HOUSING INDUSTRY ASSOCIATION

Submission to the
Australian Building Codes Board

Proposal to increase residential buildings energy efficiency requirements: Consultation Regulation Impact Statement

7 November 2021

HOUSING INDUSTRY ASSOCIATION

contents

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ABOUT THE HOUSING INDUSTRY ASSOCIATION

The Housing Industry Association (HIA) is Australia's only national industry association representing the interests of the residential building industry.

As the voice of the residential building industry, HIA represents a membership of 60,000 across Australia. Our members are involved in delivering more than 170,000 new homes each year through the construction of new housing estates, detached homes, low & medium-density housing developments, apartment buildings and completing renovations on Australia's 9 million existing homes.

HIA members comprise a diverse mix of companies, including volume builders delivering thousands of new homes a year through to small and medium home builders delivering one or more custom built homes a year. From sole traders to multi-nationals, HIA members construct over 85 per cent of the nation's new building stock.

The residential building industry is one of Australia's most dynamic, innovative and efficient service industries and is a key driver of the Australian economy. The residential building industry has a wide reach into the manufacturing, supply and retail sectors.

Contributing over $100 billion per annum and accounting for 5.8 per cent of Gross Domestic Product, the residential building industry employs over one million people, representing tens of thousands of small businesses and over 200,000 sub-contractors reliant on the industry for their livelihood.

HIA exists to service the businesses it represents, lobby for the best possible business environment for the building industry and to encourage a responsible and quality driven, affordable residential building development industry. HIA's mission is to:

> *"promote policies and provide services which enhance our members' business practices, products and profitability, consistent with the highest standards of professional and commercial conduct."*

HIA develops and advocates policy on behalf of members to further advance new home building and renovating, enabling members to provide affordable and appropriate housing to the growing Australian population. New policy is generated through a grassroots process that starts with local and regional committees before progressing to the National Policy Congress by which time it has passed through almost 1,000 sets of hands.

Policy development is supported by an ongoing process of collecting and analysing data, forecasting, and providing industry data and insights for members, the general public and on a contract basis.

The association operates offices in 22 centres around the nation providing a wide range of advocacy, business support services and products for members, including legal, technical, planning, workplace health and safety and business compliance advice, along with training services, contracts and stationary, industry awards for excellence, and member only discounts on goods and services.

1. EXECUTIVE SUMMARY

1.1 FINDINGS OF THE CONSULTATION RIS

The residential building industry acknowledges the need to build environmentally responsible housing that does not negatively impact on housing affordability and supply.

The Housing Industry Association (HIA) does not however, support the proposed NCC 2022 building fabric stringency increases and imposing additional costs and design and construction implications that would flow from the proposed changes for all new houses, apartments and large home renovations.

The Consultation RIS (CRIS) concludes that the anticipated costs associated with the two scenarios considered – which effectively require new homes and apartments to meet a 7-Star NatHERS rating and meet higher standards for the energy efficiency of fixed appliances – would exceed benefits by a factor of three to one and four to one, respectively.

Overall, the CRIS confirms that the change would result in a net social and economic loss to households (individuals) and to society of $2.366 billion under one scenario or $1.795 billion under the second scenario.

Furthermore, the CRIS finds it unlikely that any scenario would result in benefits exceeding costs, except in the event of a very significant increase in wholesale energy costs (more than three times) and/or a very significant reduction in the capital costs (a discount of around 70 to 80 per cent).

The CRIS clearly demonstrates that both of regulatory options considered would result in a significant net cost to the community in the billions of dollars, and as a direct consequence increase housing costs for home buyers and renters and reduced housing affordability.

The additional home building cost, home loan costs and resulting additional stamp duty on the dwelling, will affect every homeowner going forward, whether they see this set of requirements as their preferred approach to achieving reduced energy and emissions from their housing choice.

Notwithstanding the findings of the CRIS, HIA holds the view that the assessment significantly undervalues the true cost of implementing the higher energy efficient design requirements than current in place.

Costs relating to house redesign, internal layout changes and compromising internal room configurations, structural building changes and the specification of current industry standard building materials and products, are underestimated.

The draft NCC technical provisions (released separately to the CRIS) contain numerous issues that HIA believes must be addressed if changes are to proceed in either of the two scenarios.

The resolution of these issues will then have significant influence over final house designs and the products and materials that will need to be specified in the future.

Adapting allotment sizes, site conditions, designs, specifications and costings to meet the changes requires a significantly longer lead-in time. Client engagement, awareness and marketing time lines add to the challenges.

It is considered if these issues were adequately addressed it would in fact support the preliminary findings of the CRIS further, by revealing that the cost associated with increased energy efficiency stringency for all new Class 1 and Class 2 buildings would far outweigh the benefits.

HIA recently completed a national seminar series on the public comment draft of the technical changes with over 1,000 attendees. HIA has also been directly engaging with a range of building product manufacturers and suppliers that will be significantly affected by these changes.

Subsequent feedback from designers, builders and manufacturers reinforces HIA's response and highlights the substantial impact these changes will have on their businesses'.

1.2 Further Stringency on the Building Fabric and Star Rating Increase

NCC 2022 proposed changes provided a real opportunity to progress a new and more truly holistic approach to residential energy efficiency standards as supported by the Trajectory for Low Energy Homes of net zero 'ready' homes.

Broadly there was support, if Governments were to seeking to improve the energy efficiency performance of homes, to move away from energy efficiency standards based on the poorly defined and understood energy efficiency 'star rating' that only address one element of both energy efficiency and emissions reduction, being the heating and cooling of a home.

It is disappointing that after all of the consultation and background work on the Trajectory for low energy homes and the ABCB Scoping Study on options for improvement, that instead of proceeding with a true 'whole of home' approach to energy efficiency standards for residential buildings.

The proposed changes have reverted to repeating the past and increasing the building fabric star ratings and requiring higher performing building services/fixed appliances with energy offsets only as a potential inclusion.

The building fabric has been required to meet a minimum performance level since 2003 and has been required to meet 6 stars since 2010 which was also when a small number of fixed household appliances were regulated in their performance. Achieving 6 stars generally requires the highest insulation levels standard that walls and roof/ceiling cavities could readily and economically take based on the common construction methods in Australia.

Most houses in moderate and colder climate zones will also require some form of double glazing. To move to 7 stars there is not much more that can be done to the building fabric through 'simple' additions – it will require a range of changes to design and significant construction changes to be achieved across all house design in each region.

A far better approach is to move away from focusing solely on the building envelop to deliver an energy and emissions reduction outcomes and to move towards a more 'whole of house' approach similar to BASIX in NSW.

While it is acknowledged that the new 'whole of home' assessment is an attempt to make this change, it fails on two accounts.

Firstly the proposed whole of home approach in the NCC 2022 proposals is not significantly different from the NCC 2019 provisions apart from applying a higher stringency for both the fabric and appliances and only available offset is for installation of solar panels for the regulated building services.

Secondly, the assessment metrics remain solely focused on energy usage as a proxy for emissions reduction, with no direct reference to emissions in the calculation methods.

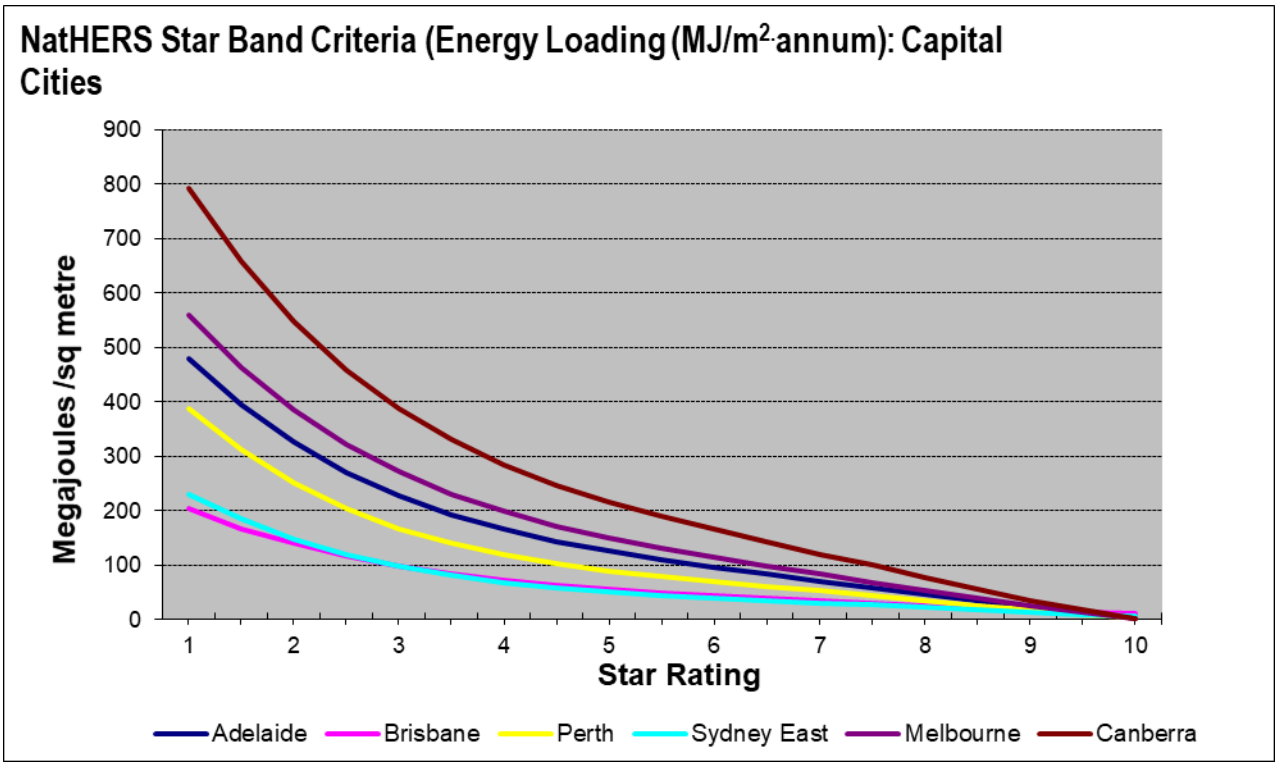
Noting that the CRIS demonstrates that the costs of the proposed changes outweigh the benefits it is hoped that the ABCB will now take the opportunity to revisit the approach proposed and look at a broader range of options for the manner in which the code moves to achieve zero energy (and carbon) ready buildings.

1.3 UNDERSTANDING THE TRUE MEANING OF INCREASES IN 'STAR RATING'

The pursuit of further discrete changes in the building fabric performance solely on the basis that the rating scheme in place has higher standards (10 stars) completely fails to align with the actual overall public policy outcome sought from the Trajectory.

In this regard it is important to understanding the NatHERS ratings, shows that the changes proposed will offer only a marginal decrease in energy consumption as opposed to improvement that was delivered by the first three benchmarks for building fabric (4, to 5, to 6 stars).

This is depicted in the following chart based on climate zone and benchmarks under the NatHERS Star Band criteria shows the diminishing return on energy savings as the star ratings increase beyond the initial 4 and 5 star benchmarks introduced:



Clearly the reduction in energy consumption for heating or cooling a home are markedly reduced as the rating moves beyond 6 stars. This is a simple outcome of the maths and the starting point where each increment is a 10 per cent reduction of a smaller number.

Further it's also important to note that:

- A 10 star house is not a net zero energy house.
- A 10 star house is not a net zero (and carbon ready) house.
- A 10 star house is only a home which requires no mechanical heating and cooling.

There is no basis or rationale in the NatHERS assessment that achieves a net zero outcome.

Such an outcome can only ever be delivered through a complete reform of what we are measuring and the way we are combining the potential tools that can deliver this outcome.

The expected outcome can be achieved with:

- a good performing building fabric (to reduce heating and cooling);
- high performing fixed appliances primarily managed by market measures such as MEPS and GEMS but with minimum installation benchmarks for new buildings as per the NCC today;

- a comprehensive assessment of the buildings energy consumption from fix and unfixed appliances (fridges, TVs, etc) to formulate a 'whole of house' energy assessment and
- appropriate renewable energy methods to offset the total energy use – whether in individual homes or via community based offsets.

To achieve this outcome, the approach to energy efficiency in the NCC needs to fundamentally change. Simply moving the dial up one star is not the right solution.

The proposed 2022 package of reforms has the scope to begin this change, but for a range of reasons it will not deliver the change needed or expected. This reality is evidenced by the CRIS which confirms that simply shifting benchmarks on what we already have does not achieve the benefits expected, but does come with more costs.

1.4 Differences in Approach from the Trajectory

It is important to note that the Trajectory for Low Energy Buildings, which industry was broadly supportive of the principles, did not recommend a 7 star stringency increase across all jurisdictions/climate zones. Rather it proposed a move between 6.5 and 7 in the colder climate zones 6, 7 and 8.

For the other climate zones it recommended 6.5 in climate zones 1 and 5, and 6 stars in climate zones 2, 3 and 4.

The Trajectory recommendations for Class 1 buildings were:

> *Findings from the various options modelled indicate for new Class 1 dwellings to be built to at least:*
>
> - *Between 6.5 and 7.0 NatHERS stars equivalent in NCC climates 6, 7 and 8;*
> - *6.5 stars equivalent in NCC climates 1 and 5;*
> - *Up to 6 stars equivalent in NCC Climates 2, 3 and 4 (noting many homes in these climates currently have credits available to build below 6 stars); and*
> - *Total combined energy usage budget for the building and services of 115MJ/m2 equivalent.*
>
> *The Trajectory recommendations for Class 2 and Class 4 buildings were:*
>
> - *7 star average and 5.5 star minimum in NCC climates 7 and 8;*
> - *6.5 star average and 5.5 star minimum in NCC climates 1, 4, 5 and 6;*
> - *6 star average and 5 star minimum in NCC climates 2 and 3.*

Unfortunately the CRIS and the draft NCC provisions has not assessed these recommendations and the NCC provisions have proposed an alternative approach using 7 star average across all climate zones.

Much of the concerns and issues raised above would still exist with the trajectory settings, however, if Governments proceed with NCC changes a more pragmatic approach would be to align the NCC provisions with the agreed recommendations for the thermal fabric settings being tailored for each climate zone as set out and agreed to in the Trajectory.

1.5 Preferred Approach – Low Cost Reforms

HIA has identified a range of reforms that could be progressed that would result in much lower cost impacts on affordability and build upon our current energy efficiency standards to address the goal of net zero energy (and carbon) ready buildings.

Most of these reforms utilise much of the work both the ABCB and NatHERS Administrator have been progressing for NCC 2022 though adjusted to be aligned to current building fabric stringency for NCC 2019.

The reforms that could be delivered as a package of reforms through NCC 2022 or alongside NCC 2022 and include:

1. Introduce the new whole of home/energy usage provisions (with the building fabric set at 6 stars)
2. Introduce the thermal bridging mitigation measures for both steel and timber framing to provide a true 6 star performance
3. Combine the NatHERS house rating tools and whole of house assessment tools incorporating energy usage/building services provisions, building fabric assessment, heating and cooling loads, thermal bridging and building sealing
4. Incorporate the new NatHERS climate files into the energy rating tools
5. Complete the re-write of the DTS elemental provisions, having these set at 6 star taking account of new knowledge on the current DTS design level
6. Introduce new enhanced detailed installation of insulation provisions as per later comments in this submission
7. Introduce the new condensation provisions and air spaces and building wall wrap permeability requirements and undertake a broader analysis of condensation risks of higher energy efficiency standards and a full cost benefit assessment of all future changes
8. Introduce the new Universal Certificate template and associated checklists
9. Introduce the new energy assessor whole of home Cert IV training units and undertake a national training program for assessors on the new NCC energy efficiency provisions
10. Commence a review of the solar panel installation and battery storage Australian Standards and commence the development of associated NCC Deemed to Satisfy Provisions, where PVs and battery storage systems are installed in houses for future incorporation in the NCC to provide single source of truth and location for onsite installation provisions.

1.6 Greater Impact in Emissions Reduction from Existing Homes

HIA supports greater efforts being made to improve the energy efficiency of existing housing stock as a next step in reducing the emissions from the housing sector, as opposed to adjusting existing standards in new homes that will only deliver a marginal increase in energy savings and emissions reduction as shown in the CRIS.

An approach that addresses the 8 million homes building before the NCC adopted acceptable minimum standards for energy efficiency would deliver a marked improvement in emissions reductions nationally as opposed to making incremental and more expensive changes to standards that already do the required heavy lifting.

The Trajectory for Low Energy Homes Report noted the following in respect to existing buildings:

- *'Existing homes represent the largest potential for energy savings in the residential building sector.'*
- *'The vast majority of Australia's housing was built before the introduction of minimum energy efficiency regulations (estimated at 8-10 million homes) for residential buildings in 2005. This means existing (pre-2005) housing will continue to pose large energy costs, health and emission issues for households, regardless of standard increases in the NCC.'*
- *Based on initial modelling…. By improving the performance of existing buildings by a relatively small amount, the energy savings and benefits roughly double.*

For example, by improving existing housing stock by just 1 per cent could deliver an additional $1.5 billion in net present value.'

These findings are compelling and supports that there would be far greater gains to be had by tackling energy efficiency upgrades for existing housing stock rather than seeking to further increase standards for our already highly efficient new houses and apartments.

HIA believes the NCC should be used as a key part of the solution for existing housing by setting a minimum deemed to satisfy benchmark for all major renovations. In combination with the introduction of a simple and affordable pathway to introduce mandatory disclosure at the point of sale and rent, rapid change can be delivered in existing housing stock and community understanding.

2. KEY CONCERNS ON THE DRAFT NCC CHANGES

2.1 OVERVIEW

HIA recently made a substantial submission to the draft NCC provisions highlighting a number of key concerns with the proposed changes in terms of their associated impacts, technical suitability and practical implications on the design and construction of new housing and apartments with respect to the following areas:

- Technical difficulties associated with proposed provisions
- Complexity of the changes
- Significant cost implications for the changes for homeowners
- Implications of the changes and corresponding thermal bridging changes
- Impact on standard building materials and construction practices
- Design implications of the changes
- Impacts on extensions and alterations
- The proposed increases exceeding the building fabric proposals in the Trajectory for low energy homes
- Construction, product and design transitional implications
- Added building envelope complexity
- A number of the provisions being incompatible creates contradictions with other parts of the NCC
- Increased condensation risk with the provisions with higher efficiency standards and increased wall, floor and ceiling/roof insulation provisions that will limit the ability for building to breathe, and cavities being packed with insulation and at capacity of space allowable
- Increased fire risk with the higher efficiency standards and increased wall, floor and ceiling/roof insulation provisions
- Availability of products to meet the new requirements
- Additional weight on ceilings and ceiling battens in achieving increases ceiling insulation
- Added complexity for design, assessment, approval and application of the NCC provisions and ultimately compliance challenges due to the added complexity.

HIA submission to the draft NCC changes is included at **Attachment 1**.

These technical changes are being considered in parallel with the consideration of the CRIS, which makes it extremely difficult for industry to have certainty about the actual changes that will take effect in NCC 2022. These technical provisions are contingent on the decision made on this CRIS therefore it is critical that a timely decision is made on what changes will move forward in NCC 2022.

It is equally important that a transition period be applied to ensure that the industry which is preparing to sell, design and approve more than 200,000 homes each year for the next two years can have business certainty and provide customers with certainty on both the design and the price of those new homes and apartments.

2.2 DESIGN IMPACTS CHANGES FOR 7 STAR HOMES AND APARTMENTS

Moving to 7 stars will be a significant change and the documentation on the NCC changes, case studies and the CRIS all underestimates the difficulty for all houses and apartments in all climate zones of Australia are required to meet this standard.

Achieving 5 stars was generally achieved with insulation upgrades for most houses which is an affordable and practical upgrade for the standard home design and suited the construction methods used in Australia at that time.

Moving to 6 stars generally required the highest insulation levels to be used in the standard wall, roof/ceiling cavities, but was still achievable. Most houses in moderate and colder climate zones also required some form of higher performing window glazing, again achievable within the current construction methods.

Despite this retrospective view of the past amendments, what is never discussed is that over the last decade there have been a dozen or so software updates over the last 10 years and other changes in the NatHERS protocols meaning that a home that was 6.0 stars in 2011 is unlikely to be 6.0 stars in 2021 - it is more likely to be 5.5 stars.

There have been multiple unregulated software updates throughout that 10 year period where every single rating reduced by 0.1 stars. Now to achieve 6 stars a vast majority of houses require double glazing apart from the smallest single storey designs.

Achieving 7 star building fabric will be different – it will be all about design as homes have already upgraded all insulation to maximums and double glazed all windows and glazed doors, meaning your only option is to change window specification (size) and to change the house design. The availability of products to achieve the 7 stars without significant design change will be extremely challenging.

Member experiences on projects where they have designed 7 star homes using the current NatHERS tools, including volume builders, confirms this is the case.

Members have shared that the increase in price due to design changes and upgraded construction is too expensive for the customer to remain interested enough in this improved outcome and they revert to a design that complies with the current standards.

2.3 Complex designs - Designs that are already having trouble with 6 Stars

There are many standard houses designs that all already struggling to achieve 6 star design and if 7 stars is introduced those house designs would need to be scrapped or may be limited to construction on certain orientations only.

This issue is not limited to volume or project homes and has a large, if not larger impact on custom built homes.

This was further demonstrated by a recent ABCB commissioned study into difficult blocks that presently struggle to meet 6 star standards and subsequently how they would meet 7 stars if changes were to proceed.

Some of the observations from the report were:

- that the Typical Houses in colder climates required significant upgrades under each difficult block scenario (with high performance double, thermally broken, argon filled, high solar gain, low e glazing required).
- specifications and upgrades required for sub optimal house designs result in an increase in cost can be observed ranging from 5 to 25%.

These challenges are not limited to project homes and equally affect custom designed houses where home owners have a specific house design in mind and are willing to pay for this outcome yet often struggle with 6 stars. Most of these designs would never achieve 7 stars no matter what insulation and glazing specification was thrown at them.

The only solution in these scenarios is for the architects to engage the energy rater immediately at concept stage and change the way they design the home. All houses will start looking the same, squares or rectangles with no courtyards or return walls to limit exposed walls to atmosphere.

The days of large expanses of windows will be completely gone as the window to floor area ratio will need to come back to around 22% as we simply don't have window specification in the country that will allow for large windows in a custom design and still achieve 7 stars.

Further to this the sample houses used for the 7 stars case studies in the CRIS are not representative examples of homes and apartments built, or they have chosen optimal orientations and situations on these case studies, as opposed to the real world challenges faced on house sites.

For apartments, the issues are equally challenging in achieving a 7 star average across the apartment building. The window to floor area ratio and therefore window/glass performance levels would add excessive costs and design challenges.

Changing over to larger sections of cladding in lieu of window/glazed facades is not likely to be a desirable outcome for apartment owners due to consumer preferences for natural light, views, overall amenity and liveability.

The CRIS case studies for apartments also need a much broader representation of case studies and examples to ascertain the real world challenges and costs.

2.4 Ability to Adequately Review and Comment on the NCC 2022 Changes

The ability of industry to provide a comprehensive analysis of the NCC 2022 proposed changes to the 7 star standard proposals has not been possible due to the need for accessing the future NatHERS tools.

Unfortunately only one of these (the least commonly used tool) being available during public comment that incorporated the updated climate files and other features required to test compliance with the proposed NCC 2022 proposals.

It is noted that there has been demonstrations and case studies made available, however, for industry to be able to truly assess the real world implications of the proposals, they should be able to access to the four accredited NatHERS tools in some way, with all the necessary features and functions and correct climate file settings and whole of home features incorporated.

Further to this, there should be the ability to have much longer consultation period so they are able to assess a range of building designs and projects with the fully functioning ratings tools and be able to get a broad understanding of the impacts of 6 vs 7 star homes, and the energy (budget) usage provisions.

Reviewing and commentating on the changes to the star ratings, has historically been extremely challenging to do and to gauge the true impacts of changes without access to the three most commonly used rating tools will mean the industry is kept waiting for much longer than is appropriate to truly test, adapt and understand what will be required.

This aspect of the amendment process remain a significant flaw and once again is placing industry and governments in an inappropriate and invidious position that the true and transparent outcomes of these changes are in fact unclear.

Reliance is placed on a small number of consultants involved in the CRIS to assure all parties that the outcomes will be what is predicted – genuine testing and comparison is essentially impossible.

2.5 Broader Implications for Class 1 Buildings

Without the energy efficiency changes, NCC 2022 is already set to be the largest single amendment to the NCC since its inception. There are a range significant amendments beyond energy efficiency that will be introduced.

These include:

- Mandatory accessible housing provisions for all new and extensions for Class 1 buildings
- More stringent condensation management provisions

- Waterproofing provisions
- Fixing and flashing requirements
- Broad range of Australian Standards changes
- NCC restructuring changes; and
- Performance Solutions changes.

All of these changes add more complexity, stringency increases and ultimately have significant impact on affordability and viability of Class 1 projects. More importantly, each of these changes requires industry to understand, adapt and adopt the changes into their current business operations and their current building designs.

These changes need to be better rationalized and not looked at in silos as individual reforms. They must be considered as the cumulative package of changes and an assessment of their overall impact must be made for all housing forms before the changes are implemented.

2.6 Broader Implications for Class 2 Buildings

Most new Class 2 buildings are constructed as mixed use buildings and the building and manufacturing sector are still adapting to the substantive changes made under NCC 2019 Section J. Many of the changes are only coming online now for projects meaning their substantive impacts on design and material selection are yet to be well understood.

As such prior to progressing further energy efficiency changes to both the individual apartments building fabric and higher building services (energy usage) provisions for Class 2 buildings, the NCC 2019 Section J changes should be given further time to be embedded into designs and construction .

Furthermore, there are other significant changes being proposed for Class 2 buildings under NCC 2022 which follow on from the significant fire safety and other design changes made in NCC 2019 (including mandatory sprinkler provisions and aforementioned Section J changes).

These include:

- Mandatory accessible housing provisions for all Class 2 buildings
- Significant more stringent waterproofing and weatherproofing provisions
- Further fire safety provisions changes and restrictions
- More stringent condensation changes
- EV charging future proofing and solar ready zones.

All of these provisions add more complexity, stringency increases and ultimately have significant impact on affordability and viability of Class 2 apartment projects.

These changes need to better rationalized and not considered in silos or as individual reforms. Again the cumulative impacts of these changes must be considered.

If a change for the energy efficiency of apartments is to proceed it should be staged and preferably not commence until 2025, giving time for the 2019 changes to be embedded, and time for the upgrading of NatHERS tools to be completed allowing the industry to design new apartment buildings with certainty of their cost and their inclusions.

3. ECONOMIC ANALYSIS

3.1 OVERVIEW

The CRIS findings is that 'Option A' creates benefits of $1,212 million and costs of $3,459 million.

This includes all potential benefits. This means the change imposes net costs on the Australian community of at least $2,247 million and has a benefit-cost ratio of 0.35 or below.

The less stringent 'Option B' is hardly an improvement: it imposes net costs of at least $1,783 million and has a benefit-cost ratio of 0.25 or below.

HIA supports the finding of the CRIS, that the costs associated with increasing the residential stringency requirements would significantly outweigh the benefits.

Notwithstanding the preliminary findings of the CRIS indicate a negative cost benefit outcome, there are a number of concerns that HIA believes require a more detailed analysis.

It is considered if these issues were adequately addressed it would in fact support the preliminary findings of the CRIS further, and reveal that the cost associated with increasing stringency of the energy efficiency requirements for all new Class 1 and Class 2 buildings would far outweigh the benefits.

The key issues include:

- It is considered that the costs identified in the CRIS for the building fabric changes to meet 7 star requirements are significantly under estimated.
- HIA member feedback indicates that the costs are likely to be far in excess of the costs assessment and conservative estimates of 2 - 4% construction cost increases.
- However, depending on the house design, orientation, home owner preferences the costs could be far greater, with estimates of an additional 5-10% construction cost increases being likely.
- A Productivity Commission report noted on past energy efficiency changes and regulatory modelled costs:

  'evidence is now appearing of compliance costs [for energy efficiency mandates] being much higher than expected. For example, the Victorian Government predicted the cost of a new house would rise by 0.7 – 1.9 per cent, but a recent survey shows that the average increase was 6 per cent.'
- This implies that, at minimum, realised construction costs for mandated energy efficiency measures are higher than computer-modelled construction costs by a factor of 3X (6 per cent vs 1.9 per cent).
- The CRIS cost and benefit numbers are computer modelled. HIA argues these should be adjusted to likely actual/realised costs and benefits.
- As a conservative estimate - applying the realised construction costs for mandated energy efficiency measures are higher than computer-modelled construction costs by a factor of 3X, and other points - it is estimated, the net costs of Option A are likely to be $12,894 million and the net costs of Option B $8,160 million. These adjusted costs are outlined in the Table below.
- At an individual dwelling level – applying the realised construction costs for mandated energy efficiency measures are higher than computer-modelled construction costs by a factor of 3X, and other points - it is estimated, the costs of Option A are likely to be $13,257 and the costs of Option B $9,093.
- These adjustments do not include a substantial cost item being the full (re)design costs of 7-stars (many current designs will be unviable) and certification of building critical products.

- It is highly likely that the benefits used in the CRIS are overstated and the actual/realised benefits for homeowners and society will be far lower that specified.
- A key component of regulatory changes is that regulation must be justified. The CRIS authors ACIL-Allen note the problems that 7-star features are trying to solve 'may exist'. HIA believes this may in part be the result of the problem seeking to be addressed already having been addressed in large part by the existing energy efficiency provisions in the code for 20 years now.
- The CRIS also notes a high level of over compliance of current energy efficiency requirements. A statement that claims problems 'may exist' and a stated already high level of industry over compliance cannot be seen as justification for new regulation to address market failure or split incentives.
- Commentary in the CRIS itself, literature from the Productivity Commission and guidelines from OBPR, imply the CRIS analysis has significant limitations in analysing the true and realised costs and equally the benefits.
- It is considered that the CRIS over-estimates the net benefits of mandating a change from 6-stars to 7-stars. The costs are underestimated and the benefits are overestimated.
- It is critical to recognise that building costs have risen substantially in recent months. The costs used in the CRIS, were prepared prior to the current increases in building materials due to supply chain constraints and COVID-19.
- Whilst some of the labour shortages and material supply constraints may be short term issues lasting at least for the next 12-18 months, it is highly unlikely that the material cost increases and labour cost increases will return to pre-COVID levels, meaning buildings that would be built under the new proposed provisions would be subjected to the higher construction costs now in effect.
- Therefore the CRIS costings need to be adjusted to account for the material and labour supply increases – a representative increase of 15% is recommended for the purpose of the RIS assessment based on a range of reports, supplier advice on price increases and industry surveys.

HIA estimated adjusted costs Table

Benefits and costs of regulatory options ($ million)		
Item	Option A	Option B
Items reported in CRIS		
Costs	-3,459	-2,373
Benefits (including all items)	1,212	589
Net benefits	-2,247	-1,783
BCR (ratio)	0.35	0.25
HIA adjustments to costs, from literature review		
Update modelling assumptions for COVID-19	-509	-346
Adjust modelled costs for actual/realised costs	-7,803	-4,745
Remove assumption that builders have idle capacity	-1,301	-791
HIA adjustments to benefits, from literature review		
Adjust modelled benefits for actual/realised benefits	-377	-183
Remove energy saving benefits to Households	-575	-302
Remove health benefits	-82	-9
HIA adjusted estimates, from literature review		
Adjusted costs	-13,072	-8,255
Adjusted benefits	178	95
Net benefits	-12,894	-8,160
BCR	0.01	0.01

* As discusssed, it possible this assumption covers various issues raised in the literature

Source: Consultation RIS; Literature Review; HIA estimates

3.2 LITERATURE REVIEW, AND COMMENTS ON CRIS ANALYSIS

The 2005 Productivity Commission Inquiry on Energy Efficiency notes the following:

> *'The Commission is concerned that the analytical basis for these regulations [minimum energy efficiency standards] (computer simulations of energy loads within buildings in each climate zone) may be flawed.'*[1]

The Productivity Commission goes on to point various problems with some of the assumptions that analysts use to evaluate energy efficiency standards and concludes that it does not favour these standards as a policy to fix the problems they purport to fix.

It is considered that concerns raised by the Productivity Commission in 2005 on the analytical basis of modelled energy efficiency assessments and energy loads apply equally to the analysis made in this current CRIS.

3.2.1 The Decision RIS must adjust modelled cost increases to match actual cost increases

The 2005 Productivity Commission report noted on past energy efficiency changes and regulatory modelled costs:

> *'evidence is now appearing of compliance costs [for energy efficiency mandates] being much higher than expected. For example, the Victorian Government predicted the cost of a new house would rise by 0.7 – 1.9 per cent, but a recent survey shows that the average increase was 6 per cent.'*

Another example is provided.

This implies that, at minimum, the realised construction costs for mandated energy efficiency measures are higher than computer-modelled construction costs by a factor of 3X (6 per cent vs 1.9 per cent).

Given this issue, and other problems with energy efficiency measures, the Productivity Commission notes there is a "compelling" case for an after-the-fact review of energy efficiency measures to inform future energy efficiency reforms to use this as a true basis of assessing changes and impacts as opposed to reliance to modelled costs.

HIA raised the same concerns with both the past 5 star and 6 star changes and regulatory analysis' and limitations on reliance on computer modelled assessments rather than true post implementation or after-the-fact reviews of mandated energy efficiency standards realized costs and benefits.

