Energy efficiency: NCC 2022 and beyond

Outcomes report

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Executive Summary

The Australian Building Codes Board (ABCB) has been directed by the Building Ministers' Forum (BMF) to investigate possible changes to the National Construction Code's (NCC's) energy efficiency provisions, with an emphasis on residential buildings in NCC 2022. This work is to be carried out in consideration of the Council of Australian Governments (COAG) Energy Council's Trajectory for Low Energy Buildings (the Trajectory). The Trajectory proposes incremental changes to the NCC to reduce the operational energy use and associated greenhouse gas emissions of buildings.

To commence this process, the ABCB released a Scoping Study titled, *Energy efficiency: NCC 2022 and beyond*, for public comment. The Scoping Study outlined a possible approach and scope of the project, with a particular focus on the 2022 version of the NCC (NCC 2022). The Scoping Study was prepared in consideration of the overarching objectives of the Trajectory, which include reducing energy bills; improving the reliability of energy networks; reducing greenhouse gas emissions; and to providing industry with certainty about future regulatory changes.

A total of 135 submissions were received on the Scoping Study from a broad range of individuals and groups. The largest number of submissions came from respondents who identified themselves as specialists in energy efficiency, designers, product suppliers, builders and engineers. A quantitative and qualitative analysis of the submissions was undertaken to inform this report.

For residential buildings, the two options proposed in the Scoping Study attracted similar levels of support. However, questions were raised about their feasibility, particularly Option 1, which proposes net zero annual energy use (NZRE) for the regulated building services. A whole-of-house approach, which allows trading between building elements, was well supported on the proviso that there remained a minimum level of thermal comfort that could not be traded.

The proposed quantified Performance Requirements for residential buildings were well supported by respondents. However, a number of respondents raised concern about their complexity, as well as the complexity of the residential changes in general. Concern was raised that this could increase the need for specialist energy

efficiency consultants. The proposal to apply a threshold to the elemental DTS Provisions also attracted considerable attention, although opinions were divided, mostly between having a smaller 120 m^2 threshold and none at all. There was also support for extending the elemental DTS Provisions to Class 2 sole-occupancy units (SOUs).

Respondents overwhelmingly supported the recommended baseline levels of energy efficiency for residential building services specified in the Trajectory. There was also support for the current Nationwide House Energy Rating Scheme (NatHERS) compliance pathway, as well as its possible expansion to accredit whole-of-house tools. The NSW Building Sustainability Index (BASIX) also received relatively strong support as a whole-of-house tool.

For both commercial and residential buildings, provision for the future installation of on-site renewables and electric vehicle (EV) charging was supported. The concept of the NCC being technology and fuel neutral attracted differing views, with some respondents arguing that gas should be phased out. There was also some concern raised about the impact of increased uptake of on-site renewables on the electricity network.

For commercial buildings, respondents expressed broad support for further investigating the areas identified in the Scoping Study. This included the use of future climate data, expanding the Verification Methods, refining the thermal bridging provisions, accommodating vertical shading, and reviewing the role of on-site renewables. Responses were, however, divided on the treatment of commercial buildings with low volume-to-surface area ratios, but the other areas identified were all generally supported, albeit with some caveats.

Information was provided by a number of respondents about current market behaviour, particularly in relation to residential buildings. Some respondents suggested there is no need for further regulation given the current and likely uptake of energy efficiency and on-site renewables. It was also suggested that the regulation impact analysis of any proposed changes must consider split incentives, property rights and equity issues. The increasing size of dwellings was also raised as working against efforts to increase energy efficiency.

The responses to the Scoping Study will inform the investigation and development of the NCC energy efficiency provisions in 2022 and beyond. For NCC 2022, the specific approach outlined in the Scoping Study, as modified by applicable responses, is repeated below.

Residential buildings

For residential buildings (houses and apartments), two sets of NCC provisions (or options) will be developed and tested through regulation impact analysis to determine the appropriate option for adoption in NCC 2022. The two options are as follows:

Option 1 involves a set of provisions which would result in residential buildings having a level of thermal comfort equivalent to 7 stars NatHERS and NZRE, (based on the societal cost of energy) for the regulated building services, i.e. space conditioning, heated water systems, lighting and pool and spa pumps.

Option 2 involves a set of provisions which would result in residential buildings having a level of thermal comfort equivalent to 7 stars NatHERS and a moderate amount of annual energy use for the regulated building services.

The two options will enable a 'whole-of-house' approach to be used to achieve compliance. In particular, compliance through Verification Methods (or whole-of-house tools) and, to a limited extent, the elemental DTS Provisions will allow some trading between the energy efficiency of building services, and allow limited offsetting with on-site renewable energy.

Testing the two options will enable the ABCB to identify the most appropriate provisions for adoption in NCC 2022 and whether a transitional period should be applied. If the less stringent Option 2 is chosen, the development of Option 1 will nevertheless provide industry with an indication of the provisions that may be adopted in a future version of the NCC.

Commercial buildings

Given that substantial changes were made to the commercial building energy efficiency provisions in NCC 2019, and with other priorities now taking precedence, the ABCB will investigate more moderate changes in NCC 2022. This may include work that will complement the residential energy efficiency provisions such as

research into the grid impacts of increased uptake of on-site renewable energy and research into provisions that accommodate the future installation of on-site renewable energy and EV charging.

More substantial changes for commercial buildings may be considered in NCC 2025. This may involve the same approach used for residential buildings in NCC 2022, i.e. the development of two possible options with one being net zero.

Next steps

In addition to the Scoping Study process, further opportunity will be provided for comment throughout the development of the proposed changes to NCC 2022. This includes a full public consultation process on the detailed changes proposed for NCC 2022, which is scheduled to occur in early 2021.

In developing the proposed changes to NCC 2022, the ABCB will also undertake a holistic review of the residential energy efficiency provisions. This will include considering related issues, such as condensation and heat and cold stress. The ABCB will also ensure the residential energy efficiency provisions take account of regional differences.

Regulation impact analysis will be undertaken to ensure all potential changes to the NCC are underpinned by a rigorously tested rationale, are effective and proportional to the issue and generate a net societal benefit. This is a requirement of the ABCB's Inter-Governmental Agreement (IGA), as well as the COAG Principles for Best Practice Regulation.

1 Introduction

1.1 Consultation on the Scoping Study

From 26 July to 8 September 2019, the ABCB released a Scoping Study, *Energy Efficiency: NCC 2022 and beyond*, for public consultation. The purpose of the Scoping Study was to seek initial views on the proposed approach and scope of future changes to the NCC energy efficiency provisions, particularly in the next version of the NCC in 2022.

This report details the findings of the consultation process, which attracted 135 submissions. Of the 135 submissions, 121 provided responses to the questions related to residential buildings and 81 provided responses related to commercial buildings. Additionally, 5 responses were submitted outside of the ABCB's Consultation Hub.[1]

Both qualitative and quantitative analysis of the submissions was carried out to inform this report. The quantitative analysis covers data captured in submissions made through the ABCB's online Consultation Hub. The ABCB recognises the limitations of this analysis given the number of submissions only represents a proportion of stakeholders.

Of the submissions received, 119 submissions will be published and available from the ABCB Consultation Hub. The remainder have asked to be kept confidential.

The submissions came from a wide range of individuals and groups. The highest number of submissions came from the industry sector identified as 'Specialist-energy efficiency', with over 16% of the total submissions. 'Architecture and design' was the second highest sector, accounting for 15.4% of submissions. The origin of submissions is summarised in Table 1.

[1] See: www.consultation.abcb.gov.au.

Table 1: Industry sectors represented by submissions

Industry sector	Number of submissions	Percentage
Specialist - energy efficiency	21	16.1%
Architecture and design	20	15.4%
Building and plumbing products	15	11.5%
Other	11	8.5%
Building Commercial and Residential	10	7.7%
Building Residential	10	7.7%
Engineering	9	6.9%
Government	9	6.9%
Community and Non-Government organisations	7	5.4%
Compliance, testing and accreditation	6	4.6%
Building Certification / Surveying	3	2.3%
Education	3	2.3%
Not Answered	2	1.5%
Trades and other construction services	2	1.5%
Building Commercial	1	0.8%
Specialist – health	1	0.8%
General Public	0	0%
Legal and Finance	0	0%
Plumbing	0	0%
Specialist - disability access	0	0%
Specialist - fire safety	0	0%
Specialist – hydraulic / plumbing	0	0%
Student / apprentices	0	0%

1.2 Report Structure

This report is divided into ten chapters, accompanied by five appendices. The report is set out according to the following structure:

- Chapters 1 and 2 are introductory and provide background information.
- Chapter 3 summarises stakeholder feedback on public policy issues raised within the Scoping Study.
- Chapter 4 describes the current market in relation to dwelling energy efficiency.
- Chapter 5 outlines general issues raised by practitioners in relation to the proposed changes to the NCC.
- Chapter 6 analyses specific responses on the Scoping Study's proposed approach for residential buildings.
- Chapter 7 analyses specific responses on the Scoping Study's proposed approach for commercial buildings.
- Chapter 8 discusses matters that, while relevant, fall outside the remit of the ABCB.
- Chapter 9 sets out preliminary conclusions based on the information provided in Chapters 3 to 7.
- Chapter 10 discusses what will happen as a result of this report.
- The Appendices (A to E) provide additional information and helpful references.

The stakeholder feedback summarised in chapters 3 to 8 includes substantial use of quotes. This is to ensure that the feedback is documented as accurately as possible, and in the intended context. This approach also means that there may be cases where stakeholder feedback contains comments that appear contradictory, or which may stray beyond the scope of the ABCB's energy efficiency project. Such feedback has been included in the interests of completeness, noting that in this report it was not possible to include every issue raised in submissions on the Scoping Study.

1.3 Limitations

It is important to note that this report only represents the views of those stakeholders who provided a response to the Scoping Study. Also, while every effort has been made to capture all of the key issues and ideas put forward, not all were able to be specifically mentioned in this report.

The summaries provided in the following chapters do not include any expression of opinion by the ABCB. The inclusion or quoting of submissions should not be interpreted as an endorsement of the views expressed.

In this report, unless otherwise stated, any reference to the NCC is a reference to the 2019 edition, which was current at the time the Scoping Study was published and when this report was compiled.

2 Background

2.1 About the ABCB

The ABCB is a COAG standards writing body that is responsible for the development of the NCC. The ABCB is a joint initiative of all three levels of government in Australia. It was established by the ABCB Inter-Governmental Agreement (IGA) first signed by the Commonwealth, States and Territories on 1 March 1994, and updated from time to time since.[2] The ABCB is also a regulatory reform vehicle for COAG, and reports to the Commonwealth Minister and State and Territory Ministers responsible for building and plumbing regulatory matters, also known as the BMF.

2.2 About the NCC

The NCC provides the minimum necessary requirements for safety and health, amenity and accessibility, and sustainability in the design, construction, performance and liveability of new buildings (and new building work in existing buildings) throughout Australia. It is a uniform set of technical provisions for building work and plumbing and drainage installations throughout Australia, while allowing for variations in geological or geographic conditions, such as climate.

The NCC is freely available online and can be accessed through the ABCB website.[3]

2.3 Energy efficiency project

The ABCB's current work on energy efficiency was initiated in 2016 by COAG Energy Council's *National Energy Productivity Plan* (NEPP).[4] Measure 31 of the NEPP led to a number of changes to the energy efficiency provisions in NCC 2019, particularly in relation to commercial buildings. For residential buildings, the NCC 2019 changes were limited to improving interpretation and compliance.

[2] *An Agreement between the Governments of the Commonwealth of Australia, the States and the Territories to continue in existence and provide for the operation of the Australian Building Codes Board (ABCB IGA),* 2017.

[3] See: www.abcb.gov.au.

[4] Council of Australian Governments (COAG) Energy Council, *National Energy Productivity Plan 2015-2030*, December 2015, p 21.

Further improvements to the NCC's energy efficiency provisions are being considered for 2022 with a particular focus on residential buildings, as directed by the BMF.

2.4 Trajectory for low energy buildings

In early 2019, COAG Energy Council agreed to a *Trajectory for Low Energy Buildings* ('Trajectory'), which proposed a pathway toward achieving 'zero energy (and carbon) ready' buildings through ongoing incremental changes to the NCC.[5] The Trajectory expands upon the NEPP.

The Trajectory identified several overarching policy objectives, including:

- reducing energy bills;
- improving the reliability of energy networks;
- reducing greenhouse gas emissions; and
- providing certainty for industry in relation to future regulatory changes.[6]

2.5 Scoping Study

The Scoping Study was prepared in consideration of the overarching objectives of the Trajectory, as a first step in developing possible changes to the energy efficiency provisions for NCC 2022 and beyond. Its purpose was to seek initial stakeholder comment on the proposed approach and possible technical changes to the NCC.[7]

[5] Council of Australian Governments (COAG) Energy Council, *Trajectory for low energy buildings,* December 2018, p 5.
[6] *Ibid.* pp 2-3.
[7] Australian Building Codes Board (ABCB), *Energy efficiency: NCC 2022 and beyond – Scoping Study*, July 2019, p 6.

3 Policy objectives

While the Scoping Study did not specifically seek comment on the underlying policy objectives, these were nonetheless commented upon in many of the submissions.

Unless otherwise stated, the issues discussed in this chapter relate to both residential and commercial energy efficiency.

3.1 Responding to climate change

Many responses made a connection between the Trajectory, the approaches outlined in the Scoping Study, and the need to respond to climate change. This was generally in the context of climate change being both a local and global issue. Consequently, many stakeholders also attached high priority, and a sense of urgency, to the proposed changes to the NCC. That said, there were few suggestions of alternative timeframes, thus indicating general acceptance of the timeframes set out in the Scoping Study. Those who did propose an alternative timeframe were seeking implementation of Option 1 as soon as possible, on the basis of the following points:

- An urgent need to respond to climate change, including protection from extreme heatwaves.
- That the technology currently exists to achieve NZRE, so delays in its implementation should be minimised.

3.2 Options 1 and 2

This section relates to residential energy efficiency only.

In consideration of a possible increase in stringency for residential energy efficiency, the Scoping Study put forward two options[8]:

[8] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [2.2] p 10.

Option 1:
NCC provisions that achieve a level of thermal comfort equivalent to 7 stars NatHERS and net zero annual energy use for regulated building services, i.e. space conditioning, heated water systems, lighting and pool and spa pumps.

Option 2:
NCC provisions that achieve a level of thermal comfort equivalent to 7 star NatHERS and maximum energy use budget greater than zero for regulated building services.

Option 1 would result in buildings achieving 'net zero regulated energy' (NZRE), which was further defined in the Scoping Study as:

> *[W]hen the net annual energy use of all the services regulated by the NCC energy efficiency provisions equals zero. Regulated services include space conditioning, heated water systems, lighting and pool and spa pumps. NZRE may be achieved by offsetting the energy use of these services with energy generated by on-site renewables.*[9]

The proposal to move to NZRE attracted substantial comment, many supportive but many also expressing concern about the practicality and cost of such a move. The key themes emerging from this part of the consultation are below.

3.2.1 Support for Option 1 – NZRE

Submissions expressing support for Option 1 contained the following broad themes:

- **Achievable**: Option 1 is achievable in terms of practicality and cost, but should also provide flexibility, i.e. allow nearly NZRE where full NZRE is impractical. Option 2 should be considered as a possible fall-back option for difficult sites. A variation on this was the suggestion that Option 1 be applied for Class 1 housing, with Option 2 being applied to the SOUs of Class 2 buildings. This was on the basis that SOU has less scope for the incorporation of on-site renewable energy generation equipment.
- **Encouraging better practice**: Option 1 could encourage increased energy efficiency, potentially leading to energy 'self-sufficiency', although it was unclear if that phrase meant fully offsetting regulated energy use with on-site renewable energy, or outright independence from the grid. Others referred to housing being carbon neutral or even carbon positive. However, the submission by

[9] *Ibid.*

Renew expressed some scepticism about the extent to which industry will voluntarily exceed minimum standards. The Renew submission cited data that suggested the current NatHERS 6 star minimum is only exceeded by around 10% of houses and 30% of apartments.[10]

- **Increasing uptake of on-site renewable energy**: Option 1 would encourage the uptake of on-site renewable energy, given it would be necessary to meet the annual energy use budget proposed for that option.[11]
- **Meeting international commitments**: Option 1 would support Australia's efforts to meet its international commitments on climate change, such as the Paris Agreement.[12]
- **Aligning with the Trajectory**: Option 1 would achieve the Trajectory's aim for zero energy (and carbon) ready buildings[13] sooner. Related to this, the Property Council of Australia (PCA) submission noted that Option 1 is 'better aligned with the longer term objective of [both] the Trajectory and industry's work outlined in ASBEC's *Built to Perform* report'.[14]
- **Reducing cost-of-living pressures**: Option 1 would support increased thermal comfort for occupants and, through improved thermal performance, may reduce the running costs of a home, thereby contributing to reducing cost-of-living pressures.
- **Reducing network costs:** The Australian National University (ANU) RE 100 Research Group submission argued that energy networks are currently undergoing costly upgrade works to cope with demand peaks (mainly from air-conditioning) that may only occur on 4 or 5 days a year.[15] This in turn can drive up electricity bills, but could be reduced if housing was more efficient and, therefore, less likely to cause demand peaks.[16]
- **Policy certainty**: Option 1 would provide policy certainty for industry around the likely speed of on-site renewable energy uptake within the housing sector. This

[10] Commonwealth Scientific and industrial Research Organisation (CSIRO), *Australian Housing Data – Energy rating National Overview,* n.d., webpage: https://ahd.csiro.au/dashboards/energy-rating/energy-rating-national-overview/.

[11] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [Fig 3] p 12.

[12] An agreement under the United Nations Framework Convention on Climate Change (UNFCCC) made at the 21st Conference of the Parties (COP21) in Paris (30 November to 12 December 2015). See: Department of the Environment and Energy (Cwlth.), *Paris Agreement,* n.d., webpage: https://www.environment.gov.au/climate-change/government/international/paris-agreement.

[13] *Trajectory for low energy buildings,* above n 5, p 4.

[14] Australian Sustainable Built Environment Council (ASBEC), *Built to Perform,* Building Code Energy Performance Trajectory Project, Final Report, July 2018.

[15] The ANU 100% Renewable Energy (RE 100) group conducts research in the deployment and integration of renewable energy, working towards carbon-neutrality throughout Australia's economy. See: http://re100.eng.anu.edu.au/.

[16] Energy Networks Association Australia, *Electricity Prices and Network Costs,* report, April 2014.

> is in contrast to Option 2, where on-site renewable energy uptake remains optional.[17]

Submissions by Renew and Melbourne City Council suggested that an additional requirement for 7.5 or 8 star NatHERS ratings should also be considered, either for NCC 2022 or 2025. Both submissions cited research undertaken in Victoria by Renew which found:

> *Whether analysed by payback time or [Net Present Value], new 7 to 8-Star all-electric homes with solar PV are highly economically attractive as compared with new 6-Star dual fuel homes in Victoria.*[18]

Some felt that Option 1, to move to NZRE, requires long-term changes in both industry practice and societal attitudes, even generational change. As one response described it:

> *Option 1 will likely require an overhaul of many different factors influencing residential construction, regulation and occupancy. This option is probably best integrated slowly as Generation Y and Millennials reach their 30s and 40s. The viability of Option 1 depends on social change coming from the grass roots whilst it is best to prepare for this, the change itself cannot be forced.*
>
> *The implementation of the energy efficiency provisions in the early 2000s is an example of social change. I feel the generation most ready to embrace the legislation that was put in place then, is today's 20-30 somethings. As a result, builders and trades are now having to change the options they provide or perish. It is only at this tipping point that industry will embrace changes like those proposed in Option 1.*

While it is possible to force change through regulation, this quote suggests that, with time, the extent to which regulation is required to force cultural change may diminish as a result of naturally occurring demands within industry and the community.

[17] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [Fig 3] p 12.
[18] Renew, *The economics of 6 to 10 star homes in Victoria*, 6 September 2019, webpage: https://renew.org.au/research/the-economics-of-6-to-10-star-homes-in-victoria/.

3.2.2 Support for Option 2

Submissions expressing support for Option 2 contained the following broad themes:

- **Incremental change**: Many submissions, whilst supportive of the principle of NZRE, expressed a preference for change to occur in small increments, or 'one step at a time'. One reason is that it would allow industry more time to adapt, i.e. a transition period. Another reason is that it would provide an opportunity to learn from its implementation by designing policy around a later transition to NZRE. Overall, there was significant support for a 'step-code' approach, with one response noting the successful use of a similar model in British Columbia, a province in Canada.[19]
- **Aligning with the Trajectory**: While some supported Option 1, others argued in favour of Option 2 on the basis that it is better aligned with the Trajectory's recommendations for NCC 2022. This is also indicated in the Scoping Study itself.[20]

3.2.3 Opposition to both options

Some stakeholders expressed opposition to both options. Their reasoning is contained in the following broad themes:

- **No further stringency increase**: Some submissions expressed the view that industry is already struggling with 6 stars and that an increase to 7 stars is not realistic. 7 stars should also not be pursued in isolation without consideration of related issues such as building sealing.
- **Exceeding the Trajectory**: Some stakeholders opposed the proposed Options 1 and 2 because they are both slightly more ambitious than the Trajectory in terms of thermal performance. These submissions did not argue against an increase in stringency as such, but rather that any increase should not depart from what was set out in the Trajectory.

3.3 Allowance for trade-offs

In its discussion of proposed Options 1 and 2, the Scoping Study flagged the concept of allowing 'trade-offs' between the building envelope (to a minimum level), services

[19] J. Glave and R. Wark, *Lessons from the BC Energy Step Code,* Province of British Columbia, Canada, June 2017.
[20] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [Tbl 2] p 11.

and on-site renewables.[21] This was part of a proposed 'whole of house' approach to verifying compliance with the Performance Requirements.[22]

The concept of allowing trade-offs, particularly for residential energy efficiency, was one of the more controversial proposals according to a number of respondents to the Scoping Study.

