AUSTRALIAN SUSTAINABLE BUILT ENVIRONMENT COUNCIL

Building Energy Performance Standards Project

Issues Paper - April 2016

The Australian Sustainable Built Environment Council (ASBEC) is the peak body of key organisations committed to a sustainable built environment in Australia.

ASBEC members consists of industry and professional associations, non-government organisations and government observers who are involved in the planning, design, delivery and operation of our built environment, and are concerned with the social and environmental impacts of this sector.

ASBEC provides a forum for diverse groups involved in the built environment to gather, find common ground and intelligently discuss contentious issues. ASBEC's objective is for Australia to be a leader in reducing ecological impacts, improving economic returns and extending community amenity of the built environment.

In 2009, The Myer Foundation and Monash University realised that Australia needed a new approach to drive action on climate change. One that understood the interests of business, government and investors and was trusted to be an independent, credible advisor in Australia's transition to a prosperous low carbon future.

That's why they partnered to create ClimateWorks Australia (ClimateWorks) - an independent, research-based, non-profit organisation committed to catalysing reductions in greenhouse gas emissions in Australia.

Since then, ClimateWorks has built a reputation as a trusted, credible and fact-based broker by working in partnership with leaders from the private, public and nonprofit sectors.

With strong links to the US-based ClimateWorks Foundation, ClimateWorks Australia also benefits from an international network of affiliated organisations that support effective policies for greenhouse gas reduction.

Acknowledgements

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We extend our appreciation to the Victorian Government as lead project sponsor, and Insulation Australasia for their contribution to funding Stage 1 of this project. We also thank the Australian Institute of Architects for their in-kind support to the project.

EXECUTIVE SUMMARY

Australia's current national emissions reduction target is to reduce emissions to 26-28 per cent below 2005 levels by 2030. As a signatory to the Paris Agreement, Australia has committed to the goal of reducing global emissions to net zero emissions and to five yearly reviews of the national target starting from 2020, with the requirement that new pledges be higher than the previous pledge and reflect the highest possible level of ambition. The built environment can significantly contribute to the emission reductions that Australia has committed to, as it makes up for almost a quarter of national emissions and represents one of the largest and lowest cost opportunities for abatement[1].

The National Construction Code is an important tool to influence emissions reductions in the built environment, providing the opportunity to influence two critical points at which the energy performance of buildings is determined: design & construction and major refurbishment. The last increases in the energy performance requirements of the Code were made in 2010, and there is currently a window of opportunity to pursue the upgrade of minimum standards at the scheduled 2019 Code update, which could deliver significant emissions reductions and avoid lock-in of poorly-performing buildings in the future.

This Issues Paper is the first step in a three stage project led by ASBEC to drive improvements in the National Construction Code (NCC). The Issues Paper sets out how the NCC currently operates and outlines a range of potential improvements. The Issues Paper is intended to support multi-stakeholder discussions taking place in 2016 to identify and progress potential improvements to the NCC. Improvements to the NCC may be implemented through the Australian Building Codes Board (ABCB), through the Council of Australian Governments' Building Ministers Forum or through other policy processes, and this project is intended to support and assist these government processes by coordinating industry and expert input.

This Issues Paper covers the following issues and potential areas for improvement in the NCC:

Option 1: Establish a trajectory for future upgrades to the NCC, in order to provide greater certainty and reduce the regulatory burden of code revisions on industry.

Questions for discussion

- *Should a trajectory for future upgrades be established? If so, what should the end goal of this trajectory be?*
- *What metrics should be used to define the end goal and progress towards it?*
- *What should the upgrade process be?*
- *Should changes be made to the process for upgrades to take better consideration of long-term benefits of energy efficiency?*
- *What further work is required to help determine the above?*

Option 2: Review and improve the NCC compliance mechanisms, for example by setting up a standardised and common methodology for the 'modelled performance solutions' compliance mechanism or introducing post-construction requirements.

Questions for discussion

- *Should the hybrid compliance pathway approach of the NCC be revised?*
- *Should the modelled performance / alternative solutions compliance pathway be improved?*
  - *How can it be improved for commercial?*
  - *How can it be improved for residential?*
- *What further work is required to better understand and determine the above?*

[1] ClimateWorks Australia, 2014

Option 3: Increase the stringency of the NCC energy performance requirements in the short term, for both residential and commercial buildings, or identifying further work needed to establish whether stringency should be increased.

Questions for discussion

- *For both residential and commercial buildings:*
  - *Should the minimum standards for commercial be increased in 2019? If so, by how much?*
  - *Should additional prescriptive requirements be set?*
  - *What further work is required to determine whether, and by how much, the minimum energy performance standards for commercial should be adjusted?*

Option 4: Other potential improvements, such as introducing post-construction requirements such as an air-leakage test, by better utilising rating tools as compliance pathways, or by facilitating the use of cloud computing and smartphone technology to make the code easier to access and comply with.

