffarianHoseini, A. (2024), "Unlocking the potentials of sustainable building designs and practices: a systematic review", *Building and Environment*, Vol. 266, p. 112069, doi: 10.1016/j.buildenv.2024.112069.

Poorisat, T., Aigwi, I.E., Doan, D.T. and GhaffarianHoseini, A. (2026a), "Integrating energy efficiency, water efficiency and indoor environmental quality towards advancing sustainable building designs and practices in New Zealand: stakeholders' perspectives", *Construction Innovation*, Vol. 26 No. 9, pp. 79-114, doi: 10.1108/CI-09-2025-0418.

Poorisat, T., Aigwi, I.E., Doan, D.T. and GhaffarianHoseini, A. (2026b), "Unveiling the roles and effective engagement of stakeholders involved in sustainable building design and practices", *Smart and Sustainable Built Environment*, pp. 1-26, doi: 10.1108/SASBE-10-2025-0678.

Rita, R.P., Saputra, A. and Ahmad, J.S.M. (2023), "Stakeholders' barriers to green building project Universitas Gadjah Mada Indonesia", *International Journal of GEOMATE*, Vol. 25 No. 107, pp. 107-114, doi: 10.21660/2023.107.3802.

Schwarz, M., Nakhle, C. and Knoeri, C. (2020), "Innovative designs of building energy codes for building decarbonization and their implementation challenges", *Journal of Cleaner Production*, Vol. 248, p. 119260, doi: 10.1016/j.jclepro.2019.119260.

Shikwambana, L., Mhangara, P. and Kganyago, M. (2021), "Assessing the relationship between economic growth and emissions levels in South Africa between 1994 and 2019", *Sustainability*, Vol. 13 No. 5, p. 2645, doi: 10.3390/su13052645.

Simpeh, E.K. and Smallwood, J.J. (2023), "Incentive mechanism for promoting the uptake of green building in South Africa", *Open House International*, Vol. 49 No. 2, pp. 340-357, doi: 10.1108/OHI-01-2023-0010.

StatsNZ (2024), "Subnational population estimates: At 30 June 2024 (2018-base)", available at: www.stats.govt.nz/information-releases/subnational-population-estimates-at-30-june-2024-2018-base/

Umar, T. (2020), *Developing Toolkits and Guidelines to Improve Safety Performance in the Construction Industry in Oman*, London South Bank University, London.

Umar, T. and Egbu, C. (2018), "Perceptions on safety climate: a case study in the Omani construction industry", *Proceedings of the Institution of Civil Engineers-Management, Procurement and Law*, Vol. 171 No. 6, pp. 251-263, doi: 10.1680/jmapl.18.00001.

United Nations (2022), "The sustainable development goals report: department of economics and social affairs", available at: https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf

Warren, L., Dawodu, A., Adewumi, A.S. and Quan, C. (2024), "Can the UK deliver zero carbon ready homes by 2050?", *Sustainability*, Vol. 16 No. 13, p. 5820, doi: 10.3390/su16135820.

Zhang, S., Wang, K., Xu, W., Iyer-Raniga, U., Athienitis, A., Ge, H., Cho, D.W., Feng, W., Okumiya, M., Yoon, G., Mazria, E. and Lyu, Y. (2021), "Policy recommendations for the zero energy building promotion towards carbon neutral in Asia-Pacific region", *Energy Policy*, Vol. 159, p. 112661, doi: 10.1016/j.enpol.2021.112661.

Appendix 1

(1) Could you please introduce yourself, including your academic and professional qualifications, relevant industry experience, current position, and the organisation you represent?

(2) In your view, what are the key benefits of existing policies and regulations in promoting Climate-Friendly Construction Practices (CFCPs) in New Zealand?

(3) In your opinion, what are the most significant barriers posed by current policies and regulations that hinder the wider adoption and advancement of Climate-Friendly Construction Practices (CFCPs) in New Zealand?

Appendix 2

Abbreviation List

APEC: Asia-Pacific Economic Cooperation;
BCA: Building and Construction Authority;
BECs: Building Energy Codes;
BRANZ: Building Research Association of New Zealand;
CC: Command and Control;
CE: Certification;
CFCPs: Climate-Friendly Construction Practices;
CNGP: Carbon Neutral Government Programme;
DOC: Department of Conservation;
EECA: Efficiency and Conservation Authority;
ECPB: Energy Conservation Policies in Buildings;
EI: Economic Incentives;
EER: Energy Efficiency Retrofit;
EPBD: Energy Performance of Buildings Directive;
ERP: Emission Reduction Plan;
EU: European Union;
GBCSA: Green Building Council of South Africa;
GHG: Greenhouse Gas;
IEQ: Indoor Environmental Quality;
IN: Information;
LEED: Leadership in Energy and Environmental Design;
MBIE: Ministry of Business, Innovation and Employment;
MEI: Mandatory Energy Improvement;
MfE: Ministry for the Environment;
NCC: National Construction Code;
NatHERS: Nationwide House Energy Rating Scheme;
NZBC: New Zealand Building Code;
NZEBs: Net Zero Energy Buildings;
NZGBC: New Zealand Green Building Council;
OP: Organisation and Professional;
REBRI: Resource Efficiency in the Building and Related Industries;
SANEDI: South African National Energy Development Institute;
SCP: Sustainable Construction Practices;
SDGs: Sustainable Development Goals;
SGBMP: Singapore Green Building Master Plan;

TE: Technology;
TTMRA: Trans-Tasman Mutual Recognition Agreement;
ULBs: Urban Local Bodies; and
WE: Water Efficiency.

Corresponding author
Tharaya Poorisat can be contacted at: tharayapoorisat@gmail.com

Journal of Engineering, Design and Technology