Therefore, following the Productivity Commission's concern on costs, it is considered that the costs provided in the CRIS and supporting costs and benefits assessments report substantially underestimate the cost of mandating a change from 6-stars to 7-stars.

3.2.2 The Decision RIS should adjust assumptions in the modelling for recent cost increases

Building costs have risen substantially in recent months. The costs used in the CRIS, were prepared prior to the current increases in building materials due to supply chain constraints and COVID-19.

The ABS reports that the cost of building a house increased by 8 per cent from the September Quarter of 2020 to the September Quarter of 2021. The cost increase has occurred because supply is constrained from meeting surging demand.

Constrained supply reflects shortages of skilled labour and international supply constraints. Surging demand is driven by low interest rates, government subsidies and a change in consumer preferences towards housing.

[1] Productivity Commission 2005, *The Private Cost Effectiveness of Improving Energy Efficiency,* see: https://www.pc.gov.au/inquiries/completed/energy-efficiency/report/energy.pdf, pg. 38/554

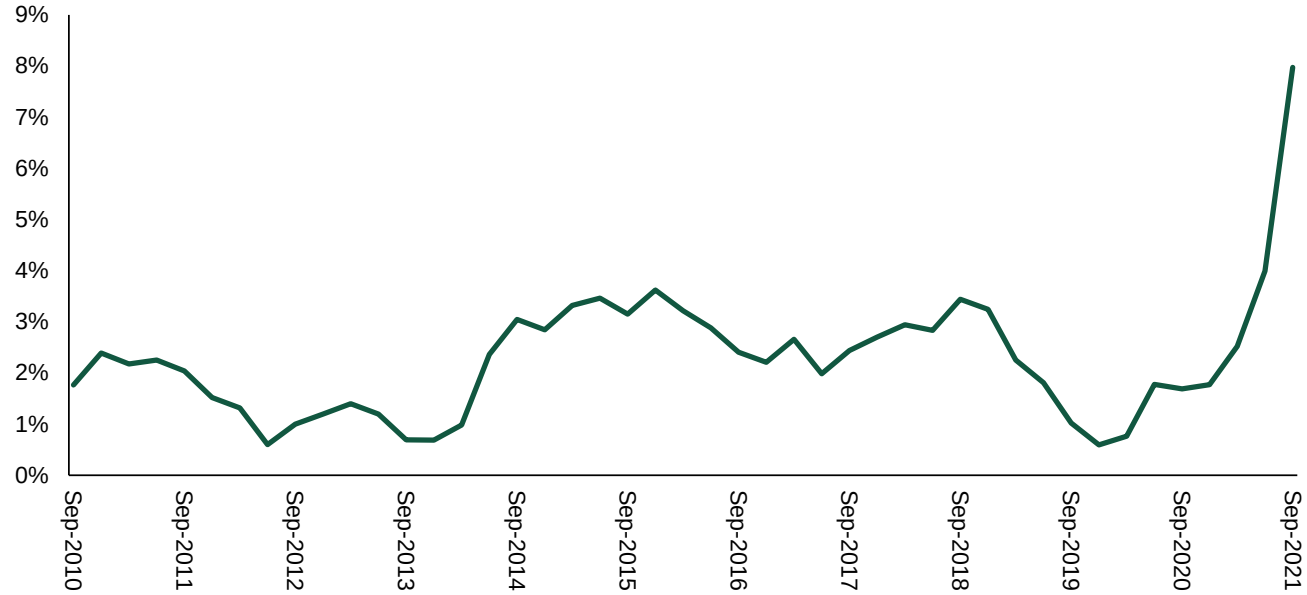
To verify the cost increases HIA has conducted a number of consultations with builders. The ABS estimate may be representative of the cost increases for larger builders. Smaller/medium sized builders consulted by HIA indicate their costs have increased by more than this. Overall, the ABS data may represent a minimum figure for the cost increase of the industry as a whole.

Builders consulted by HIA note that suppliers have said that cost increases will continue. Builders have already been told that some costs will increase again at the start of next year.

The surge in costs is unprecedented in the last decade.

Annual change in construction costs

Source: ABS



HIA argues it is unlikely that costs will return to "pre-COVID levels", even after supply chain issues are resolved. It is likely that at least some of the recent cost increases will be retained.

In response to COVID-19, suppliers are adding more domestic production, storage and logistics to their supply chain.

This means in the future, supply is likely to be more reliable, but it will also be more expensive. Adding domestic facilities increases reliability because the supply chain becomes shorter. Yet adding domestic facilities makes supply more expensive because land, labour and energy costs tend to be higher in Australia than offshore.

Therefore, after COVID-19, the supply chain will be more expensive. This means costs will not return to pre-COVID levels (if they fall at all).

The two examples of evidence for this assessment are:

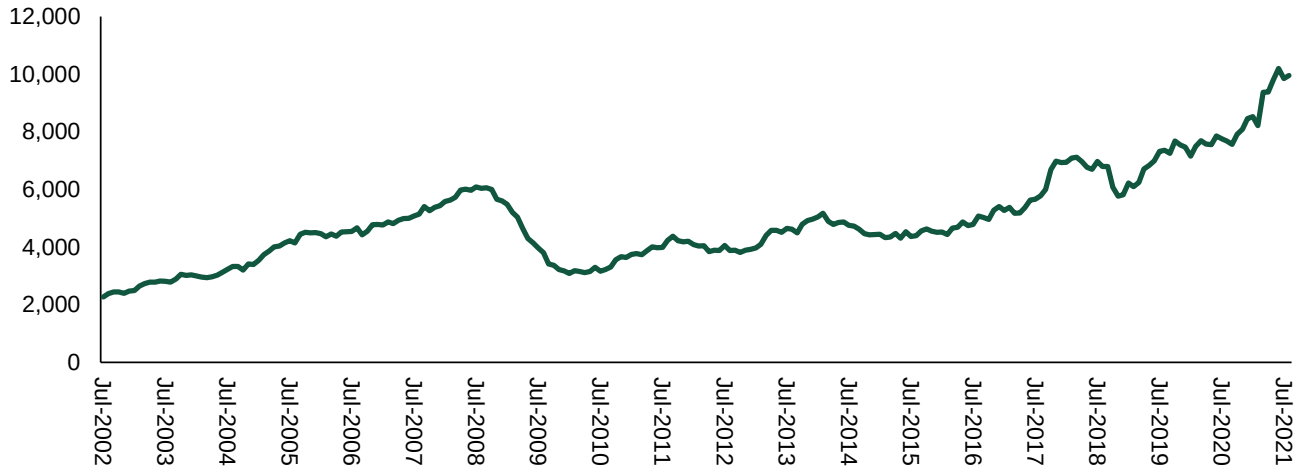
- Bunnings is a key supplier to the Australian building industry. In response to supply chain disruptions, it notes it's "continued development of domestic supply chain capabilities" [2]
- The ABS reports a dramatic increase building approvals for transport buildings, factories, and warehouses since the start of COVID-19. At the national level, this data says that businesses are following the same strategy as noted in Bunning's Annual report: they are shifting more of their supply chain to Australia.

[2] Bunnings 2021 Annual report, see 33/184 in: https://sitefinity.wesfarmers.com.au/docs/default-source/reports/2021---wesfarmers-annual-report.pdf?sfvrsn=9d9111bb_2

Approvals for domestic supply chain ($ million, over preceeding 12 months)

Note: "Domestic supply chain" is buidling approvals of transport buildings, warehouses and factories in Australia

Source: ABS



HIA argues there is significant evidence that at least some of the recent cost increases should be treated as ‘permanent’ and incorporated into the modelling, going forward.

It is recommended that RIS costings should be adjusted to account for the material and labour supply increases – a representative increase of 15% is recommended for the purpose of the RIS assessment based on:

- a range of published reports on this issue
- supplier price increases lists
- industry surveys
- that the specific materials that would be required for the upgrades (glass, insulation, framing , etc.) have been the materials incurring the more significant increases
- further expected material price increases
- labour increases and availability
- on the ground feedback from builders and in particular smaller custom builders; and
- that smaller and custom builders and trade contractors do not have as great control over material prices and buying power with suppliers that larger companies for which the ABS analysis was based off.

With all of these factors combined it is considered that 15% increase is more representative increase percentage to use in the RIS to adjust for construction cost increases, than the 8% noted by the ABS report.

This is particularly relevant given when the proposals would take effect industry and homeowners will be facing these increased prices, therefore basing the assessment off pre COVID prices is not accurate or a true reflection of what the additional cost impacts would be.

3.3 Adjust the Benefits to Reflect RIS Guidelines and Published Literature

There are a number of concerns with the stated benefits in the CRIS:

Firstly, benefits should be adjusted for actual energy savings, reflecting actual behaviour of house occupants (not modelled energy savings).

Secondly, it is argued that energy saving benefits for households should be removed. This is based on two strands of literature.

a) Benefits should be adjusted for actual problems being solved, not problems that may exist.

b) To establish benefits, the RIS must consider the counterfactual: what does the world look like with and without the mandate for 7 stars? Considering the counterfactual reveals that mandating 7 stars creates benefits and costs for households.

The CRIS includes the benefits for households, however, the CRIS does not include (or does not fully include) the costs for households.

The CRIS must fully measure both the benefits and the costs, or it should exclude both. It appears the CRIS does not have enough information to measure all the costs to households.

Therefore, the benefits to households should be excluded. If the benefits are retained but the costs are not added, the CRIS overstates the net benefits of mandating 7 stars.

Thirdly, less reliable benefits should be removed from the central case.

Economic literature that supports these points is provided in the sections that follow.

3.3.1 Benefits should be adjusted for actual behavioural change due to changing energy efficiency standards

The 2005 Productivity Commission Report on Energy Efficiency notes: “energy standards are not specified in terms of (actual or realised) energy consumption”.

This means the Government does not police energy use after the occupant has moved into their new home. There is no mechanism to ensure the actual energy use by the occupant matches the modelled energy use that is used to evaluate the standards.

Given this, the Productivity Commission notes: “there appears to be serious doubts about the effectiveness of these regulations (energy efficiency mandates) in improving energy efficiency in a systematic way.”[3]

The concern that energy efficiency regulations may not change energy use significantly is the second reason why an-after-the-fact review of energy efficiency mandates for future consideration and analysis of changes and stringency increases is needed to provide a more transparent and measurable understanding of true impacts and realised benefits.

A review was belated undertaken in 2013 by CSIRO based on 5 star homes. A similar review has not been undertaken on 6 star homes, meaning decision makers are left to assume that the energy efficiency measures do in fact create the expected benefits.

The CIE evaluated energy efficiency measures for Commercial Buildings as part of the RIS for the NCC 2019 Section J changes. In that assessment the CIE documented various recent studies that show that actual energy savings are less than what is modelled.

To deal with this issue, in the 2019 Section J RIS the CIE presented 3 scenarios for benefits:

- Realised benefits are 49 per cent of modelled benefits

[3] Productivity Commission 2005, *The Private Cost Effectiveness of Improving Energy Efficiency,* see: https://www.pc.gov.au/inquiries/completed/energy-efficiency/report/energy.pdf, pg. 37/554

- Realised benefits are 75 per cent of modelled benefits, and
- Realised benefits are 100 per cent of modelled benefits.

In that RIS, the CIE noted that consultations suggested the likely two outcomes are either scenario 1 or 2.

Submissions to 2019 Section J RIS argued that realised benefits are likely to be between 49 per cent and 75 per cent of modelled benefits.[4]

ACIL-Allen in this current CRIS present similar scenarios, but only as sensitivity scenarios.

It is considered that this CRIS should adopt one of its sensitivity scenarios (realised benefits are 50 per cent or 75 per cent of modelled benefits) as its 'central scenario'.

This change would make analysis in this CRIS consistent with that used in the Section J 2019 RIS and the Productivity Commission's view on realized benefits vs modelled benefits.

Note, this issue of 'realised benefits' vs 'modelled benefits' applies to all benefits in the RIS.

3.3.2 Even if 7 stars reduces energy use for households, this does not necessarily mean that a net benefit is created

The CRIS reports that at least 70 per cent of the benefits created by 7 stars are benefits that accrue specifically to households. These are energy savings. It is noted that even if 7 stars reduces energy use for households, this does not necessarily mean that a net benefit is created.

A net benefit is only created if the value of the energy savings is greater than the value of the costs specifically borne by households. The CRIS must balance all benefits and costs.

It can be argued that the RIS guidelines and the economic literature suggest that these energy saving benefits that accrue to households should be removed.

Firstly, it is not clear what problem is being solved by the regulation for households in a situation where the energy consumption being adjusted is already regulated. Secondly, the costs specifically borne by households of the regulation are not included. If costs to households are not included, the benefits to households should also be excluded.

Note, the RIS does include "construction costs". These construction costs are likely to be paid by households. In the RIS framework however, these costs are treated as society wide costs. They are not treated as costs that specifically accrue to households.

3.3.3 To create benefits, a regulation must solve a problem

The Office of Best Practice Regulation (OBPR) are charged with ensuring that regulatory proposals are subject to high quality analysis.

A regulatory proposal must be judged to generate net benefits, after it has been subject to OBPR's '7 RIS Questions'. The 1st RIS question is: what problem is the policy trying to solve?

It is necessary for new regulatory proposal to solve a problem i.e. a demonstrated failure that requires regulatory intervention.

This is so decision makers can be confident that it actually creates the intended benefits. If the regulation does not solve a problem, there is a serious risk it does not create benefits.

[4] The CIE 2019, RIS of Energy Efficiency Standards in Commercial Buildings, see: https://static1.squarespace.com/static/5df9aa078642f943ece6a0b3/t/5f589c857e871053b87e5a58/1599642806533/Final_RIS_Energy_efficiency_of_commercial_buildings_PDF.pdf, pg 17/252

3.3.4 Energy Efficiency probably solves an externality problem for the community

In economics literature, the problem of 'externalities' is well established, i.e. If I build a new house, and I choose 6-stars over 7-stars, the cost of the additional CO2-e emissions this creates is borne by the community and not by me. I impose 'externalities' on the community.

If I impose externality costs on others, and regulation can reduce these costs in such a way that the benefits to the community outweigh the costs of the regulation, then this regulation is justified.

This means it is reasonable for the CRIS to consider the benefits to the Australian community of the reduction in CO2-e emissions that are caused by increasing the standards.

However, these benefits are minor. The CRIS finds the value of saved carbon emissions is equivalent to 6 per cent (or less) of their estimate for additional construction costs.

This discrepancy will get worse if the CRIS incorporates realistic construction costs and realistic energy savings.

The conclusion is that mandating a change from 6-stars to 7-stars and further decreasing energy usage from a small number of household appliances, cannot be justified on the basis of CO2-e emissions benefits.

3.3.5 The CRIS does not clearly establish or demonstrate a problem for which regulatory intervention would be justified

The CRIS assumes at least 70 per cent of the benefits of changing the mandate from 6 stars to 7 stars is savings for the households building new homes. This is a striking result. The obvious question is: if these savings were available to households, why is not everybody implementing 7-stars? And why stop there? Why not 8-stars?

The CRIS assume that 'informational problems' and 'split incentives' and 'capital constraints' cause people to under-invest in energy efficiency measures in their new homes[5] which is primarily based on anecdotal evidence and the historical approach to regulations where none exist.

This assumption is crucial to CRIS analysis as it goes on to assume that 7 star features create energy savings for households. Mandating 7 star energy efficiency creates benefits for households because it means they access savings that they would have otherwise irrationally ignored.

There are a number of problems with this assumption though:

- The pursuit of further discrete changes in the building fabric performance solely on the basis that the rating scheme in place has higher standards (10 stars) completely fails to align with the actual overall public policy outcome sought from the Trajectory.
- In this regard it is important to understanding the NatHERS ratings, shows that the changes proposed will offer only a marginal decrease in energy consumption as opposed to improvement that was delivered by the first three benchmarks for building fabric (4, to 5, to 6 stars).
- The Productivity Commission argue against this approach.
- It is argued that households do care about electricity bills (and do not suffer from "informational problems")
- The CRIS concludes these problems 'may exist' (it does not show they definitely exist). The CRIS notes the problems that would justify 7 stars features 'may' exist.

  That is, it notes informational problems, split-incentives, etc., 'may' exist. It uses this characterisation because it does not present evidence that these problems actually *do* exist.

[5] ACIL-Allen pg 42/328

This assessment of the problem needs to recognise that regulations to date (20 years) have addressed the historical problem that no action was being taken by households (the market failure).

Consumers, and the community, now have an understanding and acceptance that building regulations set an acceptable standards for energy efficiency and therefore no further personal consideration is warranted apart from those consumers seeking to build beyond regulation.

The fact that the majority of Australian home buyers each year do not seek to build beyond regulation is not of itself market failure. It is the market acting in a rational and sensible manner.

- More generally, regulation must be justified. To justify regulation, the first step is establishing that problems that would be solved by the regulation *actually do exist*. If it is not demonstrated that problems *actually do exist*, then new regulation cannot be justified. This is economics jargon for the common sense adage: 'if it isn't broke, don't fix it'.

3.3.6 Split incentives and information problems

Under the 'split incentives' problem, the CRIS is essentially arguing that builders are not installing the energy efficiency features that households prefer. Though the CRIS does not elaborate on or provide evidence for this assumption.

It appears that CRIS analysis infers that builders simply do not want to incur these costs, or that builders somehow believe they will not be able to recoup costs for features that households actually want.

HIA argues that this assumption is not reasonable because, in fact, the building industry is very competitive and the builder and consumer in the majority of home building contracts is directly involved in the design and standards selected for the home.

If a consumer is aware of potential 'bill savings' from designing beyond current standards, they can request this and builders can supply it.

The reality is that builders design and build to the building code of the day, which has incorporated energy efficiency requirements for 20 years, which has addressed the split incentive. The split incentive was used as evidence for 4 stars, 5 stars and 6 stars – at what point does the split incentive fall away?

HIA would contend it would be at a point where the regulations have achieved their purpose. If a split incentive still exists today, hence the need to move to 7 stars, then arguably the first three iterations of the code have not resolved the issue.

This should be taken as a reason to 'try a different solution' rather than more of the same. Alternatively this is evidence that this aspect of the problem is no longer a defendable reason to act.

ABS data for the financial year 2020 reports there are around 75,000 residential building companies in Australia (around 50,000 house builders and around 25,000 multi-unit construction companies).[6]

There is great diversity amongst these businesses. Competition creates businesses that are willing and able to install the features that households genuinely prefer. Businesses that do not respond to this competitive pressure will go out of business.

The 2005 Productivity Commission Report on Energy Efficiency casts serious doubt on how relevant or significant the 'split incentives' problem is. The Productivity Commission in that report concludes:

> *'to the extent that energy costs are important, it will become worthwhile for both parties to sort out a new contract (or change a contract, as relevant)'.*[7]

[6] ABS Cat 8165
[7] Productivity Commission 2005, *The Private Cost Effectiveness of Improving Energy Efficiency,* see: https://www.pc.gov.au/inquiries/completed/energy-efficiency/report/energy.pdf, pg. 26/554

Under the 'informational problems' in the CRIS it assume that households don't invest in energy efficient features because they don't have perfect information about them.

In fact, households do not have perfect information about anything.

A 'lack of information' cannot be a justification for choosing one government policy over any other. Given that mandating energy efficient features is an intrusive regulation, a lack of information should halt the regulation, not cause it to proceed.

On informational problems, the 2005 Productivity Commission Report notes there is a

> *'reasonable case to be made for governments to address information failures. Supplying information directly, or requiring market participants to provide information indirectly, is warranted in some cases.'*[8]

Essentially, the Productivity Commission is arguing that if information failures do exist, this may justify the government taking steps to ensure that better information is supplied and information failures should not be the justification to infer regulatory failure and therefore the need for regulatory intervention.

Taking a step back, the premise of the informational problems argument is that Australians do not understand the drivers of their energy bills, and do not care enough about them to do anything to reduce them. This is what is meant by 'informational problems'.

This is likely to be false. Saving energy and reducing electricity bills are very important issues for Australian households. According to ABS CPI data, electricity prices grew by 5 per cent *per year* between 2001 and 2021. This is much stronger growth than general consumer price rises in the economy (2.4 per cent per year).

Electricity bills, in one way or another, are always an important feature of Federal Election campaigns. Any policy proposal that can be construed (fairly or not) as 'hiking electricity bills' is treated with deep suspicion by households.

The converse of this is common sense: it is likely that Australians will take measures that purport to reduce their energy bills seriously. The only question is what does it cost?

HIA argues that it is likely that households will adopt measures to reduce their energy bills, as long as they believe the costs of the measures are smaller than the value of the savings.

This means that Australians will properly consider energy efficiency measures that are transparently explained.

Building or buying a home is second biggest decision that most of us make (after getting married). It is common sense that Australians carefully consider different options for new build homes. This includes consideration of the benefits and costs of energy efficiency features. If Australians want energy efficiency features, and they are not supplied by a builder, they will find a builder that does supply them.

OBPR make precisely the same point. OBPR guidelines state that the benefits of regulation should be estimated based on people's preferences, as revealed by their market behaviour.[9] This means the CRIS must take existing market outcomes seriously.

It is clear from the CRIS that 7 star features are available in the market. It is clear that if people think 7 star features have merit, over and above all their other priorities, they can add them to their new home. Therefore, if people are choosing not to adopt 7 star features, the CRIS should be asking why are they not? Are there any costs from 7 star features that we are missing?

[8] Productivity Commission 2005, *The Private Cost Effectiveness of Improving Energy Efficiency,* see: https://www.pc.gov.au/inquiries/completed/energy-efficiency/report/energy.pdf, pg. 44/554

[9] OBPR, Guideline for Cost Benefit Analysis, pg 6/15, see: https://obpr.pmc.gov.au/sites/default/files/2021-09/cost-benefit-analysis.pdf

The RIS guidelines require the CRIS to identify, measure and include all costs that changing from 6 stars to 7 stars imposes on households. These costs must be included so that they can be offset against the benefits. HIA argues the CRIS does not do this.

On 'capital constraints', this argument is essentially that there is under-investment in energy efficiency measures because there are many alternative investments that are profitable.

This is actually a good thing. It is not a justification for heavy handed regulation. Competitive markets, including competitive markets for investment, mean that superior projects will proceed, while inferior projects will not proceed.

3.3.7 The CRIS does not properly measure costs to households, because it does not include a counterfactual

In its RIS guidelines the OBPR note that to evaluate a proposed regulation, it is necessary to understand what would happen if a regulation is not implemented.[10] This step is necessary for identifying all benefits and the costs of implementing the regulation. Therefore under the RIS guidelines the RIS should be considering the counterfactual for mandating 7 stars.

The Productivity Commission made a similar point in its 2005 report and they noted:

> *'the improvements (the energy efficiency measures) are not as cost effective for individual producers and consumers as they might seem, once all of the costs (including the opportunity costs of using the funds elsewhere) are considered.'*[11]

It is considered that the following table sets out the counterfactual (not mandating 7 stars vs mandating 7 stars).

Determining full effects of 7-stars, from household's perspective		
	If 7-stars is not implemented…	If 7-stars is implemented
Household spending	Households spend $3.3 billion on their existing preferences: education for their children, medical bills, on consumption they prefer	Households spend $3.3 billion on 7-star energy features
Household work decision (where applicable)	Instead of spending an extra $3.3 billion, some household may choose not earn an extra $3.3 billion and enjoy more family/leisure time	These households will have to earn more income to spend money higher housing costs; alternatively, they may have to change their living arrangements
House design	Current windows and design	Exisiting house designs are not viable or are viable but with 15 per cent smaller windows
House materials	Existing materials	Switch towards timber and away from steel
Energy use	Current energy use	Lower energy use

Source: HIA; Productivity Commission (2005)

From the table, it is clear the benefit of mandating 7 stars is the energy savings generated. The CRIS includes this benefit in the analysis.

The potential costs to households of mandating 7 stars are at least:

- Loss of amenity, potential restrictive design options due to smaller windows under 7 stars.
- The loss of benefits from spending that would of occurred had households not been mandated to spend money on 7-stars

[10] This is noted by OBPR in its Guidance Note on cost-benefit analysis, pg 14/15, see: https://obpr.pmc.gov.au/sites/default/files/2021-09/cost-benefit-analysis.pdf

[11] Productivity Commission 2005, *The Private Cost Effectiveness of Improving Energy Efficiency,* see: https://www.pc.gov.au/inquiries/completed/energy-efficiency/report/energy.pdf, pg. 45/554

- Moving to a higher portion of double glazing for windows to meet 7 stars, means heavier windows and can impact on transport, number of people required for a delivery of windows, additional framing to support heavier loads and limits on weight of lighting and placing windows – which results in need for some site glazing. This effects timing of getting houses to lock up and building scheduling.
- Due to thermal bridging changes for steel framing people will be more inclined to use timber framing as they achieve compliance easier and do not need to include the additional mitigation measure.

This not only has a detrimental impact to the steel framing supplier sector, and those building companies that prefer to use steel framing, but for home owners and trades constructing the building there are other issues of building may be more susceptible to termite damage (for example).

The CRIS does not include these costs or an analysis of the broader implications of the changes.

As outlined below, HIA argues that the literature demonstrates these costs are significant. As they are not included in the RIS, it is very likely the RIS overstates the net benefits of mandating 7-stars.

HIA acknowledges that there may not be enough information to measure these costs. But this does not mean that they should be treated as zero, which is the current CRIS assumption. If the CRIS cannot measure costs to households from 7-stars, which are significant, then it should not include the benefits to households (in the form of energy savings).

Below, in response to question 15, HIA notes evidence form the literature that says that windows do have a significant impact on people's wellbeing.

3.3.8 The cost of households diverting funding to pay for the required upgrades not accounted for

Mandating 7stars will cause families to switch from spending money on other priorities to 7-stars.

For example, assume that families are spending $3.3 billion on education for their children. Assume this generates benefits in NPV terms of $4.3 billion. To get benefits in NPV terms, assume these benefits have been discounted at the rate used in the CRIS: 7 per cent. The net benefit is $1 billion.

The CRIS assumes that if 7 stars costs $3.3 billion, and generates energy savings benefits of $3.4 billion, mandating 7 stars is justified because it generates a benefit of $0.1 billion.

This is not necessarily correct though. Under our assumptions, If homeowners spend an additional $3.3 billion on 7 stars to meet the new minimum standard, and these funds are diverted from spending on their children's education, it can be argued that it actually causes families to lose benefits worth $1.0 billion from diverting their savings to meet the new minimum NCC requirements that would've otherwise been directed to say their children's education.

Therefore 7 stars would actual generates net costs of $0.9 billion. This is energy benefits of $0.1 billion, less losses to families of $1.0 billion.

The CRIS calculates that 7-stars under option A creates benefits to households of $835 million. The CRIS assumes there is a net cost to households of $2.5 billion ($3.3 billion less $0.8 billion). Under our assumptions, this is not correct.

The total cost to households is the $2.5 billion they lose on needing to pay extra to meet the higher stringency of 7 stars plus the benefits they lose from diverting money away from education: a further $1 billion. The total cost to households is $3.5 billion.

These arguments concern the 'opportunity cost' of the funds that are used to pay for 7-stars. The opportunity cost is what I lose if I stop spending money on one priority and instead spend it on another.

In theory, the opportunity cost of funds can be accounted for via the NPV discount rate that is used to estimate the benefits. The RIS uses the OBPR recommended discount rate of 7 per cent to discount

future costs and benefits.[12] OBPR cite a Productivity Commission Report from 2010.[13] The Productivity Commission report explains the discount rate must reflect the opportunity cost of funds.

The 7 per cent discount rate that is used in the CRIS is the standard discount rate that is used for evaluating government projects. For example, if government is comparing two alternative infrastructure projects, it will compare the benefits of the projects by discounting them at 7 per cent.

If a higher discount rate is used to measure the benefits of 7 stars to households, this should cause the benefits to be significantly lower than what is in the CRIS. Put another way: if households have an opportunity cost of funds that is higher than the 7 per cent rate that is assumed, the benefits of households of 7-stars will be lower than what is measured in the RIS.

HIA argues that the economic literature says that households, in general, have a higher discount rate than what is assumed in the RIS.

Firstly, Hausman of MIT in the USA studied the behaviour of people who voluntarily purchase energy efficiency features. The study compares purchases of cheaper, less efficient air conditioners with more expensive, more efficient air conditioners. The question is how people think about 'investing' today to get energy savings tomorrow.

It is directly relevant to the current RIS. Hausman concludes that, on average, households apply a 20 per cent discount rate to future energy savings generated by an investment in better energy efficiency. This discount rate is much higher than the discount rate that is applied in the CRIS.

Hausman also shows that lower income households apply a much higher discount rate, while higher income households apply a lower discount rate. The result that poor households apply a higher discount rate to future energy savings implies they value future savings less and/or much higher energy savings are required for them to choose to invest in energy efficiency.

The author explains that poor households having a higher discount rate reflects uncertainty in their income (they don't want to allocate money to a better air conditioner, in case they need it to cover routine spending if they lose their job), a lack of savings and tax policy.[14]

HIA makes the further observation that poorer households are more constrained. A higher percentage of their spending goes to necessities, which means a higher percentage of their spending goes to things that are very valuable to them. This means they need to receive higher benefits from energy efficiency measures to justify diverting money away from other existing spending.

Secondly, Newell and Siikamaki, for the National Bureau of Economic Research (NBER) in the USA, study household discount rates, and household willingness to pay for energy efficiency features.

Their sources are a survey of households and results from consumer choice experiments on energy efficiency features. From their survey results, they conclude the average household discount rate is 19 per cent. It is concluded that households with less education, larger households, low income and low credit scores had higher discount rates.

These results are therefore consistent with the previous study. They also build a model for consumer choice and willingness to pay for energy efficiency features.[15]

- Newell and Siikamaki find a link between the discount rate that households apply to future savings, the value of these future savings and (therefore) the willingness of households to pay for energy efficiency features. OBPR recommend that willingness to pay is used to estimate benefits in RIS analysis.
- Newell and Siikamaki conclude: 'for individuals with higher discount rates the value of reduced future operating costs is lower, as is their WTP for EE [Energy Efficiency].'

[12] See: https://www.pmc.gov.au/sites/default/files/publications/cosst-benefit-analysis.docx, pg 7/15.
[13] See: https://www.pc.gov.au/research/supporting/cost-benefit-discount/cost-benefit-discount.pdf, pg 11/192
[14] Hausman T., 1979, Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables, see: https://economics.mit.edu/files/6866
[15] Newell R and Siikamahai, 2015, *Individual Time Preferences and Energy Efficiency*, NBER Working Paper 20969, see: https://www.nber.org/system/files/working_papers/w20969/w20969.pdf

The implication of this finding for the RIS is clear. Because the CRIS applies a discount rate (7 per cent) to household energy savings that is lower than the discount rate that households actually apply (the literature suggests around 20 per cent), the CRIS over-estimates the value of the energy savings. Put another way: the CRIS overestimates household willingness to pay for household energy savings.

When the CRIS applies a discount rate that is too low, it is not properly measuring the cost to households of diverting funds away from other priorities and towards 7 stars. The simplest example of this is money that is diverted away from children's education to pay for 7 stars. This example appears at the top.

Newell and Siikamaki conclude that properly measuring household discount rates is critical to understanding the 'energy efficiency' gap.

The 'energy efficiency gap' is where households under-invest in energy efficiency features, apparently because they are irrational. Newell and Siikamaki are suggesting that household behaviour may appear to be more rational, if appropriate discount rates are used.

It is acknowledge that the CRIS may be constrained by OBPR: the CRIS may be obliged to use the OBPR discount rate of 7 per cent. If the RIS cannot properly measure the benefits to households (by using the right discount rate), then these benefits should be removed from the RIS.

It is important to note that government and households are very different. Government is not very constrained in its income (it can raise more taxes). Government faces less income uncertainty (if taxation is not adequate, it can issue debt).

Households, in contrast, are constrained in their income (they are constrained by their skill level and by their desire for leisure and family time, away from work – no household works indefinitely).

Households also face uncertainty (if they lose their job, it is very difficult and costly to resort to debt). Therefore, it is very plausible that an appropriate opportunity cost of funds, or discount rate, for government projects is lower than the opportunity cost of funds for households.

HIA is not arguing that OBPR's discount rate (7 per cent) is wrong in a general sense. Rather, HIA is simply noting that the literature argues it is unlikely to be appropriate to apply the **government** discount rate to benefits that accrue to **households**. By applying the government discount rate to household benefits, the CRIS likely overstates the benefits of 7-stars.

Finally, an important implication of the literature is when the government imposes 7 stars on households, it imposes higher costs of poorer households than on richer households. This is because poorer households are more constrained today. Poorer households put lower value on diverting spending today to investments that generate a payoff tomorrow.

3.3.9 Conclusion on literature review

The Productivity Commission considered all issues that are relevant to energy efficiency measures in its 2005 report. It concluded by noting that, where new regulation can be justified:

> *'the Commission favours light-handed regulatory responses and information provision, rather than more prescriptive and intrusive approaches: mandatory labelling can be an appropriate way of providing information, but other mandatory measures, such as minimum performance standards, may not be privately cost effective.'*[16]

The CRIS notes the problems that would justify 7 stars features 'may' exist.

That is, it notes informational problems, split-incentives, etc., 'may' exist.

It uses this characterisation because it does not present evidence that these problems actually *do* exist.