3.3.1 Opposition to allowing trade-offs (residential)

Many submissions expressed opposition to allowing trade-offs. Their main concern was that a trade-off between the building envelope's thermal performance and on-site renewables could lead to poor design outcomes. The submission by Renew described this concern as follows:

> *[O]ur primary concern is the potential for Option 1 to facilitate house designs that achieve 'net zero' simply through a large solar PV system on a building whose thermal efficiency has not been improved beyond current 6-star NatHERS requirements.*

However, it is important to note that the Scoping Study did state that a minimum requirement for the thermal shell would be included in the proposed changes.[23] This would address the concern raised in the comment quoted above.

Another submission argued that such a proposal went against 'the original intent' of the NCC, that—

> *high performing building services should not be used to trade off against a poor performing thermal envelope.*

This comment suggests that allowing a trade-off between on-site renewables and building envelope thermal performance is inconsistent with the originally stated objective of the energy efficiency provisions, i.e. to reduce greenhouse gas emissions by efficiently using energy.[24] In addition to this objective, there is a broader

[21] *Ibid.* [2.3.4] pp 19-21.
[22] *Ibid.*
[23] *Ibid.* [2.2] p 11.
[24] Australian Building Codes Board (ABCB), *Building Code of Australia (BCA),* Volume Two – Housing Provisions, 2009, [O2.6] p 79: cf. *NCC 2019,* Volume Two, [O2.6] which omits the reference to 'efficiently using energy'. O2.6 was amended by BCA 2010.

efficiency objective underpinning the provisions, that goes beyond simply reducing greenhouse gas emissions, which is to also encompass issues such as health and amenity (e.g. natural ventilation and lighting), as well as running costs, i.e. energy usage.

3.3.2 Support for allowing trade-offs (residential)

While many stakeholders opposed allowing trade-offs, many others supported it, generally with some limitations to ensure a minimum level of thermal performance is maintained. These submissions also framed their arguments in terms of efficiency, although with a focus on broader economic efficiency, rather than just energy efficiency. The submission by BlueScope Steel explains this as follows:

> *The trajectory [through the NCC] should allow trading of on-site renewables with building fabric whilst maintaining a minimum star rating. The inclusion of energy efficiency in the NCC is to reduce greenhouse gas emissions from Australia's building stock. This has been achieved by requiring the building to be capable of using energy efficiently for heating and cooling.[25] The ABCB's obligation is to enact minimum regulation, which encompasses meeting the intent of the regulation at minimum cost, which this proposal fails to do. With the commercialization [sic] of renewable energy, the financial return on solar energy systems (around 8 years) now sits well above what can be expected from the financial return of building fabric provisions that are based on a neutral or better financial over the life of the building. Both can provide equivalent reductions in greenhouse gas emissions.[26] By not including trading with building fabric provisions the proposed regulation is enforcing cost with up to 40 years payback versus around 8 years. This appears to make little financial or environmental sense.*

The above quote, from the BlueScope Steel submission, places a higher emphasis on greenhouse gas reductions, as distinct from efficient energy use and consistent

[25] Possibly also a reference to O2.6 as it existed in *BCA 2009*, see above n 24.
[26] Consistent with O2.6 as it appears in *NCC 2019*; see above n 24 (cf.).

with the current NCC Objective, while also highlighting the need to consider cost efficiency for building owners.[27]

A similar point regarding the cost efficiency of higher building fabric performance requirements was made in another submission, which argued in favour of trade-offs on the basis of climate appropriateness:

> *Many of Australia's high population growth areas have climates that are not very severe. Not burdening construction in these areas [with] excessive fabric costs (intentionally or unintentionally) is an important objective.*

Overall, there appears to be two conflicting opinions running through most of the comments that discussed trade-offs. One opinions is that energy efficiency is in itself an objective, which applies even if the energy is from a renewable source. The opposing opinion is that only energy from non-renewable sources need to be used efficiently, in order to reduce greenhouse gas emissions.

3.3.3 Trade-offs for commercial buildings

For commercial energy efficiency, as was noted in the Scoping Study, the NCC (JV3) already allows for the energy generated by an on-site renewable energy system, typically solar PV systems, to offset a proposed building's total greenhouse gas emissions, as long as only the energy that is used on-site is included.[28] Accordingly, the issue of trade-offs for commercial energy efficiency was much less controversial and, as such, are not covered in this section of the outcomes report.

3.4 Provision for on-site renewable energy generation

The Scoping Study, in its discussion of NZRE homes, flagged a possible investigation into incorporating on-site renewable energy, such as PV, into the NCC.[29] The Scoping Study noted the intent of the NCC to be 'technology agnostic', and acknowledged the potential difficulties around incorporating on-site renewable

[27] *NCC 2019,* [O2.6].
[28] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [3.4.3] p 38.
[29] *Ibid.* [2.3.3] pp 17-18.

energy for some types of homes (for example, apartments).[30] This acknowledgement obviated the need for such concerns to be raised in comments on the Scoping Study, meaning that, instead, most comments focussed on potential benefits, particularly the reduced costs of incorporating on-site renewable energy at the construction stage, as opposed to retrofitting. A phrase commonly used in this regard was 'future-proofing'. It should be noted, however, that not all submissions agreed with the benefits of future-proofing, arguing instead that retrofitting is not overly difficult. These comments suggested that the decision to incorporate on-site renewable energy could be left to building owners without imposing an undue level of cost. One comment suggested, as a potential compromise, that provision for on-site renewable energy should only be mandated for apartments, where there are clear practical issues associated with retrofitting. This point is also acknowledged in the Scoping Study.[31]

Many comments also noted that the increased availability and accessibility of battery storage systems may promote the uptake of solar PV. This would be on the basis that batteries provide a way of storing energy, thus balancing out, to some extent, the otherwise intermittent nature of solar PV energy generation.

Some comments did, however, question the need for regulation in this area, on the basis that uptake of solar PV (one type of on-site renewable energy) was already healthy and increasing without any NCC mandate. These comments are in **Section 4.2** of this report.

The Scoping Study also flagged that a similar investigation into provisions for on-site renewable energy would be required for commercial buildings.[32] This attracted comment similar to those for housing, as discussed above. Consequently, they are not been repeated here.

3.5 Provision for EV charging

The Scoping Study flagged a possible investigation into making provision for the future installation of infrastructure for EV charging. Overall, there was support for this proposal. Some of the points raised included:

[30] See also **Section 3.6**.
[31] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [2.3.3] p 18.
[32] *Ibid.* [3.3.1] pp 32-33.

- EV uptake will only increase as the technology moves toward price parity with conventionally fuelled vehicles.
- General acceptance that EVs will take over from conventionally fuelled vehicles at some point in the future.
- For apartments, allocated parking spaces, while not actually required by the NCC, would nonetheless be a logical place to provide built-in charging points for residents' cars. [33] It was also noted that retrofitting would be more difficult for apartments than for houses.
- Supporting the future installation of infrastructure for new technologies can in turn increase their uptake by consumers, thus making it more useful.[34] Therefore, enabling ease of installation of charging points in buildings may increase uptake of EVs as they become more convenient to charge; and as uptake increases, so would demand for charging points.

Some respondents also raised concern about the facilitating the future installation of EV charging, especially for residential buildings. These included:

- That the idea of providing for EV charging in homes went against the principle of reducing energy use, in the sense it would add a whole new purpose for domestic electricity supplies.[35] The same response also questioned the implication that EVs reduce greenhouse gas emissions, suggesting instead that they simply move the emissions from one point in the chain to another; presumably from car exhaust to electricity generation, and assuming the electricity is not from on-site renewables.
- Consideration will also need to be given to safety considerations as well as the question of applicable consumer protection frameworks, i.e. is an EV charger considered an appliance or a part of a building?
- External (public) charging infrastructure needs to be established before the same is mandated for private homes.
- Equity issues, as only EV owners would be able to realise the benefits of paying for an EV charger in their home; assuming EVs do not reach price parity with conventionally fuelled vehicles by 2022.
- Declining car ownership may render the provision obsolete; or at least reduce the scope for a net societal benefit to be realised.

[33] The provision of resident parking for dwellings (houses and apartments) is generally considered a planning matter and as such is not regulated through the NCC.

[34] In economics, this phenomenon is known as 'network externalities', see: A.M. Garnett, P. Lewis, R.G. Hubbard and A.P. O'Brien, *Essentials of Economics,* second edition, Pearson, Frenchs Forest NSW, 2013, p 215.

[35] As opposed to reducing greenhouse gas emissions.

3.6 Technology neutrality

This section relates to residential energy efficiency only.

The Scoping Study, in its discussion of a potential move to NZRE homes in NCC 2022, made the following comment regarding the need to remain 'technology agnostic' by avoiding favouring one technology over another in the design of future regulatory requirements:

> *Solar energy is currently the most readily available on-site renewable energy source for households. However, the intent of the NCC is not to exclude the possibility of other sources that may become available in the future.*[36]

This is consistent with the performance-based layout of the NCC, which avoids prescribing specific solutions to meet its requirements. However, many submissions linked the principle of technology neutrality with the avoidance of prescribing a particular fuel source (i.e. fossil fuels versus renewable energy). While most comments did not oppose using the NCC to increase the uptake of renewables, stakeholders were strongly divided over the future role of gas as an energy source for buildings (especially houses) regulated by a future NCC. Accordingly, this section of the report is divided into two subsections: the first covering technology neutrality as envisaged in the Scoping Study; and the second covering fuel-neutrality and the role of gas.

3.6.1 Support for technology neutrality

Support for the technology neutral approach envisaged by the Scoping Study contained the following key points:

- Flexibility, consistent with the performance-based NCC.
- Promoting innovation and continuous improvement of building solutions.
- Avoids mandating one particular technology.

[36] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [2.3.3] p 18.

In general, there was no opposition to the principle of technology neutrality underpinning future NCC energy efficiency provisions.

In support of technology neutrality, the Housing Industry Association (HIA), put forward the position that:

> *The NCC should not preference one technology and [should] provide a range of solutions. If someone wants to use a new or innovative system the NCC shouldn't be too specific from a performance perspective (yes, there needs to be benchmark) but [it] shouldn't stifle innovation.*[37]

Also in support of technology neutrality, APA Group, which owns and operates gas and electricity infrastructure, stated in its submission:

> *The TN [Technology Neutral] approach allows impartial assessment of, for example, a wide range of fuel appliance types including not only existing appliances such as renewable, electric and gas appliances, but also potentially in the future, appliance fuel types that could include hydrogen, renewable gas appliances etc.… [A]ny emission or energy use reduction gains achieved by the use of renewable technology in new residential or existing commercial buildings, should be shared equally by both electric and gas appliances…when measuring energy and emission performance.*

This comment also refers to fuel neutrality, which is discussed in more detail below.

3.6.2 The role of gas

The term 'technology neutrality' refers to the principle that the NCC should avoid prescribing one fuel source over another. Technology neutrality was referenced in both of the options for residential energy efficiency canvassed by the Scoping Study, and is referred to in the Trajectory.[38] Many submissions expressed a view on the principle of technology neutrality, particularly the role of gas, with approximately even levels of support and opposition.

[37] In the interests of context, it should also be noted that the HIA's submission more broadly argued against the options put forward in the Scoping Study.
[38] *Trajectory for low energy buildings,* above n 7, p 5.

The Australian Pipelines and Gas Association (APGA), in its submission, suggested the role of renewable (or 'green') gas (also referred to in the APA submission quoted above) had not been sufficiently considered by the Scoping Study. APGA stated:

> *The Scoping Study doesn't explicitly consider the role of renewable 'green' gas in reducing or offsetting greenhouse gas emissions, and instead relies on heavily on the use of rooftop PV. In addition to the opportunities offered by solar, renewable gas provides further opportunities to reduce emissions through the use of existing infrastructure.*

The submission by the Gas Appliance Manufacturers Association of Australia (GAMAA) also expressed concerns that the proposals set out in the Scoping Study may be unduly favouring solar PV. It stated:

> *On-site solar PV is not the only source of renewable or decarbonised energy, yet it is the only sources recognised in Option 1. Whilst we recognise the challenges of accounting for off-site renewable or decarbonised energy systems in the context of buildings and the NCC, they have the same end result in terms of carbon abatement as on-site systems. Off-site electricity and gas distribution systems are already on decarbonisation journeys that the proposals acknowledges but fails to recognise in Option 1…. The rate of technological development in energy systems is very rapid and as such we do not believe it is appropriate to 'lock in' solar PV as the only accepted renewable energy option at this stage.*

It is worth noting that, contrary to the comment quoted above, both Options 1 and 2 as described in the Scoping Study are technology neutral.

Gas Energy Australia (GEA), in its submission also expressed support for a fuel neutral approach. Its arguments were similar to those of GAMAA in relation to offsetting carbon emissions and avoiding undue emphasis on solar, which according to evidence cited in the submission, already enjoys high uptake and forecast future

growth in Australia.[39, 40] The GEA submission also considered that it is important to preserve consumer choice in relation to the home energy sources.

Others, however, opposed the allowance for the ongoing use of gas as part of regulated energy usage in the NCC. A submission by a local government in metropolitan Sydney stated:

> *We question the allowance for gas in both the ABCB options as it is incompatible with the stated objective to save energy costs and emissions. In most states, the use of electric heat pumps provides a more efficient and better value outcome, even when measured only against 2019 emissions and cost parameters… The allowance for gas in Option 1 is fundamentally incompatible with the Net Zero Energy requirement. On-site renewable energy can only offset electricity usage on a kWh to kWh basis. The generation of on-site electricity cannot be used to offset gas under any recognised greenhouse gas accounting or reporting standard, including the Australian National Carbon Offset Standard. Option 1 therefore requires all electric regulated services.*

These themes of costs of separate gas infrastructure and the need to offset emissions appears in most of the comments that opposed fuel neutrality. Additionally, the submission by the My Efficient Electric Home group, also arguing against the allowance of gas under fuel neutrality.[41] It also cites a link between gas appliance usage and health issues such as asthma in children.[42] A similar argument was also put forward in the submission by the ANU RE 100 Research Group.[43] It should be noted, however, that the evidence cited referred to one study, published in the

[39] M. Roberts, J. Copper, A. Bruce, T. Barton, N. Haghdadi and R. Hu, *Solar Trends Report for Solar Citizens*, report prepared for Solar Citizens by the Australian PV Institute and the University of NSW, 2018, p 2.

[40] Australian Energy Market Operator, *Rooftop PV and Battery Storage – Key Insights,* n.d., webpage: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/NEM-Electricity-Demand-Forecasts/Electricity-Forecasting-Insights/2017-Electricity-Forecasting-Insights/Key-component-consumption-forecasts/PV-and-storage.

[41] An online group that advocates the removal of gas appliances in homes.

[42] National Asthma Council Australia, *Gas stoves and asthma in children,* Factsheet, November 2018.

[43] For a description of this group, see above n 15.

Medical Journal of Australia, which found that around 12% of childhood asthma in Australia can be attributed to the use of gas stoves for cooking.[44]

3.7 Potential implications for the electricity grid

This section relates to residential energy efficiency only.

The Scoping Study, in its discussion of the rationale and scope for Options 1 and 2, noted the statement in the Trajectory that the proposed changes to the NCC are needed to reduce energy bills and the demand on energy networks.[45] Specifically, the Scoping Study noted that one of the possible secondary benefits of the proposed move to NZRE would be the ability of on-site renewables to safeguard occupants against blackouts during periods of peak air-conditioner use, particularly if the on-site renewable energy generation is configured to power the dwelling before excess power is fed back to the grid.[46]

These statements attracted comment in submissions expressing concern about the potential implications for the grid if a change to the NCC drives a significant increase in on-site renewable energy generation, including:

- Increased PV feed-in back to the grid may result in restrictions being imposed on the amount fed back in by each system. Grid operators may also refuse to connect solar PV systems to the grid if they believe doing so may pose a risk to the grid.
- Avoiding issues associated with increased feed-in from solar PV will, to some extent, be dependent on the installation of battery storage as a way of balancing out demand and production of energy.
- To avoid unintended consequences, there is a need to co-ordinate an NCC driven increase in PV uptake with energy regulators, rather than viewing the proposal as solely a building policy issue.
- In relation to the previous point, some expressed the view that the management of network demand by States and Territories should not be a responsibility of the NCC, which should instead focus on reducing greenhouse gas emissions.
- If domestic demand from the grid is reduced too heavily, this may lead to a situation where its operation becomes dependent on large industry users.

[44] L. Knibbs, et al., 'Damp housing, gas stoves, and the burden of childhood asthma in Australia', *Medical Journal of Australia,* 2018(7), pp 299-302. Cited in: *Gas stoves and asthma in children,* above n 42.
[45] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [2.3.1] p 16.
[46] *Ibid.*

- Increased voltage driven by PV can mean increased need to update and replace grid infrastructure. This should be considered as part of any impact analysis.

3.8 Discussion

Overall, there is broad, in-principle support for Option 1. This is reflected in both the qualitative (this chapter) and quantitative results (see Chapter 6). However, there are also significant concerns about the feasibility of implementing Option 1 within the NCC 2022 timeframe, notwithstanding the possibility of a transition period. Additionally, some stakeholders also questioned the merits of Option 1 being more ambitious than the Trajectory. Accordingly, consideration could be given to adopting the incremental approach foreshadowed in the Scoping Study, whereby Option 2 is used as a stepping stone with a view to adopting Option 1 in a later version of the NCC.

Responses were divided over the proposal to allow trade-offs within Options 1 and 2 (residential). The key issue was the possibility that trading-off could lead to an overreliance on on-site renewables to offset the effects of less than optimal building envelope thermal performance. While some suggested that trade-offs should not be allowed at all, this may result in the energy efficiency provisions becoming overly stringent, particularly in cases where site-specific factors (e.g. orientation and the positioning of windows to maximise views) limit the scope for achieving optimal building envelope thermal performance.

Responses to the Scoping Study did not identify any major barriers to the inclusion of provisions for on-site renewable energy and facilitating future EV charging. However, respondents also expressed a level of uncertainty about the utility of regulating in this area due to concerns around market maturity (especially for EVs). Therefore, further research in this area may be warranted in developing regulatory proposals.

The future ongoing role of gas as a household fuel source attracted several, strongly argued comments both for and against its ongoing use. Whilst these comments are valid, it is not considered appropriate for the NCC to depart from a fuel neutral approach in the absence of an explicit energy policy commitment by governments regarding the future use of gas. It should also be noted that the on-site generation of renewable electricity can also be used to offset the use of gas.

Finally, this chapter has identified a need for further research to be undertaken to better understand the potential implications for the electricity grid arising from an increase in on-site renewable energy as a result of a future change to the NCC. The ABCB is currently engaged in preliminary discussions with energy regulators in relation to this issue.

4 Current market behaviour

This chapter examines information provided by respondents about current market behaviour with respect to the objectives outlined in the previous chapter. This includes discussion about whether improvements are occurring without regulation, and the relationship between dwelling size and energy efficiency.

Unless otherwise stated, issues discussed in this chapter relate to both residential and commercial building energy efficiency.

4.1 Market response to current NCC requirements

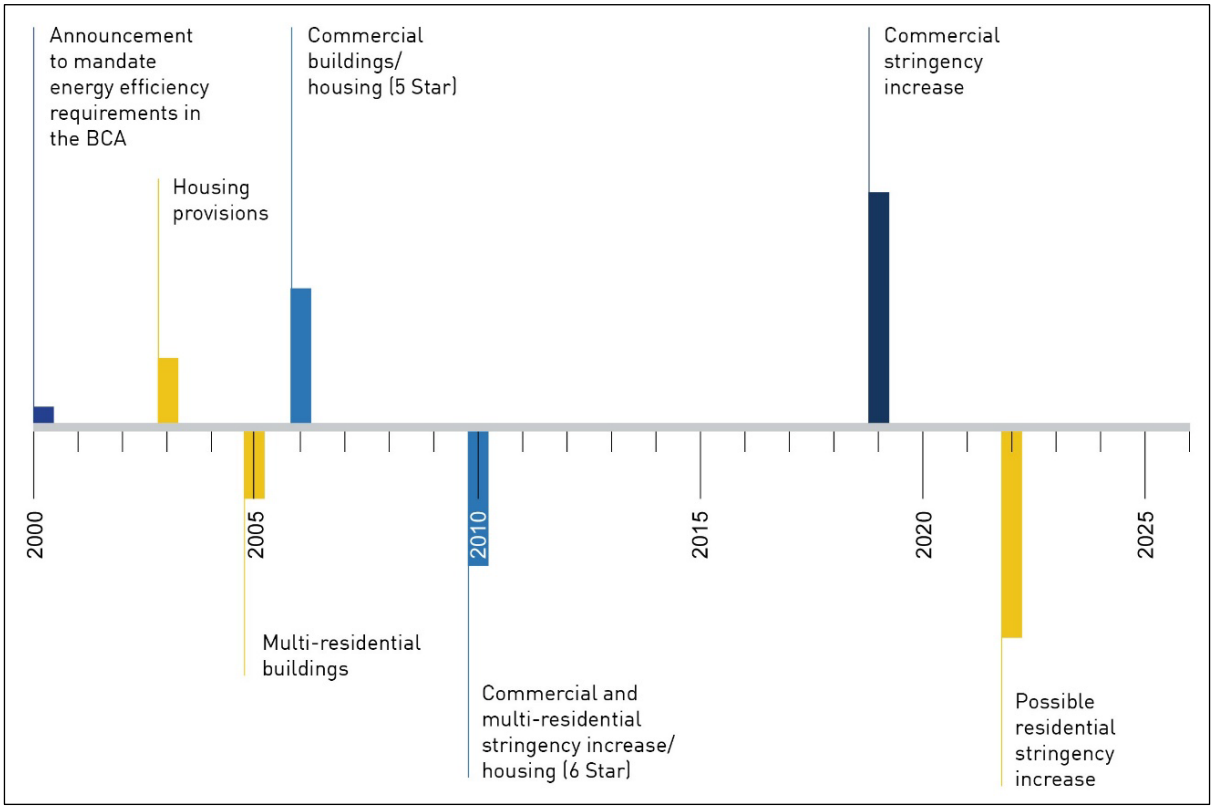
The Trajectory provides a brief summary of the improvements in building energy efficiency realised since the 1990s. It states:

> *Australia has made important progress in building energy performance. To date:*
>
> - *Energy efficiency of buildings has improved considerably since the 1990s, with state, territory, and national increases building energy efficiency regulations and various initiatives for retrofitting various buildings.*
> - *Appliance efficiency has significantly improved, largely due to requirements under the Greenhouse and Energy Minimum Standards (GEMS) Act (and its state and territory predecessors).*
> - *More than one in five Australian households now have solar panels installed on their roof – the highest rate per capita in the world.*
> - *Building rating systems such as Green Star and the National Australian Built Environment Rating System (NABERS), as well as mandatory disclosure under the Commercial Building Disclosure Program, have been effective in motivating owners of commercial buildings to make energy efficiency improvements.*[47]

[47] *Trajectory for low energy buildings*, above n 5, p 2.