Questions for discussion

- *What other options exist to improve the minimum energy performance requirements for buildings?*
- *Which of these are a priority?*
- *What further work is required to better understand and help determine the above?*

ASBEC welcomes stakeholder feedback on these issues, and other issues or potential improvements to the NCC. Please direct feedback to Suzanne Toumbourou at suzanne@asbec.asn.au.

BACKGROUND AND CONTEXT

Why is this project important?

The National Construction Code (NCC) sets minimum standards for construction, ensuring that new buildings and alterations and additions to existing buildings, are safe and meet a minimum acceptable level of health, safety, amenity and sustainability.

The National Construction Code is also an important tool to influence emissions reductions in the built environment. The built environment makes up for almost a quarter of national emissions and represents one of the lowest cost opportunities for abatement[2]. Australia's current national emissions reduction target is to reduce emissions to 26-28 per cent below 2005 levels by 2030. As a signatory to the Paris Climate Change Agreement, Australia has committed to the goal of reducing global emissions to net zero emissions and to five yearly reviews of the national target starting from 2020, with the requirement that new pledges be higher than the previous pledge and reflect the highest possible level of ambition. The NCC provides the opportunity to influence two critical points at which the energy performance of buildings is determined: design & construction and major refurbishment.

The last increases in the energy performance requirements of the Code were made in 2010, and the gap between leading commercial[3] buildings and the minimum standards has widened. In 2012, Green Star office buildings emitted on average 45 per cent fewer emissions than new office buildings built to the 2010 minimum standards[4].

There is currently a window of opportunity to pursue the upgrade of minimum standards at the scheduled 2019 Code update. The National Energy Productivity Plan, released in December 2015, announced that the COAG Energy Council will investigate improvements in and advance the NCC[5]. This also provides the opportunity to consider broader improvements to the NCC and the minimum energy performance standards for new buildings, including establishing a forward trajectory for future upgrades.

Goal of the project

This project is led by ASBEC with support from ClimateWorks Australia. The project aims to:

1. *Develop an industry-led vision* for improving the energy performance requirements for both residential and commercial buildings in the NCC, with a goal to provide certainty, foster innovation and deliver the benefits of rapidly improving energy technology and design approaches for Australia.
2. *Seek implementation of this vision*, including through coordination of the industry response to NCC upgrade processes undertaken by the Australian Building Codes Board (ABCB) and other relevant government and industry processes. The ABCB has been consulted on this project and it is understood that it is considering undertaking work on the NCC energy performance standards in 2016/17.

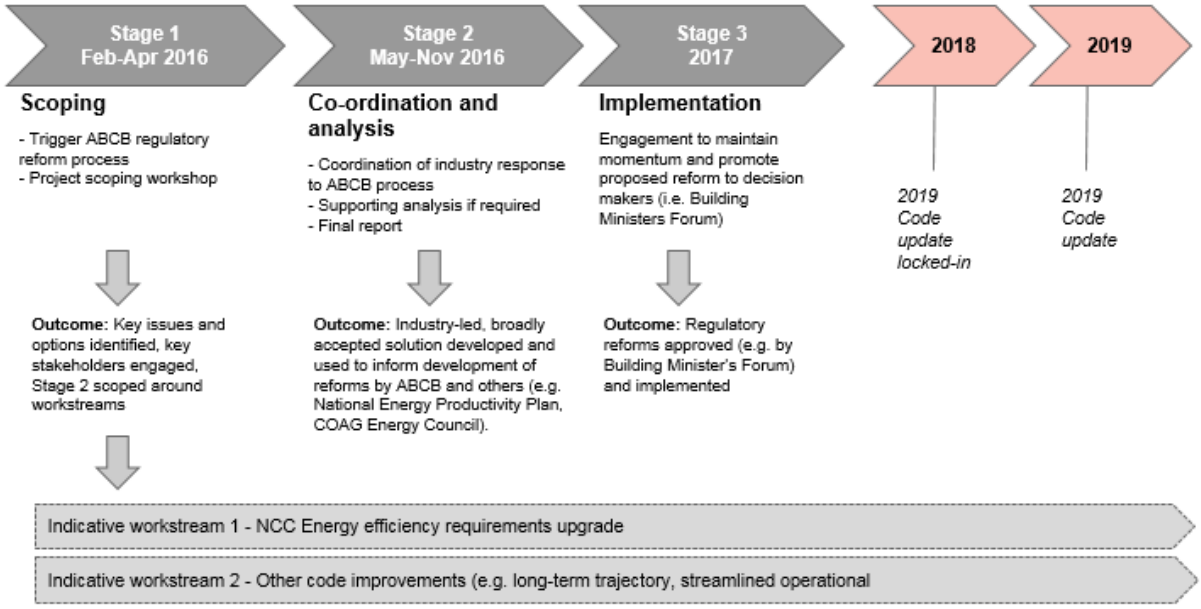
[2] ClimateWorks Australia, 2014
[3] In this Issues Paper, commercial buildings includes all non-residential buildings
[4] ClimateWorks Australia, 2013
[5] COAG Energy Council, December 2015