[16] Productivity Commission 2005, *The Private Cost Effectiveness of Improving Energy Efficiency,* see: https://www.pc.gov.au/inquiries/completed/energy-efficiency/report/energy.pdf, pg. 45/554

Regulation must be justified. To justify regulation, the first step is establishing that problems that would be solved by the regulation *actually do exist*. If is not demonstrated that problems *actually do exist*, then new regulation cannot be justified.

3.4 CHANGES REQUIRED TO THE CRIS ASSUMPTIONS

This section provides a more detailed analysis of the changes required to the CRIS assumptions. These changes would more accurately measure the net benefits of mandating a change from 6 stars to 7 stars and increasing the stringency for the captured fixed appliance.

It is noted that these changes are not necessarily comprehensive, due to a lack of data on some issues. Even if the CRIS adopts these changes, it will still likely over-estimate the net benefits of the policy.

3.4.1 Changes required to current costs indicated in the RIS

It is considered that the CRIS should make the following specific changes.

a) Adjust modelling assumptions for cost escalation under COVID-19

As set out in the literature review, costs have increased sharply during the pandemic and there is significant evidence these cost increases will not reverse.

HIA argues a conservative assumption is that underlying modelling assumptions for costs should be upgraded by 15 per cent.

Adjust modelling assumptions for COVID-19		
	Option A	Option B
Construction Costs, reflecting existing modelling assumptions	3,393	2,307
Ajdustment factor for COVID costs	+15%	+15%
Costs, reflecting assumptions adjusted for COVID-19	3,902	2,653
Implied adjsutment to net benefits, Consultation RIS to Decisions RIS	-509	-346

Source: HIA; Productivity Commission (2005)

b) Use real or actual construction costs (not modelled construction costs)

As noted, the 2005 Productivity Commission Report notes that the actual or realised construction costs of energy efficiency measures can be far greater than costs estimated in a computer model. Data presented by the Productivity Commission note that at minimum, realised or actual costs are greater than modelled costs by a factor of 3X.

To HIA's knowledge, this is the only study where an analyst has gone back and checked whether actual costs for energy efficiency measures align with modelled costs. However, because it is data published by Productivity Commission, it must be taken seriously.

Therefore, at minimum, the final RIS should increase its computer modelled costs by a factor of 3.

Adjust modelled costs to actual costs	Option A	Option B
Computer modelled cost, including adjustment for COVID	3,902	2,373
Minimum adjustment factor to convert computer modelled costs to actutal/realised costs	3	3
Estimate of actual/realised costs	11,705	7,118
Implied adjsutment to net benefits, Consultation RIS to Decisions RIS	-7,803	-4,745

Source: HIA; Productivity Commission (2005)

To further support this proposition HIA has received cost estimates and correspondence from members on the CRIS and the NCC draft provisions on the required upgrades and costs from 6 to 7 stars.

These case studies and actual projects indicate that costs for many projects are likely to be far greater than what has been indicated in the consultants cost assessment modelling report.

These case studies and projects break down the required changes and costs, and further supports the Productivity Commission's findings from their 2005 report, in that the actual/realized costs would likely be double, three times and for many house and apartment designs far in excess of the CRIS costings.

This is all supported by a range of other published reports that indicate the changes would result in construction cost increases far greater than the modelled assessment, and depending on the house design and block orientation and surrounding properties could easily exceed those costs.

This is even supported in the consultant's report used for the CRIS costings which notes:

'There will be dwellings constructed in the field where the costs of achieving 7-stars will be higher (or lower) that the costs found ion the report. In some cases, higher costs will be a result of design decisions which implicitly value other factors more than the benefits of an energy-efficient dwelling design.'

These case studies and literature review of a range of other published reports on the additional up front costs are outlined in Section 4 of this submission.

c) Changes to house designs and additional time for assessment by energy assessor and additional compliance costs

The CRIS notes that, for some period of time after the code is changed from 6-stars to 7-stars, the building industry will incur transition costs.

These are costs of re-training people and the cost of re-designing manufacturing processes, supply chains and building designs, building processes and the final product (new build homes) to meet the requirements.

The CRIS includes re-training costs but also seeks further data on re-design/re-calibration costs.

HIA has been provided with a range of feedback from members which indicates that the costs of re-design of buildings plans, specifications and re-calibration of costs for volume builders is a significant sunk cost both in terms of time and resources.

HIA has received feedback from a number of energy assessor that changing from 6 stars to 7 stars will involve significant redesign of dwellings and the majority of all volume home designs. In particular, window sizes, layouts and (in some cases) orientation of dwellings will have to change.

This feedback is consistent with the feedback received from a range of volume builders that changes from 6 stars to 7 stars as the benchmark requirements will result in the need for significant changes to 90-95% of all of their standard house plans.

One of Australia's largest volume builders cited that they presently have over 500 standard house plans and 95% of those plans will require changes in some form to adhere to the new requirements if approved.

This is not a straightforward change and it's not a matter of only changing or adjusting the plan in many circumstances. The changes will require:

- initial re-design
- re-assessment by an energy assessor in a variety of different orientations
- this would likely involve back and forward with the initial designer and many runs through the energy rating software (which is not expected to be operational and available till 1 September 2022)
- then it is a matter of finalizing the design
- have the revised plan to the estimator and suppliers for costings of the new (or amended) plan
- a completed plan produced
- a standard specification and materials inclusions lists developed
- a scope of works and tender documentation developed for contractors and suppliers; and
- marketing and promotional material updated.

There may also be implications for these designs on:

- current display homes and the need for the subsequent houses to be built as per the display home; and
- subdivisions for which the house designs are based off for lot yield.

Further these changes are not likely to be made until the final provisions are agreed to by Governments as it means many of the house designs would need to be scrapped and the new ones designed with the 7 star features.

For the accessibility housing RIS, The CIE estimated the additional costs of building verification, based on the similar feedback on the design and verification costs for changing house designs and additional verification and approval costs for the compliance of new builds with respect to the new regulations was around $290 million.

HIA argues the complexity of the required additional verification and design changes for the energy efficiency changes are comparable, if not more challenging, than the accessible housing provisions given the wide variety of house designs and that the design used for the block will be dependent on the orientation.

Therefore, HIA argues that similar compliance costs should be included for this RIS.

Members have provided the following points to HIA.

- Energy assessment for a standard volume builder home: $220
- Energy assessment for an architecturally designed, custom build home: starts at $440.

In general, architecturally designed homes have more windows.

The time that an energy assessor will need to spend on making all houses in all climate zones comply to 7 stars will like take them a lot more time depending on the house design and there scope of role is now also broader given the whole of home component.

HIA has obtained data from Rawlinsons, a highly respected and independent quantity surveyor, on the differences in between volume builders and custom builders. Rawlinson's estimate that the unit construction cost ($cost per square metre of home construction) for a custom builder is 51 per cent higher than a volume builder.

Difference in cost base between volume builder and custom builder		
	Volume builder	Custom builder
Unit construction cost ($/sqm): single storey detached home	1,473	2,230
Unit construction cost ($/sqm): double storey detached home	1,576	2,386
Cost upgrade: volume builder to custom builder		51%

Source: Rawlinsons; HIA can provide a copy of Rawlinsons report, on request

If the government mandates that the volume built homes achieve 7-stars (up from 6-stars), HIA argues that, with respect to energy efficiency measures, the government will create a situation where volume builders must behave like a custom builder. To provide 7 star features, the volume builder must provide cost flexibility, because their normal, low-cost processes are designed around 6-star features.

These costs are incurred at least until the change becomes normalised. HIA estimates this transition will take 3 years.

Therefore, for 3 years, HIA argues a 51 per cent premium should be added to the costs incurred by volume builders, to adjust from 6-stars to 7-stars.

Based on HIA's Housing 100 survey, in 2021/22 volume builders represented 40 per cent of the home building market. The remaining 60 per cent of the market is made up of custom builders and multi unit builders.

Transition costs for volume builders ($ million)		
	Option A	Option B
Total realised construction costs, adjsuted for idle capacity	13,006	7,909
Share of costs that relate to volume builder homes	0.38	0.38
Costs relating to volume builder homes	4,942	3,005
Costs incurred during transition period (3 of 10 years)	1,483	902
Transition costs (51 per cent premium)	756	460
Implied adjsutment to net benefits, Consultation RIS to Decisions RIS	-756	-460

Source: HIA; Productivity Commission (2005)

d) Remove "learning" from cost assumptions

In a narrow set of circumstances, it may be appropriate to assume costs decline over time due to "learning".

This is where the introduction of a new regulation *causes* the building industry to "learn" about the requirements. This regulation-driven learning causes costs to fall.

The CRIS notes that evidence on this type of regulation-driven learning is limited. The CRIS notes the previous ABCB Section J energy-efficiency RIS did not include an assumption that costs decline due to learning. The primary reason cited was a lack of evidence on learning that is caused by the regulation.

Another component of "learning" that analysts include in RIS analysis is general falls in technology costs. For example, the CRIS uses data from CSIRO dashboard, which shows a trend decline in the capital costs for rooftop solar PVs. CSIRO project this trend is projected to continue. Therefore, the CRIS assumes the PV-component of the costs falls over time.

It is accepted that the costs of the PV industry have fallen and may continue to fall. However, HIA argues this does not mean there is a "cost reduction" that increases the **net benefits** in the RIS, as it has been assumed.

There are also questions on the quality of some of the PV products being installed on buildings, as well as their installations compliance. There has been a number of reports of building fires attributed to PVs on roofs as well as water ingress due to installations and PVs becoming wind driven debris in high wind events.

Nor does the CRIS discuss the issue of damage due to hail events and clean up and insurance costs for replacement of PVs on roofs that has been witnessed in the past few years due to large hail storms.

The CRIS does not provide a detailed assessment of these unintended and consequential impacts of higher rates of PVs installations which would far outweigh any learning rate savings due to higher numbers of installations of PVs on buildings.

If PV costs, in general, are falling over time, this means **both**:

The costs of mandating 7-stars, **and**

The benefits of mandating 7-stars fall over time.

General falls in technology costs reduce the costs of the regulation because it is less costly for builders and homeowners to install the PV cells. General falls in technology costs cause the benefits of the regulation to fall because there are more people who are switching anyway.

Because more people are switching from 6-stars to 7-stars, there is less scope for the new mandate to cause people to change their decisions. This means the benefits of new mandate are lower.

It does not appear that the CRIS has included any reduced benefits due to learning alongside reduced costs.

Therefore, HIA argues the CRIS has over-estimated the net benefits, by assuming that costs fall over time, but not including the impact of this in the baseline, and therefore not adjusting the benefits.

The most appropriate assumption for the CRIS to make is to remove the cost reduction that is created by learning. This will result in both benefit and cost reductions being excluded.

e) Ensure small blocks cost incorporate relevant trends

The CRIS notes it will be more costly to incorporate a mandate of 7 stars, where dwellings are built on narrow and small blocks.

This is based on a difficult blocks report produced by AECOM for the ABCB which noted it was difficult to accurately estimate the prevalence of difficult blocks, though they cited feedback from stakeholders suggests the percentage of difficult blocks in a new housing development could be between 5-40% depending on sub-division design and orientation.

To try and quantify the percentage of difficult blocks the CRIS cites data produced by SGS Economics and Planning that suggests highly conservative percentages of difficult and challenging blocks in all

states and territories. Though that report was not able to be reviewed or analysed on how these numbers were derived as part of responding to the CRIS.

Table 4.11 Proportion of small and narrow blocks by state

State	Proportion of small and narrow blocks
NSW	8.4%
QLD	1.8%
VIC	7.3%
SA	5.8%
WA	5.8%
TAS	5.8%
NT	5.8%
ACT	5.8%

Source: ACIL Allen based on SGS Economics & Planning 2021, Australian Cities Residential Lot Analysis Final Memo, prepared for the Australian Building Codes Board, January.

HIA would concur with the stakeholder feedback on the prevalence of difficult and challenging blocks particular in new housing estates, and infill areas where there is a growing trend to address land supply challenges and housing affordability to look at maximising the amount of dwellings that can be incorporated into new housing developments and smaller block sizes.

Another concern on the use of the percentages used in Table 4.11 is that this percentage is lower than what is assumed from the accessible housing RIS ABCB recently completed.

In the 2021 accessible housing RIS, CIE cites data from SGS that around 11 per cent of houses and townhouses in Victoria are built on blocks that are defined as 'small' (by Victorian planning standards).[17]

This percentage is higher than what is assumed for the energy efficiency RIS. It is accepted that the definition of 'small and narrow' for energy efficiency may be different from 'small' for accessible housing. However, at the very least, this should be clarified.

More importantly, there is clear downward trend in block size. For example, UDIA report that the median lot size across capital cities has fallen from 519sqm to 420sqm between 2009 and 2020.[18]

It seems unlikely that the proportion of "small and narrow" blocks would remain constant while block sizes are falling. It is recommended that the CRIS should provide data on how the proportion of small blocks has trended over time. These insights could be incorporated into the RIS. This would increase estimated costs.

As noted above it is considered that the percentages quoted by SGS are considered to be highly conservative and as per the stakeholder feedback and a move to higher portion of townhouses and buildings built boundary to boundary a more representative yet still likely to be conservative assessment would be 10-15% of all new housing sites in all states would be considered difficult blocks that adversely affects solar passive design.]

f) Summary of cost items to date

Thus far, HIA has identified potential problems with the CRIS assumptions for:

1. The difference between realised costs and modelled costs
2. Transition costs and design costs for builders and suppliers

[17] ABCB/The CIE 2021, pg 206/398, see: https://www.abcb.gov.au/sites/default/files/resources/2021/Final%20Decision%20RIS%20accessible%20housing_PDF.pdf
[18] UDIA 2021, see: https://udia.com.au/research/udia-state-of-the-land-2021/

3. The assumption that general falls in technology costs represent an addition to the net benefits; and
4. Assumptions on the importance of smaller blocks.

It is acknowledges that there may be some overlap between these issues.

For example, transition costs, a lack of learning benefits, and more prevalent, costly small blocks (than what is assumed), and additional compliance costs, cause realised costs to be higher than modelled costs.

This is not to say that more general differences between a computer model and reality are not significant. HIA simply notes that these specific issues, plus the inherent, general difficulty of capturing reality in a computer model, could combine to drive realised costs above modelled costs.

Therefore, to be conservative, it is suggested at a minimum that the adjustment to the capital costs based on the actual/ realised costs being 3 times higher than modelled costs (the minimum factor noted by the Productivity Commission), would probably 'ticked off' against the other issues raised by HIA thus far.

3.5 Additional Cost items not Accounted For

It is considered that there is also a range of other cost items that the CRIS has not properly accounted for. There are also other items that we considered should not be included.

3.5.1 Remove assumption that 10 per cent of builders' capacity is idle and add back these costs

HIA interprets discussion on pg. 97/328 of the CRIS to imply that the CRIS has assumed that 10 per cent of builders' capacity is idle. No evidence is provided for this assumption. We are not aware of another RIS where a similar assumption has been made.

The CRIS appears to have assumed that idle capacity can be deployed without cost. As a result, the CRIS only includes only 90 per cent of modelled construction costs.

It is argued that this assumption is not appropriate for a RIS. A RIS analysis is intended to examine policies from a long-term perspective. Over the long-term, it should be assumed that builders allocate their time between work and other commitments so as to maximize their utility.

Utility is economics jargon which tries to capture income, satisfaction and pleasure. For a RIS, it should be assumed that prices (including construction costs, input costs, and the costs of builders' time) adjust to drive this outcome. Even if builders are not spending all of their time at work, this does not mean that 10 per cent of their time is free.

Withdrawing time from other priorities to increase work by 10 per cent is costly to builders. It is argued that the appropriate cost for this time is the rate at which builders supply labour. This implies that 100 per cent of modelled construction costs should be included.

Adjustment to construction costs for idle capacity ($ million)		
	Option A	Option B
Construction costs, adjusted for COVID and for actual vs modelled	11,705	7,118
Realised construction costs, assuming builders have no idle capacity	13,006	7,909
Implied adjsutment to net benefits, Consultation RIS to Decisions RIS	-1,301	-791

Source: HIA; Productivity Commission (2005)

Note, it is not relevant to observe that from time to time some builders and tradespeople find themselves unemployed.

There are always short-term fluctuations in construction and the labour market. These short-run fluctuations are not relevant for RIS analysis. It is also not relevant to argue that from time to time, people fail to allocate their time appropriately.

In long-run analysis, it should be assumed that these short-term problems are ironed out.

3.5.2 Include costs for changing of design preferences

If the government mandates that households to 7 stars for many homes this will mean that the house design will need to change to accommodate the 7 star requirements, this can include layout, material selection type, windows, wall positions etc.

These design changes is different from the design that they prefer, this is a cost to households.

For the CRIS, it notes 'design preferences are maintained (the exception is a reduction in window size).'[19] This means that the assumption is that for homes to go from 6 stars to 7 stars, there are no other required design changes (apart from changes to window size).

This assumption contrasts with feedback HIA has received from a significant Australian energy assessor. For new homes that are built under 7-stars, the energy assessor notes that, in addition to changes in window size, some homes will have to be re-oriented.

More fundamentally, the energy assessor notes that some home designs and home preferences are simply incompatible with 7 stars. Many home projects will have to start from scratch, with a completely different concept. This is a substantial cost which cannot be ignored.

This is particular relevant for custom homes where the home owner has a specific house design in mind.

It is acknowledged that it is difficult to quantify this impact. However, it is not accurate to assume this cost is zero, as the CRIS has done.

Perhaps the simplest fix for this would be to increase the allowance for "small and difficult blocks". This cost item is supposed to capture the large costs for certain blocks where it is very difficult to comply with 7 stars for physical reasons.

The CRIS could consider increasing the share of blocks that incur these costs, to account for projects where it is difficult to comply with 7 stars, given the design preferences of the owner alongside the additional design costs for volume builders to update and amend current plans.

The design costs are the costs of the homes that are not built.

[19] ACIL-Allen Consultation RIS, pg 89/328

3.5.3 *Add carbon costs from activities required to meet regulation*

The regulatory change requires additional building materials to be installed in new homes. These additional materials will have to be mined from the ground, manufactured into product and transported to building sites. The financial cost of this activity should already be incorporated in additional construction costs.

However, mining, manufacturing and transport are energy-intensive industries. They drive significant CO2 emissions. Mandating a change from 6 stars to 7 stars will require a number of material and construction changes – i.e. double glazing and use of insulated (waffle pod slabs) and the manufacturing and additional transport costs cause increases in CO2 emissions. This cost is not included in the CRIS.

These CO2 emission costs should be added. The most appropriate way to estimate these costs is for the RIS to use a "CGE model" with an emissions add-on. The model can be used to estimate the additional emissions costs in other industries that are created when activity in the building sector expands.

3.5.4 *Adjust benefits to reflect actual outcomes rather than modelled outcomes*

Similar to the discussion on modelled vs realized costs, the similar issues exist for assumed benefits and energy savings in households, who are forced to switch from 6-stars to 7-stars. ACIL-Allen note in the CRIS literature that cast serious doubt on whether computer-modelled savings match actual savings. The Productivity Commission holds the same view.

The 2019 Section J RIS, noted that most submissions argued that likely energy savings would be between 49-75 per cent of modelled savings.[20]

ACIL-Allen should adopt a similar assumption, to be consistent with the Australian literature in this RIS. ACIL-Allen note some overlap with their "rebound effect" assumption. It is recommended that the RIS should adopt a rebound effect of 25-51 per cent, applied to all benefits, to be consistent with Australian literature.

In the following table, we adjust back for the rebound effect that the RIS assumes (10 per cent) and then adopt the mid-point of the two scenarios that CIE said in the 2019 Section J RIS would be the possible outcomes (62 per cent: midpoint between 49 per cent and 75 per cent).

Adjust benefits to actual benefits ($m)		
	Option A	Option B
Computer modelled benefit assumption by ACIL-Allen (including 10 per cent rebound)	1,212	589
Computer modelled benefit assumption by ACIL-Allen (without rebound)	1,347	655
Adjustment factor: realised benefits/actual benefits	0.62	0.62
Costs relating to volume builder homes	835	406
Implied adjsutment to net benefits, Consultation RIS to Decision RIS	-377	-183

Source: HIA; Productivity Commission (2005)

3.5.5 *Remove energy savings benefits (69 per cent of benefits) should be removed*

[20] The CIE 2019, https://static1.squarespace.com/static/5df9aa078642f943ece6a0b3/t/5f589c857e871053b87e5a58/1599642806533/Final_RIS_Energy_efficiency_of_commercial_buildings_PDF.pdf, pg 17/252

As noted in the literature review, the CRIS has included the benefits to households but not all of the costs. The preferred outcome is that all costs and benefits are included.

The RIS should either include all the benefits and the costs to households, or remove the benefits. Including only the benefits likely overstates the net benefits of mandating 7-stars. If the costs are not added, the benefits should be removed.

Remove energy saving benefits to households ($m)		
	Option A	Option B
Actual energy savings, adjusting for rebound effect and actual energy use	575	302
Implied adjsutment to net benefits, Consultation RIS to Decision RIS	-575	-302

Source: HIA; Productivity Commission (2005)

3.5.6 Remove health and safety benefits from central case

The CRIS notes that its benefit item: health benefits for reduced electricity and gas generation use, “highly uncertain and speculative”.

As noted above the CRIS has not included the costs of reduced window sizes, reduced amenity from 7 stars, etc.

It is plausible that in combination, this choice of assumptions over-states the net benefits of 7 stars of health and wellbeing. On this basis, it seems logical that this should be removed from the health benefits for reduced electricity and gas generation use item.

Remove health benefits from central case ($m)		
	Option A	Option B
Actual health benefits from reduced electricity use, assuming actual savings are 62 per cent of modelled savings	82	9
Implied adjsutment to net benefits, Consultation RIS to Decisions RIS	-82	-9

Source: HIA; Productivity Commission (2005)

4. ANALYSIS OF COST AND MATERIAL CHANGES FOR 7 STAR HOMES

HIA has been provided with a selection of member's projects and analysis from their energy assessor of the changes and cost breakdowns that would arise for a range of projects.

The case studies have been prepared by three different energy assessors though costings have been mirrored across the various case studies for consistency.

The case studies focus on cost of additional materials; the costings are based on actual costs to the builder and do not include margins/profit/overheads that will add further cost.

These case studies are also over laid with information from a range of published reports including the Trajectory report for achieving Low Energy Homes, indicating what the additional capital costs would be for requiring houses and apartments to meet 7 star building fabric requirements.

Case studies vs Tony Isaccs Consulting Costs and Benefits Report

These case studies are not exhaustive examples but provide a comparative assessment against those provided in the Tony Isaacs Consulting cost and benefits assessment report which has been used as the basis for the thermal fabric upgrades and costings in the CRIS.

It should also be acknowledged that some of the required upgrade changes used in these case studies, may have been able to be altered or changed to a different or alternate approach if there was building design changes, layout/orientations adjustments.

However, it is considered a more representative example in maintaining the same house design of 6 star vs 7 star to assess what the impact of the changes would be.

If house re-designs are required then that would incur other additional comparable costs for re-design, re-verification, additional time by assessor in the assessment and approval and sign off and agreement time from the home buyers.

Findings of case studies, literature review and builder feedback

This analysis further supports the assessment outlined in this submission that the costs used for the CRIS are significantly underestimating the upgrading costs for the building fabric from 6 to 7 stars for all buildings across all climate zones.

Furthermore, this analysis clearly indicates that the CRIS costs for upgrading building fabric from 6 to 7 stars need to be adjusted in the final RIS to take account of the real world costings.

This analysis also provides further support to HIA's recommendation that the costings used in the RIS should be based on a realised cost vs a modelled cost approach that the Productivity Commission recommended from their report.

Note:

The costs used in the section and the cited various other reports were prepared prior to the current increases in building materials due to supply chain constraints and COVID-19. These costs would need to be adjusted to account for the material and labour supply increases as outlined in the previous Section of this submission.

CASE STUDY 1

Building Thermal Performance Assessments

HIA engaged a thermal performance assessor to undertake thermal performances on three house designs

- Detached Single storey speculative homes – Melbourne and Sydney
- Custom double storey home - Melbourne

The assessor used the FirstRate 5 demonstration tool that was available as part of the NCC 2022 public comment draft as well as part of the assessment checking the design against the updated ABCB heating and cooling loads standard. It is noted that the FirstRate5 demonstration tool did not contain the updated climate files so there may be some adjustment for that required.

The assessments only focussed on the building fabric changes for upgrading from 6 to 7 stars and didn't include the whole of home assessment component.

The assessments for the detached single storey speculative home were carried out under NatHERS Climate Zones for Melbourne, Sydney, and Melbourne only for the custom double storey home. Though the assessor noted that these homes were representative of real world projects that he had worked on within the last 12 months.

These assessment generally used optimal orientations for ease of assessments and analysis.

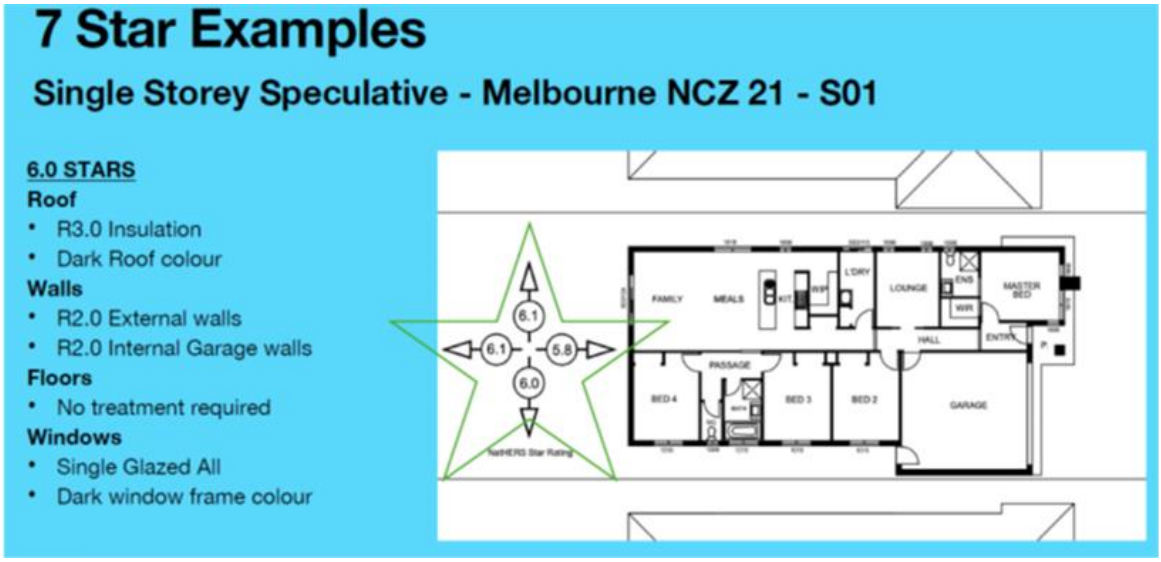
1. Single storey speculative home Melbourne.

The Melbourne home is shown below and the star rating for four orientations to achieve an average of 6 Stars.

The Melbourne home consists of a waffle raft slab, masonry veneer walls, tiled roof, aluminium framed windows, and has a ceiling height of 2590mm.

The floor/ceiling area is 204.4m2

House inclusions to meet 6 stars:



Upgrades to achieve 7 stars (average):

7 Star Examples

Single Storey Speculative - Melbourne NCZ 21 - S04

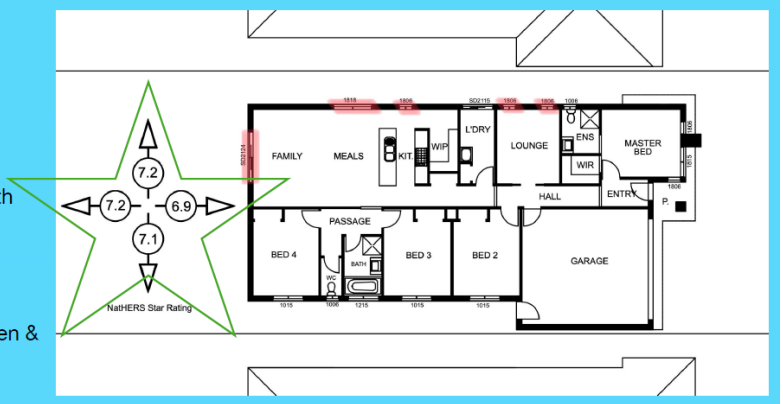
7.1 STARS

Roof
- R6.0 Insulation
- Dark Roof colour

Walls
- R2.5 External walls
- R2.5 Internal Garage, Laundry, Bath WC walls

Floors
- No treatment required

Windows
- Double Glaze Family, Meals, Kitchen & Lounge
- Single Glazed All other
- Dark window frame colour



6 star to 7 star upgrade comparison:

7 Star Examples

Single Storey Speculative - Melbourne NCZ 21 - S04

6.0 STARS

Roof
- R3.0 Insulation
- Dark Roof colour

Walls
- R2.0 External walls
- R2.0 Internal Garage walls

Floors
- No treatment required

Windows
- Single Glazed All
- Dark window frame colour

→

7.1 STARS

Roof
- R6.0 Insulation
- Dark Roof colour

Walls
- R2.5 External walls
- R2.5 Internal Garage, Laundry, Bath WC walls

Floors
- No treatment required

Windows
- Double Glaze Family, Meals, Kitchen & Lounge
- Single Glazed All other
- Dark window frame colour

The cost for the Melbourne Speculative home to increase to 7 Stars uses the Indicative costs of materials per m2 previously noted in Case Study 1:

- R2.0 wall $4.75 per m^2
- R2.5 wall $9.00 per m^2
- R3.0 ceiling $6.00 per m^2
- R6.0 ceiling $16.00 per m^2
- Aluminium Single glazed windows - clear glass $300.00 per m^2
- Aluminium Double-glazed windows - clear glass $600.00 per m^2

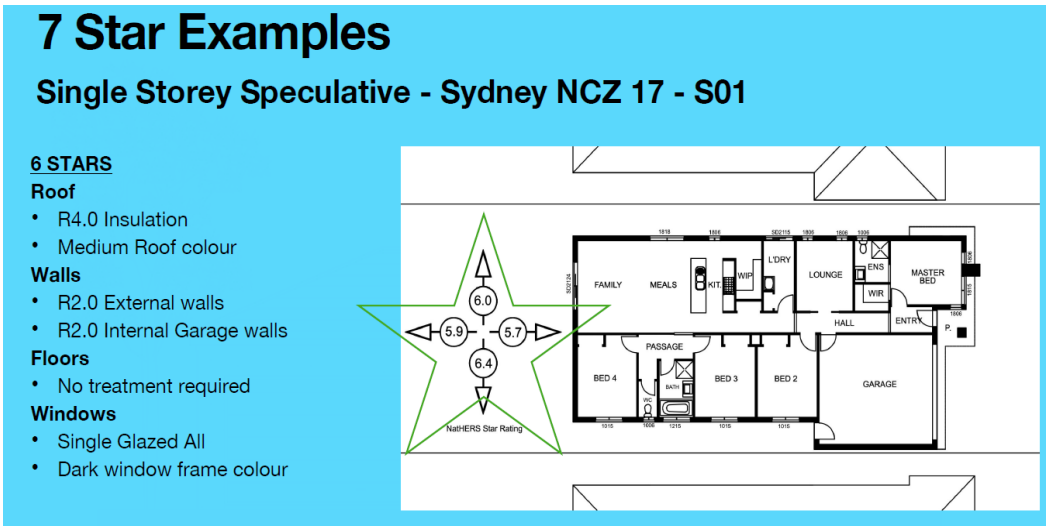
Item	Area M2	Additional M2 price	Cost from 6 to 7 Stars
Ceiling insulation R-6.0	204.4	$10	$2044.00
External wall insulation	156.0	$4.25	$663.00
Additional internal wall insulation	46.0	$9.0	$414.00
Glazing upgrade from single to double glazed	11.52	$300	$3456.00
TOTAL			**$6577.00**

2. Single storey speculative home Sydney.

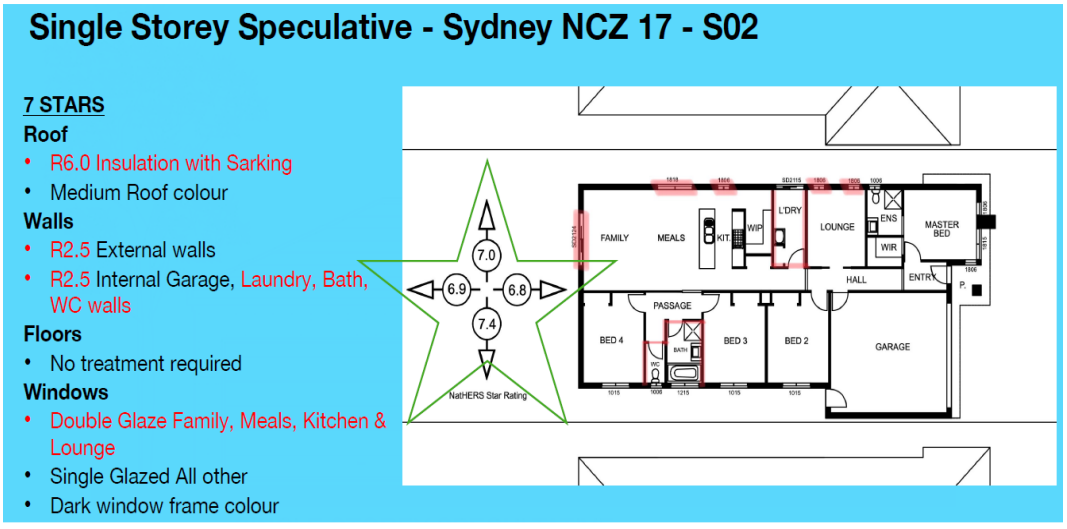
The Sydney home is shown below and the star rating for four orientations to achieve an average of 6 Stars.