These points give an indication of the improvements that have so far been realised through predominantly regulatory approaches, including changes to the NCC. In relation to the NCC specifically, the Scoping Study also provided a useful indication of progress since the initial proposal to regulate energy efficiency in 2000. This is shown in Figure 1.

Figure 1 Timeline of changes to NCC energy efficiency provisions



This information gives an overall indication of the changes in market behaviour since 2000. Responses to the Scoping Study suggest that some stakeholders question the need or merits of further increases in regulation (stringency). Key arguments put forward include:

- The previous NCC increases are sufficient and further increases will impact housing affordability. These responses implied the potential for diminishing returns from further increases in stringency, i.e. less improvement in outcomes for each incremental increase in stringency.
- Changes in energy production (i.e. the transition from coal and gas to renewable energy) will obviate the need for increased energy efficiency as a way to reduce greenhouse gas emissions. This assumes a steady transition, supported by stable energy policy.

4.2 Are improvements occurring beyond what is regulated?

This section relates to residential energy efficiency only.

The Scoping Study raises the question of whether any improvements to energy efficiency (residential or commercial) are occurring without regulation. In this regard, consideration of business-as-usual and non-regulatory alternatives to achieve the given policy objective are required elements of regulatory impact analysis.

Responses to the Scoping Study suggest there are some improvements in building energy efficiency occurring in the absence of regulation. The main example given was the increased uptake of solar PV systems, which has increased significantly as a result of financial incentives such as feed-in tariffs, rebates and subsidies. While not cited in the responses, there is research that supports the assertion that financial incentives can increase the uptake of solar PV.[48, 49]

Others felt that regulation enabling dwellings to accommodate future technologies (e.g. EV charging) may be cost prohibitive and may not actually lead to an increase in uptake. The basis for such arguments was the possibility that by the time a home-owner chooses to install the equipment, any provisions already made may be outdated and/or potentially non-compliant with future regulations. Related to this was a concern that EV technology is still in its infancy (i.e. in terms of market size, affordability and uptake) and, therefore, it is too early to regulate for the provision of home charging because it is not yet clear that EVs will become 'mainstream' in Australia, at least in the foreseeable future.

4.3 Size of dwellings

This section relates to residential energy efficiency only.

Some respondents felt that efforts to achieve low carbon buildings, particularly housing, is impossible. This is because there is no disincentive to building larger and larger dwellings that, while efficient, will inevitably consume more energy than a

[48] G. Deng and P Newton, *Assessing the Impact of Solar PV on Domestic Electricity Consumption in Sydney: Exploring the Prospect of Rebound Effects,* Co-operative Research Centre for Low Carbon Living, Sydney, 2016, p 9.

[49] K.K. Zander, G. Simpson, S. Mathew, R. Nepal and S.T. Garnett, 'Preferences for and potential impacts of financial incentives to install residential rooftop solar photovoltaic systems in Australia', *Journal of Cleaner Production,* 230(1), 2019, pp 328-338.

smaller dwelling. Among this group, there was also a view that increases in energy efficiency had been used in the past as a way of offsetting the increased greenhouse gas emissions associated with the trend toward larger houses. This formed the basis of an argument that, rather than increasing stringency yet again, policy should move toward encouraging smaller housing as a way to reduce greenhouse gas emissions. Another argument was that reducing the size of housing would also reduce embodied energy, and the influence of occupant behaviour on energy use, via lighting and air-conditioning being used in unoccupied rooms.

However, while reducing dwelling sizes may reduce energy consumption, it is generally outside the scope of the NCC to regulate the size of dwellings, either in absolute terms or relative to the number of occupants. There are several reasons for this. Firstly, the size of a dwelling in relation to its site is a planning matter. Secondly, the relationship between dwelling size and energy use is not necessarily proportional. Thirdly, many dwellings are constructed without knowledge of how many occupants they may eventually house (e.g. apartments sold off the plan). Fourthly, household sizes change over time, so that a large house that was efficiently sized for a family could become inefficient once the children grow up and leave home. This may result in only one or two parents in a three or four bedroom house (sometimes referred to as ‘empty nesters’), which may then be considered ‘oversized’.

In relation to the fourth point, it is worth noting that the Commonwealth already has a program of tax incentives to encourage Australians aged over 65 who have become ‘empty nesters’ to downsize from large family homes. This is used as a way of freeing up supply in this part of the housing market for growing families, thus reducing pressure on housing affordability.[50]

Furthermore, the threefold increase in apartment construction from 2007 to 2015 also suggests that at the State and Territory level, existing government policy already promotes the uptake of smaller dwellings (i.e. apartments rather than houses).[51]

[50] Australian Taxation Office (2018), *Downsizing contributions into superannuation*, webpage: https://www.ato.gov.au/Individuals/Super/Growing-your-super/Adding-to-your-super/Downsizing-contributions-into-superannuation/.
[51] Australian Bureau of Statistics, *Building Activity – Australia,* cat. no. 8752.0, ABS, Canberra.

4.4 Market barriers

A supporting document to the Trajectory, *Report for Achieving Low Energy Homes*, discusses a number of market failures that it considers contribute to homes using more energy than necessary, and being more expensive to operate. One such market failure is the problem of 'split incentives', which in the context of energy efficiency it describes as:

> *These occur when one party accrues the costs (that is, up-front capital investment), while the other party receives the benefits (for example, lower energy bills). This creates conflicting motivations and incentives between the builder and home owner, the real estate agent and the buyer and/or seller, or the tenant and the owner. For example, owner households have significantly higher rates of insulation, window treatments and solar electricity or hot water systems than renter households.*[52]

This issue of split incentives was also referred to in a number of responses to the Scoping Study. Although it is generally considered more of an issue in commercial buildings,[53] many stakeholders also consider it an issue for residential buildings. This concern was principally in relation to the concept of a whole-of-house approach. The following quotes (from two separate responses) illustrate the concerns raised:

> *Past or current performance is not an indicator of future performance. The lowest quality on-site renewable energy generation [equipment] will be specified by developers who don't have any financial incentive to maintain the equipment that may only last a very short time. After equipment breaks down it most likely won't be replaced and the building will have low thermal insulation performance that will be underperforming for the next 50+ years – long after the on-site renewable energy generation equipment has broken down with expensive replacement and maintenance costs.*

[52] Council of Australian Governments (COAG) Energy Council, *Report for Achieving Low Energy Homes,* December 2018, p 17.
[53] See for example: Department of the Environment and Energy (Cwlth.), *Overcoming Split Incentives,* Factsheet, September 2013.

The comment above refers to a potential unintended consequence of the proposed trading-off between building performance and on-site renewable energy; that one side of the trade-off may outlast the other.

Another, separate market barrier was also highlighted in this quote from a response to the Scoping Study:

> *I completely agree with this this methodology [the use of TDV in Performance Requirement 2] as energy used during peak hours is not the same as off-peak and this variation in supply is currently not taken into account in assessments of building performance… Only issue I have is how it is based on dollar value rather than emissions. This I see as a limitation as (at the moment) they are not equivalent and can result in higher polluting energy sources being prioritised only due to their lower price.*

The above comment refers the situation in which the building owner has a financial incentive that may compete with, or override, their consideration of environmental effects. However, it should be noted that the proposed Time Dependant Value (TDV) Performance Requirement is based on societal costs, which accounts for environmental impact.

Whilst not specific to energy efficiency, the relevance of the split incentive problem to housing (particularly off the plan apartments) is illustrated in the findings of the recent *Building Confidence* report. It noted a form of split incentive occurring in the apartment sector whereby the builder is incentivised to reduce costs, which can lead to outcomes that are not necessarily in the interest of the building's eventual occupants, the latter generally having no rights to participate in or oversee the construction of the building.[54]

4.5 Property rights

Responses to the Scoping Study suggest that some stakeholders feel that increasing the stringency of residential energy efficiency may not be achieving a balance

[54] P. Shergold and B. Weir, *Building Confidence – Improving the effectiveness and enforcement systems for the building and construction industry across Australia,* report prepared for the Building Ministers Forum, February 2018, pp 10, 21-22.

between individual property rights and the public interest. This is worth noting in relation to two key principles that govern the adoption of regulation through the NCC:

- Regulation should generally be the 'option that generates the greatest net benefit for the community' (i.e. regulation must be in the public interest).
- 'Government action must be effective and proportional to the issue being addressed' (i.e. governments must not overreach).[55]

In particular, some stakeholders felt that an increase in stringency would:

- Unduly limit design freedom, particularly in relation to window sizes/access to views, natural light and ventilation, and building layout. It should be noted that many of these issues are also influenced by site orientation, which is outside the scope of the NCC.
- Infringe upon their ability to use energy as they see fit.[56]
- Reduce consumer choice in heating/air-conditioning equipment (or its omission), as well as choice in domestic fuel source (e.g. choosing gas over electricity, see **Section 3.6** of this report for further details).

4.6 Cost burden

While the Scoping Study was clear that regulation impact analysis was a 'next step' (i.e. not part of this stage), the issue of potential cost burdens of the proposed changes was raised in many of the submissions. Primarily, these concerns relate to residential energy efficiency and will be the focus of this section of the report. The issue of cost burden is complex. Therefore, this section will be divided into sub-sections that discuss particular aspects of stakeholder concern around cost burden.

4.6.1 Housing costs / affordability

The following key themes emerged from comments that referred to issues of housing construction costs and/or implications for housing affordability:

- Some stakeholders felt it was unreasonable to impose further costs on new building owners without first considering other measures to improve the efficiency of building stock more broadly (i.e. existing buildings).

[55] Council of Australian Governments (COAG), *Best Practice Regulation – A Guide for Ministerial Councils and National Standard Setting Bodies,* 2007, p 4.

[56] This particular concern may have arisen through a misinterpretation of the 'energy budget' referred to in the Scoping Paper's discussion of compliance pathways for housing; see: *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [2.2.1] pp 13-14.

- There was a general view that, as more small cost increases are added to housing, the cumulative effect may be a material decrease in affordability.
- A perception that energy efficiency is becoming 'over-regulated' which is a regulatory burden for industry (i.e. learning and adapting to new requirements, compliance and administration) and becoming unreasonable, and therefore less able to be passed on to clients. This issue may also be more severe for small and medium business, which, according to the submission by Master Builders Australia (MBA), make up the majority of business operating in the residential construction sector.
- Regulations that seek to change consumer behaviour to reduce emissions are becoming disproportionate to those that seek to change business practices.
- There may be diminishing marginal returns in moving from 6 to 7 stars and beyond, relative to the marginal benefit gained through the initial introduction of energy efficiency provisions in the NCC. The lack of data on the benefits realised from previous changes to the energy efficiency provisions also complicates the analysis of benefits.
- Increasing the cost of goods (in this case, housing) can decrease the amount produced. Therefore, instead of housing being built to a higher stringency of energy efficiency, some housing may not be built at all.

However, it is noted that not all stakeholders agreed that cost increases would be significant. The submission by Renew suggested the opposite; that potential costs can be overstated. The Renew submission explained this as follows:

> *A comprehensive analysis of the Regulatory Impact Assessment of the change from 5 to 6-stars (2009) concluded that actual cost impacts have been lower than predicted, due to the effect of industry learning rates, innovation and adaptation, adoption of least-cost techniques, economies of scale and market transformation of higher performing products.*[57] *This is a consistent issue with cost-benefit analyses typically over-estimating future costs — the rapid decline in the costs of solar PV being a case in point.*[58]

[57] T. Isaacs and A. Pears, *How cautious analysis could lead to 'do nothing' policy - A case study of the 6-star housing Regulation Impact Statement*, July 2016.
[58] J.A. Hayward and P.W. Graham, *Electricity Generation Technology Cost Projections,* CSIRO, December 2017.

4.6.2 Equity issues

Several comments, in addressing the issue of costs, raised what are known as ‘equity issues’. Equity issues arise where an increase in a cost disproportionately affects those with the least ability to pay. In taxation terms, this is referred to as a ‘regressive’ tax. While no one is asserting that energy efficiency provisions amount to a tax, the concerns raised by some stakeholders nonetheless indicate that the proposed provisions may become regressive in effect due to the way they are applied.

The first equity issue raised in a number of submissions was that the ability to use offsets against the thermal performance of the building envelope may be biased in favour of those who can most easily afford such offsets. This group can, within limits, pay for offsets unnecessarily (e.g. oversized solar PV systems) as a way to enable them to choose a less efficient building envelope. For others, they are forced to pay for offsets using money that would otherwise have been invested in other necessary aspects of their home. Therefore, the opportunity costs are greater for those with less spare funds to spend on offsets and, thus, an equity issue arises.

The second equity issue also relates to the use of offsets, in particular solar PV, in that it is more achievable with a larger house with more roof surface available. Larger houses tend to be more expensive than smaller ones, and according to some comments, this could also serve as a disincentive, or penalty, for higher density housing, which (depending on location) tends to be at the more affordable end of the new housing market.

4.7 Discussion

This chapter was primarily concerned with assessing information gained from respondents about the current market, as opposed to informing the development of specific changes to the NCC. Nonetheless, the chapter has identified some issues that may warrant further consideration, potentially as part of regulatory impact assessment:

- Clear definition of the current market, including the effects of current regulatory and non-regulatory approaches in addition to ex-post evaluation of the effectiveness of existing measures.

- Related market issues including split incentives and equity issues.
- Whether further stringency increases (particularly for residential) could unduly impinge upon property rights.
- Impacts of a stringency increase on housing affordability.

The issue of dwelling size, while attracting many comments, may not be suitable to address through the NCC. This is because dwelling size, as with site position and orientation, are considered planning issues regulated outside the NCC. It is also noted that there is existing government policy in place, at both Commonwealth and State/Territory levels, to encourage people to choose smaller homes where appropriate.

5 Issues raised by practitioners

This chapter summarises issues specifically raised by practitioners in the building and construction industry in response to the Scoping Study. Whereas the previous chapters addressed policy and market issues more broadly, this chapter seeks to address the issues raised by those who are required to understand and apply the NCC energy efficiency provisions (i.e. practitioners). This is an important part of the Scoping Study process, as the success of future energy efficiency provisions depends in large part on how effectively it can be understood and applied by practitioners.

While many specific issue were raised, the four key themes that emerged were:

- complexity
- the proposed limitation of the application of the Elemental DTS Provisions (residential)
- use of inappropriate inputs to achieve compliance in modelling software (commonly known as ‘gaming’)
- increased reliance on specialist consultants and software.

Unless otherwise stated, issues discussed in this chapter relate to both residential and commercial energy efficiency.

5.1 Complexity

The complexity of the energy efficiency provisions proposed in the Scoping Study was raise as a concern in most submissions. Overall, there was a general view that more should be done to simplify compliance with the NCC, and that this should go hand-in-hand with any proposals to increase its stringency. As was noted in the HIA submission:

> *Energy efficiency is not a well understood part of the NCC and moving to highly sophisticated Performance Requirements that contain complicated metrics will not assist people’s understanding of the energy efficiency provisions.*

Key aspects of most calls for 'simplification' related to the language in the NCC, and ensuring transparency in how compliance is measured and verified. Furthermore, some submissions reflected a level of frustration that regulation was simply becoming 'too complicated' in general, and that those in charge of making the regulations do not understand this reality.

More specifically, some comments noted that there may be some confusion over the scope of the term 'regulated energy' (as in Net Zero Regulated Energy) if it is not always clear that it does not capture appliance and devices that consumers plug-in (e.g. TVs, computers). A similar issue was noted with respect to the proposed energy use budget, which could be misconstrued as regulating how people actually use their homes, when in fact it is simply a way of assuming how energy will be used for the purposes of verifying performance.[59] The risk of such misunderstanding is that it could generate a public or industry backlash against something that in fact is not being proposed.

Concerns around complexity were not limited to Performance Requirements and the quantification of performance. There was also comment calling for a reduction in the complexity of the Elemental DTS Provisions. There is a relationship between the scope and stringency of the Elemental DTS Provisions and their complexity. The broader the scope and higher the stringency, the more complex the provisions will necessarily become. This was the rationale of the Scoping Study's proposal to limit the application of Elemental DTS Provisions (residential), which is discussed in **Section 5.2** below.

5.2 Limiting the application of Elemental DTS Provisions

This section relates to residential energy efficiency only.

This section of the Scoping Study asked stakeholders to nominate a preferred maximum floor area threshold for the application of Elemental DTS Provisions in NCC 2022. The proposed options were 120 m², 300 m² or 'other'.

[59] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [2.3.4] pp 19-21.

The Scoping Study explained the rationale for this proposal as follows:

> *Development of the current elemental DTS Provisions in 2010 highlighted the difficulty of developing provisions at higher levels of stringency that deliver consistent building outcomes. Achieving consistent outcomes at higher stringency requires either more complex elemental DTS Provisions or much more conservative, or coarse, elemental provisions. A suggested alternative approach is to limit the application of the elemental DTS Provisions to smaller dwellings, or alterations and additions. This would reduce the need for more complex or conservative elemental provisions. Dwellings above this threshold would need to follow an alternative compliance pathway.*[60]

This attracted many responses and was one of the more contentious aspects of the Scoping Study. These submissions made many points either supporting or opposing a threshold being applied to elemental DTS Provisions, while others suggested alternative approaches to floor area as a way of defining the threshold.

5.2.1 Support for a DTS threshold

This part will cover comments supporting either the 120 m² or 300 m² thresholds, or nominating a different threshold.

Support for the lower threshold (120 m²) was generally based on reducing the risk of creating a loophole. A lower threshold would be more effective in preventing the use of the elemental DTS Provisions for larger, more complex dwellings that would be more accurately designed through other compliance pathways, such as NatHERS. Others noted that the lower threshold was more reflective of average housing sizes. In one comment, a lower threshold of 60 m² was proposed on the basis it would limit the elemental DTS Provisions to only the smallest 10% of dwellings by floor area.[61]

[60] *Ibid.* [2.4.2.2] p 24.

[61] Note: This comment did not cite any data to support its assertion that 60 m² is in fact representative of the smallest 10% of dwellings by floor area.

The Property Council of Australia (PCA) submission also made a link between the proposed thresholds and the average size of dwellings by floor area. The PCA submission, which supported a 120 m² threshold, stated:

> *Of the options presented, our preference would be for the lower threshold of 120 m². Data available from CSIRO shows that 30-50 per cent of Class 1 houses across Australia are below 120 m² and 95 per cent or more are below 300 m².*[62] *It therefore wouldn't make sense to apply a threshold of 300 m² if 95% of dwellings exist below this threshold.*

The submission by Overton Architecture and Energy also supported the 120 m² threshold, but went further, commenting more broadly about the future of the elemental DTS Provisions as the stringency of the energy efficiency provisions increases over time:

> *Use of the [elemental] DTS provisions should be limited to a relatively small area, certainly no more than the lower limit of 120 m² as suggested in the [scoping] study. Experience with the EE DTS to date suggests that correlation of DTS with performance simulation results becomes more and more difficult as the stringency increases, and this trend would be exacerbated as the buildings increase in size and complexity. In the medium term, the EE DTS provisions would be ideally phased out altogether, however, keeping them for the 2022 revision would seem a practical measure to maintain short term continuity of the system.*
>
> *By way of qualification, it is my opinion that DTS provisions should only be phased out for the most complicated building fabric performance assessment. Other more specific elements such as services, ventilation and air-leakage could be maintained in DTS.*

Another submission suggested that elemental DTS is being 'abused' to obtain compliance for buildings that would have achieved only 4 or 5 stars using NatHERS.

[62] The specific dataset cited here was not named in the submission.

5.2.2 Opposition to a DTS threshold

This part will cover comments opposing any imposition of a threshold on the elemental DTS Provisions. The key objections were as follows:

- The need for a baseline minimum standard. Some stakeholders believe the role of setting a minimum could be unintentionally ceded to third-party consultants and software tools if there is not a clear minimum fixed within the NCC itself.
- The elemental DTS Provisions should remain available to minimise compliance costs on simple or standardised dwelling designs.
- The possibility that the floor area threshold for using elemental DTS Provisions would become an unwritten limit in dwelling sizes more generally, i.e. that many standard designs that are slightly larger than the threshold would be adjusted down as a way to avoid using more complex compliance pathways. This, in turn, could reduce design quality and/or consumer choice. As one stakeholder put it:

  There would seem to be a risk of using standardised elemental provisions to create "efficient but less livable" houses, and this risk may be greater if a lower 120 m² [threshold] were to be adopted.

- DTS provides a level of certainty for product manufacturers. As explained in the submissions by Rheem Australia and the Australian Industry Group:

  Deemed-to-Satisfy Provisions currently form the basis for the majority of installations and allow manufacturers, suppliers, merchants and builders to develop products and offers with knowledge that there is an economically sustainable market for their products. An "energy budget" approach should be available to allow flexibility and freedom of choice for home builders and their customers, however a base level of options is necessary for ongoing manufacturer and supplier confidence.

- Some comments disputed the disadvantage of allowing elemental DTS Provisions to be used for larger dwellings. Similarly, other comments questioned whether imposing a threshold would actually lead to any reduction in greenhouse gas emissions.
- Potential cost impacts, with limiting the elemental DTS Provisions may reduce flexibility and, therefore, increase compliance costs.
- The elemental DTS Provisions also have a role in helping to educate new NCC users on how to comply with the NCC, in the sense that learning to use the elemental DTS Provisions can be a 'stepping stone' on the path to using

Performance Solutions. Accordingly, reducing or limiting the elemental DTS Provisions may diminish the work of new practitioners and increase reliance on specialist consultants (see **Section 5.4**).

- Some practitioners prefer the elemental DTS Provisions. As one comment put it:

  I have found that builders prefer to follow direct, consistent instructions and are more likely to do the job properly if they understand why they are doing it.

- The market should be allowed to determine the best compliance pathway for each specific project, weighing up the costs of using the elemental DTS Provisions versus a Verification Method.

5.2.3 Suggested alternative approaches

Some responses, both supporting and opposing a threshold for the elemental DTS Provisions, offered alternative approaches to the use of floor area as the means of defining the threshold. These included:

- Provide a set of elemental DTS Provisions covering various scales (of complexity) reflecting dwelling size changes.
- For alterations and additions, use the proportion of the building affected by the works, rather than the floor area.
- Use building complexity rather than floor area (although no means of determining 'complexity' was offered).
- Consider comparable overseas approaches (if any exist).

5.2.4 DTS for Class 2 buildings

While most responses to the proposal to set a threshold for the elemental DTS Provisions addressed the question in the context of Class 1 dwellings, there was also a number of calls to extend the elemental DTS Provisions to sole-occupancy units (SOUs) in Class 2 buildings (i.e. individual apartments).[63] Currently, Class 2 SOUs are only covered (for DTS) by the NatHERS compliance pathway.[64]

[63] 'Sole-occupancy unit' is the NCC defined term for an individual apartment within a Class 2 building.
[64] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [Fig 2] p 9.

Given that many SOUs would likely be under the proposed 120 m² floor area threshold for elemental DTS Provisions, some stakeholders argued that there may be merit in extending that option to Class 2 SOUs.

The City of Sydney, in its submission, set out the following arguments in support of extending elemental DTS to SOUs:

> *[I]n terms of building designer accountability, a DTS elemental compliance pathway must be made available for apartment buildings. If, as indicated in the Scoping Study, the elemental DTS pathway is restricted by floor area maxima (say 120 m²), then there is no reason why [SOUs] falling inside the threshold should not be allowed to demonstrate compliance via what the Scoping Study call 'more conservative, or coarse elemental provisions'.*
>
> *Further, in the residential market, increased building size does not necessarily result in more complex design or technology [in] fit out therefore a limit on floor to which elemental DTS applies is not logical in terms of driving acceptable design outcomes.*
>
> *By providing this option, the NCC could help address:*
>
> - *Disengagement in thermal comfort among the apartment building design profession. [D]esigners outsource responsibility to demonstrate compliance to third party service providers, to the extent that the designers consistently do not adequately mark up plans/elevations with annotations relating to thermal performance, but ratings are still undertaken (to some extent under duress), with inadequate documentation, and compliance (with inadequate evidence) implied via plan stamping.*
> - *Potential cost/time saving through avoided modelling and certificate fees.*

The same submission then noted that elemental DTS Provisions may be an appropriate option:

> *'…for a sector of the construction industry that uses highly predictable, and repeated materials and methods'.*

A similar argument was also put in another response from a local government in metropolitan NSW, which stated:

> *Elemental DTS Provisions are important for all building sizes and provide clear requirements where compliance can be easily validated. We recommend elemental provisions for thermal performance be extended to Class 2 buildings and that the elemental provisions for regulated loads be introduced without any cut-off threshold for floor area.*
>
> *In the residential market, increased building size does not necessarily confirm an increase in sophistication of design or systems. Developers of large apartment buildings still favour reliance on domestic scale systems for heating and cooling and there should be no scenario where a larger building is able to deliver equipment that does not meet the minimum standard prescribed by Elemental DTS Provisions.*

Overall, there is a strong view that elemental DTS Provisions, with or without a floor area threshold, should be made available for Class 2 SOUs, at least in situations where the design and services are relatively conventional and predictable.

5.3 The issue of 'gaming'

In its discussion on the 'current situation', the Scoping Study noted that one of the key changes to the residential energy efficiency provisions introduced by NCC 2019, was improvements to the reference building Verification Method (VM) (V2.6.2.2), to limit the software that that can be used and include more detail around modelling inputs to prevent gaming.[65]

The term 'gaming' generally refers to the intentional misuse of the reference building VM to achieve a sub-optimal outcome, whilst giving the impression that the Performance Requirement has been met. This can occur when the specific input requirements of V2.6.2.2 are not complied with when practitioners use NatHERS in

[65] *Ibid.* [2.1] p 9.

conjunction with the VM. In particular, this applies to the temperature settings and the unique features of the proposed house.[66] Whilst the issue of 'gaming' was first identified in relation to the 2016 version of V2.6.2.2, it nonetheless attracted several comments in the Scoping Study. However, not all of these comments specifically referred to the reference building VM.

In these comments the following key issues were raised:

- Competitive pressure on practitioners who do not engage in the practice.
- Any new Performance Requirements should be stringent enough to prevent new forms of gaming emerging once they are implemented.
- A general perception that the use of modelling software lacks transparency and is seen by some as a 'black box' process. Furthermore, some suggested this issue could be exacerbated by extending modelling to a whole-of-house approach.
- The trustworthiness of the reference building VM is dependent on the integrity of the practitioner using it.

5.4 Reliance on specialist consultants and software

Many of the responses submitted by practitioners expressed concern that increases in complexity and stringency of the energy efficiency provisions is driving an increased reliance on specialist consultants and/or modelling software. This, in turn, increases compliance costs for practitioners (e.g. for software licence fees and consultant fees).

In addition to these costs, some comments also noted that reliance on specialist third-party consultants also increases the amount of design co-ordination required on each project, which also consumes time and, therefore, has a cost.

In relation to the DTS compliance pathways, there is also a view that using the DTS Provisions should not require specialist consultants, given that the DTS pathway is intended for simpler, standardised solutions. There is also a related concern that practitioners may be able to use a consultant's report to hide energy efficiency losses within complex calculations, thereby making detection of non-compliant designs difficult.

[66] Australian Building Codes Board, *Reference Building Verification Method V2.6.2.2,* Advisory Note, October 2017, p 3.

These issues and costs were described in the following quote, taken from the submission by Ajar Architects:

> *As an architect, it is not cost effective for my clients to pay me to do the energy assessment anymore, it costs 75% less than my fees to pay a consultant to do the same energy assessment work. My concern is that the consultants use programs with built-in assumptions that no one has reviewed for many years. To increase regulations and not review the accuracy of assumptions is flawed.*

In such cases, the practitioner is potentially missing out on otherwise billable work, while also having to recoup consultant fees by passing them on to the client, or having the client engage a consultant directly.

Related to the issue of costs is the perception that the NCC is forcing practitioners to buy software in order to comply. This was likened to the situation where many of the documents referenced in NCC (e.g. Australian Standards, etc.) must be purchased. While the NCC does not compel the use of either software or referenced documents, this must be balanced against the reality that it may also be unfeasible to avoid the use of software and/or referenced documents. Furthermore, the production of such resources comes at a cost, which if not subsidised by government, must be recovered through users. Nonetheless, some practitioners do feel 'held to ransom' by the developers of modelling software, particularly if regulation specifies which software must be used, thereby reducing competition between providers.

5.5 Discussion

The two key issues raised by practitioners in response to the Scoping Study were the complexity of the energy efficiency provisions, and the proposal to set a floor area threshold for the use of elemental DTS Provisions. The latter of these also lead to several submissions calling for the extension of the elemental DTS Provisions to SOUs in Class 2 buildings. Related to these issues are the role and appropriate use of software and reliance on third-party consultants.

The complexity of the current energy efficiency provisions, and the potential for a future increase in complexity, appears to be among the most pressing concerns for practitioners. This is before consideration of proposals such as the floor area

threshold for the elemental DTS Provisions. While it is recognised that, as stringency increases, it can become more difficult to formulate elemental DTS Provisions, there is a view among practitioners that having provisions that are ‘coarse’ or ‘conservative’ may be preferable to having them limited to only smaller dwellings or extensions/alterations. It is also worth noting that the NCC currently does not define what is an alteration or extension for purposes of its application; rather, this a matter for individual State/Territory building legislation.

Any reduction in the scope of the elemental DTS Provisions is seen as exacerbating concerns around the level of dependence on third-party consultants to establish compliance with the NCC (DTS or Performance Solutions). This dependence comes with a cost (fees, certificates, etc.) which some practitioners feel is difficult to justify or pass on where the construction methods used are conventional and standardised as opposed to complex or bespoke solutions.

It is this argument about simplifying compliance for standardised construction that has also fed in to the calls for the elemental DTS Provisions to extend to SOUs in Class 2 buildings. Submissions that made this argument generally based it on a view that, in many cases, Class 2 buildings, whilst large, can still be constructed using materials and methods that are conventional and standardised. That is, they argue that for conventionally designed Class 2 buildings, the NCC should not be forcing practitioners to engage third party consultants to undertake complex and potentially costly modelling to determine compliance with the NCC.

As noted in Section 5.3, the issue of gaming in the modelling process has already been identified and addressed through an ABCB Advisory Note and subsequent changes to NCC 2019.

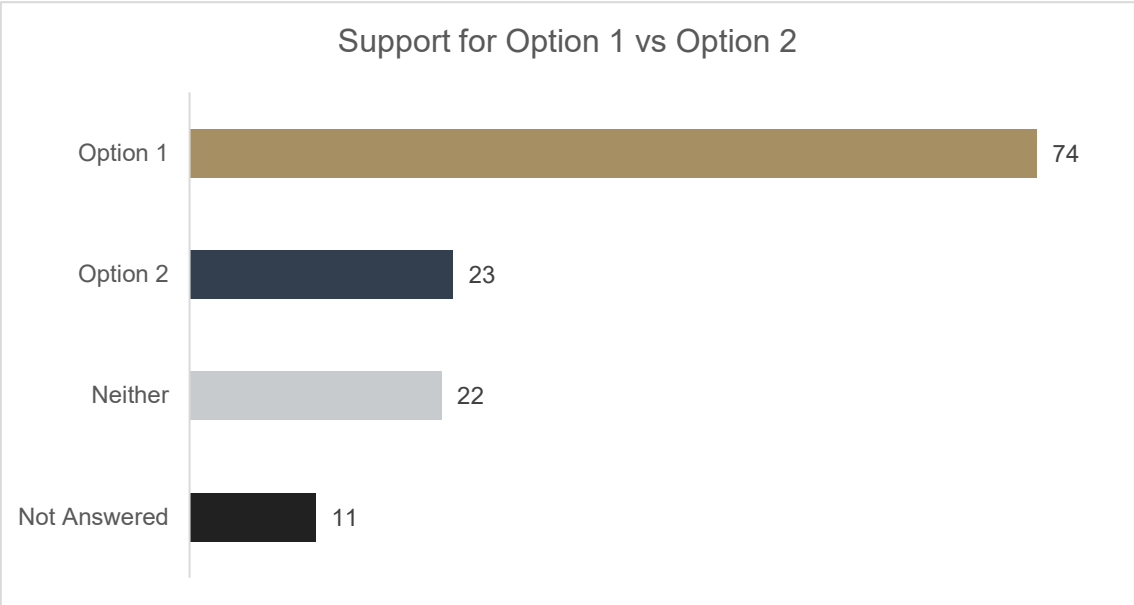
6 Specific analysis of residential responses

Overall, the (121) submissions received through the ABCB Consultation Hub expressed general support for the proposed approach and scope of the residential energy efficiency provisions outlined in the Scoping Study. This chapter provides an analysis of the responses to the specific survey questions that respondents were asked to answer in Consultation Hub.

6.1 Option 1 versus Option 2

Question 1 asked which of the two options outlined in the Scoping Study best achieves both the Trajectory's objectives and the ABCB's IGA obligations. In general, (107) submissions supported either Option 1 or Option 2, with 74 indicating a preference for Option 1. 22 submissions did not support either Option 1 or Option 2. See Figure 2.

Figure 2 Residential Question 1



As has been discussed previously, some respondents indicated a preference for Option 1, but expressed concern about its feasibility in NCC 2022. Likewise, some respondents chose Option 2, but indicated that Option 1 would better achieve the stated objectives. Detailed qualitative analysis of the comments on the proposed two options is in **Section 3.2**.

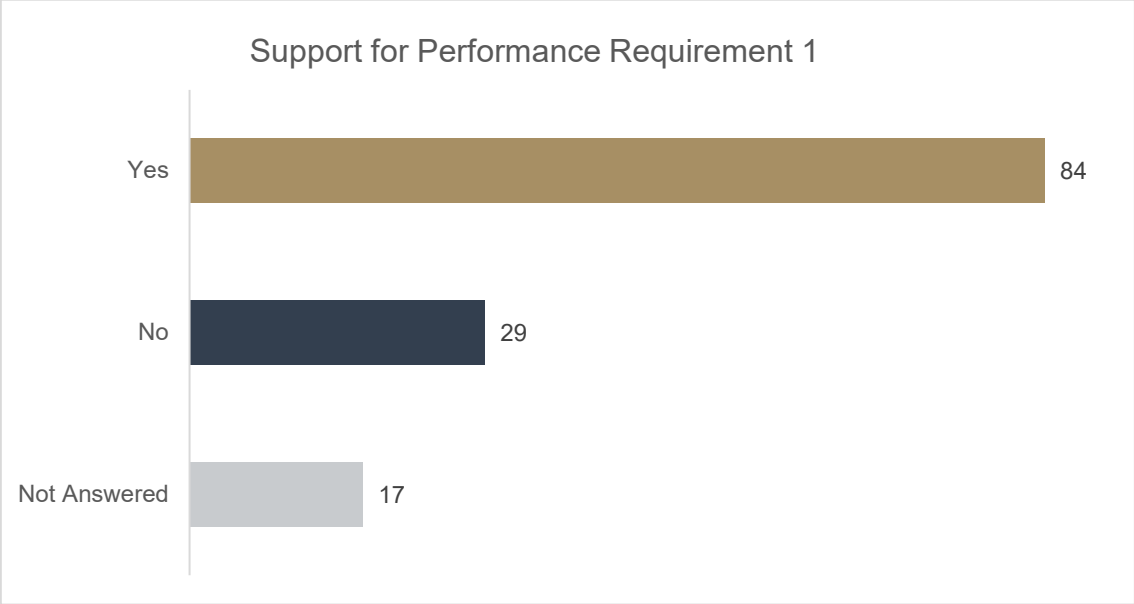
6.2 Performance Requirements

Questions 2 and 3 asked whether the proposed Performance Requirements, PR1 and PR2, were the appropriate for quantifying thermal performance and annual energy use. Around 90% of all submissions responded to the questions.

6.2.1 Performance Requirement 1

84 submissions were supportive of the heating and cooling load limits prescribed in PR1 as shown in Figure 3.

Figure 3 Residential Question 2



Common themes in the submissions about PR2 are outlined below.

6.2.1.1 Climate-based targets

Submissions were generally supportive of setting achievable quantitative targets for thermal performance that vary depending on climate. For example, an anonymous respondent noted:

> *Explicit quantification of Performance Requirements is always welcome. The details and arguments for this changed approach for PR1 appear persuasive. Many of Australia's high population growth areas have climates that are not very severe. Not burdening construction in these*

> *areas with excessive fabric costs (intentionally or unintentionally) is an important objective.*

A similar view was expressed by Jesse Clarke (Pro Clima):

> *The limits need to be climate based metrics. Otherwise it will be either too easy to comply in some climates or way too onerous and expensive in some climates. Also the climate regions may require different solutions as we move towards net zero energy buildings. So the metrics need to be set accordingly with due respect for energy and the dehumidification required to maintain healthy conditions when necessary in tropical climates.*

However, some respondents questioned the applicability of the metric when designing naturally ventilated buildings, particularly in tropical climates, such as Graeme Doreian's (AFICA) comment questioning:

> *Building energy efficiency regulations are based on computer modelling of a fully refrigerated house, which is the most expensive means to cooling… …Where is an option for natural ventilated homes in the building energy efficiency regulations? Say in the tropics.*

Another common theme with reference to the building climate was that the future climate of the building should be considered, as expressed by an anonymous respondent:

> *The PR1 needs to consider the climate that the building will be in, in the future. Not historical climate. Calculating to 2050 is recommended and revising in 2030.*

6.2.1.2 Transparency and flexibility

Of those responses that were supportive of PR2, the most common theme was the benefits quantified requirements provide in terms of transparency and flexibility for practitioners. This is reflected in the following comment by an anonymous respondent:

> *This is an appropriately transparent requirement for heating, sensible and latent cooling and would allow alternative model pathways, such as the*

> *Passive House Standard which meets the performance requirements for; PR1– minimum thermal performance of the building fabric, PR2 – maximum energy usage budget for services, thermal bridging and air sealing. Therefore this software should be considered as an approved alternative pathway.*

Another common theme was the benefit of expanding the existing compliance pathways in the NCC, which is reflected in the following anonymous response:

> *I see the ability to assess residential developments against a stated performance metric as a positive, allowing for more methods of achieving compliance outside of NatHERS which I personally find rather limiting.*

6.2.1.3 Complexity concerns

Of responses that were not supportive of PR1 a common theme was the apparent complexity of the proposal, and that a simple option for compliance is necessary, such as the response from the following anonymous respondent:

> *This sort of technical calculation seems to me to be just complicating the issue for the building designer. Your rules must be more simple and straight forward if you want them to be used across the board. Why not release a booklet with various options for walling that will comply with the new energy efficiency requirements. And then you can say that there is also an option to calculate it manually for an alternative solution.*

Another example of this view was expressed by Simon Croft (HIA):

> *Energy efficiency is not a well understood part of the NCC and moving to highly sophisticated Performance Requirements that contain complicated metrics will not assist people's understanding of the energy efficiency provisions.*
> *The Performance Requirement for thermal performance should detail the relevant building elements and then have associated Performance Requirements for building sealing [as per] NSW Part 2.6 Performance Requirements.*

However, there were some that also acknowledged the simplicity of PR1. This was reflected in part by Darren O'Dea (Fabric First):

> *This is a positive and simple message for industry to understand. However, a much more considered building fabric must be considered including a total ban on single glazing.*

6.2.1.4 Tools and users

Some concern was raised about the underpinning methodology and the tools that would be used to achieve compliance with PR2. For instance, Anthony Wright (CSIRO) noted:

> *If there was a 'maybe' answer CSIRO would have chosen it. There is insufficient information in the scoping paper to determine whether this method is appropriate. ASHRAE 140 is insufficient to provide equivalence between tools. Further work needs to be done to ensure that the methodology does not introduce loopholes which might undermine the minimum standard.*

Conversely, some users pointed out benefits of providing additional flexibility in assessment tools, as noted by the following anonymous respondent:

> *There are several private sector tools which start ups like us are using to help people with existing homes and help people building new homes get a better result, beyond what using NatHERS accredited software would deliver. We are already locked out of the new building market to a large extent because building owners have to pay for the Section J modelling then our modelling on top, to get a good outcome. Asking them to pay for additional modelling when they assume they already paid for government backed modelling is a hard ask. If government moves into whole of house, with government tools and large amounts of red tape we will be locked out altogether.*

Some respondents noted that how the analysis is done is also an important consideration, as seen in the following anonymous response:

> *Who (which professions/persons) will be making these calcs and what level of control / purview will exist in how they arrive at the 'passmark' loads? The Scoping Study is written in a way that a general reader (non NCC specialist) cannot readily understand who will be performing the proposed calculation. Given the existing extensive gaming that occurs around reference building modelling currently its clear that new PR methods must tighten governance not worsen it.*

Another anonymous respondent highlighted the risks of users manipulating the software packages that are used:

> *It is my belief that all building Energy assessments should only be performed by Heating, Ventilation and Cooling engineers (HVAC) and not by people who drop and drag inputs on a program such as NatHERS, as the energy rating is open to manipulation simply by renaming a room from Theatre to Guest by way of example.*
> *HVAC engineers when supplied with manufacturer specific information which has to be independently verified by certified global laboratories will be able to calculate this improvement and then all products are competing on an equal basis.*

6.2.1.5 Passive design versus mechanical heating and cooling

Some submissions questioned the fundamental aim of PR1 being to limit loads on the assumption that spaces are mechanically heated and cooled. These comments pointed out that passively designed spaces should be considered more explicitly, particularly in sub-tropical climates, as pointed out by the following anonymous respondent:

> *The whole point of 'Passive Design' is to avoid the need for mechanical (or other) means of heating and cooling. (i.e. reverse cycle air-conditioners). Any method of assessment that takes into account the Heating / Cooling Load required to condition a space is flawed.*
>
> *Passive design and air-movement (i.e. Ceiling Fans) should be the dominant requirement for 'Sub-Tropical' climates.*

However, another anonymous respondent noted the complexities in this line of thinking, due to the common installation of mechanical space conditioning in houses that are designed to be naturally ventilated:

> *The majority of housing in the NT (Darwin Region) use air-conditioning to provide human comfort in the climate zone 1 (tropical region). Many tropical houses have building fabric that is designed to be passively cool the house with features such as large glazed area of the facade to allow for cross flow ventilation, lightweight and uninsulated walls, raised floors and roofs, ventilated roof spaces and leaky building envelopes, when air- conditioning is provided to these houses they do not perform very well in terms of energy efficiency. Currently in the Darwin region the general public believe that they are being energy efficient by living in a tropically designed home, yet the majority of these homes are also fitted with air-conditioning to achieve the desired human comfort, when operated in a conditioned mode these homes are highly inefficient. PR1 would set a minimum standard for human comfort conditions based on HDH, CDH and humidity level and the requirements for air-conditioning used to achieve human comfort and this would then quantify the effects of average air conditioning use of homes in this location.*

6.2.1.6 Testing

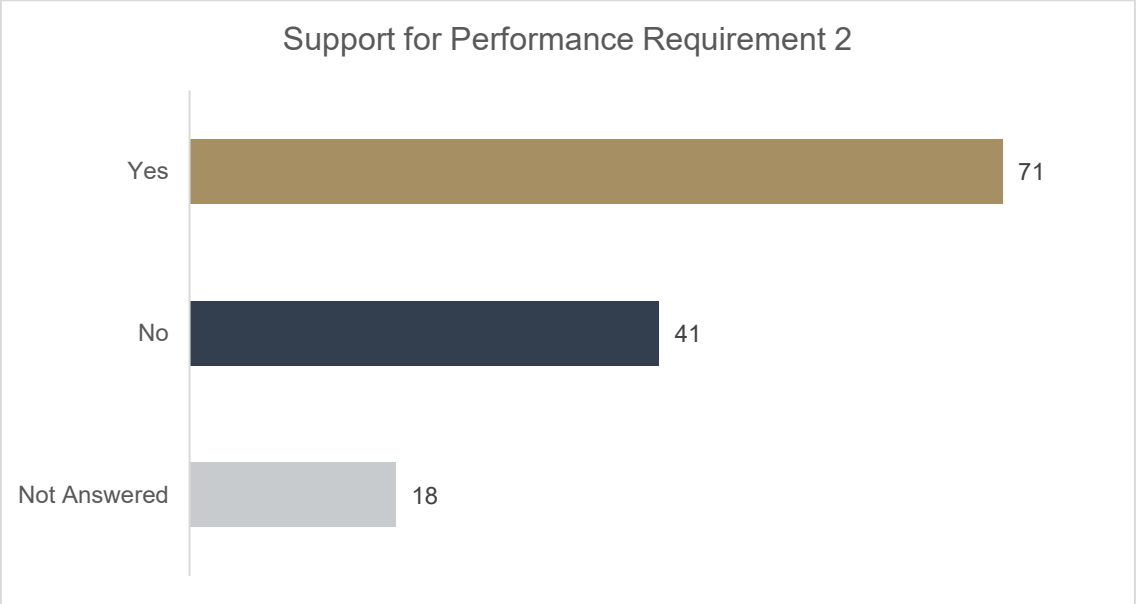
A number of respondents noted that further rigorous testing should be completed to provide stakeholders with confidence that this method would result in beneficial outcomes, as noted by Sandra Qian (GBCA):

> *We expect to see further analysis regarding the proposed method for quantifying PR1, noting that industry needs to have confidence that it will deliver expected performance outcomes and benefits and represent an improvement on the existing approach.*

6.2.2 Performance Requirement 2

71 respondents indicated that they supported the energy use budget in PR2, which is based on time-dependent value. See Figure 4.