The Sydney home consists of a waffle raft slab, masonry veneer walls, tiled roof, aluminium framed windows, and has a ceiling height of 2590mm.

The floor/ceiling area is 204.4 m^2



House inclusions to meet 6 stars:



Upgrades to achieve 7 stars (average):

Cost of upgrades to achieve 7 star (average) using the following indicative costs (per m^2) previously noted:

- R2.0 wall $4.75
- R2.5 wall $9.00
- R4.0 (R-4.1) ceiling $7.20
- R6.0 ceiling $16.00
- Aluminium Single glazed windows - clear glass $300.00
- Aluminium Double-glazed windows - clear glass $600.00

Item	Area M2	Additional M2 price	Cost from 6 to 7 Stars
Ceiling insulation R-6.0	204.40	$8.80	$1798.72
External wall insulation R-2.5	156.00	$4.25	$663.00
Additional internal wall insulation R-2.5	46.00	$9.0	$414.00
Glazing upgrade from single to double glazed	11.52	$300	$3456.00
TOTAL			**$6331.72**

3. Double storey custom home Melbourne

The double storey custom house is shown below and the star rating to achieve 6.1 Stars.

The house consists of a suspended concrete slab floor on the ground floor, masonry veneer walls ground floor, timber floor joist system first floor, rendered EPS with a cavity on first floor external walls, tiled roof ground floor front and first floor and flat metal roof over living, meals and alfresco, aluminium framed windows.

Home orientated as shown on plan. Wall height 2590mm.

7 Star Examples

Double Storey Custom Design

6.1 STARS

Roof

- R5.0 Pitched Tiled area
- R4.0 + R1.0 Anticon Flat metal roof
- Darks Roof colours

Walls

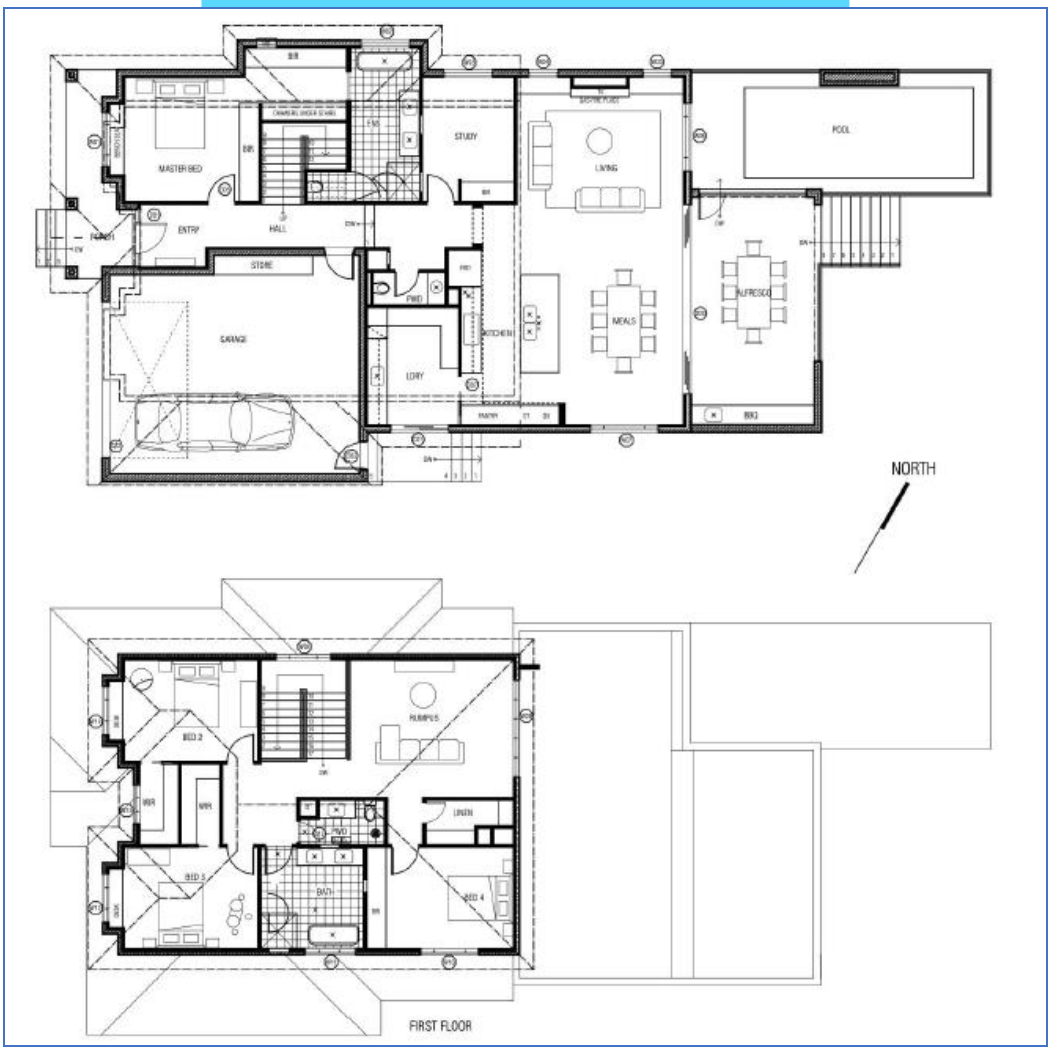
- R2.5 External walls
- R2.5 Internal Garage walls

Floors

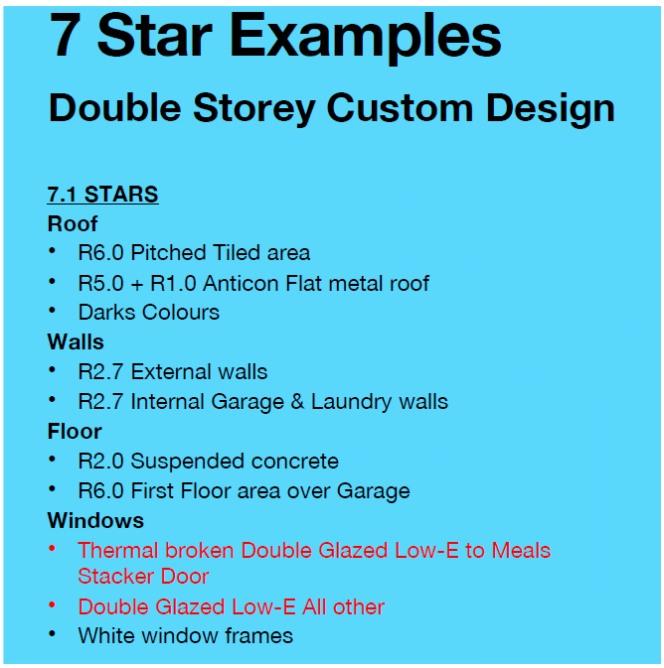
- Suspended concrete - None
- R3.5 First Floor area over Garage

Windows

- Double Glazed All
- White window frame colour



Inclusions required to achieve 7 stars:



Cost of upgrades to achieve 7 Star (average) using the following indicative costs (m2) previously noted:

- R2.0 floor $4.75
- R3.5 floor $6.20
- R2.5 wall $9.00
- R2.7 wall $13.30
- R4.0 (R-4.1) ceiling $7.20
- R5.0 ceiling $11.30
- R6.0 ceiling $16.00
- Aluminium Double-glazed windows - clear glass $600.00
- Aluminium Double-glazed Low-e $700.00
- Aluminium Double glazed Low-e with a thermal break $850.00

Item	Area M2	Additional M2 price	Cost from 6 to 7 Stars
Ceiling insulation R-6.0	140.00	$4.70	$658.00
Ceiling insulation R-5.0 & foil	81.00	$4.10	$331.10
Wall insulation R-2.7	264.00	$4.30	$1135.20
Internal garage & laundry walls R-2.7	32.24	$4.30	$138.63
Floor insulation R-2.0	227.00	$4.75	$1078.25
Floor insulation R-6.0	36.00	$10.00	$360.00
Double glazed Low-e upgrade	36.45	$100.00	$3645.00
Double glazed Low-e with thermal break	16.38	$150.00	$2457.00
TOTAL			**$9803.18**

CASE STUDY 2

The following case study was undertaken by a different energy assessor that is accredited in NSW and does a high volume of both project, custom homes and commercial buildings energy assessments.

This case study is on project home in Vincentia NSW, Climate Zone 6 (further details on this project and house specifications and plans can be provided upon request).

The living areas (Family, Dining, Living rooms) are orientated northeast which represents good solar passive expose for this climate zone.

The baseline or current fabric insulation and glazing specifications meet the current BASIX 6 Star equivalent for this dwelling in this Climate Zone.

Total floor area 191m2. Conditioned area 120m2

Current requirements to meet 6 Stars – BASIX equivalent

- Ceilings R-3.0
- Walls R 1.5
- Single glazed windows (clear glass)
- Heat load 72.9
- Cool load 14.2

Upgrade to meet proposed 7 Star energy requirements – BASIX equivalent

- Ceilings R-6.0
- Walls R-2.5
- Double glazed windows (clear glass)
- Heat load 47.3
- Cool load 10.2

Cost increase under 7 Stars

Cost of upgrades to achieve 7 Star (average) using the following indicative costs (m2) previously noted:

• Wall insulation go from R-1.5 to R-2.5	103m2 @ $4.50	$463.50
• Ceiling insulation go from R-3.0 to R-6.0	139m2 @$10.00	$1,390.00
• Windows single glaze to double glazed	34.2m2@$300.00	$10,260.00

Total additional cost **$11,994.50**

LITERATURE REVIEW

In addition to these case studies in undertaking a literature review of a range of recent reports and other studies on the cost impacts of upgrades required for 6 star vs 7 stars the following reports are cited:

- The Trajectory for Low Energy Homes
- The ABCB Commissioned difficult blocks report
- The Built to Perform report by ClimateWorks

Trajectory for Low Energy Homes assessment

Table 9 (Appendix C) of Appendix C of the report included a base building typology on base building designs and modelled the capital cost upgrades for both building fabric and regulated services upgrades.

Region	Climate Zone	Capital Costs – Thermal upgrades ($)	Capital Costs – Appliance Upgrades ($)	Total Capital Costs ($)	Annual Energy Bill Savings ($)
Darwin	1	$1,356	$1,960	$3,316	$700
Brisbane	2	$7,444	$1,960	$9,404	$511
Sydney East	5	$8,168	$1,960	$10,146	$225
Adelaide	5	$5,681	$1,960	$7,641	$237
Perth	5	$5,219	$1,960	$7,179	$310
Melbourne	6	$4,443	-$702	$3,741	$141
Canberra	7	$1,652	-$702	$950	$770
Hobart	7	$4,263	$2,533	$6,796	$349

ABCB Difficult Blocks Report

The ABCB commissioned AECOM to undertake an analysis of difficult blocks in Australia, to examine characteristics and challenges of site constraints in relation to achieving NatHERS 7 Star energy efficiency.

The report broke down the difference between the additional cost to build a 7 star house on a difficult site and a 6 star house on a difficult site based on a ‘typical house’ design.

The report noted difficult blocks have characteristics such as small areas and challenging proportions, poor solar orientation (relevant to the Climate Zone) and problematic topography.

Regardless of the percentages used, more importantly, the difficult blocks report provided a detailed costs breakdown representing the difference between the additional cost to build a 7 star house and a 6 star house on a difficult site based on the following ‘typical house’ design.

The costs show that there for some blocks and house designs going to 7 stars will incur substantial additional costs in excess of $16,000 not including that capital costs for the appliance upgrades/regulated energy usage provisions.

Location	NatHERS Climate Zone	Small area and challenging proportions	Small area, challenging proportions, and poor orientation (East)	Small area, challenging proportions, and poor orientation (West)	Problematic topography
Canberra	24	+$1770	+$6160	+$1950	+$1100
Western Sydney	28	+$860	+$7450	+$9250	+$16,110
Newcastle	15	+$860	+$9540	+$11,980	+$7760
Darwin	1	N/A as both Star ratings result in a decrease in cost from the baseline	N/A as both Star ratings result in a decrease in cost from the baseline	N/A as both Star ratings result in a decrease in cost from the baseline	+$17,480
Brisbane	10	+$4120	+$930	+$7890	+$16290
Townsville	5	N/A as both Star ratings result in a decrease in cost from the baseline	N/A as both Star ratings result in a decrease in cost from the baseline	N/A as both Star ratings result in a decrease in cost from the baseline	+$4190
Adelaide	16	+$2770	+$16,780	+$11,970	+$12,690
Hobart	26	-$4160	+$2460	+$2460	+$1090
Melbourne	21	+$3980	+$2760	+$2760	+$780
Ballarat	66	+$7460	+$5520	+$760	+$2060
Perth	13	+$510	+$1140	+$560	+$170
Albany	58	+$10,220	+$6750	+$5420	+$6340

Climate Works Built to Perform Report

The CRIS as part of establishing the perceived problem notes the ASBEC/Climate Works Built to Perform report. The report which was advocating for changes to the NCC similar to the proposed Trajectory and NCC 2022 proposals.

The report noted that to include these upgrades there will be additional upfront costs for houses and apartments and the report included some indicative cost modelling on an analysis on the additional upfront costs.

The report cited the following (pg 20) additional upfront cost would be approximately:

- $6,800 for the modelled individual apartment archetype ($89 per square metre),
- $8,000 for the attached housing archetype ($63 per square metre)
- $14,000 for the detached housing archetype ($74 per square metre)

BUILDER FEEDBACK

HIA sought feedback on the houses modelled and the upgrade costs outlined in the CRIS from a range of large scale Australia volume home builders and their advice was as follows:

> *'The nine homes selected for the CRIS modelling are old in design and much smaller in area than the market currently is seeking and purchasing.*
>
> *Small homes receive great energy benefit due to NatHERS area adjustment factors and also reduced glazing areas.*
>
> *Four of the CRIS home designs are incredibly small and should be excluded from the CRIS as the costs of upgrading the small homes are not representative of a normal new homes and has skewed the results.*
>
> *We have run simulations on a different homes. Ranging from 25 to 54 sqrs, single and doubles.*
>
> *The upgrades required to go from 6 to 7 stars ranged from approx. $5500 to $12500 with the avg being $9750.*
>
> *These tests did not focus on their full range of house designs which also includes a lot larger homes, meaning the upgrades would be much higher.*
>
> *These upgrades have also just focused on the design and construction changes for the building fabric upgrades and have not included the whole of home and PVs component'*

In addition to this another large project home builder's energy provided an analysis of the upgrades required for two of their most popular homes built and the upgrades required were:

- For the 270 m^2 house the thermal upgrades from 6 to 7 stars was: $12,271
- For the 370 m^2 house the thermal upgrades from 6 to 7 stars was: $11,279.

This advice further supports the Productivity Commissions 2005 report analysis that the realised costs are likely to be much higher than modelled costs.

This feedback further supports the outcome of the case studies presented in this submission and in turn the literature review in that the costs indicated in the CRIS for the building thermal upgrades are significantly undervaluing the true cost of implementing the higher energy efficient design requirements and that these need to be adjusted in the Final RIS.

5. RESPONSES TO RIS CONSULTATION QUESTIONS

HIA's responses to **Questions 1-38** are provided below.

Question 1

Does the CRIS adequately identify and define the problem?

No

Comment:

The CRIS cites in defining the problem and why the proposals are being put forward as previous Government commitments and Trajectory reports, Scoping and Options papers. These commitments are reports identifying high level broad ranging policy objectives and not clear single and specific targets.

These commitments in of themselves do not present compelling evidence of the purpose in changing the mandate from 6 to 7 stars and whether it would actually make a meaningful or tangible difference in achieving these high level commitments, as opposed to a specific target were that to exist.

The pursuit of further discrete changes in the building fabric performance solely on the basis that the rating scheme in place has higher standards (10 stars) completely fails to align with the actual overall public policy outcome sought from the Trajectory.

In this regard it is important to understanding the NatHERS ratings, shows that the changes proposed will offer only a marginal decrease in energy consumption as opposed to improvement that was delivered by the first three benchmarks for building fabric (4, to 5, to 6 stars).

The CRIS assume that 'informational problems' and 'split incentives' and 'capital constraints' cause people to under-invest in energy efficiency measures in their new homes[21] which is primarily based on anecdotal evidence and the historical approach to regulations where none exist.

This assumption is crucial to the CRIS analysis as it goes on to assume that 7 star features create energy savings for households. The assumption is that mandating 7 star energy efficiency creates benefits for households because it means they access savings that they would have otherwise irrationally ignored.

There are a number of problems with this assumption:

- The Productivity Commission argue against this approach.
- The CRIS acknowledges and presents evidence that there is presently a high level of over compliance, therefore it is questionable what is the regulatory failure that proposal is seeking to address.
- It is argued that households do care about electricity bills (and do not suffer from "informational problems").
- The CRIS concludes these problems 'may exist' (it does not show they definitely exist). The CRIS notes the problems that would justify 7 stars features 'may' exist.

  That is, it notes informational problems, split-incentives, etc., 'may' exist. It uses this characterisation because it does not present evidence that these problems actually *do* exist.

  This assessment of the problem needs to recognise that regulations to date (20 years) have addressed the historical problem that no action was being taken by households (the market failure).

  Consumers, and the community, now have an understanding and acceptance that building regulations set an acceptable standards for energy efficiency and therefore no further personal consideration is warranted apart from those consumers seeking to build beyond regulation.

  The fact that the majority of Australian home buyers each year do not seek to build beyond

[21] ACIL-Allen pg 42/328

regulation is not of itself market failure. It is the market acting in a rational and sensible manner.

More generally, regulation must be justified. To justify regulation, the first step is establishing that problems that would be solved by the regulation *actually do exist*. If it is not demonstrated that problems *actually do exist*, then new regulation cannot be justified.

Question 2

Are there any other problems not considered by the CRIS?

Yes

Comment:

NCC 2022 proposed changes provided a real opportunity to progress a new and more truly holistic approach to residential energy efficiency standards as supported by the Trajectory for Low Energy Homes of net zero 'ready' homes.

Broadly there was support, if Governments were to seeking to improve the energy efficiency performance of homes, to move away from energy efficiency standards based on the poorly defined and understood energy efficiency 'star rating' that only address one element of both energy efficiency and emissions reduction, being the heating and cooling of a home.

It is disappointing that after all of the consultation and background work on the Trajectory for low energy homes and the ABCB Scoping Study on options for improvement, that instead of proceeding with a true 'whole of home' approach to energy efficiency standards for residential buildings.

The proposed changes have reverted to repeating the past and increasing the building fabric star ratings and requiring higher performing building services/fixed appliances with energy offsets only as a potential inclusion.

The building fabric has been required to meet a minimum performance level since 2003 and has been required to meet 6 stars since 2010 which was also when a small number of fixed household appliances were regulated in their performance. Achieving 6 stars generally requires the highest insulation levels standard that walls and roof/ceiling cavities could readily and economically take based on the common construction methods in Australia.

Most houses in moderate and colder climate zones will also require some form of double glazing. To move to 7 stars there is not much more that can be done to the building fabric through 'simple' additions – it will require a range of changes to design and significant construction changes to be achieved across all house design in each region.

A far better approach is to move away from focusing solely on the building envelop to deliver an energy and emissions reduction outcomes and to move towards a more 'whole of house' approach similar to BASIX in NSW.

While it is acknowledged that the new 'whole of home' assessment is an attempt to make this change, it fails on two accounts.

Firstly the proposed whole of home approach in the NCC 2022 proposals is not significantly different from the NCC 2019 provisions apart from applying a higher stringency for both the fabric and appliances and only available offset is for installation of solar panels for the regulated building services.

Secondly, the assessment metrics remain solely focused on energy usage as a proxy for emissions reduction, with no direct reference to emissions in the calculation methods.

Noting that the CRIS demonstrates that the costs of the proposed changes outweigh the benefits it is hoped that the ABCB will now take the opportunity to revisit the approach proposed and look at a broader range of options for the manner in which the code moves to achieve zero energy (and carbon) ready buildings.

Question 3

Does the CRIS establish a case for amending the energy efficiency provisions in the NCC??

No

Comment:

Refer response to **Question 1**.

Question 4

Does the CRIS present clear, well differentiated options for amending the NCC that can achieve the stated policy objective?

Please select all that apply

☐ The options are clear ☐ The options are well differentiated ☐ The options can achieve the stated policy objectives

☐ None of the above statements are true

Comment:

Refer response to **Question 8**.

Question 6

Are there any other feasible options to address the problems identified in the previous chapter that have not been assessed in the CRIS and should be considered?

Yes

Comment:

HIA supports greater efforts being invested in improving the energy efficiency of existing housing stock as opposed to regulations continually targeting only new buildings.

This approach would deliver a marked improvement in emissions reductions nationally as opposed to making incremental and more expensive changes to standards that already do the required heavy lifting.

The Trajectory for Low Energy Homes Report noted the following in respect to existing buildings:

- *'Existing homes represent the largest potential for energy savings in the residential building sector.'*
- *'The vast majority of Australia's housing was built before the introduction of minimum energy efficiency regulations (estimated at 8-10 million homes) for residential buildings in 2005. This means existing (pre-2005) housing will continue to pose large energy costs, health and emission issues for households, regardless of standard increases in the NCC.'*
- *Based on initial modelling…. By improving the performance of existing buildings by a relatively small amount, the energy savings and benefits roughly double.*

For example, by improving existing housing stock by just 1 per cent could deliver an additional $1.5 billion in net present value.'

These findings are compelling and supports that there would be far greater gains to be had by tackling energy efficiency upgrades for existing housing stock rather than seeking to further increase standards for our already highly efficient new houses and apartments.

Question 7

Of the options discussed in this chapter which would be the most effective at achieving the stated objectives and why?

Comment:

Refer response to **Question 8**.

Question 8

Which is your preferred option?

	Option A	Option B	Status quo	Unsure
Class 1 *Please select only one item*	○	○	○	○
Class 2 *Please select only one item*	○	○	○	○

Comment:

HIA does not support any of the options and believe that the CRIS should have considered a broader range of options as opposed to the two regulatory options based primarily on the existing star rating for the building fabric being increased to 7 stars.

The CRIS also does not provide a thorough analysis of the status quo or an enhanced status quo and has essentially dismissed any other options altogether. The CRIS acknowledges that presently there is a high level of over compliance to current energy efficiency requirements in all jurisdictions and fails to make clear a case for why mandating an increase for this aspect of the code will deliver a net benefit.

HIA has identified a range of reforms that could be progressed that would result in much lower cost impacts and build upon our current well performing energy efficiency standards.

Most of these reforms utilises much of the work both the ABCB and NatHERS Administrator have been progressing for NCC 2022 though adjusted to be aligned to current building fabric stringency for NCC 2019.

The reforms would be delivered as a package of reforms for NCC 2022 or alongside NCC 2022 and include:

1. Introduce the new whole of home/energy usage provisions (with the building fabric set at 6 stars)

2. Introduce the thermal bridging mitigation measures for both steel and timber framing to provide a true 6 star performance

3. Combine the NatHERS house rating tools and whole of house assessment tools incorporating energy usage/building services provisions, building fabric assessment, heating and cooling loads, thermal bridging and building sealing

4. Incorporate the new NatHERS climate files into the energy rating tools

5. Complete the re-write of the DTS elemental provisions, having these set at 6 star taking account of new knowledge on the current DTS design level

6. Introduce new enhanced detailed installation of insulation provisions

7. Introduce the new condensation provisions and air spaces and building wall wrap permeability requirements and undertake a broader analysis of condensation risks of higher energy efficiency standards and a full cost benefit assessment of all future changes

8. Introduce the new Universal Certificate template and associated checklists

9. Introduce the new energy assessor whole of home Cert IV training units and undertake a national training program for assessors on the new NCC energy efficiency provisions

10. Commence a review of the solar panel installation and battery storage Australian Standards and commence the development of associated NCC Deemed to Satisfy Provisions, where PVs and battery storage systems are installed in houses for future incorporation in the NCC to provide single source of truth and location for onsite installation provisions.

Question 11

Should thermal bridging in timber-framed buildings be incorporated in the analysis?

Comment:

HIA has a range of concerns with the proposed introduction of thermal bridging requirements.

This includes:

1. The variability of research on this matter
2. Suitability of solutions being put forward
3. Cost impacts of the changes on steel framing and lightweight cladding
4. Practical and buildability issues on the thermal bridging options
5. The need for thermal bridge at ceiling levels for steel framed roofs
6. Conflicting provisions with other NCC parts
7. Safety issues with the floor and roof proposed thermal bridging mitigation measures for example the options of strips over ceiling joists/framing or continuous layer of insulation are not practical or buildable solutions and create safety risks by people working in roof spaces and structural supports that they are relying on.
8. That the provisions will make the use of standard 90 mm framing extremely difficult to achieve compliance with going forward in moderate and cold climate zones and in particular Climate Zone 6
9. Applying the measures to one form of construction and material type and the impacts this will have on selection and choice of framing solution given it penalises one form of construction over others.

There has been much discussion on the effect of thermal bridging on the thermal resistance of framed building elements. As is widely known and acknowledged, thermal bridging depends on many factors and all efforts to identify, quantify and mitigate its effects have practical limitations.

HIA agrees in principle with the concept of equivalent performance, subject to recognition that:

- all methods of quantifying thermal bridging effects is imprecise;
- simplified calculation methods have limitations
- heat gains and losses in buildings depend on other factors such as convective bridging, and
- over- and under-performance of individual building elements and dwellings is inevitable, regardless of the materials and configurations used.

Placing precise bounds on “R-Value equivalence” without recognising these factors is unlikely to deliver better energy efficiency outcomes but may have the effect of reducing the structural choices available to designers and builders.

Until these matters are resolved the provisions should be held over and be fully worked through the implications and challenges, and this is relevant regardless of the framing type.

Broader implications on the proposals

The CRIS does not provide a full and complete assessment of the broader implications that the

proposed thermal bridging would have on steel framing and its impacts on that industry segment.

If a builder needs to do things in addition to meeting the building fabric requirements to mitigate thermal bridging to achieve compliance for one type of framing system over another naturally they would consider their options weigh up costs and implications. Even more so this is relevant if the requirements would mean changing standard forms of constructions and materials used i.e. no longer using 90 mm framing or needing to create cavities and different and more expensive wall wraps and insulation.

Steel framing has been gradually growing in uptake and there has also been a recent surge due to increased building activity and material supply constraints.

However, in discussions on the proposed NCC 2022 thermal bridging people are starting to re-consider their approaches as well as investment in changing systems and specifications.

This is a real and significant issue beyond technical consideration of the change and warrants detailed consideration of the broader implications prior to proceeding with the changes.

Question 12

Is it reasonable to assume that industry's response to the proposed changes will be to select the lowest cost alternatives in every case?

No

Comment:

No. The outcome from the proposed changes will be driven by a combination of consumer preferences and the relative costs the industry faces in delivering compliance mechanisms. Further, each interaction between consumer preferences and relative costs will be impacted by the local conditions and constraints. The outcomes from regulatory change are complicated. This complexity adds to costs. It is not clear that this complexity and these costs are recognised in the RIS.

As noted the Productivity Commission found in 2005 that actual costs from energy efficiency mandates were at least 3 times larger than predicted costs of energy efficiency mandates.

Question 13

How would industry most likely respond to the proposed whole-of-home changes under each of the proposed options?

Select the action that you think industry will take.

	Install what is cheapest to meet the requirements (the cheaper of more efficient appliances or PV)	Continue to install the same equipment and install PV (to meet the energy budget)	Continue to install the same equipment and improve the thermal shell	Switch to using a performance solution	Other - please explain below	Unsure
Class 1 *Please select only one item*	○	○	○	○	○	○
Class 2 *Please select only one item*	○	○	○	○	○	○

Comment:

Refer response to **Question 12**.

Question 14

How would industry most likely respond to the proposed thermal fabric changes under each of the proposed options?

This question asks about industry behaviour when altering a house design from 6-star to 7-star in situations where the proposal will require it.

	Substantially maintain existing home designs, and improve the performance of materials like insulation and windows	Change building designs – reduce window sizes	Change orientation of living rooms within the home	Switch to using a performance solution	Other - please explain below	Unsure
Class 1 *Please select only one item*	○	○	○	○	○	○
Class 2 *Please select only one item*	○	○	○	○	○	○

Comment:

See response to **Question 12**.

Question 15

In some cases, smaller windows are assumed to be used to constrain costs or achieve compliance with the proposal. Should the impact on occupant amenity be valued and how?

Yes

Comment:

The RIS notes that homes with 7-stars tend to have windows that are 15 per cent smaller than homes with 6-stars. HIA argues that it is commonly accepted that homes with a better aspect (NE facing) are more valuable than homes with poorer aspect (South facing).

This relates to the amount of natural light they receive. Further, a paper for the US Green Building Council, prepared by the University of Oregon, finds that workers in buildings with poorer ratings of light quality and with poorer views use significantly more sick leave hours. In this study, "light quality" refers to natural light quality or "daylighting." The authors introduce their study as an attempt to "place a value on windows."

The authors note the two variables (quality of natural light and quality of view) explained 6.5 per cent of the variation in sick leave use, a statistically significant result.[22] They also conclude that both of the variables, independently, significantly influence sick leave. This implies that lower natural light quality, via smaller windows, significantly increases sick leave amongst workers.

This result could be interpreted two ways. It could be that spaces with poor natural light cause people to become sick. Or it could be that people prefer to be in spaces with better natural light, and will take steps to avoid spaces with low natural light.

Both interpretations support the conclusion that smaller windows, caused by 7 stars, will create a cost for households.

[22] United States Green Building Council, Elzeyadi of University of Oregon, see: https://www.usgbc.org/sites/default/files/OR10_Daylighting%20Bias%20and%20Biophilia.pdf

Question 18

Is it practical to apply the whole-of-home proposal to refurbishments?

No

Comment:

For the reasons outlined in the CRIS itself it is impractical to apply the whole-of-home proposal to refurbishments:

The extent to which refurbishments comply with the NCC will vary by project (i.e. it is unknown what proportion of refurbishments will need to comply with the new NCC requirements and to what extent). Furthermore, at this stage it is still unclear if, and how, the proposed who requirements would apply to refurbishments.

Most existing buildings would be unable to comply with the NCC provisions, particularly given the new whole-of-home provisions assume that the building fabric is built to 7 stars which for existing homes or renovations only part on depending on the scope of works will not be the case as the star rating assessment is a whole of building rating not an individual wall or part of the building.

Given these complexities, refurbishments and renovations should be completely exempt from the proposed whole of home provisions.

Question 22

Are the assumptions used to estimate current and future penetration of solar PV in new buildings under the BAU appropriate?

	Yes	No - please state why below	Unsure
Class 1 *Please select only one item*	○	○	○
Class 2 *Please select only one item*	○	○	○

Unsure

Comment:

Australia already has one of highest uptake of solar PV in homes. It is hard to predict what the future uptake may be given there are a range of policy and behavioural instruments that would influence future uptake outside of the NCC proposals.

This includes but not limited:

- current Federal and State Government incentive, rebate and loan schemes for installing solar PV panels
- grid capacity
- current fuel/appliance preferences of homeowners
- feed in tariffs and offsets from energy companies
- proposals from the Australian Energy Market Commission to charge homeowners for putting energy back into the grid
- upfront costs
- design and construction implications for buildings (potential fire risk, structural loading, water

ingress, insurance from damage, maintenance, etc.)

- valuation of including solar PV on homes weighed up against additional upfront costs, and
- ability to offset or use as credits towards meeting broader energy efficiency requirements.

Question 26

Are the cost estimates presented in this chapter reasonable?

	Yes	No - costs are under-estimated	No - costs are over-estimated	Other	Unsure
Class 1 - Option A (Table 5.1) *Please select only one item*	○	○	○	○	○
Class 1 - Option B (Table 5.2) *Please select only one item*	○	○	○	○	○
Class 2 - Option A (Table 5.3) *Please select only one item*	○	○	○	○	○
Class 2 - Option B (Table 5.4) *Please select only one item*	○	○	○	○	○

No

Comment:

Under both Option A and Option B for both Class 1 and Class 2 buildings the cost estimates are significantly under estimated as to what would be the true and realised costs if the changes were to proceed.

Refer to Sections 3 and 4 of this submission for further details of the additional costs and the costs not accounted for.

Question 27

Are the changes in energy consumption presented in this chapter reasonable?

	Yes	No - the value of changes in energy use are under-estimated	No - the value of changes in energy use are over-estimated	Other - please explain below	Unsure
Class 1 - Option A (Table 5.9) *Please select only one item*	○	○	○	○	○
Class 1 - Option B (Table 5.10) *Please select only one item*	○	○	○	○	○
Class 2 - Option A (Table 5.11) *Please select only one item*	○	○	○	○	○
Class 2 - Option B (Table 5.12) *Please select only one item*	○	○	○	○	○

Comment:

The RIS documents evidence that actual energy consumption tends to fall by much less than modelled energy consumption. The RIS makes a minor adjustment for this (10 per cent rebound

effect).