Figure 4 Residential Question 3



6.2.2.1 Benefits of TDV of energy

Many respondents noted the benefits of the proposed PR2 in the Scoping Study, such as James Adams (BlueScope):

> *TDV may be a reasonable basis to commence regulating the building energy use. Given the expected changing dynamics of the grid, if adopted, it would be envisaged that this method will subsequently require regular updating. The benefits of this method would be further strengthened by equipment minimum energy performance requirements.*

A common theme reflected by respondents is the benefit of considering how a building's energy demand and supply affects energy networks. This is reflected by the comment of an anonymous respondent:

> *This comprehensive approach will benefit on-site generation at peak times, and support grid supply and demand, allowing for a more resilient power system.*

The ability to account for demand response was also supported, as reflected by an anonymous respondent:

> *In theory this is a really good idea and we support it. The problem is demand response and load shifting. If products have timers, or can be*

made "smart" or have demand response capability, they should get an allowance where it is assumed some of the energy would be load shifted.

6.2.2.2 Complexity

A number of respondents raised concern about the complexity of the TDV metric, which underpins PR2. Many of these concerns were reflected in the following anonymous response:

The Method may have theoretical merit but its not practical, and will be: expensive to administer (i.e. to keep up to date and to have the degree of granularity and dynamism that exists around energy pricing) and/or
Will quickly not reflect actual energy pricing as this is a relatively dynamic metric compared to the review time frames of the code (i.e. the code does not 'vary' month by month or even each year, but uses a 3 yearly cycle ...thus is too static to accommodate a dynamic pricing model.
No matter how much the government of the day wants to hard wire 'price' and 'cost savings' into building policy, the Code is not the right vehicle for this.
A national carbon price combined with Time of Use retail energy markets are the macro economic levers that best serve this purpose.
Please do not over-complify (sic) the NCC's approach to embedding energy efficiency in new residential or commercial development

Other respondents noted difficulty of users understanding and applying the metric, as noted by Simon Croft (HIA):

Again, think about the main user groups of the NCC and we want to ensure we have a well understood and utilised NCC. Moving to a TDV will not assist in achieving this goal and will only confuse people no end.

6.2.2.3 Cost versus greenhouse gas metric

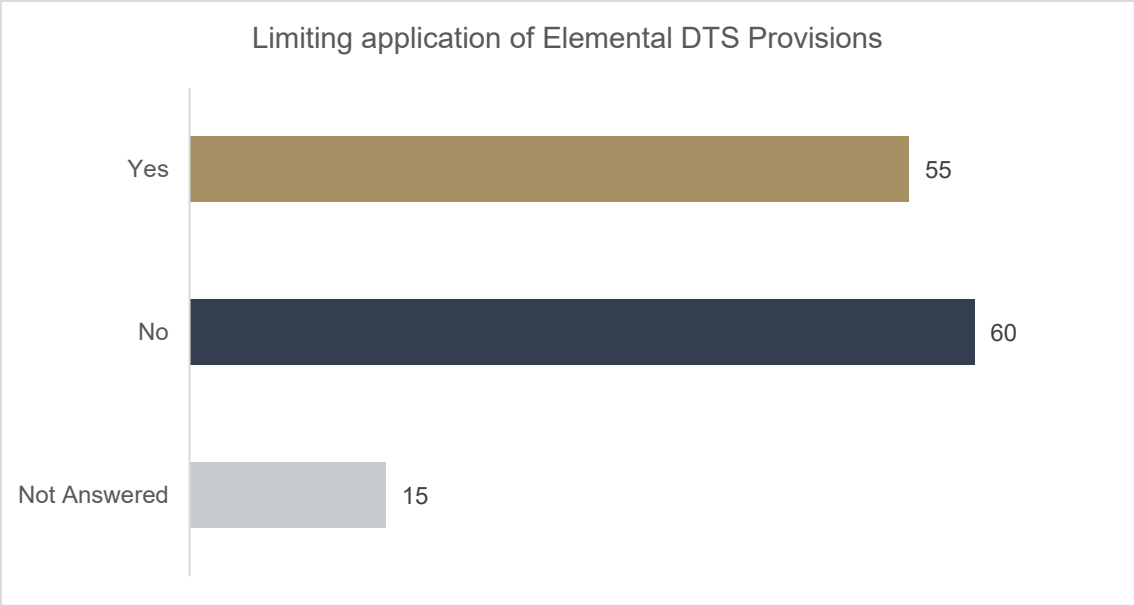
Some respondents suggested that a greenhouse gas metric rather than a cost metric should be included in PR2, as summarised by an anonymous respondent:

The cost of energy is not a useful metric - as it is subject to market fluctuation. PR2 should use maximum allowable carbon emissions based on KWh for a building as its metric, if the trajectory is to meet its objective to reduce the operational energy use and associated greenhouse gas emissions of buildings.

6.3 Limiting the application of the elemental DTS Provisions

Question 4 asked whether the application of the elemental DTS Provisions should be limited to buildings under a certain floor area. There are mixed responses to this question. 55 submissions supported the inclusion of a threshold, while 60 opposed the proposal. 15 submissions did not answer this question. See Figure 5.

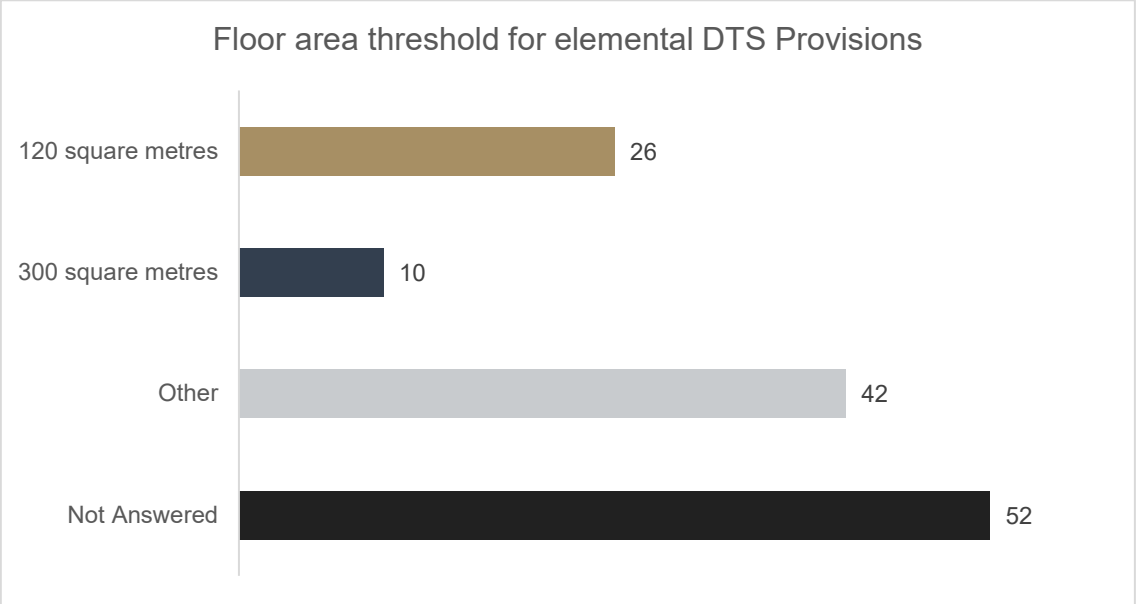
Figure 5 Residential Question 4



A qualitative review of responses to this issue was discussed previously in **Section 5.2**.

Question 5 sought views on what floor area threshold might be appropriate for the elemental DTS Provisions. This attracted diverse views. Of the limits proposed in the Scoping Study, 26 respondents chose 120 m² and 10 chose 300 m². 42 respondents suggested other thresholds from 50 m² to 500 m². See Figure 6.

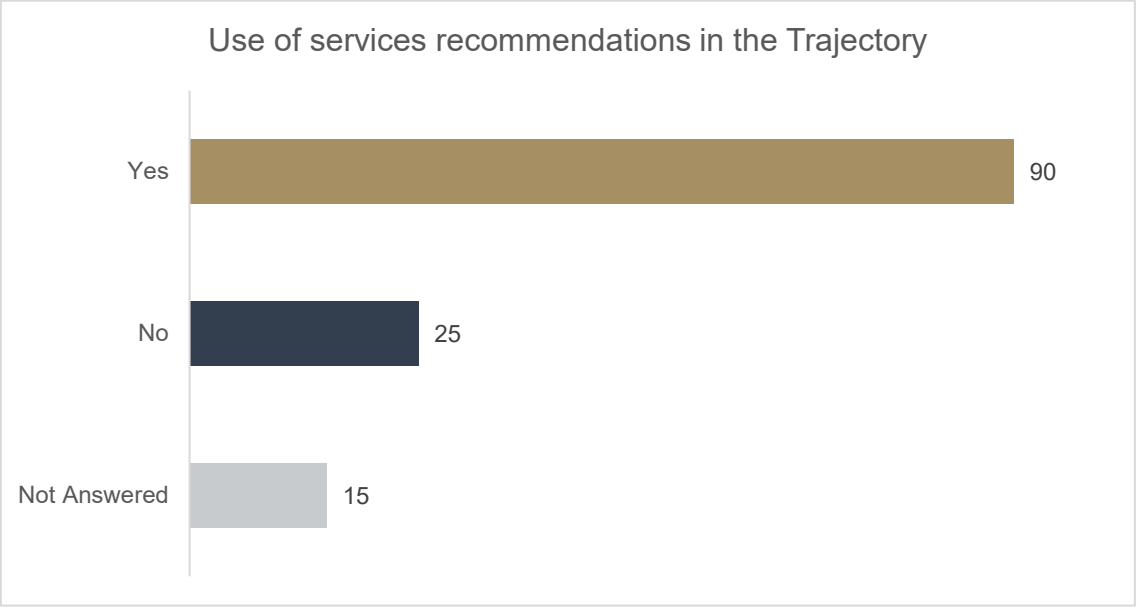
Figure 6 Residential Question 5



6.4 Efficiency of building services

Question 6 asked whether it is reasonable to use the Trajectory's recommended levels of energy efficiency for building services as the minimum requirements for developing the whole-of-house elemental DTS Provisions. 90 submissions were supportive of this approach, while 25 submissions selected 'No' and 15 chose 'Not answer'. See Figure 7.

Figure 7 Residential Question 6

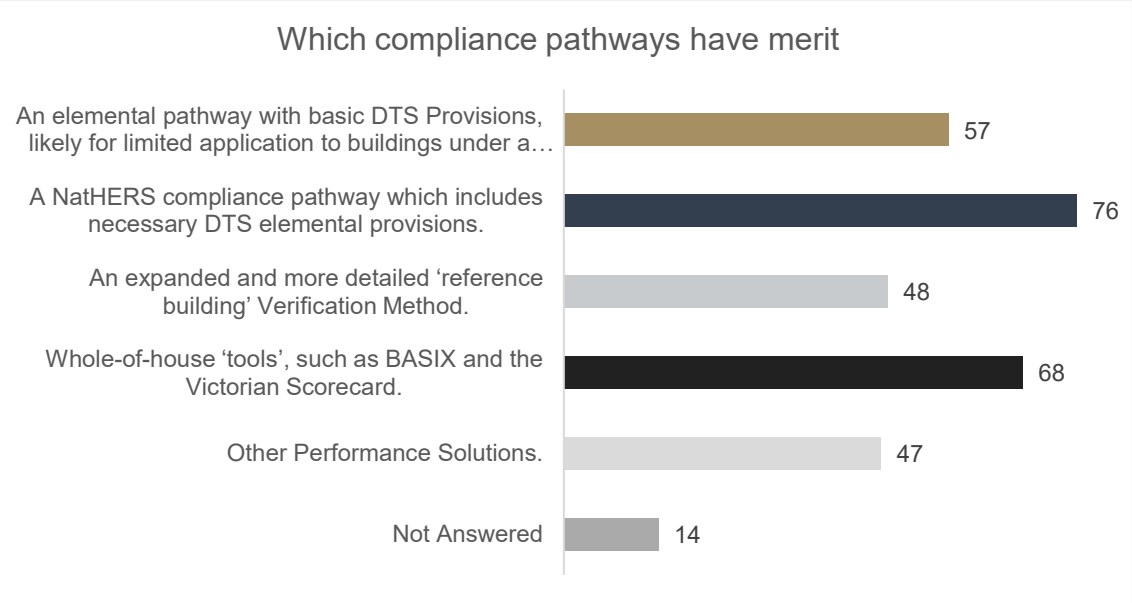


The general support for this proposal indicates that use of the Trajectory's recommendations is a sensible starting point for investigating the elemental DTS Provisions. Objections mainly came from concern about the overlap between the NCC and Minimum Energy Performance Standards (MEPS), which may require certain appliances to go beyond MEPS. However, it should be noted that the recommended levels in the Trajectory only establish the central case for the Elemental DTS Provisions, with MEPS providing the absolute minimum level of energy efficiency.

6.4.1 Compliance pathways

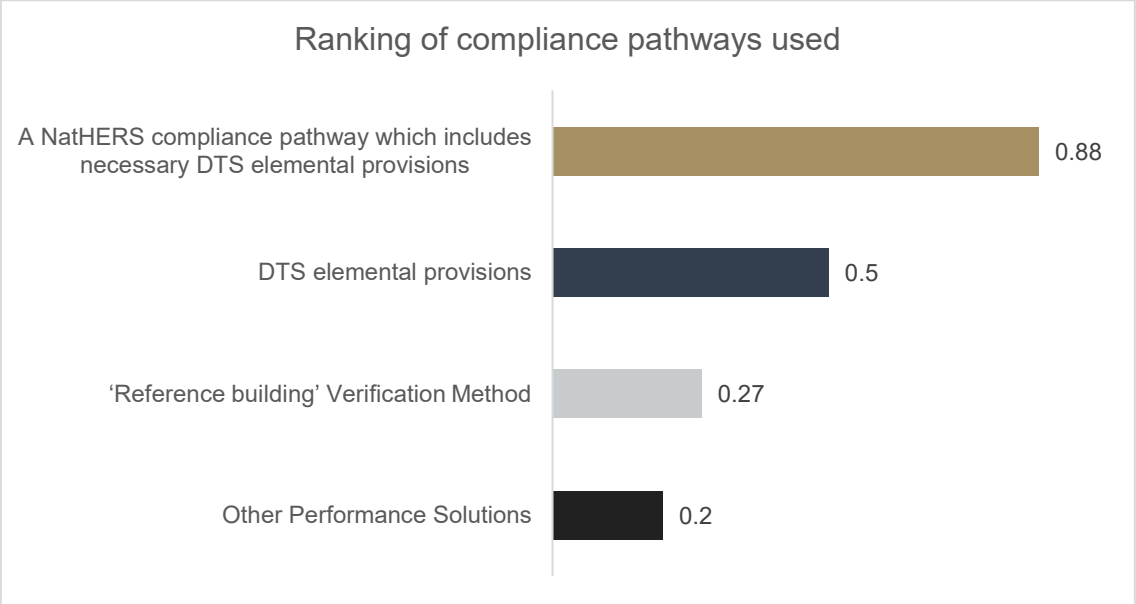
Questions 7 and 8 were both about the compliance pathways in the NCC. Question 7 asked which compliance pathway(s) has merit in exploring, while Question 8 was about which compliance pathway(s) respondents were using. See Figures 8 and 9.

Figure 8 Residential Question 7



Support was spread across all compliance pathways with NatHERS (76 submissions), whole-of-house tools such as BASIX and Scorecard (68), elemental DTS Provisions (57), reference building Verification Method (48), and other Performance Solutions (47).

Figure 9 Residential Question 8



Although support was expressed for different compliance pathways, the NatHERS compliance pathway was the most commonly used approach by respondents.

The above ranking was automatically calculated by the Consultation Hub in consideration of the weighting of each position. Question 8 asked respondents to rank the top two compliance pathways they use. When a pathway is selected as the top preference, it is given a weighting factor of 2, and their second preference is given a weighting factor of 1. Then the total weighted score is divided by the total number of respondents who answered the question[67].

6.4.2 Whole-of-house software tools

Question 9 asked which whole-of-house software tools are best suited to demonstrating NCC compliance with the Performance Requirements proposed in the Scoping Study. BASIX is the preferred over the Scorecard (45 submissions versus 15). However, a similar number of the submissions (47) support Other tools. Noting

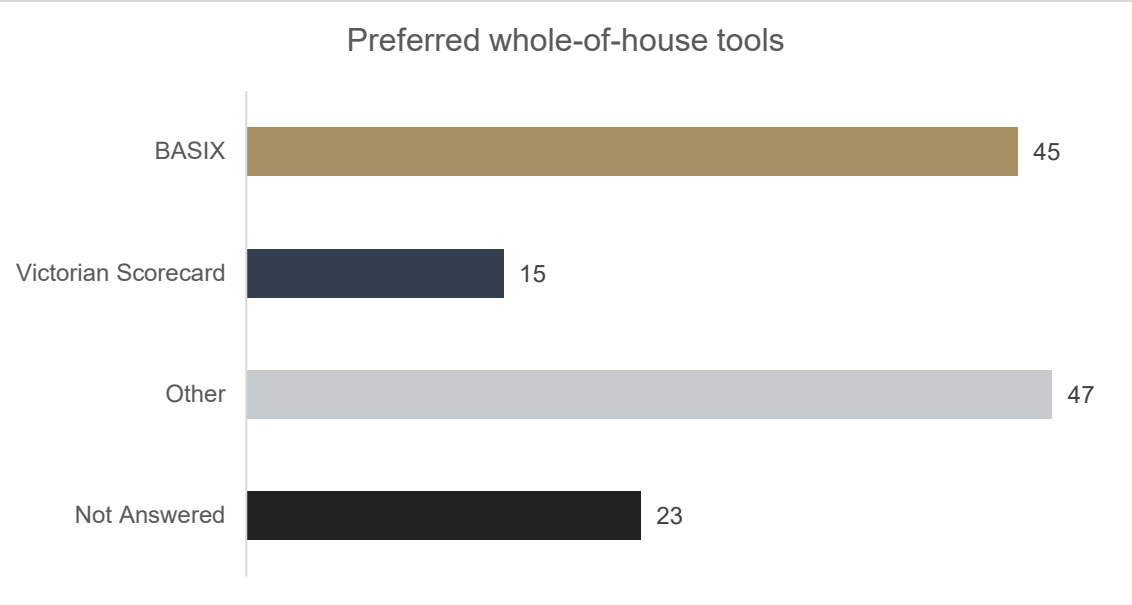
[67] The calculation method for ranking questions in Consultation Hub is detailed on its website: https://delib.zendesk.com/hc/en-us/articles/206570883-Ranking-question-component-how-are-rankings-calculated-:
The weighted average score for each option is calculated as: (w1c1 + w2c2 + w3c3 + ... + wncn) / t

Where:
w1, w2 ... wn are the weightings of position 1, position 2, etc.
c1, c2 ... cn are the number of respondents who chose position 1, number of respondents who chose position 2, etc
t is the total number of respondents who answered the question. A respondent is included in the total if they ranked any item in the question, even if they did not select a position for this particular item.

This calculation is repeated for each option to be ranked.

NatHERS is a scheme not a tool, 11 submissions included it in their response as Other tools. Other submissions supported Passive House tools (8 submissions) or an independent tool (8 submissions).[68] See Figure 10.

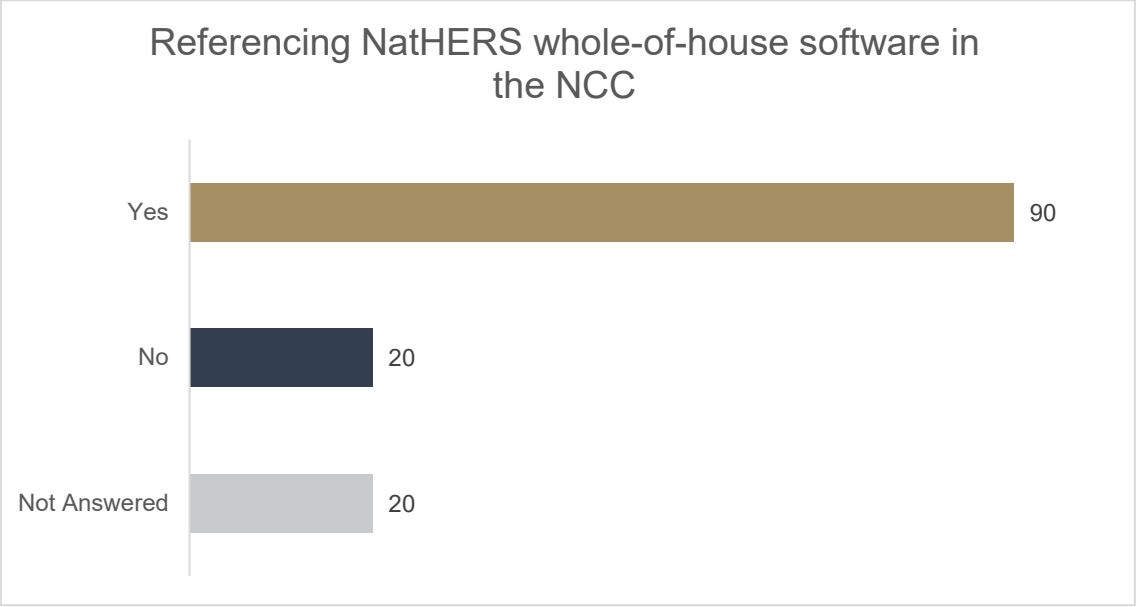
Figure 10 Residential Question 9



Question 10 asked whether the ABCB should consider referencing whole-of-house tools accredited under NatHERS. See Figure 11.

[68] Passive house is a fabric-first construction standard summarised by 5 design principles and performance criteria", which "relies on building physics and carefully integrated, minimal building services and technology. See: Australian Passive House Association, *What is Passive House?*, n.d., webpage: https://passivehouseaustralia.org/APHA/What_is_Passive_House/The_Basics/APHA/What_is_Passive_House/The_Basics.aspx?hkey=1358a504-1570-4812-baae-aa881764eaca.

Figure 11 Residential Question 10



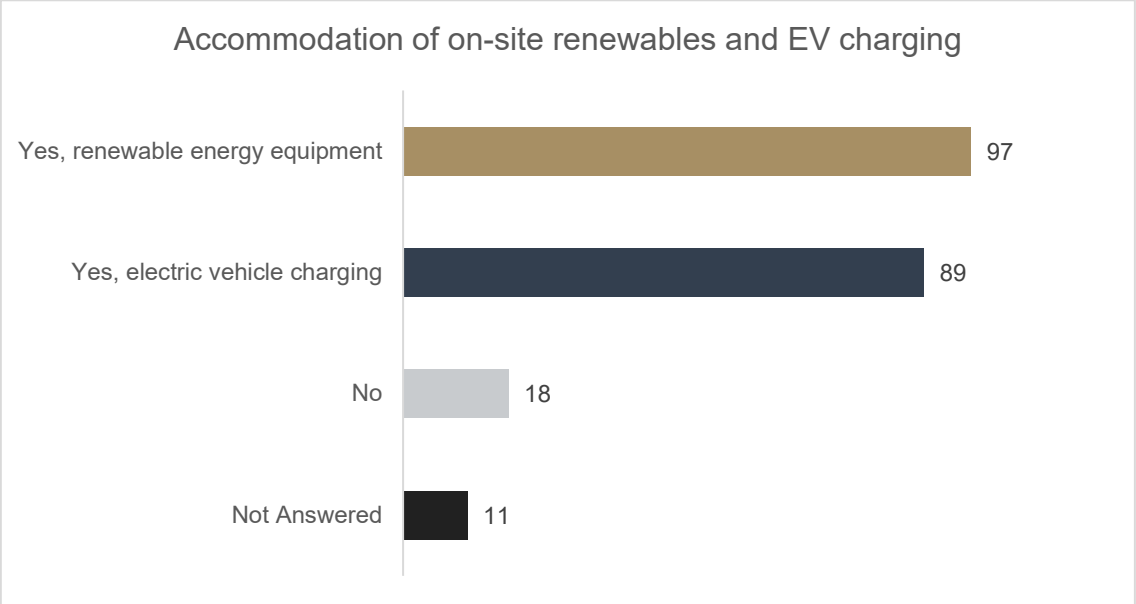
90 submissions suggested that the NCC should reference whole-of-house tools accredited under NatHERS, provided NatHERS is expanded to fulfil the role. However, some comments noted NatHERS' inability to properly account for airtightness and thermal bridging, as well as concerns that NatHERS was disadvantaging Passive House designs.

20 submissions did not support referencing NatHERS accredited whole-of-house tools in the NCC. Complexity and inflexibility were raised as the major concern.

6.4.3 On-site renewable energy / EV charging provisions

Question 11 asked whether the ABCB should investigate provisions to ensure residential building have the capability to accommodate the future installation of on-site renewable energy equipment and/or electric vehicle charging. See Figure 12.

Figure 12 Residential Question 11



97 submissions supported the investigation of provisions that would accommodate the future installation of on-site renewable energy equipment and 89 submissions supported the same for electric vehicle charging. 18 submissions did not agree with the proposal due to concerns of affordability, complexity, over-regulation (letting the market decide) and impacts on other elements. However, it may be that these respondents misunderstood that the proposal only involves facilitating the future installation of such equipment. A qualitative review of responses to this issue was discussed previously in **Section 3.3** and **3.4**.

6.5 Discussion

The quantitative and qualitative review of responses to the Scoping Study in this chapter provide useful insights into the proposed approach to residential energy efficiency. In particular, while the majority of respondents supported Option 1, there was also concern raised about its feasibility. Similarly, while the majority of respondents supported the proposed quantified Performance Requirements, concerns were also raised about their underpinning methodologies and complexity. On complexity, however, there was some indication that some respondents incorrectly assumed the proposed Performance Requirements would be applied to all building solutions, rather than just to Performance Solutions developed from first principles.

Another factor noted in relation to the BASIX and TDV options was the lack of available data for Australian conditions to support whole-of-house. Queensland in particular noted the significant difficulty and cost that would be associated with generating this data.

Views about whether the elemental DTS Provisions should be limited to dwellings under a certain threshold varied substantially, with no clear approach that would satisfy the majority of respondents. There were a number of respondents that suggested the elemental DTS Provisions should be extended to Class 2 SOUs.

Respondents overwhelmingly supported the recommended baseline for building services in the Trajectory. There was also support for the current NatHERS compliance pathway, as well as its possible expansion to accredit whole-of-house tools. BASIX also received relatively strong support as a whole-of-house tool. The CSIRO's AusZEH tool was also identified as another potential whole-of-house tool.

Respondents generally noted that there was merit in investigating provisions that would accommodate the possible future installation of on-site renewables and EV charging. Some concern was raised about the changing nature of this technology and the extent of uptake in Australia.

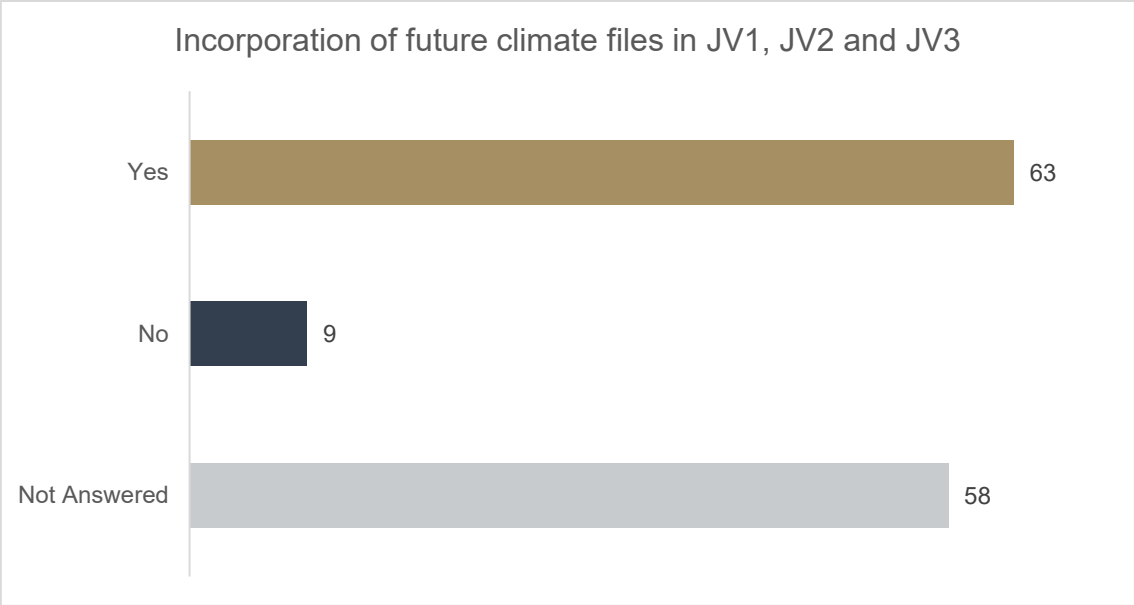
7 Specific analysis of commercial responses

While the primary focus of the Scoping Study was on residential energy efficiency, ten questions were also posed about commercial buildings. These questions had a lower response rate than those on residential buildings, with 81 respondents answering any of the questions about commercial buildings. The following analysis should be considered in that context.

7.1 Future climate files

Question 1 of the commercial building questions asked whether the ABCB should investigate the incorporation of future climate files in the existing Verification Methods, JV1, JV2 and JV3. For this question, 63 respondents selected 'Yes', 9 selected 'No', and 58 did not make a selection. This is represented in Figure 13.

Figure 13 Commercial Question 1



Supporters of the use of future climate files noted reports about the world's changing climate and the benefits of accounting for this over the life of a building. The support for this option is well represented by John Eccles, who noted that:

> *Current reports around the world verify that climate change is definitely occurring with temperatures rising to record levels. We must be ready with the tools to address the changes necessary.*

Some respondents provided dissenting views, expressing concern that future predictions contained too much uncertainty and could not be relied upon. Ania Hampton (Edefice) stated that:

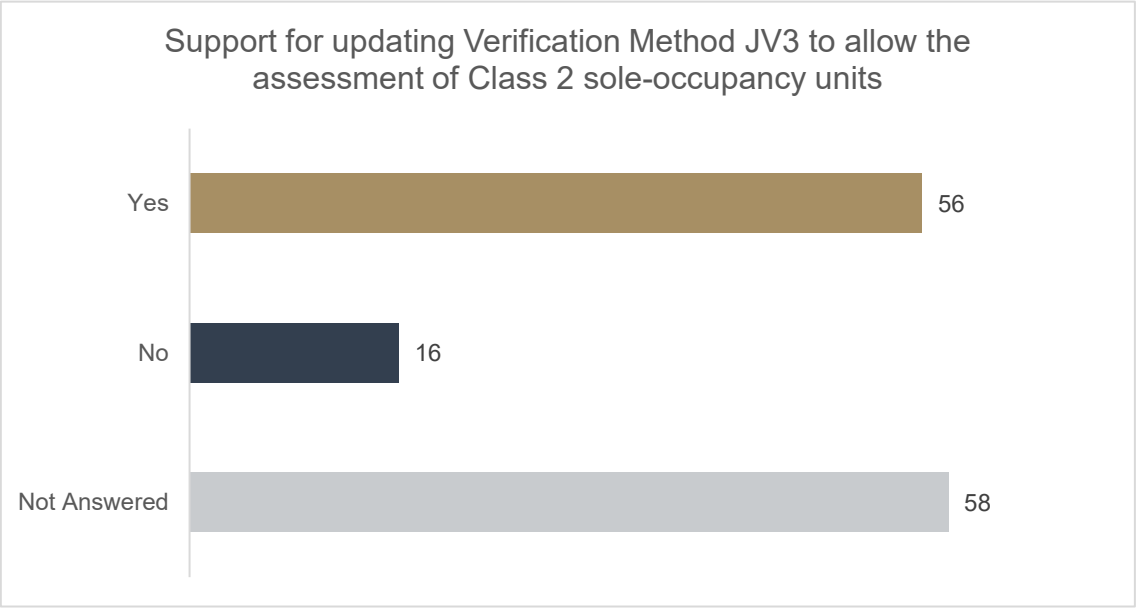
> *The IPCC models have consistently failed to predict temperatures since the beginning. Measured data, while showing a change in global temperatures, does not line up with the predictions.*

Although tangential to the question asked, several respondents suggested that the climate files should be aligned to the 69 NatHERS climate zones.

7.2 Expanding JV3 to Class 2 buildings

Question 2 asked respondents whether they support expanding the Verification Method JV3 to Class 2 SOUs. For this question, 56 respondents selected 'Yes', 16 respondents selected 'No', and 58 did not make a selection. This is represented in Figure 14.

Figure 14 Commercial Question 2



The increase in flexibility and potential reduction in regulatory burden were prime reasons given for support of this proposal, with many respondents indicating that they prefer to use JV3 than the NatHERS compliance pathway. Samantha Anderson (Inhabit Australasia) commented that:

> *Additionally, the use of NatHERS tools to rate apartments can be inefficient and laborious. Adoptions of specific and defined procedures to model apartments under JV3 would ensure dwellings can still be assessed individually but would facilitate more efficient optimization of performance.*

However, other responses were concerned that this approach could lead to poor performance in individual apartments. Marcus Strang (The Australian Passive House Association) made comments representative of this cohort:

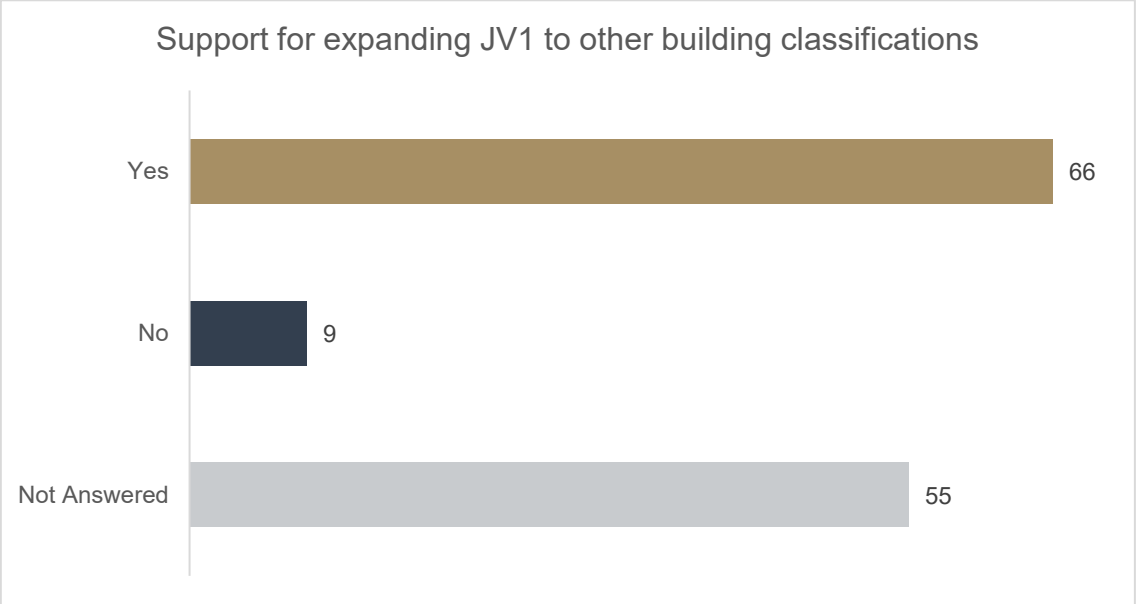
> *Careful consideration should be given as to what methodology is employed to ensure that if JV3 was applied to Class 2 SOU's every SOU within the development would still achieve individual targets.*

Some responses also suggested changes to the JV3 modelling protocols, with a split between those suggesting increased flexibility and others preferring more prescription.

7.3 Expanding JV1 (NABERS) to more building classifications

Question 3 asked whether Verification Method JV1 should be expanded to allow assessment of other building classifications (i.e. Class 2 apartments, Class 3 hotels, Class 6 shopping centres, Class 8 data centres and Class 9a hospitals). For this question, 66 respondents selected 'Yes', 9 selected 'No', and 55 did not make a selection. This is represented in Figure 15.

Figure 15 Commercial Question 3



Supporters of this proposal cited the benefits of expanding the use of NABERS, which is already widely used and understood by industry. An anonymous respondent captured the mood of those who supported the expansion of JV1:

> *If a consultant has done modelling to achieve a NABERS rating then the team should not have to undertake an additional model to demonstrate the same thing.*

Many respondents, who were both supporters or detractors, had concerns about how widely NABERS was used outside the assessment of office buildings. Concerns were also raised about how readily, apart from Class 5 use, NABERS would align with the aspects of buildings regulated by the NCC. Paul Bannister (Delta Q Consulting) suggested that:

> *In general these NABERS ratings do not present the simple boundaries that is available for offices. NABERS apartments coverage varies between little more than the lights in the corridors to the whole HVAC system, lifts and such; shopping centres has a widely variable boundary within the HVAC system; data centres I'm not even sure sits within the NCC because it's process cooling rather than comfort cooling, but the infrastructure rating would cover that well if this was considered to be within Code; hotels and hospitals are both whole building ratings and thus include large*

amounts of non-regulated energy uses. I'm not saying it can't be done but it's difficult and non-intuitive.

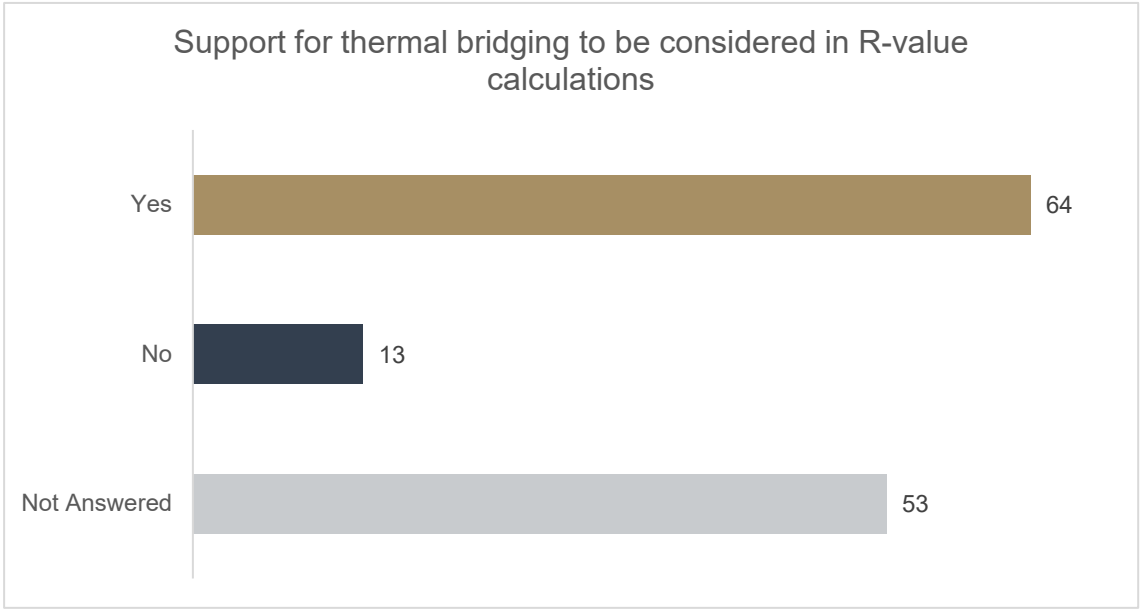
Several respondents raised concern about applying JV1 to Class 2 buildings, such as Robert Keating (Bob Keating Design & Drafting) who simply stated that:

Class 2 should be treated differently.

7.4 Thermal bridging

Question 4 asked whether the ABCB should investigate accounting for the effect of thermal bridging caused by penetrations. For this question, 64 respondents selected 'Yes', 13 selected 'No', and 53 did not make a selection. This is represented in Figure 16.

Figure 16 Commercial Question 4



There was broad quantitative and qualitative support for expanding the thermal bridging provisions. An anonymous respondent noted that:

International examples of best practice with building science show how important it is to take into consideration.

However, some stakeholders were concerned about the increasing complexity of calculations, or the availability of information to enable these calculations to be performed. Dr Clyde Anderson (Anderson Energy Efficiency) suggested that:

The level of detail required to properly calculate the conductance may not be available so early in the building design process.