For the 2019 RIS on energy efficiency for Commercial Buildings, The CIE reported that most submissions argued that actual energy savings would be 49 per cent to 75 per cent of modelled energy savings.[23]

Question 28

Can you provide estimates of the costs to redesign buildings and alter building products that would be incurred by industry to meet the proposed new NCC requirements?

Yes

Comment:

The CRIS notes that, for some period of time after the code is changed from 6-stars to 7-stars, the building industry will incur transition costs.

These are costs of re-training people and the cost of re-designing manufacturing processes, supply chains and building designs, building processes and the final product (new build homes) to meet the requirements.

The CRIS includes re-training costs but also seeks further data on re-design/re-calibration costs.

HIA has been provided with a range of feedback from members which indicates that the costs of re-design of buildings plans, specifications and re-calibration of costs for volume builders is a significant sunk cost both in terms of time and resources.

HIA has received feedback from a number of energy assessor that changing from 6 stars to 7 stars will involve significant redesign of dwellings and the majority of all volume home designs. In particular, window sizes, layouts and (in some cases) orientation of dwellings will have to change.

This feedback is consistent with the feedback received from a range of volume builders that changes from 6 stars to 7 stars as the benchmark requirements will result in the need for significant changes to 90-95% of all of their standard house plans.

One of Australia's largest volume builders cited that they presently have over 500 standard house plans and 95% of those plans will require changes in some form to adhere to the new requirements if approved.

This is not a straightforward change and it's not a matter of only changing or adjusting the plan in many circumstances. The changes will require:

- initial re-design
- re-assessment by an energy assessor in a variety of different orientations
- this would likely involve back and forward with the initial designer and many runs through the energy rating software (which is not expected to be operational and available till 1 September 2022)
- then it is a matter of finalizing the design
- have the revised plan to the estimator and suppliers for costings of the new (or amended) plan
- a completed plan produced
- a standard specification and materials inclusions lists developed
- a scope of works and tender documentation developed for contractors and suppliers; and
- marketing and promotional material updated.

[23] The CIE 2019, see: https://static1.squarespace.com/static/5df9aa078642f943ece6a0b3/t/5f589c857e871053b87e5a58/1599642806533/Final_RIS_Energy_efficiency_of_commercial_buildings_PDF.pdf, pg 17/252

There may also be implications for these designs on:

- current display homes and the need for the subsequent houses to be built as per the display home; and
- subdivisions for which the house designs are based off for lot yield.

Further these changes are not likely to be made until the final provisions are agreed to by Governments as it means many of the house designs would need to be scrapped and the new ones designed with the 7 star features.

For the accessibility housing RIS, The CIE estimated the additional costs of building verification, based on the similar feedback on the design and verification costs for changing house designs and additional verification and approval costs for the compliance of new builds with respect to the new regulations was around $290 million.

HIA argues the complexity of the required additional verification and design changes for the energy efficiency changes are comparable, if not more challenging, than the accessible housing provisions given the wide variety of house designs and that the design used for the block will be dependent on the orientation.

Therefore, HIA argues that similar compliance costs should be included for this RIS.

Question 29

Are there any other costs (e.g. transition costs) not identified for builders and other stakeholders in transitioning to the proposed new NCC requirements?

Yes

Comment:

See response to **Question 28**.

Question 31

Do you agree with the conclusions reached for the energy market impacts?

No

Comment:

No. The RIS documents evidence that actual energy consumption tends to fall by much less than modelled energy consumption. The RIS makes a minor adjustment for this (10 per cent rebound effect).

For the 2019 RIS on energy efficiency for Commercial Buildings, The CIE reported that most submissions argued that actual energy savings would be 49 per cent to 75 per cent of modelled energy savings.

Question 32

Are there any other assumptions or parameters that should be included in the sensitivity or breakeven analysis?

Comment:

HIA argues that various issues (insights from the literature, the difference between realised costs and modelled costs, etc.) imply that the central case requires adjustment. HIA argues that the central case overstates the net benefits of mandating 7-stars.

Question 37

Are there any other unintended consequences not described in the CRIS that are likely to arise from the proposed options?

Yes

Comment:

Increased energy efficiency standards impacts on condensation

Concern continues to be had about the impact of increased energy efficiency standards and greater sealing up of buildings and the related impact this will have on condensation and moisture build up in residential buildings.

With the proposed stringency increases in energy efficiency standards, the insulation upgrades required to meet the NCC will see wall cavities between studs in most climate zones, and in particular the colder and moderate climates, having insulation in excess of the highest R-Value permissible placed in between and depending on framing type may need additional wall wrap or rigid board insulation to achieve compliance.

For roof spaces in most situations will be a minimum of R4.0 but commonly R6.0 to achieve compliance as well as under roof insulation. This will add additional weight to plasterboard and ceiling battens as well at perimeter of building will see insulation abutting roofing or require some sort of baffles or perimeter batts – increasing complexity and materials and installation practices.

For floor and sub floor wall insulation, the energy efficiency provisions are increasing the required sub floor insulation requirements between the sub floor members and depending on climate zones introducing new requirements for sub floor wall insulation.

There is a real risk that the proposed energy efficiency stringency increases will increase condensation risk for buildings and the ability for building elements to breathe.

Technical issues with the draft provisions

HIA recently made a substantial submission to the draft NCC provisions highlighting a number of key concerns with the proposed changes in terms of their associated impacts, technical suitability and practical implications on the design and construction of new housing and apartments with respect to the following areas:

- Technical difficulties associated with proposed provisions
- Complexity of the changes
- Significant cost implications for the changes for homeowners
- Implications of the changes and corresponding thermal bridging changes
- Impact on standard building materials and construction practices
- Design implications of the changes
- Impacts on extensions and alterations
- The proposed increases exceeding the building fabric proposals in the Trajectory for low energy homes
- Construction, product and design transitional implications
- Added building envelope complexity
- A number of the provisions being incompatible creates contradictions with other parts of the NCC
- Increased condensation risk with the provisions with higher efficiency standards and increased wall, floor and ceiling/roof insulation provisions that will limit the ability for building to breathe, and cavities being packed with insulation and at capacity of space allowable
- Increased fire risk with the higher efficiency standards and increased wall, floor and

ceiling/roof insulation provisions

- Availability of products to meet the new requirements
- Additional weight on ceilings and ceiling battens in achieving increases ceiling insulation
- Added complexity for design, assessment, approval and application of the NCC provisions and ultimately compliance challenges due to the added complexity.

HIA submission to the draft NCC changes is included at **Attachment 1**.

These technical changes are being considered in parallel with the consideration of the CRIS, which makes it extremely difficult for industry to have certainty about the actual changes that will take effect in NCC 2022. These technical provisions are contingent on the decision made on this CRIS therefore it is critical that a timely decision is made on what changes will move forward in NCC 2022.

It is equally important that a transition period be applied to ensure that the industry which is preparing to sell, design and approve more than 200,000 homes each year for the next two years can have business certainty and provide customers with certainty on both the design and the price of those new homes and apartments.

Increased complexity and compliance

The provisions are becoming more complex in the way they are being drafted and it appears limited regard has been given to their practical application by builders, designers and approval authorities in their day to day application.

One only has to look at how the NCC across the code deals with sarking/wall wrap provisions and uses no less than 6 different terms and is asking this simple product to meet multiple outcomes - fire, weatherproofing, condensation and energy efficiency provisions - yet each part of the NCC is drafted differently with different criteria for this product.

What hope does a builder or tradie have when they are turning up at a hardware supplier trying to pick the right wall wrap product and its compliant installation when there is so much competing aspects of the NCC?

Whether there are even products available to meet the different parts of the NCC in one product is questionable.

A better rationalisation is needed to take the draft provisions and provide practical and clearly understandable provisions including figures and installation diagrams along with simpler calculations and solutions that can be easily applied on site.
Without the energy efficiency changes, NCC 2022 is already set to be the largest single amendment to the NCC since its inception. There are a range significant amendments beyond energy efficiency that will be introduced.

These include:

- Mandatory accessible housing provisions for all new and extensions for Class 1 buildings
- More stringent condensation management provisions
- Waterproofing provisions
- Fixing and flashing requirements
- Broad range of Australian Standards changes
- NCC restructuring changes; and
- Performance Solutions changes.

All of these changes add more complexity, stringency increases and ultimately have significant impact on affordability and viability of Class 1 projects. More importantly, each of these changes requires industry to understand, adapt and adopt the changes into their current business operations and their current building designs.

These changes need to be better rationalized and not looked at in silos as individual reforms. They

must be considered as the cumulative package of changes and an assessment of their overall impact must be made for all housing forms before the changes are implemented.

Mixed Use Class 2 buildings

The draft NCC 2022 provisions have continued to essentially apply the same approach to regulation of Class 1 buildings as it does for Class 2 buildings.

Whilst there has been new pathways added for a Class 2 building to achieve compliance, it still is developed on the basis essentially that the Class 2 building is a standalone set of low rise apartments. In reality most contemporary Class 2 buildings are built as mixed use buildings consisting of ground floor or basement carpark, first floor shops, offices, and floors above with the apartments and some buildings consisting of mix of Class 2 and Class 3 sole occupancy units. These buildings also have large communal areas with pools, gyms and outdoor/indoor areas and some instances roof top gardens/spaces.

While the NCC does cater for this with the Section J commercial buildings provisions and the associated Class 2 SOU provisions, though it is getting increasingly complex with the building façade and building services. However, there remains significant uncertainty on compliance of these buildings.

NCC 2022 presented an opportune time to review the NCC energy efficiency provisions for mixed use Class 2 buildings and develop a more streamlined and simplified Deemed-to-Satisfy path.

HIA SUBMISSION TO NCC 2022 PUBLIC COMMENT DRAFT

NCC Public Comment Draft Response Sheet

This response sheet is to be used for submitting responses to the National Construction Code (NCC) 2022 Public Comment Draft

ABCB

Your details

Name: Simon Croft

Organisation: Housing Industry Association (HIA)

Response(s)

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Condensation Provisions

Recommended change to draft:

General comment

Comment/reason for change:

Condensation challenges

The Housing Industry Association (HIA) recognises the importance of measures to address condensation risks in buildings. HIA is also concerned to ensure that other proposed NCC reforms do not result in detrimental impacts to the building and increase condensation risks and/or fire or safety risks.

The NCC 2019 condensation measures were introduced that lacked clarity and conflicted with existing parts of the NCC dealing with ventilation, exhausts, wall wrap/sarking, etc.

More importantly the provisions lacked a clear purpose in what they were seeking to address and failed to fully articulate the problem.

For NCC 2022 there remains concern that the project work has continued to progress with measures for the NCC without clearly defining the scope, purpose and problem seeking to be addressed.

The process also continues to look at the provisions in isolation of existing parts of the NCC, namely structural, weatherproofing, fire, thermal bridging and acoustics. It is noted that the condensation and energy efficiency provisions have sought to resolve some of these inconsistencies however, there remain issues such as the thermal bridging measures, roof space ventilation, etc. that appear to be overlooked.

The provisions are becoming more complex in the way they are being drafted and it appears limited regard has been given to their practical application by builders, designers and approval authorities in their day to day application.

One only has to look at how the NCC across the code deals with sarking/wall wrap provisions and uses no less than 6 different terms and is asking this simple product to meet multiple outcomes - fire, weatherproofing, condensation and energy efficiency provisions - yet each part of the NCC is drafted differently with different criteria for this product.

What hope does a builder or tradie have when they are turning up at a hardware supplier trying to pick the right wall wrap product and its compliant installation when there is so much competing aspects of the NCC?

Whether there are even products available to meet the different parts of the NCC in one product is questionable.

A better rationalisation is needed to take the draft provisions and provide practical and clearly understandable provisions including figures and installation diagrams along with simpler calculations and solutions that can be easily applied on site.

Lack of true consideration of impacts

The proposed NCC 2022 condensation changes have been progressed without any cost impact assessment being undertaken despite the significant impacts the changes will have on certain products and construction practices such as mandatory ducting of exhausts for all homes.

For example mandatory ducting, while encouraged and promoted, is not practically achievable under all circumstances i.e. laundry cupboards, centrally located toilets, kitchens, bathrooms that are built on ground floors of row houses or zero lot line houses.

To achieve compliance this proposal has impacts on a range of building features including what type of floor joists/trusses can be used and on fire rating of grills into fire rated wall systems or vents or extensive ducting and consideration of location of any steel beams.

In the ventilation and exhausting provisions, the provisions are aiming to remove damp air from buildings by ducting, make up air, and fan/exhaust performance. However, there has been little to no regard of what impact this will have for products already in the market and what transition will be applied for selling off these products.

The majority of traditional ceiling mounted exhaust fans currently sold on a daily basis across Australia will unlikely meet the new flow rates and similarly for recirculating range hoods meaning the provisions are essentially banning recirculating range hoods.

These two product categories are very large sellers in the market and a 1 year transition to move the market completely away from these products would be inadequate and significant.

The effected manufacturers and suppliers of these products should be directly consulted prior to a move to essentially ban them from use in new buildings and major renovations/extensions.

Prior to progressing and finalising NCC 2022 condensation provisions at a minimum a Preliminary Impact Assessment should be undertaken to assess true and real impacts.

Increased energy efficiency standards impacts on condensation

Concern continues to be had about the impact of increased energy efficiency standards and greater sealing up of buildings and the related impact this will have on condensation and moisture build up in residential buildings.

With the proposed stringency increases in energy efficiency standards, the insulation upgrades required to meet the NCC will see wall cavities between studs in most climate zones, and in particular the colder and moderate climates, having insulation in excess of the highest R-Value permissible placed in between and depending on framing type may need additional wall wrap or rigid board insulation to achieve compliance.

For roof spaces in most situations will be R4.0 or even up to R6.0-&7.0 to achieve compliance as well as under roof insulation. This will add additional weight to plasterboard and ceiling battens as well at perimeter of

building will see insulation abutting roofing or require some sort of baffles or perimeter batts – increasing complexity and materials and installation practices.

For floor and sub floor wall insulation, the energy efficiency provisions are increasing the required sub floor insulation requirements between the sub floor members and depending on climate zones introducing new requirements for sub floor wall insulation.

There is a real risk that this will actually increase condensation risk in sub floors and have detrimental impact on sub floor members and reducing circulation of air and ability for building elements to breathe.

Maintaining ventilation of sub floors spaces is an important component of the NCC framing provisions (Part 3.4) as are maintaining breeze paths in sub floor spaces. It is also important for visual inspection perspective to ensure no termite activity.

Hot and humid climates

The issue of condensation in buildings emerged in the cold climates of Australia, however, concerns with condensation risk and condensation build up in buildings is now being raised in all areas of Australia.

The majority of the reforms for NCC 2022 will only apply to buildings Climate Zone 4 to 8 which leaves the top half of Australia not covered by the provisions.

The analysis and work has not focussed on these regions such as south, north and central Queensland, Northern Territory and Western Australia.

Whether the same reforms are needed for these regions and what the more humid situations and condensation risk presented, needs to be considered but certainly these areas of Australia should be considered going forward.

Apartments vs houses

The condensation work has essentially focussed on houses and essentially replicated the provisions for Volume Two in Volume One to apply to apartment buildings. This is not appropriate.

The construction practices differ greatly between houses and apartments and it could be argued that the condensation and mould build up is greater problem in apartments than it is for houses that have more natural breeze paths and ventilation to an apartment building particularly a high rise apartment in central city locations that may have limited to no openable windows and centrally located bathrooms and laundries.

The provisions and associated impact assessments should be looking at apartments and houses separately as reforms for one do not necessarily work for the other and vice versa.

Further work

With these considerations in mind, there would be merit in holding over both the energy efficiency and condensation changes and undertaking a more thorough and holistic analysis, supported by a dedicated condensation RIS, for NCC 2025.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Energy Efficiency Provisions

Recommended change to draft:

1. Maintain the current the building fabric star rating as per NCC 2019
2. In place of increasing the building fabric star rating, the following enhancements to NCC 2022 energy efficiency provisions be made:
    1. Introduce the new whole of home/energy usage provisions (with the building fabric set at 6 stars)
    2. Introduce the thermal bridging mitigation measures for both steel and timber framing to provide a true 6 star performance

3. Combine the NatHERS house rating tools and whole of house assessment tools incorporating energy usage/building services provisions, building fabric assessment, heating and cooling loads, thermal bridging and building sealing
4. Incorporate the new NatHERS climate files into the energy rating tools
5. Complete the re-write of the DTS elemental provisions, having these set at 6 star taking account of new knowledge on the current DTS design level
6. Introduce new enhanced detailed installation of insulation provisions as per later comments in this submission
7. Introduce the new condensation provisions and air spaces and building wall wrap permeability requirements and undertake a broader analysis of condensation risks of higher energy efficiency standards and a full cost benefit assessment of all future changes
8. Introduce the new Universal Certificate template and associated checklists
9. Introduce the new energy assessor whole of home Cert IV training units and undertake a national training program for assessors on the new NCC energy efficiency provisions
10. Commence a review of the solar panel installation and battery storage Australian Standards and commence the development of associated NCC Deemed to Satisfy Provisions, where PVs and battery storage systems are installed in houses for future incorporation in the NCC to provide single source of truth and location for onsite installation provisions.

Comment/reason for change:
The residential building industry acknowledges the need to build environmentally responsible housing to the extent that it does not negatively impact on housing affordability and supply.

The Housing Industry Association (HIA) does not however, support the proposed NCC 2022 building fabric stringency increases and imposing additional costs and design and construction implications that would accompany the introduction of the proposed changes for all new houses and apartments and home renovations.

The Consultation RIS (CRIS) that was released alongside the NCC draft provisions concludes that the anticipated costs associated with the changes – which would effectively require new homes and apartments to meet a 7-Star NatHERS rating and meet higher standards for the energy efficiency of fixed appliances – would exceed benefits by a factor of three to one and four to one, respectively.

Overall, the CRIS confirms that this would result in a net social and economic loss to households and society of $2.366 billion under one scenario or $1.795 billion under the second scenario.

The RIS clearly demonstrated that both of regulatory options considered would result in a significant net cost to the community in the billions of dollars, and as a direct consequence increase housing costs for home buyers and renters and reduce housing affordability.

The additional home building cost, home loan costs and resulting additional stamp duty on the dwelling will affect every homeowner going forward, whether they see this set of requirements as their preferred approach to achieving reduced energy and emissions impacts as opposed to other more holistic approaches.

HIA holds the view that the RIS significantly undervalues the true cost of implementing minimum requirements for higher energy efficient design.

Costs relating to house redesign, internal layout changes and compromising internal room configurations, structural building changes and the specification of current industry standard building materials and products, are underestimated.

The draft NCC technical provisions contain numerous issues that must be addressed if changes are to proceed in this form.

The resolution of these issues will have significant influence over final house designs and the products and materials that will need to be specified in the future.

Adapting allotment sizes, site conditions, designs, specifications and costings to meet the changes requires a significantly longer lead-in time. Client engagement, awareness and marketing time lines add to the challenges.

HIA recently completed a national seminar series on the public comment draft with over 1,000 attendees. HIA has also been directly engaging with a range of building product manufacturers and suppliers that will be significantly affected by these changes.

Subsequent feedback from designers, builders and manufacturers reinforces the above and highlights the substantial impact these changes will have on their businesses'.

Summary of impacts of the changes

As noted HIA is not supportive of increasing the building fabric stringency to 7 stars and further detail on these issues are outlined in the specific comments on the draft changes which highlight the following technical and practical implications:

- Technical difficulties associated with proposed provisions
- Significant cost implications for the changes for homeowners
- Implications of the changes and corresponding thermal bridging changes
- Impact on standing building materials and construction practices
- Design implications of the changes
- Impacts on extensions and alterations
- The proposed increases exceeding the building fabric proposals in the Trajectory for low energy homes
- Construction, product and design transitional implications
- Added building envelope complexity
- A number of the provisions being incompatible creates contradictions with other parts of the NCC
- Increased condensation risk with the provisions with higher efficiency standards and increased wall, floor and ceiling/roof insulation provisions that will limit the ability for building to breathe, and cavities being packed with insulation and at capacity of space allowable
- Increased fire risk with the higher efficiency standards and increased wall, floor and ceiling/roof insulation provisions
- Availability of products to meet the new requirements
- Additional weight on ceilings and ceiling battens in achieving increases ceiling insulation
- Added complexity for design, assessment, approval and application of the NCC provisions and ultimately compliance challenges due to the added complexity.

Further details on these issues are set out below.

Further stringency on the building fabric and Star Rating Increase

NCC 2022 proposed changes provided a real opportunity to progress a new and more truly holistic approach to residential energy efficiency standards as supported by the Trajectory for Low Energy Homes of net zero 'ready' homes and move away from energy efficiency standards being set based on the poorly defined and understood energy efficiency 'star rating' that only address one element of both energy efficiency and emissions reduction.

It is disappointing that after all of the consultation and background work on the Trajectory for low energy homes and the ABCB Scoping Study, that instead of proceeding with a true whole of home approach to energy efficiency standards for residential buildings the proposed changes have reverted to just increasing building fabric star ratings and requiring higher performing building services/fixed appliances with energy offsets only a potential inclusion.

The building fabric is already meeting 6 stars and generally requires the highest insulation levels standard wall, roof/ceiling cavities could readily and economically take based on the common construction methods in Australia.

Most houses in moderate and colder climate zones will also require some form of double glazing. To move to 7 stars there is not much more that can be done to the building fabric through 'simple' additions – it will require

a range of changes to design and significant construction changes to be achieved across all house design in each region.

A far better approach is to move away from focusing solely on the building envelop to deliver an energy and emissions reduction outcomes and to move towards a more “whole of house” approach similar to BASIX in NSW.

While it is acknowledged that the new ‘whole of home’ assessment is an attempt to make this change, it fails on two accounts.

Firstly the proposed whole of home approach in the NCC 2022 proposals is not significantly different from the NCC 2019 provisions apart from applying a higher stringency for both the fabric and appliances and only available offset is for installation of solar panels for the regulated building services.

Secondly, the assessment metrics remain solely focused on energy usage as a proxy for emissions reduction, with no direct reference to emissions in the calculation methods.

Noting that the CRIS demonstrates that the costs of the proposed changes outweigh the benefits it is hoped that the ABCB will now take the opportunity to revisit the approach proposed and look at a broader range of options for the manner in which the code moves to achieve zero energy (and carbon) ready buildings.

Design Impacts Changes for 7 Star Homes and Apartments

Moving to 7 stars will be a serious issue and the documentation on the NCC changes, case studies and the CRIS all under estimates how hard that is actually going to be for the industry if all houses and apartments in all climate zones of Australia are going to be required to meet 7 star standard.

Achieving 5 stars was generally achieved with insulation upgrades for most houses which is an affordable and practical upgrade for the standard home design and construction methods used Australia at that time.

Moving to 6 stars required the highest insulation levels to be used in the standard wall, roof/ceiling cavities but was achievable with most houses in moderate and colder climate zones also required to use some form of higher performing window glazing.

What is never discussed is that with the dozen or so software updates over the last 10 years and other changes in the NatHERS protocols a home that was 6.0 stars in 2011 certainly is not 6.0 stars in 2021, it is more likely to be 5.5 stars.

There have been multiple unregulated software updates throughout that 10 year period where every single rating reduced by 0.1 stars. Now to achieve 6 stars a high majority of houses require double glazing apart from the smallest single storey designs.

Achieving 7 star building fabric will be all about design as when you have upgraded all insulation to maximums and double glazed all windows and glazed doors, your only option is to change window specification (size) and change the house design. The availability of products to achieve the 7 stars without significant design change will be extremely challenging.

Member experiences on projects where they have designed 7 star homes using the current NatHERS tools, including volume builders, shows they reach the same conclusion - that the increase in price due to design changes and upgraded construction is too expensive for the customer to remain interested enough in this improved outcome to pay for the additional costs.

Complex designs - Designs that are having trouble with 6 Stars

There are many standard houses designs that all already struggling to achieve 6 star design and if 7 stars is introduced those house designs would need to be scrapped or may be limited to construction on certain orientations only.

This issue is not limited to volume or project homes and has a large, if not larger impact on custom built homes.

This was further demonstrated by a recent ABCB commissioned study into difficult blocks that presently struggle to meet 6 star standards and subsequently how they would meet 7 stars if changes were to proceed.

Some of the observations from the report were:

- that the Typical Houses in colder climates required significant upgrades under each difficult block scenario (with high performance double, thermally broken, argon filled, high solar gain, low e glazing required).
- specifications and upgrades required for sub optimal house designs result in an increase in cost can be observed ranging from 5 to 25%

These challenges are not limited to project homes and equally affect custom designed houses which home owners have a specific house design in mind and willing to pay for this outcome often struggle with 6 stars. Most of these designs would never achieve 7 stars no matter what insulation and glazing specification was thrown at them.

The only solution in these scenarios is for the architects to engage the energy rater immediately at concept stage and change the way they design. All houses will start looking the same, squares or rectangles with no courtyards or return walls to limit exposed walls to atmosphere.

The days of large expanses of windows will be completely gone as the window to floor area ratio will need to come back to around 22% as we simply don't have window specification in the country that will allow for large windows in a custom design and still achieve 7 stars.

Further to this the sample houses they have used for the cost benefit analysis of 7 stars case studies used for the CRIS are not representative examples of homes and apartments built, or are choosing optimal orientations and situations on these case studies, as opposed to the real world challenges faced on house sites and design issues.

For apartments, the issues are equally challenging to achieve a 7 star average across the apartment building. The window to floor area ratio and therefore window/glass performance levels would add excessive costs and design challenges.

Changing over to larger sections of cladding in lieu of window/glazed facades is not likely to be a desirable outcome for apartment owners due to consumer preferences for natural light, views and overall amenity and liveability.

The CRIS case studies for apartments also need a much broader representation of case studies and examples to ascertain the real world challenges and costs.

Ability to adequately review and comment on the NCC 2022 changes

The ability of industry to provide a comprehensive analysis of the NCC 2022 proposed changes to the 7 star standard proposals has not been possible due to the need for accessing the future NatHERS tools and only one of these (the least commonly used tool) being available during public comment that incorporated the updated climate files and other features required to test compliance with the proposed NCC 2022 proposals.

It is noted that there has been demonstrations and case studies available, however, for industry to be able to truly assess the real world implications of the proposals, they should be able to access to the 4 accredited NatHERS tools in some way, and that each of these have all the necessary features and functions and correct climate file settings and whole of home features.

Further to this, there should be the ability to have much longer consultation period so they are able to assess a range of building designs and projects with the fully functioning ratings tools and be able to get a broad understanding of the impacts of 6 vs 7 star homes, and the energy usage provisions.

Reviewing and commentating on the changes to the star ratings, has historically been extremely challenging to do and to gauge the true impacts of changes.

This is like no other part to the NCC where changes are proposed as there are not clearly prescribed changes given the high use of simulation assessments and the truly known impacts are only realised when the final accredited assessment tools and trained energy assessors are able to undertake proper assessments against real world house projects.

This aspect of the system remain a significant flaw and once again is placing industry and governments in an inappropriate and invidious position that the true and transparent outcomes of these changes are in fact unclear.

Reliance is placed on a small number of consultants to assure all parties that the outcomes will be what is predicted – genuine testing and comparison is essentially impossible.

Differences in approach from the Trajectory

It is important to note that the Trajectory for Low energy buildings, which industry was broadly supportive of the principles, did not recommend a 7 star stringency increase across all jurisdictions/climate zones. Rather it proposed between 6.5 and 7 in the colder climate zones 6, 7 and 8.

For the other climate zones it recommended 6.5 in climate zones 1 and 5, and 6 stars in climate zones 2, 3 and 4.

The Trajectory recommendations for Class 1 buildings were:

Findings from the various options modelled indicate for new Class 1 dwellings to be built to at least:

• Between 6.5 and 7.0 NatHERS stars equivalent in NCC climates 6, 7 and 8;

• 6.5 stars equivalent in NCC climates 1 and 5;

• Up to 6 stars equivalent in NCC Climates 2, 3 and 4

(noting many homes in these climates currently have credits available to build below 6 stars); and

• Total combined energy usage budget for the building and services of 115MJ/m2 equivalent.

The Trajectory recommendations for Class 2 and Class 4 buildings were:

• 7 star average and 5.5 star minimum in NCC climates 7 and 8;

• 6.5 star average and 5.5 star minimum in NCC climates 1, 4, 5 and 6;

• 6 star average and 5 star minimum in NCC climates 2 and 3.

Unfortunately the Consultation RIS and the draft NCC provisions has not assessed these recommendations and the NCC provisions have proposed an alternative approach using 7 star average across all climate zones.

Much of the concerns and issues raised above would still exist with the trajectory settings, however, if Governments proceed with NCC changes a more pragmatic approach would be to align the NCC provisions with the agreed recommendations for the thermal fabric settings being tailored for each climate zone as set out and agreed to in the Trajectory.

Broader implications for Class 1 buildings

NCC 2022 is likely to be the largest single amendment to the NCC and there are a range significant amendments beyond energy efficiency that will be introduced.

These include:

- Mandatory accessible housing provisions for all new and extensions for Class 1 buildings
- More stringent condensation management provisions
- Waterproofing provisions
- Fixing and flashing requirements
- Broad range of Australian Standards changes
- NCC restructuring changes; and
- Performance Solutions changes.

All of these provisions add more complexity, stringency increases and ultimately have significant impact on affordability and viability of Class 1 projects.

These changes need to better rationalized and not looked at in silos as individual reforms. They must be considered as the cumulative package of changes and an assessment of their overall impact be made for all housing forms.

Broader implications for Class 2 buildings

Most new Class 2 buildings are constructed as mixed use buildings and the building and manufacturing sector are still adapting to the substantive changes made under NCC 2019 Section J. Many of the changes are only coming online to projects now and their substantive impacts on design and material selection are yet to be well understood.

As such prior to progressing further energy efficiency changes to both the individual apartments building fabric and higher building services (energy usage) provisions, for Class 2 buildings, the NCC 2019 Section J changes should be given further time to be embedded into construction and materials and designs.

Furthermore, there are other significant changes being proposed for Class 2 buildings under NCC 2022 which follow significant fire safety and other changes made for Class 2 buildings in NCC 2019 (including mandatory sprinkler provisions and aforementioned Section J changes in NCC 2019 for Class 2 buildings).

These include:

- Mandatory accessible housing provisions for all Class 2 buildings
- Significant more stringent waterproofing and weatherproofing provisions
- Further fire safety provisions changes and restrictions
- More stringent condensation changes
- EV charging future proofing and solar ready zones

All of these provisions add more complexity, stringency increases and ultimately have significant impact on affordability and viability of Class 2 apartment projects.

These changes need to better rationalized and not be looked at in silos or individual reforms but look at the cumulative impacts of these changes. If they are proceed they should be staged for introduction and preferable not commence until 2025.

Low cost package of reforms that could achieve same benefit without the significant disruption and costs

HIA has identified a range of reforms that could be progressed that would result in much lower cost impacts and build upon our current well performing energy efficiency standards.

Most of these reforms utilises much of the work both the ABCB and NatHERS Administrator have been progressing for NCC 2022 though adjusted to be aligned to current building fabric stringency for NCC 2019.

The reforms would be delivered as a package of reforms for NCC 2022 or alongside NCC 2022 and include:

1. Introduce the new whole of home/energy usage provisions (with the building fabric set at 6 stars)
2. Introduce the thermal bridging mitigation measures for both steel and timber framing to provide a true 6 star performance
3. Combine the NatHERS house rating tools and whole of house assessment tools incorporating energy usage/building services provisions, building fabric assessment, heating and cooling loads, thermal bridging and building sealing
4. Incorporate the new NatHERS climate files into the energy rating tools
5. Complete the re-write of the DTS elemental provisions, having these set at 6 star taking account of new knowledge on the current DTS design level
6. Introduce new enhanced detailed installation of insulation provisions as per later comments in this submission
7. Introduce the new condensation provisions and air spaces and building wall wrap permeability requirements and undertake a broader analysis of condensation risks of higher energy efficiency standards and a full cost benefit assessment of all future changes
8. Introduce the new Universal Certificate template and associated checklists

9. Introduce the new energy assessor whole of home Cert IV training units and undertake a national training program for assessors on the new NCC energy efficiency provisions
10. Commence a review of the solar panel installation and battery storage Australian Standards and commence the development of associated NCC Deemed to Satisfy Provisions, where PVs and battery storage systems are installed in houses for future incorporation in the NCC to provide single source of truth and location for onsite installation provisions.

Greater advantage in emissions reduction for improving performance of existing homes

HIA supports greater efforts being invested in improving the energy efficiency of existing housing stock as opposed to regulations continually targeting only new buildings. This approach would deliver a marked improvement in emissions reductions nationally as opposed to making incremental and more expensive changes to standards that already do the required heavy lifting.

The Trajectory for Low Energy Homes Report noted the following in respect to existing buildings:

- *'Existing homes represent the largest potential for energy savings in the residential building sector.'*
- *'The vast majority of Australia's housing was built before the introduction of minimum energy efficiency regulations (estimated at 8-10 million homes) for residential buildings in 2005. This means existing (pre-2005) housing will continue to pose large energy costs, health and emission issues for households, regardless of standard increases in the NCC.'*
- *Based on initial modelling…. By improving the performance of existing buildings by a relatively small amount, the energy savings and benefits roughly double.*
  For example, by improving existing housing stock by just 1 per cent could deliver an additional $1.5 billion in net present value.'