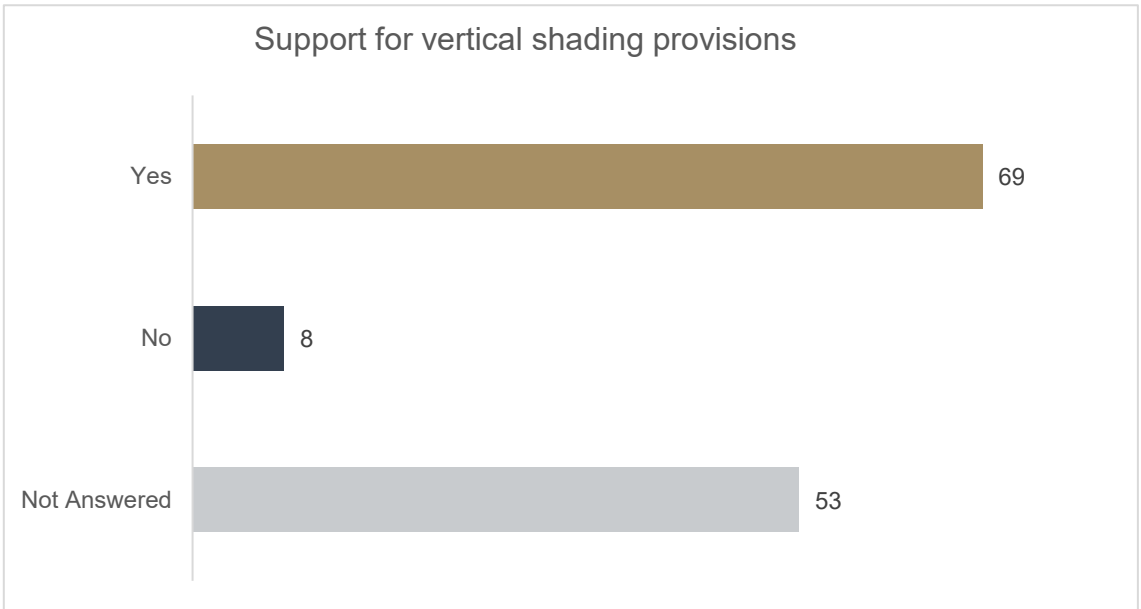
There was concern about the impact of these changes on industry, with some respondents suggesting that there may be supply chain impacts. An anonymous respondent commented that:

This is a relevant bridging path that needs consideration but it should be recognized that this could represent (another) significant change for industry and would need to be scoped to understand the potential impact of how the requirements would be managed in design, construction and material supply – a suitable consultation process and transitional period would need to be considered to allow the supply chain to manage the impact.

7.5 Vertical shading

Question 5 asked whether provisions for vertical shading should be included in the DTS façade provisions. For this question, 69 respondents selected 'Yes', 8 selected 'No', and 53 did not make a selection. This is represented in Figure 17.

Figure 17 Commercial Question 5



There was strong support both quantitatively and qualitatively for the inclusion of vertical shading. An anonymous respondent noted that:

This seems a highly logical extension of current provisions offering useful benefits with minimal cost or complexity, especially on smaller commercial properties constrained by their aspect and surroundings.

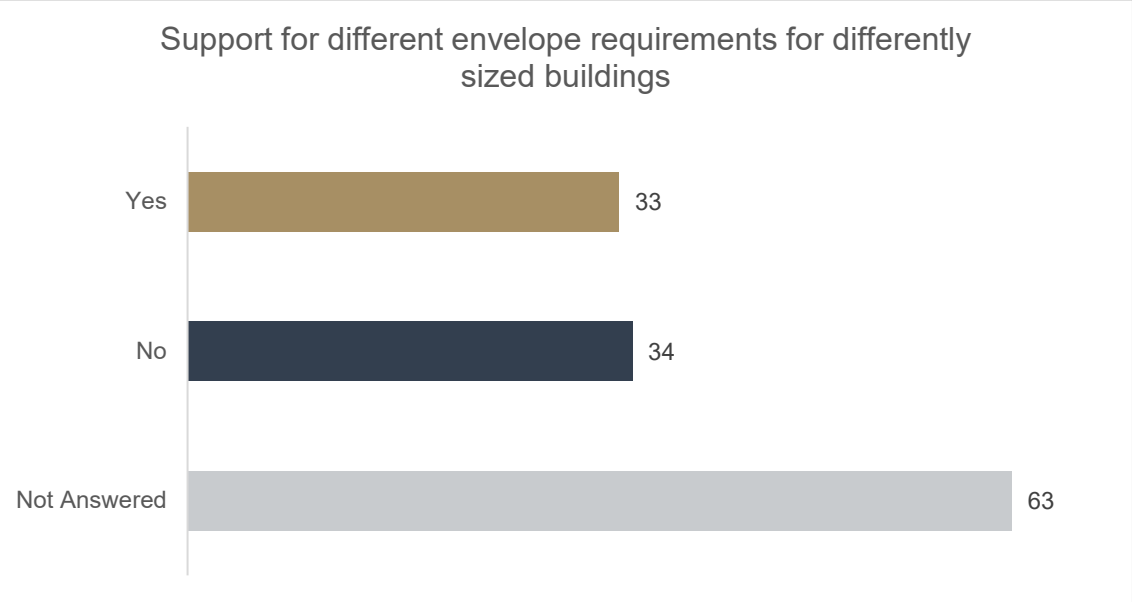
Negative responses were primarily concerned with the effectiveness or value of vertical shading compared with other options. An anonymous respondent asked the rhetorical question:

Why resort to shading methods which of course will work but will add costs to construction and ongoing maintenance and of course can be removed and never replaced at any future time.

7.6 Buildings with low volume-to-surface area ratios

Question 6 asked whether smaller buildings with low volume-to-surface ratios should have different envelope requirements. For this question, 33 respondents selected 'Yes', 34 selected 'No', and 63 did not make a selection. This is represented in Figure 18.

Figure 18 Commercial Question 6



As noted above, opinions on refinements to these provisions were mixed. Consistency of outcomes was a central theme. An anonymous stakeholder who opposed any changes suggested that:

> *All buildings should perform equally well, without some buildings being given preference for reduced energy efficiency.*

This theme was present among both those who supported and opposed the changes. Torquil Canning who supported the changes noted that:

> *Size can effect surface area to volume ratio...giving a greater advantage to larger buildings. So yes as long as the net zero energy goal is still in focus.*

Several respondents raised concerns similar to those of section 4.3 about the risk of encouraging larger buildings than necessary. James Adams (BlueScope) suggested that:

> *Any regulation should be mindful of encouraging larger spaces than required for the building function by raising volume to surface area of a building to escape a limit.*

The benefits of consistent regulation were raised by several stakeholders in opposition to the changes. Danielle King (Green Moves Aust Pty Ltd) suggested that:

> *Consistency is important and saves market and compliance confusion.*

Paul Bannister (Delta Q Consulting) raised concern that volume-to-surface area ratios may not be the cause of the issues identified. He suggested that:

> *I think there is a degree of misinterpretation of the results here. The issue I believe is not so much one of building size as of the general skewing of the 2019 results to cooling versus the previous bias towards heating.*

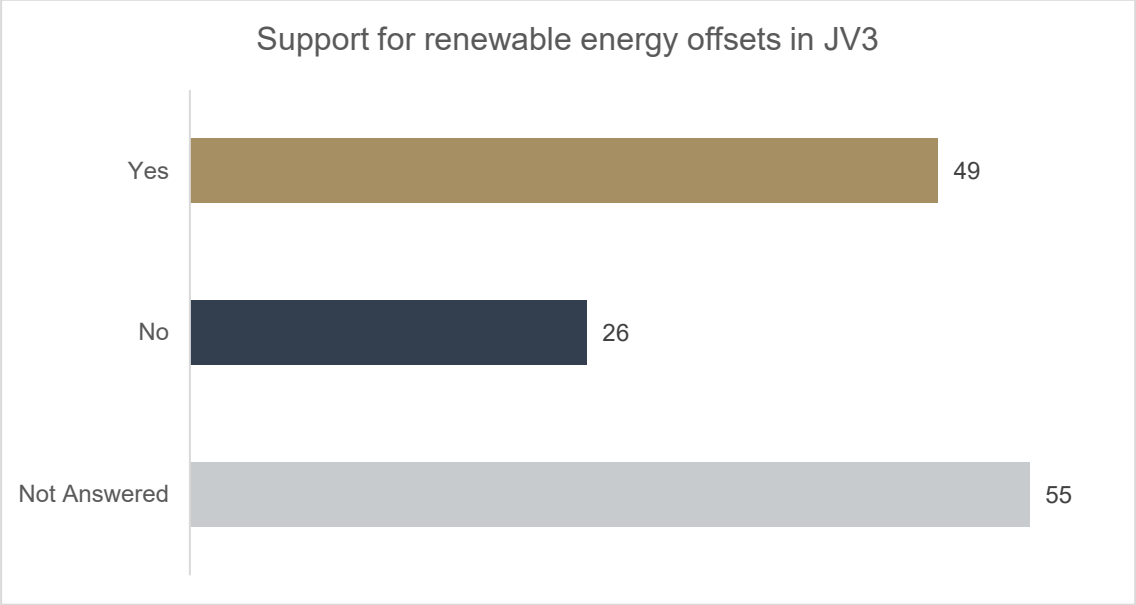
7.7 On-site renewable energy generation

This section addresses several questions related to the provision of on-site renewable energy. The Scoping Study was concerned with whether on-site renewable energy should be used to offset energy use in JV3, whether mandatory requirements should be included, and whether provisions should be made for its future installation. Provision for the future installation of electric vehicle charging was also included within these questions.

7.7.1 Trade-off within JV3

Question 7 asked whether, under JV3, greenhouse gas emissions of the proposed building should be allowed to be offset by on-site renewable energy. For this question, 49 respondents selected 'Yes', 26 selected 'No', and 55 did not make a selection. This is represented in Figure 19.

Figure 19 Commercial Question 7



While there was support for continuing to allow energy generated and used on-site to offset a proposed building's greenhouse gas emissions, strong dissenting views were also expressed.

Supporters like Andreas Boomkamp (Ancon Building Products) noted that:

> *The amount of renewable energy produced in Australia needs to be increased so that the dependency on coal and gas stops. Offsetting any renewables that are built with the building will help to promote more renewable energy.*

Many stakeholders, both those supporting and opposing the offsets, were concerned about on-site renewable energy being used to justify a poor performing envelope. Chris Derksema (City of Sydney) suggested:

> *Onsite renewables should be allowed to offset energy end use from energy using equipment on site but not be used to allow any reduction of envelope performance below a minimum standard.*

The retention of minimum standards for the building envelope was a common theme. Nayan Das (Australian Glass and Window Association) suggested that:

> *The performance of the building should have a minimum threshold to deter any malpractices of offsetting building envelop performance with on site energy.*

Several respondents also raised concerns about the lifetime of on-site renewable energy equipment and its maintenance, which may lead to perverse outcomes. An anonymous respondent noted that:

> *Renewable energy system designed to capture and reused on site to maintain the offset will need to be protected and maintained (for at least 10 - 20 years) in a manner to ensure that the output of the predicted energy or is maintained or subsequently improved from the level that should have been achieved from the renewable system for a limited amount of time.*

On the contrary, several respondents suggested expansion of the offsetting provisions. Mike Rainbow (Ark Resources) suggested:

> *JV3 should reconsider the current approach of offsetting only renewable energy consumed on-site. It should allow offsetting of export during periods of high grid demand (high TDV) since this is tackling a national supply problem.*
> *Arguably, even export during low grid demand could be admitted since this promotes low/negative spot-market prices that are motivating hydro power plants to pump during the middle of the day rather than at night therefore significantly diminishing the business case for coal-fired 'baseload' generation in Australia.*

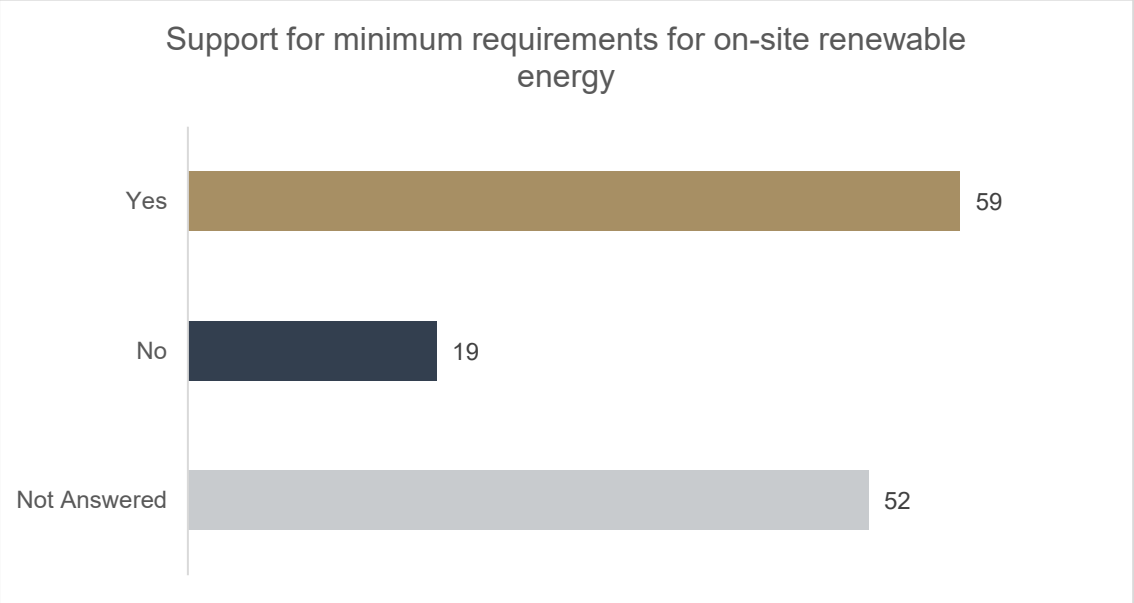
Leon Bogers (Gas Appliance Manufacturers Association of Australia) suggested the provisions should be expanded to include off-site renewable or decarbonised energy systems:

Whilst we recognise the challenges of accounting for off-site renewable or decarbonised energy systems in the context of buildings and the NCC, they have the same end result as on-site systems in terms of carbon abatement.

7.7.2 Minimum requirements

Question 8 asked whether minimum requirements for on-site renewable energy should be introduced for some commercial buildings. For this question, 59 respondents selected 'Yes', 19 selected 'No, and 52 did not make a selection. This is represented in Figure 20.

Figure 20 Commercial Question 8



While there was support for the inclusion of minimum levels of on-site renewable energy generation, substantial dissenting views were also expressed, as well as reservations over the way this would be implemented.

An anonymous respondent summarised the case for inclusion as follows:

Incorporating PV on site reduces reliance on the grid and supports carbon neutral targets around the country. It also provides a level of resilience to developments (i.e. if the grid blacks out under pressure).

It was suggested by some respondents that this would also help resolve split incentive issues, for instance an anonymous respondent suggested:

> *Often the buildings that have most to gain from on-site renewable energy ignore it due to the different factors motivating a developer compared to a building owner. Including a requirement will force them to actually consider it in design. This will also create better amenity buildings for the final owners and reduce energy consumption across Australia.*

However, there was concern even among supporters that on-site renewable energy generation might not be appropriate for all buildings. An anonymous respondent suggested:

> *However, a building should have the option of off-site PV, through Green Energy; this should be a significant portion, and drive the electricity grid to cleaner energy.*

Concerns were also raised by some respondents that the NCC should remain technology neutral, and not specify a particular type of on-site renewable energy. Leon Bogers (GAMAA) suggested that:

> *The rate of technological development in energy systems is very rapid and as such we do not believe it is appropriate to 'lock in' solar PV as the only accepted renewable energy option at this stage.*

Some stakeholders suggested that results would be better achieved without making these provisions mandatory. Ania Hampton (Edefice) suggested that:

> *This is a commercial issue that the market will sort out - most of our clients already install PV because it makes financial sense, aligns with their/tenants' corporate values and tenants expect it. Forcing the market in a particular direction reduces innovation and experimentation (why would someone look into geothermal, for example, when they are already required to install PV?) and goes against free market principles.*

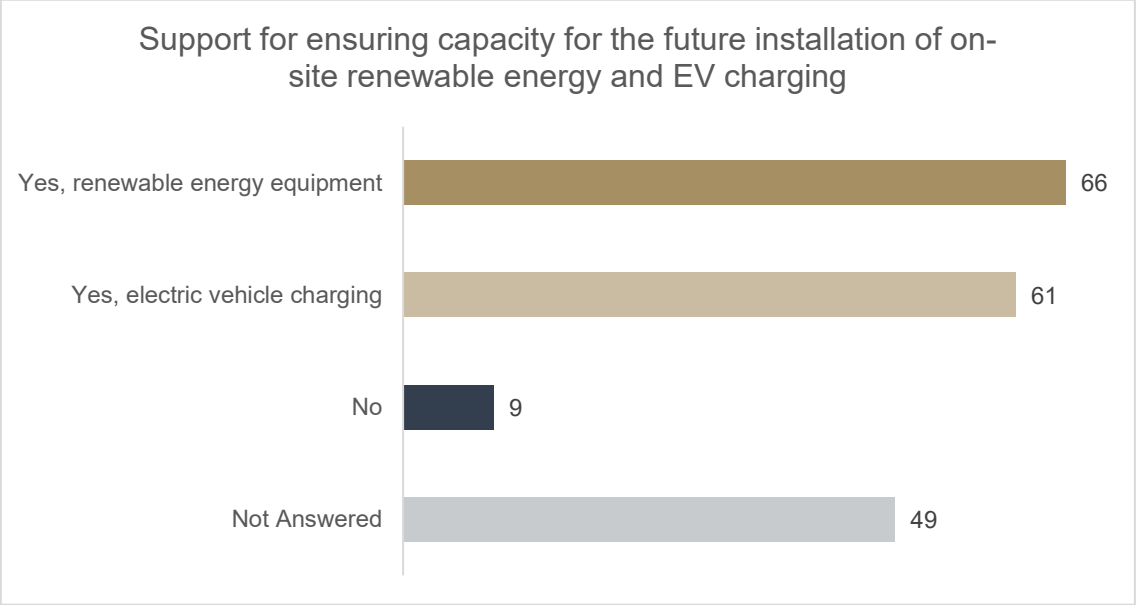
Concerns were also raised by some respondents that mandatory requirements may perversely encourage poor design. Marcus Strang (The Australian Passive House Association) suggested:

While we are very supportive of encouraging the use of renewables, a blanket rule of applying a minimum requirement to particular commercial buildings is perhaps an over simplification. This may present more problems than solutions whereby tokenistic systems are placed on buildings without the appropriate level of analysis to determine the effectiveness of the system, accounting for things such as orientation, overshadowing etc.

7.7.3 Accommodating future installation

Question 9 asked whether the ABCB should investigate provisions to ensure that commercial buildings have the capability to accommodate the future installation of on-site renewable energy equipment and/or electric vehicle charging. Respondents could select multiple options. For this question, 66 respondents selected 'Yes, renewable energy equipment', 61 selected 'Yes, electric vehicle charging', 9 selected 'No', and 49 did not make a selection. This is represented in Figure 21.

Figure 21 Commercial Question 9



There was strong support for the NCC facilitating the future installation of both on-site renewable energy equipment and EV charging. An anonymous respondent made comments representative of a number of comments received:

> *The growing investment in renewables means that adding some products post-construction can be a costly deterrent, particularly where building envelope modification is required. Therefore the capability to easily accommodate the future installation of on-site renewables would likely improve adoption rates and reduce the cost of installation.*

Stakeholders in support suggested that provisions for electric vehicle charging would encourage the uptake of these vehicles. Respondents also noted the advantages of aligning EV charging with the daytime period when solar energy is readily available. An anonymous respondent pointed out that:

> *EV charging during normal working (majority daylight hours) using excess PV production makes more sense than charging from grid overnight using more Carbon intensive methods. Building in EV stations would encourage the growth of EV market and allow more grid friendly charging in the absence of large scale storage.*

Some respondents also commented on the costs of inaction in this area, with James Thomson (Australian Industry Group) noting that:

> *However, an overlooked problem is that regulatory frameworks have yet to respond to technical infrastructure requirements to meet growing demand for EVs – inaction which may result in very costly retrofits for EV owners in the future. In particular, little attention is being given to the technical infrastructure needs of the built environment in both residential and commercial premises to facilitate integration, charging and energy management.*

Concern about whether these measures should be put in place for buildings where on-site renewable energy is not presently suitable were addressed two ways. Some stakeholders suggested that this may change through the life of the building and so should still be included, while others argued for such provisions only to be included where currently practical. Andrew Ferris (Andrew Ferris Drafting and Design) represented the latter:

> *but in the context of "where practical to do so" - not meant as a cop out for those who do not want to do it - but so that it is acknowledged that in some situations, it is not workable.*

While the Scoping Study did not suggest that the NCC should require the installation of the necessary infrastructure, some stakeholders suggested that such provisions should be left to the market. Jeffrey Armstrong (Jeffrey Armstrong Pty Ltd) suggested:

> *I think consideration and incentive should be given to the provision of these items but it should not be prescribed by legislation. Desire by the end-user will determine the uptake not legislation.*

For electric vehicles, some stakeholders raised concerns that other technologies may supersede the individual electric vehicle, with both hydrogen celled cars and driverless vehicles raised as other pathways to be considered.

7.8 Other considerations

Respondents raised many points not directly associated with the Scoping Study. Some of these points, listed in Chapter 8, are outside the scope of the ABCB. Others represent stakeholder views and may inform the future direction of commercial energy efficiency in the NCC, if they are found to align with government policy.

The most common item was support for the inclusion of Passive House Certification as a Verification Method. An anonymous respondent suggested:

> *The Passive House energy standard should be seriously looked at as a basis of updating the NCC for residential and non-residential buildings.*

However, some respondents were equally as strident against the Passive House approach, typified by one anonymous respondent:

> *Please do NOT consider "Passive House" as a method of compliance with NCC.*

Several stakeholders suggested that stringency levels should be increased for commercial buildings. Mike Rainbow (Ark Resources) suggested:

> *Do not baulk at another commercial stringency increase in 2022 comparable to NCC 2019. Formalise trajectories early to allow industry and its supply chains to plan with confidence and quickly adapt.*

Some stakeholders preferred to increase stringency in particular areas, with glazing a common area of suggestion. However, other respondents suggested that it would be beneficial to take time to evaluate the impact of the NCC 2019 changes and minimise technical revisions for NCC 2022 until these are fully evaluated. Simon Croft (HIA) suggested:

> *Further changes atop the commercial energy efficiency provisions should not be considered until NCC 2025. The changes for NCC 2022 should be left to settle in and only include changes where there is errors, emissions or improvements for clarity and readability but not technical changes.*

Reductions in the scope of regulation were suggested by some respondents. For example, Lachlan Grieve (Lighting Council Australia) suggested deregulating lighting.

Some stakeholders were either concerned about the complexity of the regulation or suggested that enhanced education was required to help communicate the provisions to practitioners. Nayan Das (Australian Glass and Window Association) suggested:

> *The industry is widely lacking understanding and the correct interpretation and use of these tools currently. Introducing a greater complexity into the system will result in less accurate outcomes and therefore fewer well-performing buildings. Incomprehensive protocols and insufficient knowledge by the assessors and certifiers allow discrepancies between the predicted energy consumption during design stages and the actual performance of the occupied buildings.*

Several respondents suggested enhancements to the sealing and air tightness requirements, either via enhanced stringency or by making the blower door Verification Method JV4, mandatory.

There was also support among several respondents for discouraging the use of gas, and for the NCC to favour all-electric buildings.

7.9 Discussion

There is broad agreement among many stakeholders on the areas for adjustment in commercial buildings. The survey responses have helped to establish support, and inform the areas in which these investigations should focus.

There was broad support for the use of future climate data among respondents. If developed appropriately, this should resolve the concerns raised about the accuracy of projections.

The application of Verification Method JV3 to Class 2 SOUs was well supported. This should include consideration of how the appropriate level of performance of each SOU as well as that for the building as a whole can be ensured.

A closer examination of how NABERS applies to buildings outside Class 5 offices may be necessary to assess how it aligns with the NCC. This will establish the feasibility of expanding JV1 to other building classifications. An examination of how widespread NABERS use is outside of Class 5 buildings will also help determine the practical benefits of expanding JV1.

Appropriate methods of refining the treatment of thermal bridging with respect to penetrations should be considered, with particular consideration given to the complexity of the approach. The complexity of more detailed provisions was a common area of concern for respondents.

The practical details of how vertical shading should be best included are to be examined. There was broad support for this among most respondents.

Further investigation is needed into modifying the façade provisions for buildings with low volume-to-surface area ratios. This study has seen substantive arguments both for and against changes.

Measures should be considered which ensure a minimum standard for the building envelope while retaining the ability to offset the energy use of services with on-site renewable energy. Such measures would allow on-site renewable energy to still be used as an avenue for offsetting, while resolving the common concerns raised by respondents.

The practical considerations of requiring on-site renewable energy should be investigated, with a particular focus on how the NCC can allow for other options when PV is not practicable. This could include investigation of provisions that accommodate the future installation of on-site renewables and EV charging.

The ABCB's work plan and policy direction will determine when the above investigations may take place.

8 Matters out-of-scope

This chapter provides an outline of issues raised in response to the Scoping Study that were deemed to be outside its scope. They have been discussed in this report because they give an indication of issues that stakeholders considered important which, whilst relevant, fall outside the remit of the ABCB.

The following matters out-of-scope were raised in responses to the Scoping Study (listed in no particular order):

- **Enforcement of the current energy efficiency provisions**. Some stakeholders argued that enforcement of the current provisions should be improved before seeking to increase stringency. However, enforcement of the energy efficiency provisions, as with any other part of the NCC, is the responsibility of the States/Territories.
- **Documentation:** Related to the issue of enforcement is documentation. There is a view among stakeholders, particularly practitioners, that compliance with the current energy efficiency provisions is not always supported by adequate documentation. Whilst the NCC does include some provisions, documentation is generally considered to be an administrative issue managed by the States/Territories. [69]
- **Existing buildings:** Several comments suggested that rather than increase stringency for new buildings, improvements should be made to the efficiency of existing buildings. However, the NCC is not retrospective, and as time passes the proportion of building stock that complies with each generation of past NCC energy efficiency provisions will increase, so that eventually most existing buildings will be to some extent energy efficient.

  Post the release of the Scoping Study, the COAG Energy Ministers' Council has announced work to be led by the Department of Energy and Environment into consideration of options for improving the energy efficiency of existing buildings.
- **Changes made post-construction:** Some comments noted that the effectiveness of the energy efficiency provisions can be compromised by changes made to buildings (particularly houses) post-construction. While this may be true, it is outside the scope of the NCC to control how people use and modify their buildings, particularly if such modifications are too minor to be considered regulated building work under relevant State/Territory legislation.
- **Plug-in appliances:** Some comments suggested that the some types of plug-in appliances could be covered within the definition of regulated energy. This was on the basis that appliance such as fridges are used continuously for long

[69] *NCC 2019*, Part A5.

amounts of time, and in most, if not all, households. However, as was noted by the Scoping Study, appliances, including fridges, can be changed from one owner or tenant to the next and it is not practical to record the changes or reassess energy efficiency with each change of owner or tenant.[70]

- **Embodied energy:** The term 'embodied energy' refers to the energy consumed by all of the processes associated with the production of a building, from the mining and processing of natural resources to manufacturing, transport and product delivery.[71] A number of comments called for embodied energy to be included in future NCC energy efficiency provisions. However, this would require a separate policy decision by governments given that it would significantly expand the current scope of the NCC' sustainability objective.[72]
- **Water efficiency:** Several comments called for the NCC's energy efficiency provisions to be expanded to also cover water efficiency, which is covered by BASIX in NSW. However, the NCC already covers water efficiency for residential and commercial buildings; the relevant provisions are contained in NCC Volume Three – Plumbing Code of Australia.[73]
- **Best practice:** Several comments called for the NCC energy efficiency provisions to reflect best practice, rather than minimum necessary standards. This however would be inconsistent with the ABCB IGA, which is clear in stating that the role of the NCC is to set minimum necessary standards.[74]

[70] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [2.3.4] p 20.

[71] G. Milne, 'Embodied energy', in: Department of the Environment and Energy (Cwlth.), *Your Home – Australia's Guide to Environmentally Sustainable Homes*, 2013, pp 205-209.

[72] Sustainability is listed within the objectives of the NCC, which also include: safety, health, accessibility and amenity. See: *ABCB IGA*, above n 2, [6.1.a.C] p 12.

[73] See *NCC 2019 Volume Three,* Performance Requirements: BP1.2(1)(d), BP2.6(1), BP6.2(1)(d).

[74] *ABCB IGA*, above n 2, [6.1.a] pp 11-12.

9 Conclusions

This chapter sets out conclusions from the analysis of the responses to the Scoping Study. These conclusions will inform the future development of the NCC energy efficiency provisions for 2022 and beyond in accordance with the approach, timelines and further consultation processes that were outlined in the Scoping Study.

The views provided on the Scoping Study were numerous and varied. Therefore any summaries or conclusions risk over-simplifying the complex and differing viewpoints provided by respondents. Nevertheless, it is necessary to aggregate responses to provide an indication of the way forward. The nuanced views provided in individual responses may still be used to inform the development of NCC provisions for 2022 and beyond, despite not necessarily being covered explicitly in this chapter.

These conclusions must be considered in the context of the consultation process that produced the submissions from which a number of key conclusions have been provided below.

The consultation solicited responses on a voluntary basis from both individuals and organisations, and should not be assumed to be representative of any particular group of stakeholders. Respondents to the consultation were self-selected and in some cases were large organisations representing many individuals, while in other cases individuals representing multiple organisations provided responses.

Residential buildings

While Option 1 was well supported in principle, there were concerns among some stakeholders regarding its feasibility and consistency with the Trajectory. This suggests that further consideration of both Options 1 and 2 is warranted, in line with the approach outlined in the Scoping Study. This may result in an incremental approach to adoption, as foreshadowed in the Scoping Study.[75]

In general, support was expressed for developing elemental DTS Provisions that are both conservative and relatively straightforward. These may be complemented by more flexible Verification Methods and other performance-based compliance

[75] *Energy efficiency: NCC 2022 and beyond – Scoping Study*, above n 7, [2.2] pp 12-13.

pathways. There was a mixed response to limiting the application of the provisions based on floor area. Support was expressed for expanding the application of elemental DTS Provisions to Class 2 SOUs.

Respondents generally supported the proposed quantified Performance Requirements because they provide greater certainty and flexibility in demonstrating compliance with the NCC via Performance Solutions. Concerns around complexity were noted and will be considered as the Performance Requirements are further developed. The inclusion of relatively straightforward elemental DTS Provisions and Verification Methods may help to address these concerns.

The issue of technology-neutrality and the future of gas as a household fuel attracted significant comment, both for and against. Many of the stakeholders who opposed a technology/fuel neutral NCC did so on the basis of a belief that gas should be phased out over time. However, the fuel-neutral approach is consistent with the Trajectory and the general approach to Code authoring. Furthermore, the future of gas as a household fuel may be more appropriately dealt with through energy policy, rather than building policy.

Concerns were raised that on-site renewable energy should not be allowed to trade-off minimum building fabric performance, although this was not proposed in the Scoping Study. The approach proposed in the Scoping Study addresses this concern, where minimum building fabric performance is regulated by a separate Performance Requirement that does not allow trade-off with other building elements.

Respondents overwhelmingly supported the recommended baseline levels of energy efficiency for residential building services that were specified in the Trajectory. There was also support for the current NatHERS compliance pathway, as well as its possible expansion to accredit whole-of-house tools. BASIX also received relatively strong support as a whole-of-house tool.

The proposal to investigate provisions that would facilitate the future installation of on-site renewable energy equipment and EV charging was generally supported. However, the investigation will need to consider the likely technology and uptake of on-site renewables and EVs.

There was some concern amongst respondents about the potential effect on the electricity network from an increase in uptake of on-site renewable energy. This supports the case for further research into this issue.

Impact analysis of the NCC changes proposed in the Scoping Study will be necessary to fully understand the current market and to consider issues such as split incentives, property rights and equity issues. The size of dwellings was also noted as a contributor to energy use and emissions. However, dwelling size is a planning matter and is covered by other policy areas (for example, tax incentives for downsizing and the promotion of higher density development through State/Territory planning systems).

Many submissions highlighted the general complexity of the proposed energy efficiency provisions. Some practitioners expressed concern about compliance with the NCC becoming overly reliant on the use of modelling software and/or the engagement of specialist consultants to undertake energy assessments.

Commercial buildings

For commercial buildings, the responses expressed broad support for further investigating the areas identified in the Scoping Study. This included the use of future climate data, expanding JV1 and JV3, refining the thermal bridging provisions, accommodating vertical shading, reviewing the role of on-site renewables, and provisions that facilitate the future installation of on-site renewables and EV charging.

Responses were, however, divided on the treatment of buildings with low volume-to-surface area ratios, but the other areas identified were all generally supported, albeit with some caveats. These caveats will inform the direction of the ABCB's further investigations.

Policy direction and the ABCB's work plan will determine which of the supported areas are further investigated and when any resultant changes may be adopted. In this regard, with substantial changes having been made in NCC 2019 and other priorities having been identified, this work is likely to be limited for NCC 2022 to areas that complement the work on residential buildings.

10 Next steps

10.1 We asked, you said, we did

We asked: for your comments on approach and possible technical changes to the energy efficiency provisions for NCC 2022.

You said: you raised several important issues about what was proposed in the Scoping Study. These covered matters of public policy, current situation, practitioner concerns, and technical aspects of the proposed changes for residential and commercial energy efficiency.

We did: we have documented and responded to as many of your concerns as possible within this Outcomes Report. We will now use these insights to inform the next steps in the ABCB's Energy efficiency project.

10.2 Next steps and timeframes

This report will inform the further development of proposed change to the energy efficiency provisions for NCC 2022. These changes are likely to be significant and as such will require regulation impact analysis to assess and make a recommendation of whether or not government intervention is justifiable, and if so, whether a transition period should be provided.

The first stage of the impact analysis process will likely be conducted in the form of a Regulation Impact Statement (RIS). The RIS process involves a Consultation RIS, for public comment, then a Final RIS for decisions by governments.

The timeframes for this are outlined in **Table 2.**

Table 2: Key project milestones and dates

Milestone	Date
Review feedback on Scoping Study	September – October 2019
Establish work plan	November 2019
Develop draft provisions with assistance from expert consultants, technical committees and working groups	November 2019 – September 2020
Develop Consultation RIS	May – October 2020
Draft provisions and Consultation RIS released as part of NCC 2022 public consultation process	January – March 2021
Review public comment and update both provisions and RIS	April – September 2021
Decision RIS and provisions finalised	October 2021
NCC 2022 provisions scheduled to be published	January 2022
NCC 2022 comes into effect with possible transitional arrangements if necessary	1 May 2022

APPENDICES

Appendix A List of submissions

The following individuals and organisations made submissions on the Scoping Study.

This list does not include those who selected ‘publish anonymously’ or ‘do not publish’ for their submission. For the purposes of this report, identical submissions were grouped and treated as a single submission.

Jamie Adams – BlueScope Steel
Alexis
Dr. Clyde Anderson – Anderson Energy Efficiency
Samantha Anderson – Inhabit Australasia
Keanu Andrews – Think Brick Australia
Jeffrey Armstrong – Jeffrey Armstrong Pty Ltd
Milan Bachraty
Paul Bannister – Delta Q Consulting
Shannon Best – Council Alliance for a Sustainable Built Environment
Leon Bogers – Gas Appliance Manufacturers Association of Australia
Andreas Boomkamp – Ancon Building Products
Richard Cameron – Tecta Pty Ltd
Torquil Canning
Andrew Champness – Air Leakage Measurement Australia
Dennis Claridge – Energy Inspection Pty Ltd
Jesse Clarke – Pro Clima
David Clothier – TAFE SA
Simon Croft – Housing Industry Association
Jess Cuman – Adapt Design Group
Nayan Das – Australian Glass and Window Association
Spiros Dassakis – Swimming Pool & Spa Association of Australia
Ingram Davids
Bryn Dellar – Energy Inspection Pty Ltd
Bryn Dellar – Energy Makeovers Pty Ltd
Bryn Dellar – Onsite Energy Solutions Pty Ltd
Chris Derksema – City of Sydney
Graeme Doreian – Aluminium Foil Insulation Council of Australia Inc.
Simon Dunstan – SJD Homes
John Eccles

Lebon Ferri – Ecoharmony

Andrew Ferris – Andrew Ferris Drafting and Design

Adam Gowlett

Lachlan Greve – Lighting Council of Australia (1)

Lachlan Greve – Lighting Council of Australia (2)

John Griffiths – Gas Energy Australia

Anthony Gunther – Viridian Glass

Ania Hampton – Edefice

Josh Hankley – APA Group

Anna Harvey – My Efficient Electric Home Group

Michael Jeffreson – Demaine Partnership Architects

Gareth Jennings – Rheem Australia

Robert Keating – Bob Keating Design & Drafting

Danielle King – Green Moves Australia Pty Ltd

Margot Kirke – Kitchen and Home Sketch Designs

Paul Lan – LS Architects

Jasper Lee

Ron Lochert – Engineer

Craig Lovel – Australian Modern Building Alliance

Sophi MacMillan – Vinyl Council of Australia

Martin Mariappan

Master Builders Australia

Damien Moyse – Renew

Anna Nadolny – ANU RE100 Research Group

Darren O'Dea – Fabric First

Peter Overton – Overton Architecture and Energy

Bryce Parker – Pryce Parker Homes Pty Ltd

Greg Picker – Air-conditioning and Refrigeration Equipment Manufacturers Association

Daniel Pleiter – South East Councils Climate Change Alliance

Property Council of Australia

Sandra Qian – Green Building Council of Australia

Maroun G Rahme – Nu-Rock Technology

Mike Rainbow – Ark Resources

Henning Rasmussen

Andrew Robertson – Australian Pipelines and Gas Association

Joanna Roslyn Rees – Ajar Architects

Emily Schiavello – Design Matters (formerly Building Designers Association of Australia)

Joel Seagren – Fantech

Dejan Simovic

Janine Strachan – Green Design Solutions

Marcus Strang – The Australian Passive House Association

James Thomson – Australian Industry Group

Suzanne Toumbourou – Australian Sustainable Built Environment Council and ClimateWorks Australia

Urban Development Institute of Australia

Dennis Van Puyvelde – Energy Networks Australia

Michael Ward – Australian Glass Group

Vincent Wardill – Technoform Australia/New Zealand

Guiliano Zanus – Green Design & Consulting

Appendix B Methodology

This section outlines the methodology used in reviewing responses to the Scoping Study and producing this report.

B.1 Development of the Scoping Study

The Scoping Study was developed in-house by the ABCB Office.

B.2 Consultation process

Consultation on the Scoping Study was undertaken between 26 July and 8 September 2019, using the ABCB Consultation Hub. The ABCB Consultation Hub is facilitated by a third party online platform, Citizen Space. Further information about the Consultation Hub can be found on the ABCB website.[76]

The consultation for the Scoping Study can found under the 'Closed Consultations' tab on the Consultation Hub. This includes:

- A copy of the Scoping Study.
- Copies of responses received on the Scoping Study (except for confidential responses, and those submitted outside of Citizen Space).
- The questions that were asked as part of the consultation process.
- Information about privacy and the collection of personal information.

B.3 Review of responses

The review of responses was undertaken in-house by the ABCB Office, using the following methods:

- Quantitative analysis, using the data analysis tools provided with the Citizen Space platform, which is the basis of the ABCB's Consultation Hub.
- Qualitative analysis, which is a manual process applied to the content of the free text fields of each response.

[76] See: https://consultation.abcb.gov.au/.

Appendix C Acronyms and Abbreviations

The following table, Table C.1 contains acronyms and abbreviations used in this report.

Table C.1 Acronyms and abbreviations

Acronym/Abbreviation	Meaning
ABCB	Australian Building Codes Board
above n	followed by a number, is used in the footnotes to direct the reader to an earlier footnote, generally for the purpose of locating the full publication details of a source cited.
ACT	Australian Capital Territory
AEMO	Australian Energy Market Operator
ANU	Australian National University
APA	APA Group Limited
APGA	Australian Pipelines and Gas Association
ASBEC	Australian Sustainable Built Environment Council
ASHRAE	American Society of Heating, Refrigerating and Air-conditioning Engineers
BASIX	Building Sustainability Index (NSW)
BMF	Building Ministers' Forum
CDH	Cooling Degree Hours
Cf.	used in the footnotes, means 'compare' (L. 'confer'). It is used to indicate a contrast between two or more sources cited.
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cwlth.	Commonwealth of Australia
DEE	Department of the Environment and Energy (Cwlth.)
DELWP	Department of Environment, Land, Water and Planning (Vic.)
DGH	dehumidification gram hours
DTS	Deemed-to-Satisfy
EE	energy efficiency
ENAA	Energy Networks Association of Australia

Acronym/Abbreviation	Meaning
EU	European Union
EV	electric vehicle
GAMAA	Gas Appliance Manufacturers Association of Australia
GEA	Gas Energy Australia
HDH	Heating Degree Hours
HIA	Housing Industry Association
HVAC	heating, ventilation and air-conditioning
Ibid.	used in the footnotes, means 'in the same place' (L. 'ibidem'). It is used to refer to a source cited in footnote above.
IGA	Inter-government agreement
kWh	kilowatt hour
m²	square metres
MBA	Master Builders Australia
MEPS	Minimum Energy Performance Standards
NABERS	National Built Environment Rating Scheme
NatHERS	Nationwide House Energy Rating Scheme
NCC	National Construction Code
n.d.	used in the footnotes, indicates a source without a known publication date.
NEPP	National Energy Productivity Plan
nNZRE	nearly Net Zero Regulated Energy
NSW	New South Wales
NT	Northern Territory
NZRE	Net Zero Regulated Energy
PCA	Property Council of Australia.
PR	followed by a number (1 or 2) means a Performance Requirement proposed by the Scoping Study
PV	photovoltaic; a type of solar panel used to generate electricity.
Qld	Queensland
SA	South Australia.
SOU	sole-occupancy unit; the NCC defined term that, for Class 2 buildings, refers to an individual apartment.

Acronym/Abbreviation	Meaning
Tas	Tasmania
TDV	Time Dependent Value
UK	United Kingdom of Great Britain and Northern Ireland
USA	United States of America
Vic	Victoria
VM	Verification Method
WA	Western Australia.

Appendix D Glossary

The following terms used in this report have special meaning, as set out below:

Class (of building), means a building classification as defined in Part A6 of the NCC.

Commercial building, means a Class 3, 5, 6, 7, 8 or 9 building, and the common areas of a Class 2 building.

Comment, means a statement made within a Submission.

Compliance pathway, means a way of complying with the NCC: either a Performance Solution or a DTS Solution.

Deemed-to-Satisfy Provisions, has the meaning that it has in the NCC.

Deemed-to-Satisfy Solution, has the meaning that it has in the NCC.

Electricity grid, means the electricity distribution network(s) in a State or Territory (either government or privately owned).

Energy efficiency provisions, means the Section J of NCC Volume One; Parts 2.6 and 3.12 of NCC Volume Two; and, for heated waters services, Part B2 of NCC Volume Three.

On-site renewable energy, means renewable energy generated on the site upon which building using it is located.

Performance Requirement, means a Performance Requirement as defined in the NCC, or proposed in the Scoping Study.

Performance Solution, has the meaning that it has in the NCC.

Residential building, means a Class 1 building, an SOU in a Class 2 building, or a Class 4 part of a building.

Scoping Study, means *Energy Efficiency: NCC 2022 and beyond – Scoping Study*, published by the ABCB in July 2019.

Submission, means a submission made to consultation on the Scoping Study.

Trajectory, means the *Trajectory for low energy buildings*, published by the Commonwealth Department of the Environment and Energy for the COAG Energy Council in December 2018.

Whole-of-house approach, means a way of verifying compliance with the NCC, as defined in Section 2.3.4 of the Scoping Study.

Appendix E Bibliography

This bibliography lists documents that were referenced in the Scoping Study, submissions, this report, or that are otherwise considered to be of relevance to the content of this report.

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