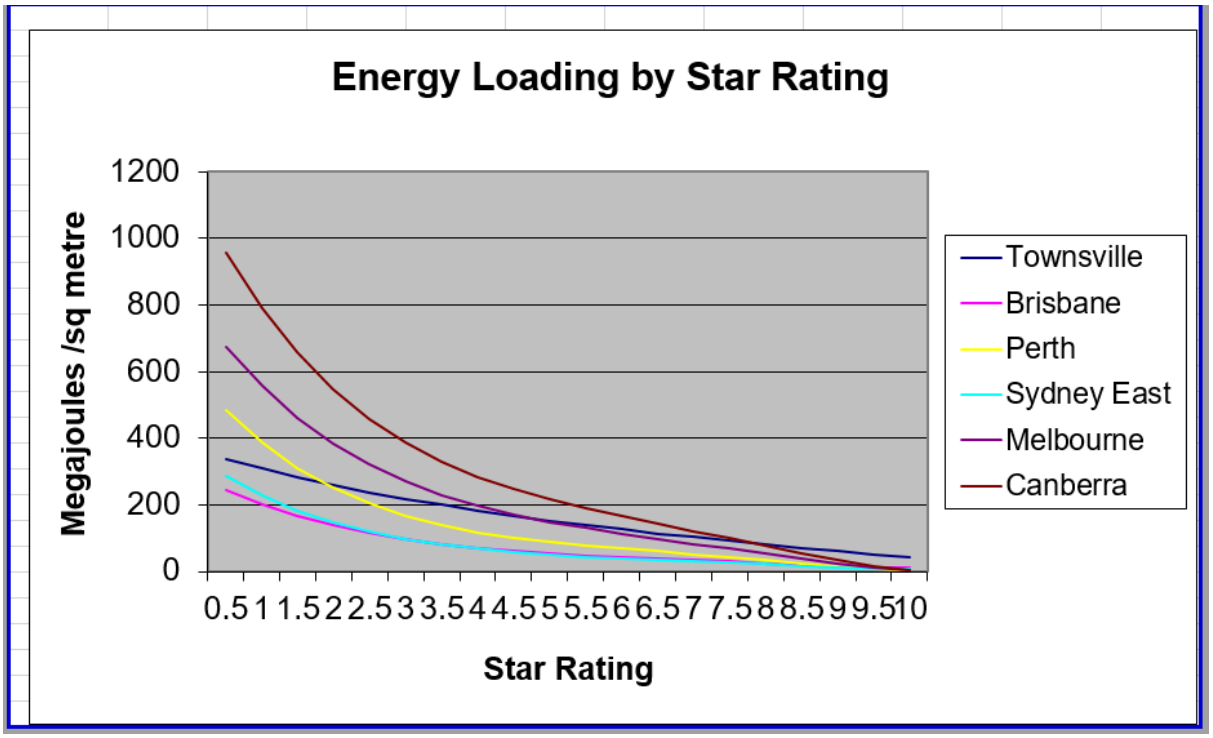
These findings are compelling and supports that there would be far greater gains to be had by tackling energy efficiency upgrades for existing housing stock rather than seeking to further increase standards for our already highly efficient new houses and apartments.

Understanding true meaning of NatHERS 'star' rating

The pursuit of further discrete changes in the building fabric performance solely on the basis that the rating scheme in place has higher standards (10 stars) completely fails to align with the actual overall public policy outcome sought from the Trajectory.

In this regard it is important to understanding the NatHERS ratings, shows that the changes proposed will offer only a marginal decrease in energy consumption as opposed to improvement that was delivered by the first three benchmarks for building fabric (4, to 5, to 6 stars).

This is depicted in the following chart and associated graph (based on climate zone and region) which shows the diminishing return on energy savings as the star ratings increase beyond the initial 4 and 5 star benchmarks introduced:



Region	Climate region Location	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Region 1
1	Darwin	853	773	706	648	598	555	516	480	446	413	381	349	317	285	253	222	192	164	140	119	2
2	Port Hedland	643	569	507	455	411	373	340	310	284	260	237	215	194	172	151	131	111	93	76	62	3
3	Longreach	654	550	465	396	340	294	257	226	200	178	159	141	124	107	90	74	58	43	29	18	4
4	Carnarvon	209	181	157	137	120	105	93	82	73	66	59	53	47	41	36	31	27	22	18	14	5
5	Townsville	337	309	283	259	238	218	200	183	168	153	140	127	114	103	92	81	71	61	52	44	6
6	Alice Springs	681	562	464	385	321	269	228	196	170	148	130	113	99	84	70	56	43	29	17	7	7
7	Rockhampton	344	295	255	222	194	171	152	136	122	110	99	90	80	71	63	54	46	38	31	24	8
8	Moree	597	481	388	315	258	214	180	155	135	119	106	94	83	71	60	47	35	24	14	7	9
9	Amberley	407	334	275	226	187	157	132	113	97	85	75	67	59	52	45	38	31	24	18	12	10
10	Brisbane	245	203	167	139	116	97	83	71	62	55	48	43	38	34	30	25	21	17	13	10	11
11	Coffs Harbour	286	232	188	153	125	103	86	73	63	55	49	44	39	34	29	24	19	15	11	7	12
12	Geraldton	349	285	233	191	158	132	112	96	83	73	64	57	50	43	36	29	22	16	10	5	13
13	Perth	483	387	311	251	204	167	139	118	102	89	79	70	61	52	44	34	25	17	9	4	14
14	Armidale	801	661	545	451	375	314	266	227	195	169	147	128	110	93	76	60	43	27	13	1	15
15	Williamtown	429	349	284	232	191	159	133	114	98	86	76	67	58	50	42	34	26	19	12	6	16
16	Adelaide	584	480	394	325	270	227	192	165	143	125	109	96	83	70	58	46	33	22	11	3	17
17	Sydney East	286	230	184	148	120	98	81	68	58	50	44	39	35	30	26	22	17	13	9	6	18
18	Nowra	517	423	346	284	235	195	164	140	121	105	92	81	70	60	50	40	30	20	12	5	19
19	Charleville	525	434	359	298	249	209	177	151	131	114	100	87	76	66	56	45	35	26	17	9	20
20	Wagga	804	663	548	455	380	321	273	235	204	178	156	137	118	100	82	64	47	30	15	3	21
21	Melbourne	676	559	462	384	321	271	230	198	171	149	131	114	98	83	68	54	39	25	13	2	22
22	East Sale	791	653	541	449	376	317	269	231	201	175	153	133	115	98	80	63	46	30	15	2	23
23	Launceston	895	740	615	513	431	366	314	272	237	208	183	160	138	117	95	74	53	33	15	1	24
24	Canberra	957	792	657	547	458	387	330	284	247	216	189	165	142	120	99	77	56	35	17	2	25
25	Cabramurra	1666	1404	1188	1012	870	753	658	580	513	454	401	352	303	255	208	160	114	71	33	1	26
26	Hobart	876	723	598	498	417	354	303	262	229	202	177	155	134	113	92	71	51	31	14	0	27
27	Mildura	660	541	444	367	305	256	218	187	163	143	126	110	96	81	67	53	38	25	13	3	28
28	Richmond	555	450	365	298	245	203	171	146	127	112	99	87	77	66	55	44	34	23	14	7	29
29	Weipa	830	743	671	611	560	517	479	445	414	384	355	326	296	266	237	207	179	153	130	111	30
30	Wyndham	1229	1071	943	839	754	685	626	576	530	488	447	406	364	321	278	234	192	154	121	95	

Further it's also important to note that:

- A 10 star house is not a net zero energy house.
- A 10 star house is not a net zero (and carbon ready) house.
- A 10 star house is only a home which requires no mechanical heating and cooling.

There is no basis or rationale in the NatHERS assessment that achieves a net zero outcome.

Such an outcome can only ever be delivered through a complete reform of what we are measuring and the way we are combining the potential tools that can deliver this outcome.

The expected out can be achieved with:

- a good performing building fabric (to reduce heating and cooling);
- high performing fixed appliances primarily managed by market measures such as MEPS and GEMS but with minimum installation benchmarks for new buildings as per the NCC today;
- a comprehensive assessment of the buildings energy consumption from fix and unfixed appliances (fridges, TVs, etc.) to formulate a 'whole of house' energy assessment and
- appropriate renewable energy methods to offset the total energy use – whether in individual homes or via community based offsets.

To achieve this outcome, the approach to energy efficiency in the NCC needed to fundamentally change. Simply moving the dial up one star is not the right solution.

The proposed 2022 package of reforms has the scope to begin this change, but for a range of reasons it will not deliver the change needed or expected. This reality is evidenced by the CRIS which confirms that simply shifting benchmarks on what we already have does not achieve the benefits expected, but does come with more costs.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Energy Usage Provisions

Recommended change to draft:

General comments

Comment/reason for change:

- The tables included in the Whole-of-home Efficiency Factors document do not differentiate between the same water heater technologies with significantly different performance characteristics
- It is disappointing that storage gas water heaters have not been represented fairly in both the Efficiency Factors document and the ABCB Whole of Home calculator.
- 5 star gas storage water heaters have the same energy consumption profile as 5 star gas instantaneous gas water heaters, yet the Whole of Home calculator indicates that storage water heaters underperform their instantaneous equivalents.
- It is considered that the whole of home calculation is likely to see an increase in demand for heat pump water heaters (HPWH), however existing regulations surrounding heat pump performance (the Clean Energy Regulator's TRNSYS modelling) are not watertight. For example, a heat pump product can be designed to theoretically meet the TRNSYS model's heating loads in cold weather, however anecdotal feedback from the field is that some HPWHs do not provide the same outcome in real life, often at the expense of consumer amenity
- Whilst supportive of the whole of home approach, HIA questions whether the "societal cost of energy" (SCoE) metric that is used to drive the energy calculation is appropriate. It is understood that an assumed carbon price of $12 per tonne has been used, however unaware that that the Australian Government had agreed a price for carbon, nor is it clear as with regards to the weighting that this component has in calculating the overall SCoE.
- HIA is concerned that the proposed update frequency for the energy factors used in Volume Two is insufficient given that some will be 3 years out of date by their time of publication.
- There is concern on the added complexity to this change and how the regulated services will be interpreted and applied in practice with energy assessors making the choices as part of their assessment and default selections made.
- Many of the decisions on hot water and heating appliances in made interactively throughout a project with home owners and factor into construction costs and evolve as project progresses. This will no longer be able to occur and will require far greater upfront design and selections.

- There is concern of introducing the provision of installation of PV panels on roofs without appropriate design and installation standards and available orientation, roof space/roof design, weatherproofing, structural loading and maintenance and fire safety provisions.
- It is also unclear how the energy usage provisions would apply to renovation and extension projects when it is making assessment against the whole building and that the building fabric is set at 7 stars.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Energy Usage Provisions

Recommended change to draft:

General Comment

Comment/reason for change:
HIA has had a number of conversations with representatives from the gas industry, and they have expressed their significant concerns over the impacts the proposed changes will have on the viability of the gas sector going forward...

HIA supports the concerns of the gas industry and believe that any future NCC changes should not seek to provide an advantage to one technology/energy source over another.

Homeowners would also be effected by any such changes where they may seek to use gas instantaneous hot water, gas for their air-conditioning units and gas cooktops.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Thermal Bridging

Recommended change to draft:

General comment

Comment/reason for change:
HIA has a range of concerns with the proposed introduction of thermal bridging requirements.
This includes –

1. The variability of research on this matter
2. Suitability of solutions being put forward
3. Cost impacts of the changes on steel framing and lightweight cladding
4. Practical and buildability issues on the thermal bridging options
5. The need for thermal bridge at ceiling levels for steel framed roofs
6. Conflicting provisions with other NCC parts
7. Safety issues with the floor and roof proposed thermal bridging mitigation measures for example the options of strips over ceiling joists/framing or continuous layer of insulation are not practical or build able solutions and create safety risks by people working in roof spaces and structural supports that they are relying on.
8. That the provisions will make the use of standard 90 mm framing extremely difficult to achieve compliance with going forward in moderate and cold climate zones and in particular Climate Zone 6
9. Applying the measures to one form of construction and material type and the impacts this will have on selection and choice of framing solution given it penalises one form of construction over others.

There has been much discussion on the effect of thermal bridging on the thermal resistance of framed building elements. As is widely known and acknowledged, thermal bridging depends on many factors and all efforts to identify, quantify and mitigate its effects have practical limitations.

HIA agrees in principle with the concept of equivalent performance, subject to recognition that:

- all methods of quantifying thermal bridging effects is imprecise;

- simplified calculation methods have limitations
- heat gains and losses in buildings depend on other factors such as convective bridging, and
- over- and under-performance of individual building elements and dwellings is inevitable, regardless of the materials and configurations used.

Placing precise bounds on "R-Value equivalence" without recognising these factors is unlikely to deliver better energy efficiency outcomes but may have the effect of reducing the structural choices available to designers and builders.

Further detailed comments on the technical matters outlined above are included in this submission against the relevant clauses and further comments on the broader impact the changes will have will be provided in response to the CRIS.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: EV Charging Future Proofing and Solar Ready Zones

Recommended change to draft:

1. Hold over changes and give further consideration for NCC 2025
2. Produce an ABCB Handbook that provides information and design option for future proofing Class 2-9 buildings with EV charging infrastructure, battery storage systems and solar ready zones to encourage further voluntary uptake and promote further market demand for these inclusions prior to progressing with regulation.

Comment/reason for change:

Electric vehicles (EVs) presently account for a small fraction of Australia's passenger vehicle fleet.

While it is acknowledged through a range of policy and other mechanisms that there is likely to be a greater uptake in electric vehicles over the next decade, however, it is considered that it is premature to require all Class 2 buildings to require the future proofing measures at this time based on a range of assumptions.

A core part of the NCC provisions is about minimum necessary regulation and to address a demonstrated need and that there are no other non-regulatory solutions available and therefore regulatory intervention being a last resort.

While it is acknowledged these provisions are about 'future proofing' for the potential for this infrastructure to be fitted in future, and to avoid potentially costs retrofitting where it is required for the building post the completion and years down the track if and when there is significantly greater uptake of electrical vehicles.

However, the current proposals are making a number of assumptions on demand and jumping straight to a regulatory solution without progressing this firstly through non-regulatory means and incentivising and increasing market demand and improved knowledge for choice.

The apartment market is very much a demand driven market, and if apartment owners are seeking specific inclusions when they are looking at purchasing new apartments they will make choices based on their specific needs. If this becomes a high demand item, the developers and builders of apartments will respond with providing the inclusions that they seek.

The additional costs for the EV charging future proofing as stated in the PIA is an average of approx. $400 per car parking space and if that is factored across the entire apartment building that is a significant additional expensive on all apartment owners regardless of whether they will ever want or use the EV charging infrastructure.

There are other significant changes being proposed for Class 2 buildings for NCC 2022 and follows significant fire safety and other changes for Class 2 buildings in NCC 2019 (including mandatory sprinkler provisions and aforementioned Section J changes in NCC 2019 for Class 2 buildings).

These include:

- Mandatory accessible housing provisions for all Class 2 buildings
- Significant more stringent waterproofing and weatherproofing provisions

- Further fire safety provisions changes and restrictions
- More stringent condensation changes
- Significant energy efficiency stringency increases and energy usage provisions.

All of these provisions add more complexity, stringency increases and ultimately have significant impact on affordability and viability of Class 2 apartment projects.
These changes need to better rationalized and not be looked at in silos or individual reforms but considered in light of the cumulative impacts of these changes.

As such it is recommended that the EV charging infrastructure proposals and solar ready zones, be held over for further consideration for NCC 2025 alongside the next proposed changes for commercial buildings arising from the Trajectory proposals.

Over the interim period the ABCB could produce an ABCB Handbook that provides information including design options, structural loading and fire safety considerations for future proofing Class 2-9 buildings with EV charging infrastructure, battery storage systems and solar ready zones to encourage further voluntary uptake and promote further market demand for these inclusions prior to progressing with regulation.

This would also provide further time to look at the fire safety risks and additional structural loading and design implications that have been raised and concerns on the different challenges these would present.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H4P7 & F8P1

Recommended change to draft:

Revise the Performance Requirement to—

(a) be less qualitative and provide more quantified values
(b) subject to (a) the Performance Requirement should be broken down to provide better linkages to the relevant aspects of the condensation DTS Provisions namely:
    (i) wall sarking permeance
    (ii) roof space air spaces and ventilation
    (iii) ventilation and ducting
    (iv) exhaust/fans performance

Comment/reason for change:

Whilst it is acknowledged that, H4P7 (F8P1 Volume One) the relevant condensation management Performance Requirement is not proposed to be changed for NCC 2022, it is considered that the current Performance Requirement is highly qualitative and lacks appropriate detail.

By having such a qualitative Performance Requirement and also given that it provides little to no linkages to the corresponding DTS Provisions, it makes undertaking Performance Solutions relating to the condensation provisions very difficult for practitioners and approval authorities to consider, formulate and accept solutions.

It also increases the risk of inconsistent and variable solutions as there is not established benchmarks or metrics to develop the solution against as to what an acceptance criteria would be and would be up to the individuals own opinions.

In reality the relevant Performance Solutions related to condensation will be minor DTS variations but how that would relate to the Performance Requirement as drafted is unclear.

Yes this could be done through guidance or case studies, but given all the efforts the ABCB is going to quantify the NCC Performance Requirements that newly introduces Performance Requirements should be incorporated that are quantified as far as practical.

These comments were also provided to the NCC 2019 drafting of this Performance Requirement, and it was hoped through the Stage 2 work that this would've been addressed and goes to the heart of what the NCC is seeking to address related to condensation in buildings but is yet to be clearly defined.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H4V5 & F8V1

Recommended change to draft:

1. Confirm that the AIRAH DA07 document complies with ABCB Protocol for referenced documents OR include the relevant sections called up in the in H4V5 within NCC itself as opposed to included further referenced documents when only specific clauses or sections are being referenced
2. Confirm/provide information on how it can be verified in practice on the criteria of 'from the 5th year after construction onwards'

Comment/reason for change:

Refer to comment on recommended change to draft.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6O1, H6F1, J1O1, J1F1

Recommended change to draft:

Do not include H6O1(d) and J6O1(d), H6F1(d) and J1F1(d) and await the further ABCB work on building resilience project

Comment/reason for change:
Don't believe it is appropriate at this time to include information in a subtle sub-clause to an Objective on building resilience and should await broader discussions on this topic.
If the NCC was to go there, why is this Objective not in the structural section for resisting cyclones and high wind events, bushfire section for bushfire resistance, water ingress resistance section, etc.

Does it not also open the door to criticism of whether NCC can actually deliver on these matters such as black outs which is far beyond control of NCC and individual building.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6P1

Recommended change to draft:

Do not include the new Performance Requirement H6P1 and maintain the drafting of the building fabric Performance Requirement P2.6.1 from NCC 2019

Comment/reason for change:
HIA continues to hold reservations on the complexity and suitability of the new proposed building fabric Performance Requirement as it relates to Class 1 buildings.

Most Performance Solutions for Class 1 buildings would only relate to small DTS variations for example going forward using the ISO thermal bridging standard as opposed to the NZS standard.

How this new Performance Requirement would apply to those types of Performance Solutions and be able to verify, formulated, criteria, etc. it is not clear.

Whilst the current the drafting of the building fabric Performance Requirement P2.6.1 from NCC 2019, is somewhat qualitative in nature, it is considered to have a more direct relationship/linkages to the corresponding DTS Provisions and simpler and clearer for the potential development of Performance Solutions for Class 1 buildings to the various aspects of the DTS Provisions as opposed to a first principle holistic Performance Solution which would be extremely rare for houses.

If the PR proceeds as drafted case studies on developing and documenting those types of Performance Solutions is needed.

If the PR does proceed an application box should be included to note that assessment of both heating and cooling loads is not required in all climate zones.

Noting that the Performance Requirement only applies to the loads of habitable rooms only it should be made clearer as most assessments have generally been based on the floor area of the building as opposed to only the habitable rooms.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6V2

Recommended change to draft:

1. Provide further information and report on the proposed changes to H6V2 to aid consideration particularly given there was a raft of changes in NCC 2019 on this Verification Method and it is now proposed a range of new elements to the method
2. If changes proceed, the NCC should provide worked examples/case studies of applying the revised verification using reference building method and new inputs and modelling requirements

Comment/reason for change:

1. It is important to note that BCC nor the residential working group were provided with the draft changes for H6V2 prior to inclusion in the public comment draft or the report to accompany the changes. Prior to discussing suitability of proposed changes BCC and the residential working group should be given the opportunity to review and comment on the report.
2. Notwithstanding comment 1, if changes proceed for H6V2, the NCC should provide worked examples/case studies of applying the revised verification using reference building method and new inputs and modelling requirements

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NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6V2(2)(v)(iii), (v)(iv)

Recommended change to draft:

Clarify why cooking equipment and appliances are being regulated in the Verification Method, when the NCC doesn't regulate these matters.

If they are intended for specific purpose under the Verification Method – provide explanatory information as to purpose/extent of their application for this Verification Method and how it can be verified as appliances and cooking equipment are not part of building approval requirements.

Comment/reason for change:

Refer to comment on recommended change to draft.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6V2(2)(w)(ii)

Recommended change to draft:

Rationalise application of H6V2(2)(w)(ii)(B)&(C) as the clause as drafted is essentially regulating compliance with both the building sealing DTS Provisions and the Verification of Building sealing (blower door) Verification Method whereas they are alternate compliance paths.

Comment/reason for change:

Refer to comment on recommended change to draft.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6V3(c)

Recommended change to draft:

Write out the ventilation provisions of clause 6.4 of AS/NZS 5601.1 into the NCC as opposed to adopting the gas standard into the NCC and Volume Two.

Comment/reason for change:

H6V3(c) is specifying the ventilation provisions of clause 6.4 of AS/NZS 5601.1 where a gas fuelled combustion appliance is installed, it would be a more complete solution for the NCC to include the requirements within NCC itself as opposed to referencing compliance with specific clauses of AS/NZS 5601.1.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1P2

Recommended change to draft:

Provide clarity on application of J1P2 where the building is a mixed use building and documenting compliance

Comment/reason for change:

Whilst a specific Performance Requirement for Class 2 SOUs is supported as opposed to a single Section J Performance Requirement for all buildings, it remains unclear how it applies to a mixed use building or a building containing a mix of both Class 2 and Class 3 buildings.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1P3

Recommended change to draft:

1. Provide clarity on application of J1P3 where the building uses combined services across the building and/or as a mixed use building and how this is determined.
2. Explain the application of J1P3 to a renovation to a Class 2 building that triggers NCC compliance.

Comment/reason for change:

Whilst a specific Performance Requirement for Class 2 SOUs building services is supported.

However, it remains unclear how this Performance Requirement and associated DTS Provisions applies with broader JP1/Section J commercial provisions as it applies to where:

- the Class 2 building is provided with combined services across the apartment complex, or
-
- Where the building contains a combination of shared services and individual services a building; or
- mixed use building or a building containing a mix of both Class 2 and Class 3 buildings; or
- to a renovation to a Class 2 building that triggers NCC compliance.

These situations are very common and standalone Class 2 buildings are less common and most have some form of mixed use component, there are also a range of apartments built with a combination of self-contained apartments (Class 2) and serviced apartments (Class 3) and practitioners and approval bodies would benefit from clarity on these matters if the new provisions are introduced.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1P4

Recommended change to draft:

Include application box on what building classes this Performance Requirement applies to and the extent to which it applies

Comment/reason for change:

The Performance Requirement is written that it would apply to all Class 2-9 buildings and all carparks for a building whereas the corresponding DTS provisions contain limitations on what class of buildings to which the provisions pertain to and also contains a number of exemptions from compliance for the solar ready zones.

An application and limitation clause should be included with the Performance Requirement to align application with the corresponding DTS Provisions of J9 if the provisions proceed for NCC 2022.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1V5

Recommended change to draft:

1. Provide case studies and worked examples of applying the new Verification Method J1V5

Comment/reason for change:

This new Verification Method is very complex and would benefit from case studies/guidance.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1V5(1)(a)(ii) & (b)(ii)

Recommended change to draft:

Explain logic and clarify why a building needs to meet a heating and cooling equal to 120% of the heating/cooling loads from the building fabric Performance Requirement.

Comment/reason for change:

This seems excessive and essentially appears to requiring application of this method to achieve a higher building fabric performance to the mandatory Performance Requirement.

If this is the case it is therefore questionable to suitability of its inclusion or benefit to its inclusion.

Better clarity and explanation of the VM is needed.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J2D2(2)(b)

Recommended change to draft:

Consider suitability of the use of term in this clause

'improving the thermal performance of the building fabric'

as it doesn't seem to fit in a DTS Provision and would appear more consistent to be saying

'by complying with-'

and then directing users to the relevant DTS provisions you need to meet.

Comment/reason for change:

Refer to comment on recommended change to draft.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J3D3

Recommended change to draft:

Include the provisions of J3D3 for reducing heating and cooling loads of SOUs of Class 2 or Class 4 Part using house energy rating software (star rating) in its own Section J Part.

Comment/reason for change:

Part J3 is titled 'elemental provisions for a Class 2 building and Class 4 part' however, the provision of J3D3 for reducing heating and cooling loads of SOUs of Class 2 or Class 4 Part using house energy rating software (star rating) and what energy rating must be achieved is contained with Part J3 under the part titled elemental provisions.

Whilst Part J2 provides a flag/application clause that directs the reader to J3D3 where they using house energy rating software (star rating) to demonstrate compliance, however, this creates unnecessary confusion and it is considered a better approach to include under its own Part in Section J or under the new proposed Part J2.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1P4 Renewable energy and electric vehicle charging

Recommended change to draft:

A building must have features that facilitate incorporation of renewable energy *infrastructure, including* electric vehicle charging equipment.

Comment/reason for change:

Sentence reads as needing '*renewable energy charging equipment*', in the absence of "electric vehicle". Commas are needed to clarify the differences, or specify that electric vehicle charging equipment is an additional requirement.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: F8D3(2), 10.8.1(2)

Recommended change to draft:

Provide greater clarity on application of this clause to brick veneer and cavity construction

Comment/reason for change:

There remains significant confusion on application of this clause and whether it applies to a sarking installed where a cavity is in place i.e. for a battened out cavity construction system or brick veneer.

I.e. sarking isn't required to be installed in this situation but if it is installed in CZ 4-8 is it then required to be vapour permeable even though a cavity is installed between cladding and sarking.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2(a) and (b)

Recommended change to draft:

Clarify application/interpretation of 'operated on demand' and 'operated continuously'

Comment/reason for change:

Feedback on this clause is that it would benefit from definition or explanatory information on what/how 'operated on demand' and 'operated continuously' applies/should be interpreted i.e. for a toilet exhaust fan or a 3 in 1 bathroom light, exhaust, heater.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2(a) and (b)

Recommended change to draft:

Provide information on verifying flow rates of exhausts and different flow rates for current products on market

Comment/reason for change:

Feedback on this clause is that it would benefit from information on verifying flow rates of exhausts and different flow rates for current products on market and that occasionally these products are not installed until after building has been signed off given they have not historically been a regulated building element.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Condensation Provisions 10.8.1 (3) (Housing provisions) & F8D3 (3)

Recommended change to draft:

Except for single skin masonry, or ~~s~~ingle skin concrete, structural insulated panels (SIP's), Insulated Sandwhich Panels or single skin solid timber/cross laminated timber (CLT) walls, where a pliable building membrane is not installed in an external wall, the primary water control layer must be separated from water sensitive materials by a drained cavity.

Comment/reason for change:

Allowances are already made for single skin masonry and single skin concrete. Considering the insulation values are higher within structural insulated panels and cross laminated timber, it makes sense to include them within the Deemed-to-Satisfy provisions.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.1 (2) (Housing Provisions) & F8D3 (2).

Recommended change to draft:

Where pliable building membranes, sarking-type materials or insulation layers are installed on the exterior side of the primary insulation layer of an external wall they must have a vapour permeance of no less than-

(a) in climate zones 4 and 5, 0.143 ug/N.s (Class 3 in accordance with AS 4200.1): and
(b) in climate zones 6, 7 and 8, 1.14ug/N.s (Class 4 in accordance with AS 4200.1)

Comment/reason for change:

It would be more practical if the requirements are express in 'class' as this is easily identifiable with the manufacturers specifications.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.1 (2) (Housing Provisions) & F8D3 (2).

Recommended change to draft:

Where pliable building membranes, sarking-type materials or insulation layers are installed on the exterior side of the primary insulation layer of an external wall they must have a vapour permeance of no less than-

(a) in climate zones 4, 5, 6 and 7, 0.143 ug/N.s (Class 3 in accordance with AS 4200.1): and
(b) in climate zone~~s 6, 7 and~~ 8, 1.14ug/N.s (Class 4 in accordance with AS 4200.1)

Comment/reason for change:
The Sustainable Building Research Centre (SBRC) at the University of Wollongong has been conducting hydrothermal research related to walls with vapour-permeable membranes in cooler climates.

This work has undertaken a range of modelling on the NCC 2022 condensation proposals and the primary findings of the SBRC report was that Class 3 vapour-permeable wall configurations perform as well as Class 4 wall configurations in cool climates.

The simulations presented demonstrate that walls with Class 3 membranes can pass the AIRAH DA07 mould index test when simulated in NCC Climate Zones 6 and 7.

HIA supports the findings of this work, which also enables a broader range of building wall wraps primarily Class 3 membranes to be used to meet both the condensation and energy efficiency provisions.

This particularly important for Climate Zone 6 and the use of reflective membranes (which meet a Class 3 type membrane in accordance with AS 4200.1) to assist in achieving total wall R-values under the elemental DTS external wall provisions for CZ6 which is extremely limiting without this inclusion and was including in earlier drafts from TIC.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2 (1)(b)(ii) (Housing Provisions) & F8D4 (1)(b)

Recommended change to draft:

Separation of continuously vented kitchen areas into two L/S (air flow rate) values, one for zoned kitchens and another for open planned living

Comment/reason for change:

Continuous ventilation is typically applied to buildings that have a high performing passive designs.

Knowing air flow rates can be determined in such cases using verification methods J1V4 or H6V3 which require area size as an input data, the DtS proposal appears to neglect kitchens layouts. Some house designs have kitchens within open plan living areas, others may be located in their own separate zone.

This will have an impact on the required air flow dispersal, it is suggested the ABCB provide separate values for both *zoned kitchens*; it is also suggested definitions are provided for each situation.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.3 (1) (Housing provisions) & F8D4 (Volume 1)

Recommended change to draft:

Excluding single skin masonry, single skin concrete, structural insulated panels (SIP's), Structurally Insulated Panels, or single skin or solid timber/ cross laminated timber (CLT) roofs/ceilings, in climate zones 6, 7 and 8, a roof must have a roof space that

(a) is located immediately above the primary insulation layer; and
(b) has a height of not less than 20mm; and
(c) is either-
  (i) ventilated to outdoor air through evenly distributed openings in accordance with Table 10.8.3; or
  (ii) located immediately underneath the sarking of a tiled roof where the sarking has a vapour permeance of not less than 1.14 ug/N.s or Class 3 in accordance with AS 4200.1

Comment/reason for change:

While it is accepted within NCC 2019 certain types of single leaf wall constructions are exempt from condensation provisions, the same philosophy has not been applied to roof construction. It is therefore flawed not to provide such options to the end user as part of Deemed-to-Satisfy provisions.

Further to this, it becomes particularly problematic for precast concrete floors/roofs to be providing an air gap where there is not a subsequent ceiling in place.

As for reasons expressed earlier, it is also advisable to state the class of membrane required.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 10.8.2 (Housing Provisions) & Table F8D4 (Volume 1)

Recommended change to draft:

Add following notes to Table

NOTE:

1. The distance from the bottom of the door to the floor coverings is acceptable at 15mm in circumstances where privacy is compromised.
2. These provisions do not apply to a European or laundry cupboard
3. The door undercut would only apply provided it wouldn't compromise the structural integrity of the door
4. If a door is an inwards opening door into a sanitary compartment and has lift off hinges, the door gap provided for the door would satisfy the provisions of this table

Comment/reason for change:

1. The undercuts in the table are excessive and for most bathrooms and toilets the floor areas will be between 3m2 -10m2 in and the flow rates of the exhaust would not need to be in excess of the minimum stated.

   The undercut should be similar to the requirements in AS 2688 Clause 4.1.2 which states that clearances at the bottom of doors should not exceed 15 mm this is an appropriate dimension that can act as an exemption within DtS provision for figures nominated in the table.

   Issues including air quality and sound dispersal may have a detrimental effect on an occupants wellbeing should they feel their privacy is compromised.
2. In apartments and small lot houses/secondary dwellings – European or laundry cupboards are common and driers in these rooms usually have bi-fold, sliding or concertina doors or other type of cabinetry doors that run on a top and bottom track. If these doors were required to be cut down the structural integrity and functionality would be significantly compromised or require a completely different system.

   Further to this when in operation of a drier in most instances the Euro laundry/laundry cupboard doors are left open.

   As such it is recommended that European laundries be exempt from the door undercut provisions.
3. Most internal doors in houses and apartments are hollow core doors with only a top and bottom rail in the door for structural integrity and these rails are generally 25-30 mm any cuts larger than 15mm – ideally 10 mm max significantly compromise the structural integrity of the door.
4. Under the construction of sanitary compartments provisions of 3.8.3.3 it has provisions requiring if a door opens inwards into a sanitary compartment and there isn't a clear 1.2 m space that it be readily removed from outside the compartment. In practice this involves cutting the top of door down approx. 15mm and using lift off hinges as such if that door gap is already provided it should suffice in lieu of a door undercut.

Alternative options are also desirable, wall and door ventilation grills. Could be defined in terms of total clear area (similar to subfloor ventilation).

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2(4) F8D4(4)

Recommended change to draft:

1. Clarify how it will be known what type of clothes dryer is being installed?
2. Provide exemption and clarification that the door undercut provisions do not apply to an external door

Comment/reason for change:

1. The provisions get triggered where the room has a venting clothes dryer but the selection and installation of a clothes dryer is not known at time of installation and appliances such as dryers can change over time and should clarify how this would be verified.
2. The door undercut provisions should not be applied to external doors as they are openable and therefore able to provide natural ventilation to the room and further to this cutting them down would compromise the building sealing and weatherproofing. Providing a simple clarification on application will help to avoid any potential misunderstandings or arguments on site between parties on this matter.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2(2)

Recommended change to draft:

1. Retain current option for roof space ventilation provisions in lieu of ducting/exhausting provision from NCC 2019 or include a Verification Method on roof space ventilation as per the provisions for NCC 2019.
2. Consider introducing a 2-3 year transition period for the kitchen ducting/exhausting provisions to enable a sell down of existing recirculating range hoods.

Comment/reason for change:

Mandatory ducting/exhausting to outside while encouraged and promoted is not practically achievable under all circumstances i.e. laundry cupboards, centrally located toilets, kitchens, bathrooms that are built on ground floors of row houses or zero lot line houses is very difficult to achieve compliance.

To achieve compliance it has impacts on a range of building features including what type of floor joists/trusses can be used and on fire rating of grills or vents or extensive ducting and consideration of location of any steel beams.

It can also mean that fire rated walls are needed to have penetrations and vents to achieve compliance.

Whilst the intent of the changes in seeking to remove damp area from buildings by ducting, make up air, fan/exhaust performance. However, in practice it can be very challenging to di this under all circumstances.

Further to this, there has been little to no regard for what impact this will have for products already in the market and what will the transition be in selling off these products.

The bulk majority of traditional ceiling mounted exhaust fans currently sold daily in the market will unlikely meet the new flow rates and the ability to duct to outside.

The provisions are also essentially banning use of recirculating (pull out) range hoods.

These two product categories are very large sellers in the market and a 1 year transition to move the market completely away from these products is significant and shouldn't be under estimated.

The effected manufacturers and suppliers of these products should be directly consulted prior to a move to essentially ban them from use in new buildings and major renovations/extensions.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

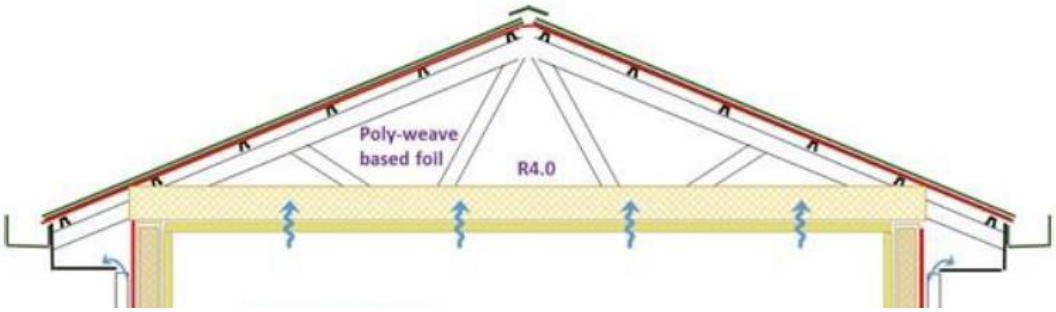
Clause/Figure/Table: 10.8.3 and Table 10.8.3, F8D5 and Table F8D5

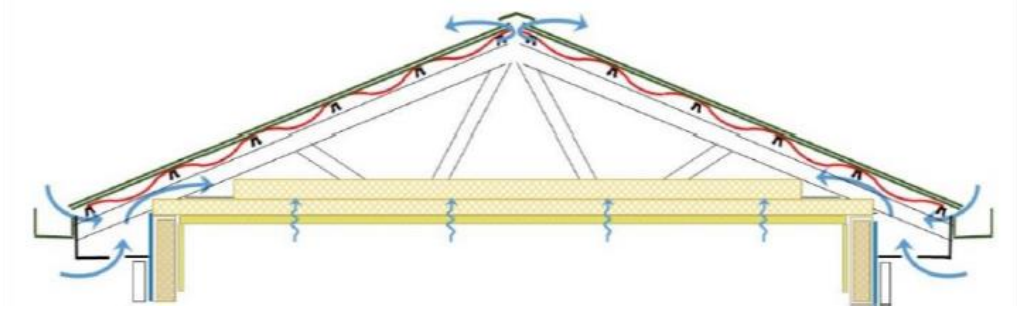
Recommended change to draft:

1. Provide clarity on where the 20 mm air space applies to in the roof and relationship to battens, sarking and ceiling space
2. Provide solutions/options for the perimeter of the building at roof/wall where the insulation would be abutting up to the roofing

Comment/reason for change:

1. There has been confusion from various parties on the application of the 20 mm air space in the roof and where this applies and how this relates to roof battens installation. Some explanatory information and figures would assist with interpretation
2. At the perimeter of the outside of walls and with the increased insulation required to get to 7 stars will see the need to use R4.0 and up to R6.0-R7.0 and will mean that the insulation batts will interact with roof at external walls as depicted below. The NCC needs to look at providing options to overcome this such as by permitting use of perimeter batts that may be able to be at lower R value to ensure air gaps still maintained.





NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.3 and Table 10.8.3, F8D5 and Table F8D5

Recommended change to draft:

Provide figures/depictive construction details in the NCC (not a handbook) for the roof space ventilation requirements related to application of Table 10.8.3

Comment/reason for change:

The NCC should include construction detail figures of what and how the roof be constructed as per the prescribed ventilation openings in Table 10.8.3 i.e. The installation of sarking at eaves and ridge, ridge capping and what additional ventilation is required.

Worked examples would also be useful rather than just relying on interpretation of the relevant ventilation openings table

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NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2 (1) (a)(ii) and F8D4(a)(i)(ii)

Recommended change to draft:

Provide an explanatory note to clarify whether operated continuously means the installation of a mechanical ventilation system and that the exhaust system will need to operate 24hrs a day where the room is in use of not

Comment/reason for change:

Clarification will assist with interpretation and application of clause

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NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2 (3) & (4) & F8D4(4)

Recommended change to draft:

Change the term naturally ventilated to not ventilated in accordance with Clause 10.6.2 (broader ventilation DTS Provisions).

An exhaust system serving a bathroom or sanitary compartment that is not ventilated in accordance with clause 10.6.2 must -

Comment/reason for change:

The term naturally ventilated is not defined nor is there an explanation of how this is achieved. If the purpose is just to indicate that it must have a window that can be openable then a cross reference to the clause is a better option.

However, this does not indicate that the window must be opened while the exhaust system is running. Therefore benefits of the clause will not be achieved if people don't open the window. Condensation will continue to be a problem.

If naturally ventilated has additional meanings i.e. the ventilation must be a fixed ventilation opening then this should be included in an explanatory note. Something along the lines of (i.e. fixed window pane with permanent fixed vent with an area equal to 5% of the floor area of the room).

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: F8D5 of Volume One & Part 10.8.3

Recommended change to draft:

Part 10.8.3 of Housing Provisions:

(1) In climate zones 6, 7 and 8, a roof must have a roof space that—

(a) is located immediately above the primary insulation layer; and

(b) has a height of not less than 20mm; and

(c) is either—

(i) ventilated to outdoor air through evenly distributed openings in accordance with Table 10.8.3; or

(ii) located immediately underneath the sarking of a tiled roof where the sarking has a vapour permeance of not less than 1.4 µg/N.s; or

(iii) tiled roof without sarking type material at roof level.

F8D5 of Volume One:

(1) In climate zones 6, 7 and 8, a roof must have a roof space that—

(a) is located immediately above the primary insulation layer; and

(b) has a height of not less than 20mm; and

(c) is either—

(i) ventilated to outdoor air through evenly distributed openings in accordance with Table F8D5; or

(ii) located immediately underneath the sarking of a tiled roof where the sarking has a vapour permeance of not less than 1.4 µg/N.s; or

(iii) tiled roof without sarking type material at roof level.

(2) The requirement of (1) do not apply to a roof that is subject to Bushfire Attack Level FZ requirement.

Comment/reason for change:

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table notes (2) for Tables 13.2.3 under Housing Prov. & - Tables J3D7 under NCC Volume One.

Recommended change to draft:

Add (iv) to Table Notes (2) under Tables 13.2.3a - Tables 13.2.3r of ABCB Housing Provisions:

(2) A roof is considered 'Vented' if it –

(i) has one wind-driven roof ventilator per 50 m^2 of respective ceiling area, in addition to roof vents; or

(ii) has one powered roof ventilator per 200m^2 of respective ceiling area, in addition to roof vents.; or

(iii) complies with Part 10.6; or

(iv) a tiled roof without sarking type material at roof level.

Add (iv) to Table Notes (2) under Table J3D7a - Table J3D7e NCC Volume One:

(2) A roof is considered 'Vented' if it –

(i) has one wind-driven roof ventilator per 50 m^2 of respective ceiling area, in addition to roof vents; or

(ii) has one powered roof ventilator per 200m^2 of respective ceiling area, in addition to roof vents.; or

(iii) complies with Part 10.6 of F8D5; or

(iv) a tiled roof without sarking type material at roof level.

Comment/reason for change:

Previously under NCC 2019, unsarked tiled roofs are deemed ventilated. This definition is recommended to be maintained as tiled roofing without sarking are known to provide a ventilated roof space.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: F8D5(1)(a) 10.8.3(1)(a)

Recommended change to draft:

Provide explanatory information on what constitutes the 'primary insulation layer'.

Comment/reason for change:

It is common in metal roof construction for roof insulation to be located both at ceiling level and at roof level. This has advantages where the level of insulation required for a roof may be that it is more practical to provide at both ceiling and roof levels. It is also a common condensation management technique to place an insulation blanket directly below metal roofing.

It needs to be clarified if the primary insulation layer relates to R-Value, the primary insulation layer being the higher R-Value. This is important where an insulation blanket is used for both the overall required R-Value and condensation management as stated.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.5k and various other external wall tables

Recommended change to draft:

Re-craft the Table to allow a broader range of options while maintaining a standard 90 mm wall for two storey and lightweight cladding solutions.

Comment/reason for change:

As a starting point for most of the available solutions for Table 13.2.5k for example it results in R2.7 wall insulation being required which is the largest permissible for a 90 mm wall.

However, this is only for a single storey wall brick veneer wall at 2.4m or 2.7m.

If the wall is a 2 storey wall you need to add for both upper and lower storey another R0.5.

That would equate to that wall now being R3.2.

If you use a lightweight cladding it then requires you add another R0.3.

That would equate to that wall now being R3.5.

If that wall had metal/steel wall framing you would also need to apply the thermal bridging mitigation measure.

This table therefore is not workable and needs to be re-developed to provide more readily attainable solutions.

Many of the other elemental tables for the various climate zones for external walls in applying similar common situations significantly disadvantage 2 storey and lightweight cladding designs and further compounded with the thermal bridging mitigation measures.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: F8D3(2), 10.8.1(2), Table 13.2.5u and Table 13.2.5v, C1.9

Recommended change to draft:

Review the thermal bridging mitigation options for steel wall frames i.e. option of lining outer surface with insulation R-Value of at least R0.6 or additional insulation strips, to ensure it doesn't contradict or compromise the condensation provisions and fire safety/non-combustibility provisions.

Ensure there are available products in the market to satisfy the proposed measures.

May need to consider an exemption for NCC 2022 where it also needs to meet thermal bridging mitigation measure from the vapour permeability criteria, and let market catch up and innovate for introduction in NCC 2025.

Comment/reason for change:

Most if not all products on-market that would achieve required R-value and incompressible criteria (to ensure they don't reduce installation issues and retain thermal performance) are impermeable, having a continuous layer of impermeable insulation would conflict with condensation management.

Furthermore, complying strip of correct R-Value thermal break is not readily available in Australia. R0.6 thermal breaks limited commercial product available in Australia or NZ.

Given required thickness it would likely mean that the sarking would need to be a rigid board insulation and be thicker than the permissible exemption in C1.9 for sarking type materials from non-combustibility requirements and need to be non-combustible however the condensation provisions would require it to be vapour permeable. It's unlikely a product will be able to meet both non-combustible and vapour permeability requirements.

Further consideration is needed on the relationship between the various provisions for wall wraps.

This would also need to be considered from weatherproofing perspective for wall cladding also.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.2(2)

Recommended change to draft:

Clarify application of this clause as it relates to the pliable building installation standard AS 4200.1

Comment/reason for change:

This clause, though not proposing to change, contains installation requirements for reflective insulation whereas AS 4200.1 is referenced in other parts of NCC including condensation provisions which creates uncertainty on what must be followed for installation of reflective insulation.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.2

Recommended change to draft:
13.2.2 should be re-written to be provide more detailed installation of insulation requirements.

Comment/reason for change:
13.2.2 and formerly 3.12.1.1 are written in very qualitative language and provides no real details of correct insulation installation. There has been a range of work done both for AS 3999 and on insulation road map and compliance reports that show that there would benefit in the NCC providing more detailed installation of insulation requirements to assist with compliance.
With the ramping up of insulation required in roofs, ceilings, walls, and sub floors having correct installation details becomes increasing important and even more so with the proposed thermal bridging provisions to ensure safe and compliant installations.
Further detailed provisions and installation figures should be included for:
Floor insulation and installation requirements including-

- slab edge insulation
- under slab insulation
- sub floor insulation installation
- sub floor wall installation

Wall insulation and installation requirements for-

- building wall wrap
- bulk insulation
- insulating double brick walls
- panel and single skin construction

Roof/ceiling insulation and installation requirements for:

- roof blanket
- sarking
- ceiling insulation
- thermal bridging measures
- cathedral roofs
- single skin roofing panels.

This is important as these provisions apply to all of the NCC compliance paths i.e. reference method, elemental and star rating.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Part 13.2

Recommended change to draft:
Separate Part 13.2 so that roofs, walls and floors all have their own dedicated Parts or Specifications for each.

Comment/reason for change:
It is recommended that Part 13.2 be separated so that each of roofs, walls and floors all have their own dedicated Parts or Specifications.
This could be:

- Part 13.2.1 - **Roofs** with the corresponding tables and roof lights provisions
- Part 3.12.3 – **External Walls** with the corresponding tables
- Part 3.12.4 – **Floors and slabs** with the corresponding tables

This will help with interpretation and application and not have tables spreading over pages and pages.

This change would complement the suggested changes to 13.2.2 in making the provisions simpler to understand and more logical layout.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.3(2)

Recommended change to draft:

Remove provision restricting roof and wall colours in climate zone 1-5

Comment/reason for change:
Thermal modelling was done on a home across 8 climate zones: Sydney, Brisbane, Darwin, Hobart, Perth, Adelaide, Canberra, and Melbourne.

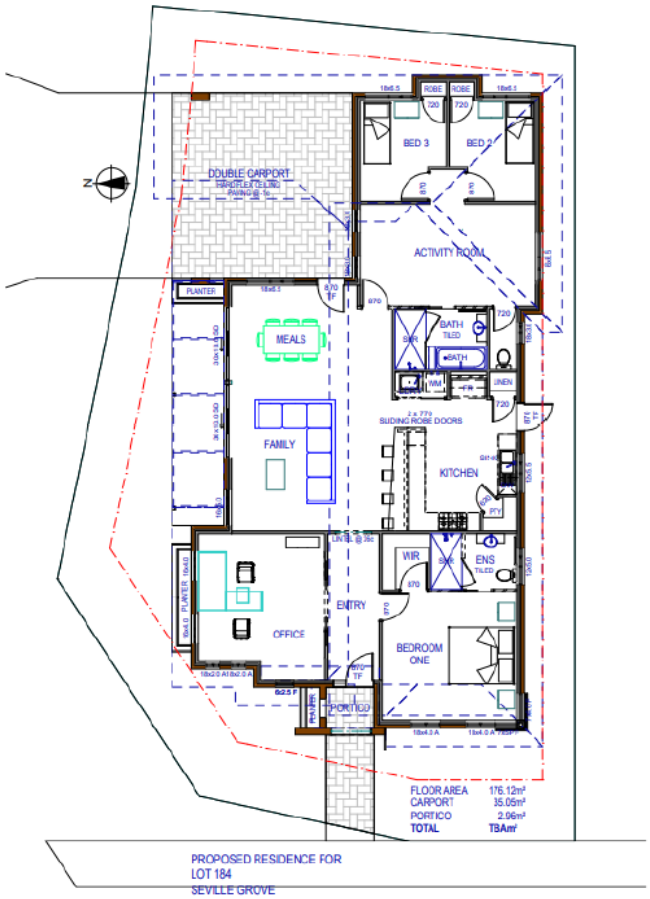
In this modelling the effect of different wall construction types (cavity brick, brick veneer, and lightweight), wall colour (light, medium, and dark), wall insulation (R1, R1.5, R2, R2.5, and R3) and roof and wall colour (light, medium, dark) on the star rating and total energy usage was investigated.

The findings of the modelling showed that there was minimal benefits from an overall total energy usage from limiting the roof and wall colours as proposed in the NCC draft provisions in respect to the total of the cooling and heating energy loads required to keep the home at a comfortable climate.

Modelling

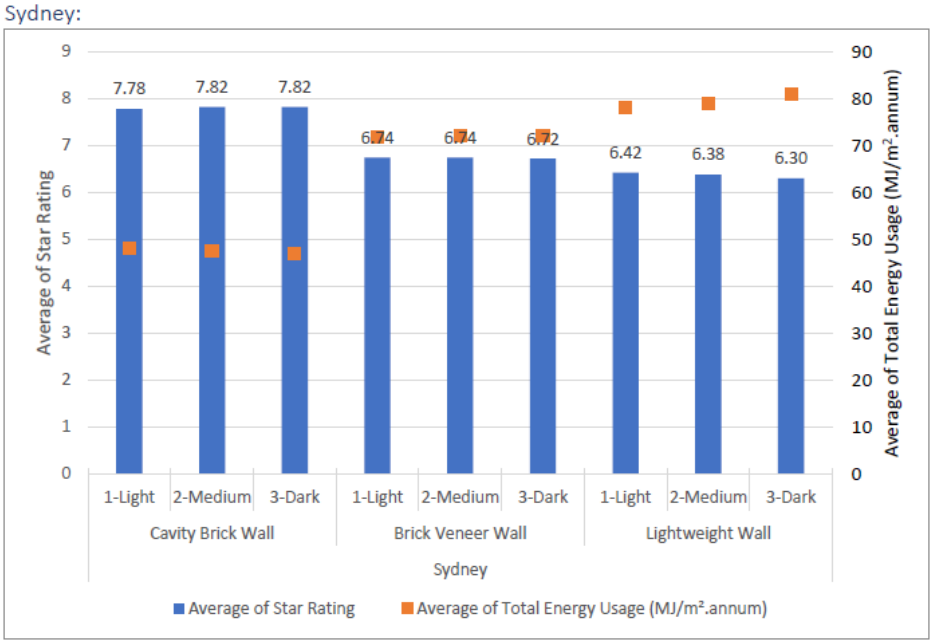
This modelling contains the below graphs which compare the effect of wall construction type and wall colour across the 8 climate zones listed above. Roof colour was kept constant at medium and the insulation was averaged across all levels. The floor plan of the building that was modelled is below.

The modelling provided herein primarily relates to the roof colours but similar modelling was done for the walls which resulted in similar findings and can be provided to ABCB if required.

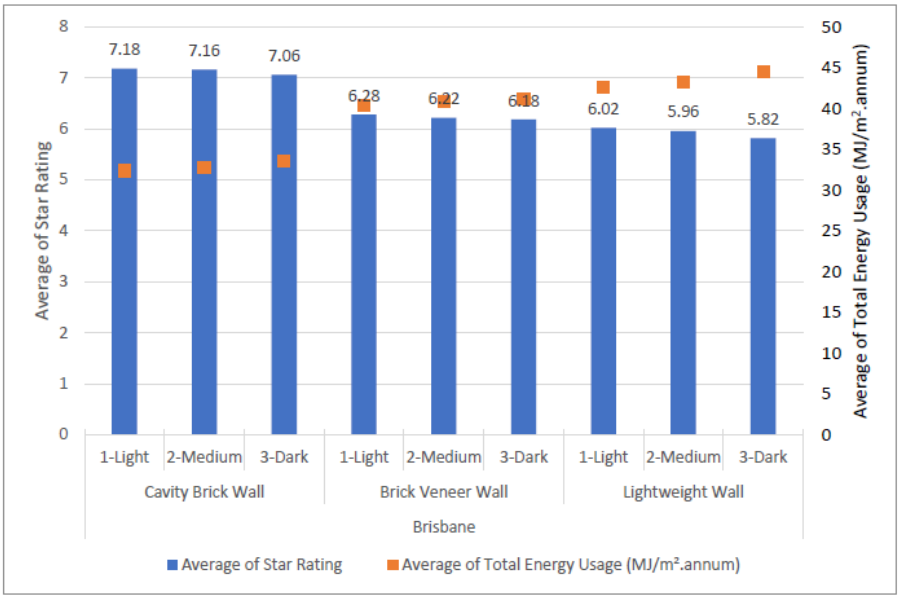


Wall Type vs. Wall Colour by Climate Zone

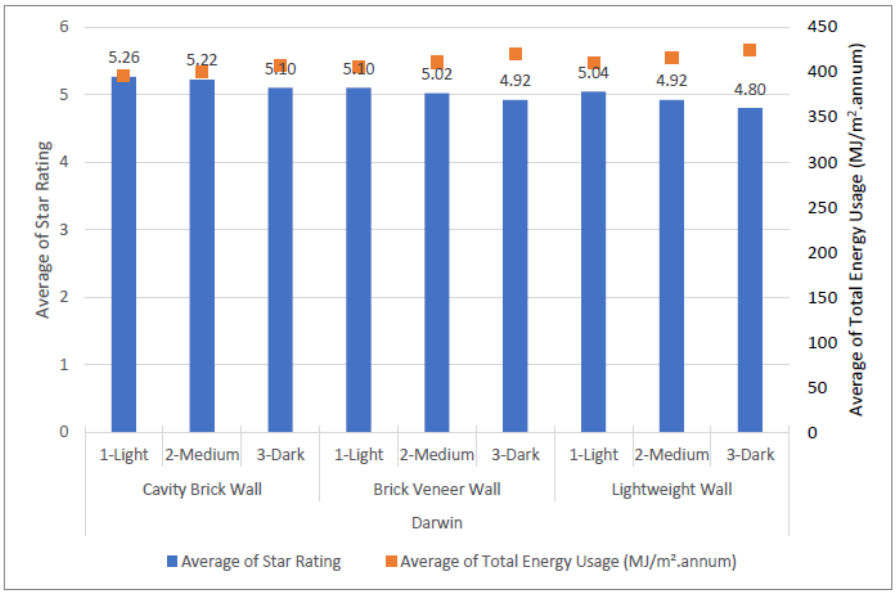
Sydney:



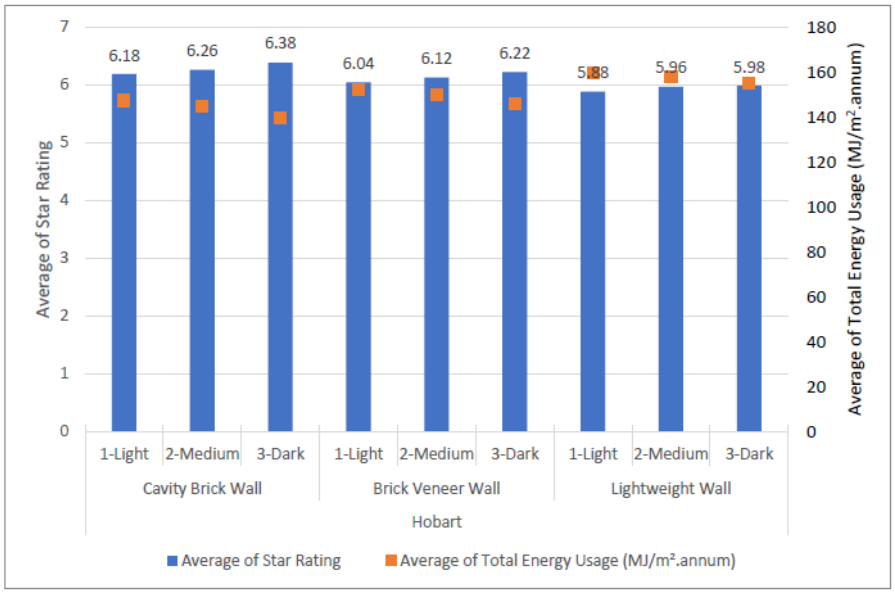
Brisbane:



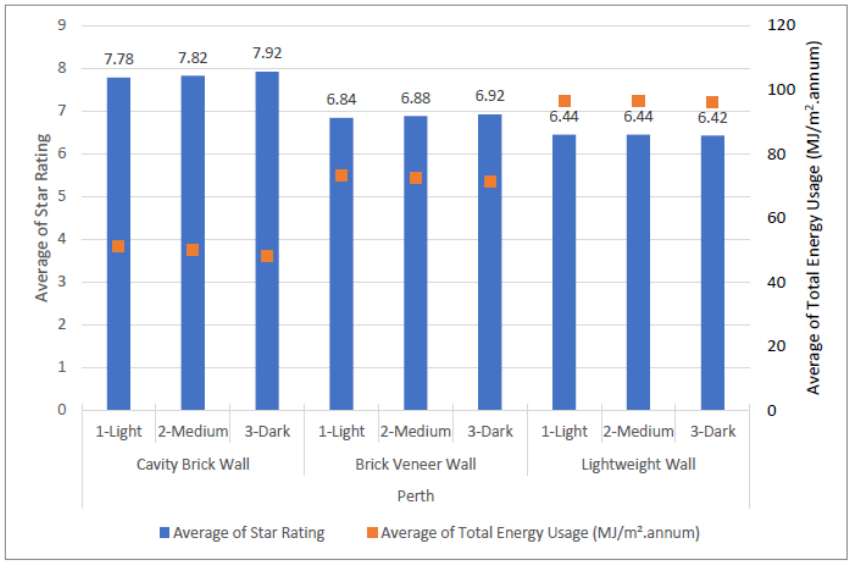
Darwin:



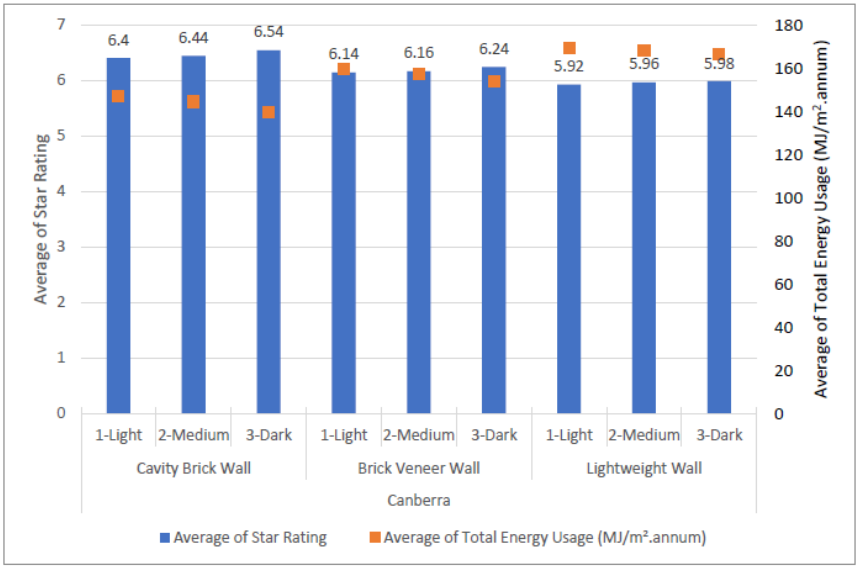
Hobart:



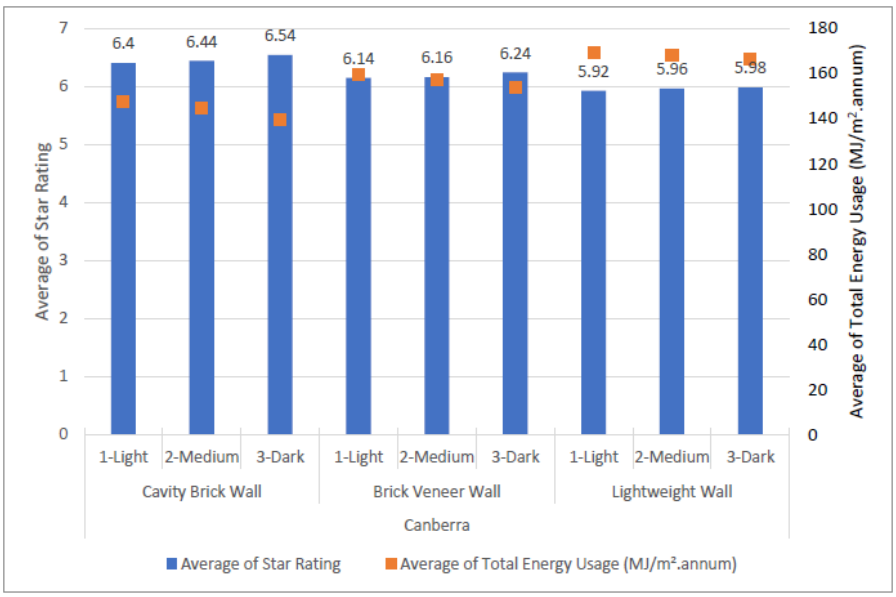
Perth:



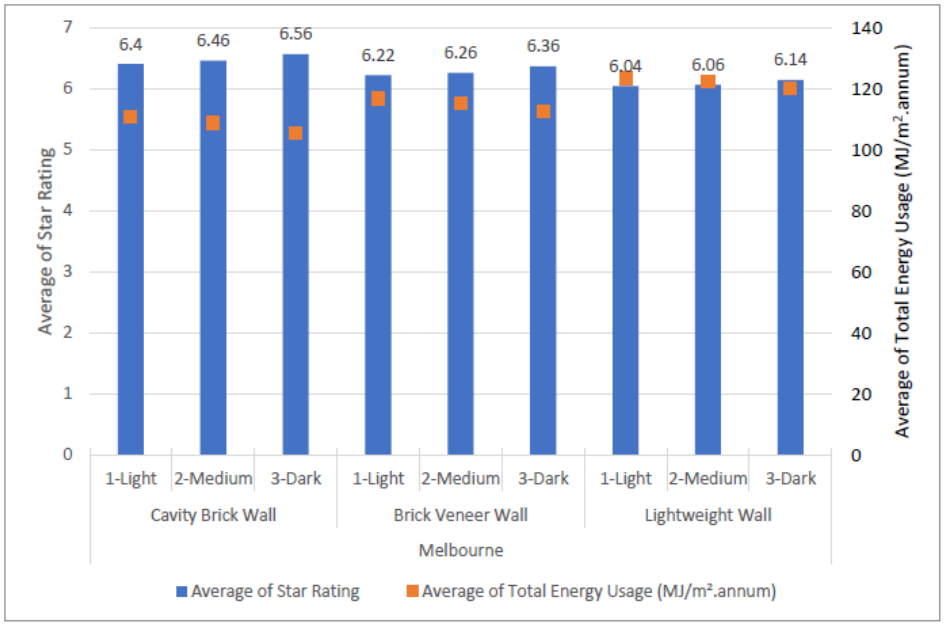
Adelaide:



Canberra:



Melbourne:



NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.3 a-r

Recommended change to draft:

1. Notes to the table. Note (4) needs to be completed. . roof ventilation must comply with ????
2. Notes to the table. Note (2)(c) needs to be completed. Complies with ????

Comment/reason for change:

Note hasn't been completed

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.3 a-r

Recommended change to draft:

Amend Notes (2)(a) & (b) to the table. By changing the words "in addition to roof vents" to -

In addition to ventilation required by Clause 10.8.2.

Comment/reason for change:

There are no additional vents required in the roof space with the exception of required in Climate Zones 6, 7 and 8 so why reference additional vents.

Just specify the wind driven or powered roof ventilator.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6D2(2)

Recommended change to draft:

Re draft H6D2(2) to address that a number of the provisions of Part 13.7 of the Housing Provisions applies to installation of building services regardless of which compliance path is used to determine the regulated building services energy usage for the building.

Comment/reason for change:

As currently drafted H6D2(2) states that Performance Requirement H6P2 for the net equivalent energy usage of the building is satisfied by – complying with either:

(a) S42C3 (house energy rating assessment path) OR
(b) With Part 13.6 and 13.7 of the ABCB Housing Provisions; OR
(c) For a heated water supply system, with Part B2 of The PCA

However, there are provisions of Part 13.7 that would apply regardless of which path is used to determine the regulated appliances energy performance for the building. This would include:

- Insulation of the services (13.7.2)
- Central heating water piping (13.7.3)
- Heating and cooling ductwork (13.7.4)
- Where an electric resistance space heating is installed (control and isolating switches 13.7.5 (a) and (b))
- Switching and installation provisions for artificial lighting (13.7.6)
- Cover and time switch requirements for swimming and spa pool plant (13.7.8 & 13.7.9)

Essentially this is a similar issue to the building fabric requirements whereby regardless of which path is used to determine the building fabric provisions i.e. VURB, star rating, etc. that there are components of the elemental DTS Provisions that need to be meet in addition to the rating/modelling.

Another approach could be to better rationalise Part 13.6 and 13.7 and separate the components related to energy usage and installation requirements.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6D2(2)(c)

Recommended change to draft:

Re draft H6D2(2) to address how the clause applies to the other regulated building services where the heated water supply system complies with H6D2(2)(c) i.e. complies with Part B2 of the Plumbing Code of Australia (PCA).

Comment/reason for change:

The provisions of H6D2(2) is not clear how the whole of home/energy usage provisions apply to the other regulated services where the heated water system is done in accordance with B2 of the PCA.

For example if the heated water system is determined in accordance with the PCA as per H6D2(2) what does the heating/air-conditioning, lighting and where relevant swimming pool and spa plant need to meet?

It is assumed that those other regulated services would need to then meet either a house rating assessment or complying with the relevant Parts of 13.6/13.7 of Housing Provisions but that is not clear by current drafting.

Furthermore, it is not clear how the whole of home provisions would apply and the whole of home calculator and potential offsetting through installation of on-site solar panels.

Additional aspect includes whether it is the building certifier/surveyor who determines compliance of the heated water system or plumbing regulator dependant on whether solutions using the BCA or follows the PCA.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6D2(2)

Recommended change to draft:

Clarify how the whole of house energy usage provisions/whole of home provisions will apply to an extension or alteration or addition to home that triggers NCC compliance.

Comment/reason for change:

The new whole of home provisions are written essentially assuming the building is a new building but under many circumstances the provisions of the NCC will apply to an extension or alteration or addition to home.

How will the new whole of home provisions apply to these situations? The new whole of home provisions are not practical or feasible for extension or alteration or addition to home

The NCC should provide clarity on this matter and potentially exemptions and not just dismiss this comment as the application of the NCC to existing buildings and to renovations and additions is to the determination of each state and territory Government.

These new provisions will require guidance and clarity to practitioners and home owners on application to this type of projects.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6D2(1)(a) and Specification 42

Recommended change to draft:

Amend H6D2(1)(a) and Specification 42 as follows:

H6D2(1)(a):

Performance Requirement H6P1 for the thermal Performance of the building is satisfied by—

(a)Complying with—

(i) Specification 42, for using house energy rating software ~~reducing the heating or cooling loads; and~~

~~(ii) Section 13 of the ABCB Housing Provisions clauses—~~

~~(A) 13.2.2 for building fabric thermal insulation~~
~~(B) 13.2.3(6) and 13.2.5(5) for thermal breaks; and~~
~~(C) 13.2.3(4) for compensating for loss of ceiling insulation, other than where the house rating tool used can automatically compensate for loss of ceiling insulation; and~~
~~(D) 13.2.6(3) and 13.2.6(4) for floor edge insulation; and~~
(E) ~~Part 13.4 for building sealing.~~

Specification 42 Using house energy rating software:

S42C3 Additional Deemed-to-Satisfy Provisions

In addition to complying with the house energy rating a building must comply with Section 13 of ABCB Housing Provisions clauses—

(A) 13.2.2 for building fabric thermal insulation
(B) 13.2.3(6) and 13.2.5(5) for thermal breaks; and
(C) 13.2.3(4) for compensating for loss of ceiling insulation, other than where the house rating tool used can automatically compensate for loss of ceiling insulation; and
(D) 13.2.6(3) and 13.2.6(4) for floor edge insulation; and
(E) Part 13.4 for building sealing

Comment/reason for change:

1. In relation to change to H6D2(1)(a) it would align the terminology and title to Specification 42
2. It is also suggested to include the 'hang over or extra' DTS elemental provisions that need to be complied with in addition to having a star rating assessment listed within Specification 42 for completeness and will also enable clearer wording on NatHERS certificates in that they will be able to refer back to Specification 42 of NCC as to what the assessment relates to and other provisions that need to be meet.
   This has been a poorly understood component of the star rating pathway that these other provisions also apply.
   The drafting proposed similar approach used in Volume One for JV1, JV2 and JV3

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: S42C3

Recommended change to draft:

Re-draft clause to include the whole of home rating requirement within clause itself as opposed to referencing the benchmark specified in H6P2

Comment/reason for change:

The drafting of this clause could be inferred that the whole of home rating needs to be a Performance Solution given that it is referring the DTS back to the Performance Requirement.

I can't think of another DTS clause in the NCC that requires referring back to the Performance Requirement for determining compliance for a DTS solution.

How this would be documented in the Universal Certificate (UC) and verified is also problematic and will continue the disconnect that exists between the energy rating and the NCC itself and documenting compliance.

It would clearer and more complete solution to reference the specific acceptance criteria for regulated appliances under a house rating in S42C3 itself which would form the basis of the settings on this matter in the rating tools and also documented on the UC.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Definition for energy value

Recommended change to draft:

Remove notion of cost to society from a technical based NCC definition

Comment/reason for change:

The focus of the definition should be based on a more practical approach and standard NCC convention of focus on technical focus related to the building itself.

Suggest it would be better to maintain the focus on the buildings regulated services having features that facilitate the efficient use of energy aligned with the approach in NCC 2019 as opposed to incorporating the notion of net cost to society that moves the NCC away from a technical basis.

The definition of energy value reads more like what an NCC Objective of Functional Statement would constitute as it's talking to intent of the policy/technical provisions.

The notion of net cost to society also further complicates an already highly complex part of the NCC and the Performance Requirement.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.6 (4)(b) Floors and subfloor walls

Recommended change to draft:

Provide alternate to waffle pod option for traditional raft slab with appropriate underfloor insulation in climate zones 6, 7 and 8

Comment/reason for change:

Waffle pod slabs have limitations on the effectiveness in all site classifications and many practitioners have a preference for using traditional raft slabs. As an alternate to waffle pod slabs a solution should be provided for raft slab with required under slab or slab edge insulation.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.6 (4)(b) Floors and subfloor walls

Recommended change to draft:

(4) (b) when in climate zones 6, 7 or 8, must be a waffle pod slab *(excluding Class A and Class S sites);* and

Comment/reason for change:

1. Sandy soils do not wick heat to the same extent as clay soils, even when fully saturated.

2. Please find attached the following papers that confirm the finding at (1) –
Thermal Properties of Soils as affected by Density of Water Content
Soil Thermal Conductivity – Effects of Saturation and Dry Density
Thermal Properties of Soils – United States Army Corps of Engineers

3. The Summary of changes against 13.2.6 (p14) notes that;
   "…The most commonly used floor construction in Australia, as shown in CSIRO data, is waffle pod slab floors. It is the dominant floor construction in the cooler climates of Victoria and the ACT. In cooler climates, the use of a waffle pod slab instead of a concrete slab-on-ground will improve the NatHERS rating by around 0.4 stars. Hence, it is proposed to acknowledge the benefits of waffle pod slabs by requiring waffle pods in climate zone 6 to 8 under the DTS elemental provisions…"

   This data has been drawn from the CSIRO NatHERS data portal, however, the portal has a limited sample size to draw from for Queensland and WA and WA in particular. WA uses very limited portion of waffle pod slabs due to relatively sandy soils and different construction methodologies used. As such it doesn't present a representative sample for that region.

4. Waffle pods may be isolative on Class M and H sites, but achieve very little benefit on Class A and S sites, and very disproportionate in both cost and benefit when considered against the additional 20m³ (twenty cubic metres) of concrete required to construct over a typical CSOG.

Based on the finding of the attached papers, and the additional energy generated by the additional concrete requirements for a waffle pod slab, their limited use and benefits for this type of slab type in Class A and S sites, these site classifications should be exempt in the affected climate zones.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.3h and other roofing tables

Recommended change to draft:

Clarify impact on associated structural members, fixings, battens and plasterboard due to the additional weight of the ceiling insulation increases for 7 star

Comment/reason for change:

Table 13.2.3h for example generally requires R4.5 insulation at ceiling level, but this doesn't account for loss of ceiling insulation calculations that would apply in addition to this also meaning even higher than R4.5 insulation would be required.

If the frame is steel/metal frame it would also require the thermal bridging mitigation measure meaning more weight in the ceiling frame and plaster board ceiling.

Under other scenarios R3.0 insulation in ceiling if metal frame would require the thermal bridging mitigation measure to increase ceiling insulation to R6.0.

These additional weights will impact associated structural members, fixings, battens and plasterboard due to the additional weight of the ceiling insulation increases

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NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.3v

Recommended change to draft:

Include other thermal bridging solutions that are more practically achievable

Comment/reason for change:

The options available for thermal bridging mitigation are very limiting for 7 stars where insulation at ceiling level is required to be R4.0 or greater.

The most practical option of increased insulation between framing members is not an option, and option of insulation strip above the ceiling framing is impractical and creates safety issues for subsequent trades who need to move around in the ceiling space and need to support themselves on the structural members.

The continuous layer is also not practical or buildable.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.6

Recommended change to draft:

Provide guidance on how to measure the sub-floor wall height. For example, by referring to the subfloor ventilation floor height measurement.

Also provide guidance on how to determine sub-floor wall height for sloping sites – is it the minimum, the maximum, or applying the average height along a given length of the wall?

Comment/reason for change:

Provision is unclear on how the sub-floor height is measured and could lead to inconsistency in application. Some may measure to the underside of the lowest horizontal member of the subfloor space, some may measure the underside of the floor, and others may measure to the underside of the sub-floor insulation.

Clarity would be beneficial and the tables differ based on height.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.6b

Recommended change to draft:

1. Provide information on performance of insulation products in close proximity to the ground
2. Provide information on bushfire performance requirements for insulation products in close proximity to the ground

Comment/reason for change:

Subfloor wall insulation is not a common inclusion in houses and the proposed changes will now require sub-floor insulation for a number of climate zones and depending on sub-floor wall height.

As noted this is not currently done, and the sub-floor walls are not like an external walls and if the sub-floor has shielding to make it enclosed it will only be enclosed on the outside face be open frame on inside face or a block or brickwork wall. The NCC hasn't provide the solutions for how to construct the insulated sub-floor wall or what products to be used particularly if they are left exposed on internal face.

Further, if the building is in a bushfire prone area there are requirements for sub-floor spaces and members within certain distances from the ground to say be non-combustible. As such the energy efficiency provisions should clarify or include a note of what is required for the insulation if the building is in a bushfire prone area.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.3v and Table 13.2.3w, and 13.2.5s through 13.2.5w

Recommended change to draft:

1. Remove option for continuous layers of insulation.
2. Consider alternative locations for the additional insulation layers

Comment/reason for change:

Concerns are raised with how the provisions would work from an installation perspective. Especially where material is placed within framing connections not allowed under the framing and other construction standards (e.g. AS 2699 has not considered impact of thermal breaks on load/deflection of masonry ties, AS 3999 does not allow installation of material between structural members). This is true for both the continuous layers and the strips.

Also, most if not all products on-market that would achieve required R-value and incompressible (to reduce installation issues and retain thermal performance) are impermeable, having a continuous layer of impermeable insulation would conflict with condensation management.

- Required bulk insulations assumed in tables are too thick to work with standard framing sizes, for both timber and steel
- Complex thermal break options, need to be standardised and simplified
- application of board or strip across Climate Zones & building type is inconsistent
- Complying strip of correct R-Value thermal break is not readily available in Australia, max thickness likely ~30mm. R0.6 thermal breaks limited commercial product available in Australia or NZ
- Timber batten 35mm ~R0.25 for light weight cladding is a common practice, but not included here

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NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.3(3)

Recommended change to draft:

Include a diagram of the intended arrangement for insulation, reflective insulation, and 20mm air gap for pitched roofs

Include an explanation of where the 20mm air-gap should be in relation to vapour permeable roof sarking (e.g. for low-pitched metal roofs)

Comment/reason for change:

This is causing some confusion regarding relationship between air-gap in roof, and space between roof and ceiling.

Questioned as to if it will clash with 13.2.2(3): The 20mm ventilation required under condensation will affect the thickness of the insulation asked for in 13.2.2 (3).

A pitched roof naturally gets closer to the ceiling height at the external wall. The thickness of the insulation will be minimized to allow 20mm ventilation gap which affects following the provision of 13.2.2 (3) (a) (insulation installed so it maintains its position and thickness.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table Table 13.2.5v

Recommended change to draft:

Either add:

a *sarking-type material* on the external side of the frame with an outward facing emissivity of no more than 0.1, or

a continuous insulation product with an R-value of at least R0.38, or add R0.6 to the frame only.

Comment/reason for change:

The use of the term "**reflective pliable moisture permeable membrane**" is neither defined within the NCC, referenced standards or used within industry; and if adopted it would further add to the growing list of terms used to describe flexible building membranes. This approach references existing, defined terms and provides clear guidance on the material performance requirements.

The specification already nominates the emissivity performance characteristics of the material and could also nominate the permeability if required.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.5a to 13.2.5o

Recommended change to draft:

Add reflective foil (with suitable permeability limits) provisions for timber framed brick veneer construction to allow more achievable solutions for higher wall heights and 2 storey applications. E.g R3.0 in these tables becomes R2.5 + reflective.

Comment/reason for change:

This option is currently *unavailable* in the (baseline) timber brick veneer tables where foil would be equally effective in providing a cost effective added R-value adjacent to the air-gap created by the drainage cavity.

This solution is both cost effective and frequently used in the market so requires no re-training to implement. It is recommended that reflective foil options be added to the brick veneer tables to provide an easily installed option to increase the R-value of the overall wall system.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.5a to 13.2.5o

Recommended change to draft:

Add continuous insulation (with suitable permeability limits) provisions for timber framed brick veneer construction to allow more achievable solutions for higher wall heights and 2 storey applications.

Comment/reason for change:

This option is currently unavailable in the (baseline) timber brick veneer tables where it could be an option in providing an added R-value. It is recommended that a continuous insulation option be added to the timber tables.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.3, J3D7 (3)

Recommended change to draft:

Clause 13.2.3 (3) (c) (ii) below is a general roofing clause and is currently applicable to all climate zones. Propose that this clause is limited to CZ 6, 7, 8 to align with the corresponding condensation provisions in 10.8.3.

Recommended change: 13.2.3 (3) (c) (ii) in accordance with 10.8.3 for climate zones 6, 7 and 8

(3) *Reflective insulation* installed to comply with (1) must—

(a) be downward facing; and

(b) have an emissivity of not more than 0.05; and

(c) be adjacent to a roof space—

(i) of not less than 20 mm; and

(ii) in accordance with 10.8.3.

The same should apply to J3D7(3) where F8D5 is referenced.

Comment/reason for change:

As drafted clause 13.2.3(3)(c)(ii) is a general roofing clause applicable across all climate zones, but this clause makes specific reference to Clause 10.8.3 which is only applicable to climate zones 6, 7 and 8.

Additionally, by making reference to 10.8.3, this clause is in conflict with the "Vented/Standard" options presented in each of the climate zone Tables 13.2.3a to 13.2.3r as these options appear for all climate zones, including 6/7/8.

These need to be better rationalised and clear on scope of application between the varying NCC Parts.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.3 (5) (a), J3D7(5)(a)

Recommended change to draft:

Delete clause 13.2.3 (5) (a), 13.2.5(4)(a), J3D7(5)(a)

(5) The thermal bridging in a steel-framed roof must be addressed by—

(a) achieving the *Total R-Value* in Tables 13.2.3t and 13.2.3u, calculated in accordance with AS/NZS 4859.2; or

(b) complying with one of the options in Tables 13.2.3v or 13.2.3w.

Comment/reason for change:

Total R-value is a calculation designed to show the performance of a material assembly – by definition from the notes below the table shown below, it is inclusive of the frame, insulation and lining – as it compares the entire assembly the target Total R-values for timber and steel frame should be the same if the overall assembly is going to provide the same performance – only the insulation material (bag) R-value will vary to offset thermal bridging.

This difference is clear in the DTS elemental solution tables but very unclear and potentially misleading in the Total R-value tables as the values require reverse analysis to generate a useable Material R-value – in Table 13.2.3t below, there is a very real risk that practitioners either do not notice the shift from Material to Total R-value or do not have the skill or list of assembly variables to make the reverse calculation. Given there are already Material R-value solutions provided within the NCC it is recommended that these Total R-value tables be deleted.

Table 13.2.3t: Pitched steel-framed roof with flat ceiling – Minimum Total R-Value to account for thermal bridging

Minimum *R-Value* from Tables 13.2.3a to 13.2.3i, and Table 13.2.3s if applicable	Minimum ceiling *Total R-Value*
1.0	1.05
1.5	1.49
2.0	1.87
2.5	2.25
3.0	2.59
3.5	2.90
4.0	3.19
4.5	3.46
5.0	3.72
5.5	3.95
6.0	4.17

Table Notes

The *Total R-Value* calculation must only include the ceiling frame, insulation and lining. It is not to include the internal air film, roof space or roof lining.

DRAFT

Total R-value calculation is to be done in accordance with AS/NZS 4859.2, which references NZS 4214 for thermal bridging. This standard however is low on details for calculation of thermal bridging in roofs.

In walls the framing and insulation are sandwiched between cladding layers, and the only air layers are inside and outside the wall.

In a ceiling there are likely to be differences in the height of the frame and the insulation beside it, yet the notes to the tables don't allow for air films or the roof space to be included in the calculation.

So the path to calculating a Total R-value for the system is not clear, and will be subject to variance in how it is conducted in industry.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Thermal bridging mitigation Tables J3D7v,w, Tables 13.2.3v,w, Tables 13.2.5t,u,v,w and Table 13.2.6j,

Recommended change to draft:

Add additional detail and installation guidance to ensure consistent application of the thermal bridging mitigation requirements.

Comment/reason for change:

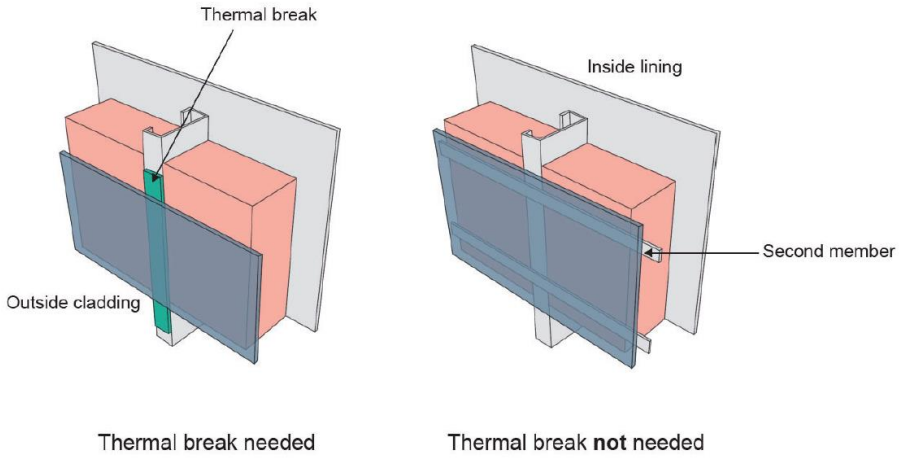
The buildability of thermal break strips and continuous insulation is currently heavily dependent upon installation techniques and may result in a wide range of performance outcomes.

To ensure a consistent market outcome, the use of thermal break strips and continuous insulation needs to be defined to cover the following variables:

1. Compression – is the R-value stated in the Tables compressed in-situ or the uncompressed R-value – without definition there is a risk that materials will not offer the correct resistance to thermal bridging or construction will not provide sufficient space for the insulation.
2. Installation guidance – given the presence of structural members, services, downlights, flues, HVAC units and other obstacles within the roof space there needs to be further guidance on how to adequately install a 'continuous layer' of insulation whilst avoiding these elements…but still being 'continuous'.

3. Safety – in ceilings, the use of continuous insulation will conceal the position of the joists meaning that future access to the roof space will be dangerous - homeowners and trades alike will need to undertake a survey of the roof space to establish the position of a safe walkway for services.
4. Batten construction – if a counter batten is used in a lightweight wall to create a space for insulation, will the batten require a thermal break and if so what value (if any) does this thermal break need to be?
   Refer **Handbook: Energy Efficiency NCC Volume One Figure 10.4 Wall thermal break construction** – can this detail be included as a note or mandatory guidance within the Housing Provisions?

Figure 10.4 Wall thermal break construction



NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.6j

Recommended change to draft:

Specify in Table 13.2.6j how to mitigate thermal bridging where floor insulation from Tables 13.2.6a and 13.2.6d to 13.2.6h as applicable is equal to R0.5.

Comment/reason for change:

Table 13.2.6d contains floor insulation R-values of 0.5. Table 13.2.6i specifies how to mitigate thermal bridging for floors requiring R0.5, but the alternate mitigation Table 13.2.6j does not have a solution for this situation. As it is specified in Table 13.2.6i, it seems that the omission in Table 13.2.6j is an oversight.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.6a – 13.2.6j

Recommended change to draft:

Remove reflective insulation option due to safety concerns

Comment/reason for change:

Use of foil under floors has been banned in New Zealand since 2016 due to the risk of electrocution after underfloor installations were linked to installer deaths.

The primary reasoning is concern relating to the attachment of the foil to the building (typically with electrically conductive fasteners) and proximity to electrical wiring which it typically run along or below sub-floor joists/bearers.

Furthermore, having reflective insulation installed above the joists would create a significant safety issue in laying the subsequent floor and need for trades to be walking on the joists as part of installation.

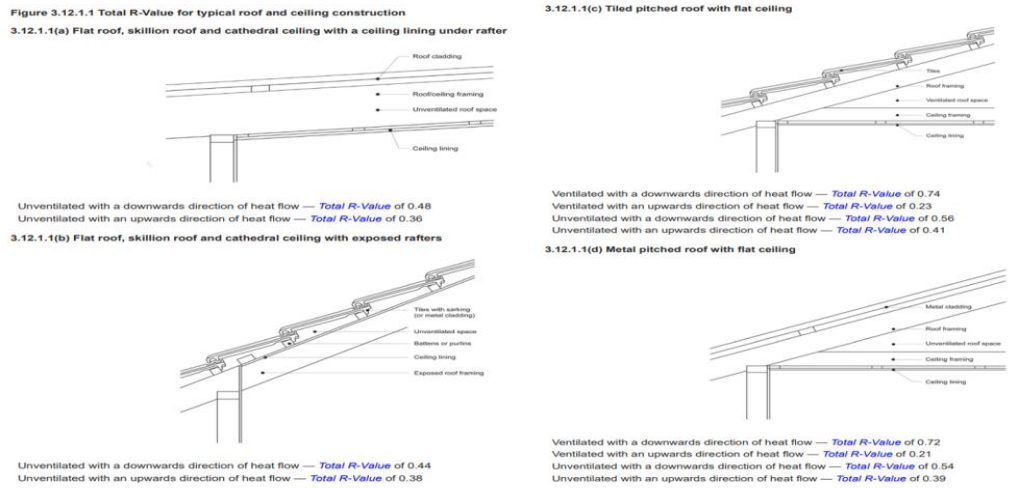
The only real viable option for sub floor insulation is installing insulation between the joists.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Figure 3.12.1.1 (a)(b)(c)(d)

Recommended change to draft:

Recommend to retain the Figures 3.12.1.1 in the Housing Provisions:



Comment/reason for change:

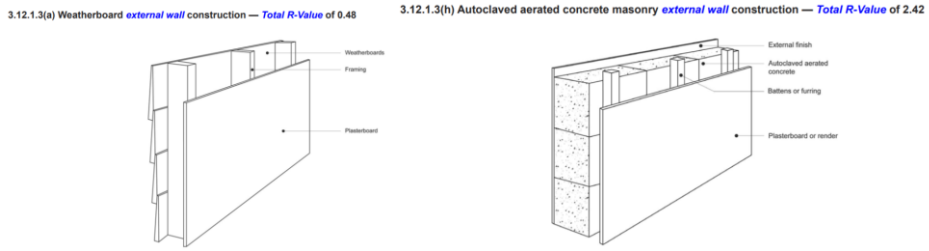
These images provide good guidance and show the typical roofing construction for residential buildings. It is recommended to retain these images to support practitioners in identifying differences between typical roofing systems.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

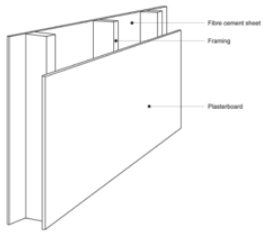
Clause/Figure/Table: Figure 3.12.1.3 (a) - Figure 3.12.1.3 (h)

Recommended change to draft:

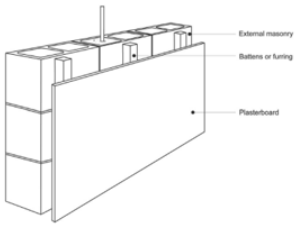
Recommend to retain the Figures 3.12.1.1 from Volume 2 or move them to Housing Provisions:



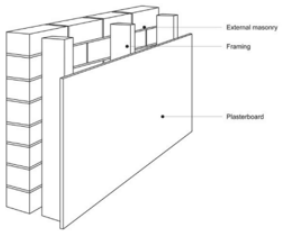
3.12.1.3(b) Fibre-cement sheet *external wall* construction — *Total R-Value* of 0.42



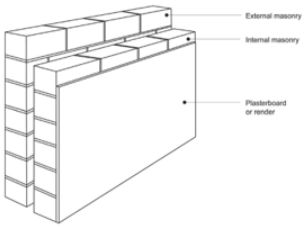
3.12.1.3(d) — Concrete blockwork masonry *external wall* construction — *Total R-Value* of 0.54



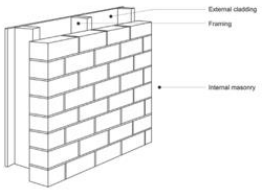
3.12.1.3(c) Clay masonry veneer *external wall* construction — *Total R-Value* of 0.56



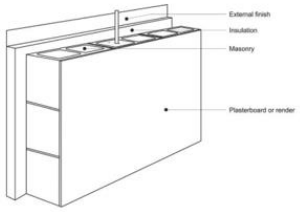
3.12.1.3(e) Cavity clay masonry *external wall* construction — *Total R-Value* of 0.69



3.12.1.3(f) Externally insulated clay masonry (reverse clay masonry veneer) *external wall* construction *R-Value* of 0.53



3.12.1.3(g) Externally insulated concrete masonry *external wall* construction — *Total R-Value* of 0.46



Comment/reason for change:

These images provide good guidance and show the typical walling construction for residential buildings. It is recommended to retain these images to support practitioners in identifying differences between typical roofing systems and the respective thermal performance.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J3D6

Recommended change to draft:
Change clause as highlighted below**.**

J3D6 Wall thermal breaks of a sole-occupancy unit of a Class 2 building and a Class 4 part

A wall must have a thermal break, consisting of a material with an *R-Value* of not less than R0.2, installed at all points of contact between the external cladding and the metal frame if the wall—

(a) does not have a wall lining or has a wall lining that is fixed directly to the same metal frame; and

(b) has lightweight external cladding with low thermal mass such as weatherboards, fibre-cement or metal sheeting fixed to a metal frame.

Comment/reason for change:

To better clarify the thermal characteristics of what lightweight cladding is beyond just the examples listed (as the examples may not cover all products). This would be in line with the Explanatory note in 13.2.5. (3) of the Housing Provisions.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table J3D7p

Recommended change to draft:

Renumber tables from Table J3D7p onwards.

Provide for additional Tables between existing J3D7o and J3D7p to accommodate;

A table for ***Timber-frame flat, skillion or cathedral roof – minimum R Value for ceiling insulation: climate zone 6,*** and

A table for ***Flat concrete roof – minimum R Value for ceiling insulation: climate zone 6.***

Comment/reason for change:

Elemental provisions missing for Climate Zone 6.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table J3D14b

Recommended change to draft:

Climate Zone 5 - WA - *2.56*

Comment/reason for change:

Extent of WA Climate Zone 5 resembles the extent and conditions of SA, so the Energy Factors (E_F) should match.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table J3D14b

Recommended change to draft:

Climate Zone 6 - WA - *3.58*

Comment/reason for change:

Extent of WA Climate Zone 6 resembles the extent and conditions of SA, so the Energy Factors (E_F) should match.

Clause/Figure/Table: Table 13.2.3v

Recommended change to draft:

- Delete table and replace with:
- "No thermal bridging mitigation measures required for steel framing".

Comment/reason for change:

Analysis undertaken by NASH and others has shown that no mitigation measures are required due to different frame ratios for steel and timber, encapsulation of the bottom chord of the truss by insulation, timber conductivity and the use of ceiling battens.

Clause/Figure/Table: Table 13.2.5c, Table 13.2.5v, Table 13.2.5k

Recommended change to draft:

- Simplify table.
- Develop solutions for 90 mm studs.

Comment/reason for change:

The maximum insulation batt for a 90 mm stud is R2.7. The R-values in the table after stud height and double storey are taken into account, the R-values required rise to R3.5. This is further exacerbated with light weight wall construction where an additional R0.3 is required. This requirement will reduce competition within the house building industry and lead to subsequent cost increases.

Clause/Figure/Table: *Table 13.2.5u*

Recommended change to draft:

- Add new option:

Vapour permeable (Class 3) reflective membrane with minimum 20 mm air space.

- Change "line the outer surface of the frame with additional insulation with an R-value of at least R0.26" to "provide a thermal break to the studs with an R-value of at least R0.25".
- Change "line the outer surface of the frame with additional insulation with an R-value of at least R0.45" to "provide a thermal break to the studs with an R-value of at least R0.25".
- Change "add an additional continuous insulation product with an R-value of at least R0.3" to "provide a thermal break to the studs with an R-value of at least R0.25".

Comment/reason for change:

Reflective membrane with an air space will provide a satisfactory solution in most cases.

The wording for thermal breaks and continuous insulation layers is currently confusing and the products specified are not commercially available.

The continuous insulation sheath will not meet the vapour permeability requirements set out in the condensation provisions.

The thickness of the thermal breaks or insulation layer will increase the wall thickness and therefore reduce liveable area in the house.

Clause/Figure/Table: Table 13.2.5w

Recommended change to draft:

- Add new option:

Vapour permeable (Class 3) reflective membrane with minimum 20 mm air space.

- Clarify and rationalise what is meant by the current descriptions of continuous insulation product and add R0.6 to frame only.

Comment/reason for change:

Reflective membrane with an air space will provide a satisfactory solution.

The wording for thermal breaks and continuous insulation layers is currently confusing and the products specified are not commercially available.

The continuous insulation sheath will not meet the vapour permeability requirements set out in the condensation provisions.

The thickness of the thermal breaks or insulation layer will increase the cavity depth and hence the total wall thickness and therefore reduce liveable area in the house. The increased cavity depth may require more expensive brick ties to adequately support the brick work.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.3 a to r Table Note 2(c)

Recommended change to draft:

(2) A roof is considered 'Vented' if it—

(a) has one wind-driven roof ventilator per 50 m^2 of respective ceiling area, in addition to roof vents; or

(b) has one powered roof ventilator per 200 m^2 of respective ceiling area, in addition to roof vents; or

(c) complies with .

Complete note (c).

Comment/reason for change:

(c) notes 'complies with' but does not advise what is needs to comply with.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.7(c)

Recommended change to draft:

Do not remove the option for climate zone 5.

Comment/reason for change:

Do not support the removal of 13.2.7(c) as it provides a suitable option for masonry separating construction and high thermal mass solution for climate zone 5 for the construction of the wall separating the house and the attached Class 10a building.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.5c

Recommended change to draft:

Resolve the anomaly in the table for eaves between 450 and 600 mm and wall height between 2.4 and 2.7.

Comment/reason for change:

It is considered that this is an ammonal in the Table in requiring R2.5 for eaves between 450 and 600 mm and wall height between 2.4 and 2.7. Looking at the table it looks like it would make more sense for requiring R2.0. based on the corresponding requirement for lightweight and darker wall colours.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Explanatory note in 13.2.5. (3) of the Housing Provisions

Recommended change to draft:

Include definition of what is considered lightweight cladding to exclude higher thermal mass claddings that may otherwise be considered lightweight such as AAC cladding.

Comment/reason for change:

Presently the various external wall tables require higher insulation R values for lightweight claddings but doesn't define what constitutes a lightweight cladding beyond some examples in explanatory information. These leaves the matter for interpretation and that is not an ideal outcome.

Inclusion of a definition or further expansion of the explanatory information that excludes higher thermal mass cladding such as AAC cladding would better clarify the thermal characteristics of what lightweight cladding is beyond just the examples listed.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Solar absorptance values

Recommended change to draft:

Include a table of expanded explanatory information on the various solar absorptance tables to assist with application of the wall and roof elemental tables.

Comment/reason for change:

The various external wall and roof elemental tables contain different values for insulation required for the wall and roof/ceiling based on solar absorptance colours/values.

However, there is no clause or table to define the various solar absorptance values or does it cover the likes of raw timber cladding for example.

Given the application of these tables is dependent on the solar absorptance values it is considered that additional detail is needed for the NCC to assist with application.

This may be through explanatory information and examples solar absorptance values and referring to manufactures product technical statements or similar.