Outline of the project and purpose of this Issues Paper

The project is expected to take two years, and involve three distinct stages:

1. **Stage 1 - Scoping:** The development of an Issues Paper and running of a workshop in April 2016 involving relevant government, expert and property sector stakeholders to scope the second stage. The workshop will include separate streams for residential and commercial buildings, and will seek to complement and avoid duplication with work already under way through the ABCB and through the National Energy Efficiency Buildings Project.
2. **Stage 2 - Coordination and analysis**: The coordination of the industry response and input to the ABCB and other relevant regulatory processes. This streamlining would take place through a series of follow-up workshops throughout 2016 with industry, and would enable a faster, more effective and cohesive industry response to these regulatory processes than might otherwise be possible. Stage 2 may also include supplementary research to support the industry response.
3. **Stage 3 - Implementation**: Engagement to maintain momentum and promote proposed reform to decision makers.

Figure 1: Project timeline



This Issues Paper is part of the first stage and aims to identify the key issues relating to potential NCC energy performance standard improvements.

1. ABOUT THE NATIONAL CONSTRUCTION CODE

The NCC is a COAG initiative and is managed by the Australian Building Code Board (ABCB). The NCC sets out the minimum standards in relation to safety, health, amenity and sustainability for all new building work throughout Australia. It is comprised of the Building Code of Australia (BCA) and the Plumbing Code of Australia (Volume 3).

The BCA[6] includes two volumes:

1. Volume 1 applies to multi-residential, commercial, industrial and public buildings (Class 2 to 9).
2. Volume 2 applies to low rise residential (Class 1) and non-habitable buildings (Class 10).

This section provides context on:

- The goals of the NCC
- The energy performance requirements in the NCC, including:
  - The scope of these requirements
  - The pathways for building owners to comply with these requirements
  - The current standards for residential buildings
  - The current standards for commercial buildings
  - The administration governance arrangements for these requirements
- Other related tools, policies and processes

1.1 Goals of the NCC

The overall goal of the NCC is to "enable the achievement of nationally consistent, minimum necessary standards of relevant safety (including structural safety and safety from fire), health, amenity and sustainability objectives [in the design and construction of new buildings] efficiently."[7]The goal of the energy performance provisions of the NCC is to "reduce greenhouse gas emissions"[8] [9].

1.2 Energy performance requirements in the NCC

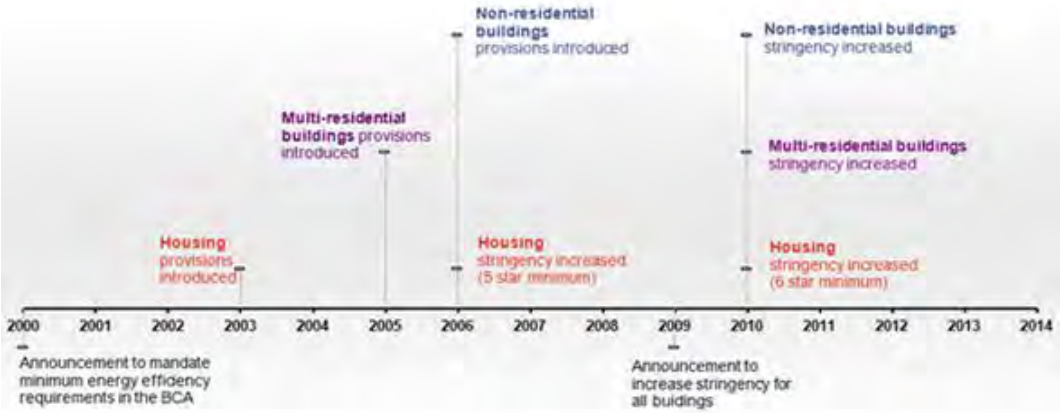
Mandatory energy performance requirements were introduced in the NCC in 2003 for residential[10], in 2005 for multi residential and in 2006 for commercial buildings[11]. Since then, the mandatory requirements for housing have been upgraded twice, in 2006 and in 2010; the requirements for commercial and multi-residential have been upgraded once, in 2010.

The NCC's energy performance requirements cover:

- Thermal performance of the building fabric for new buildings
- Buildings undergoing major renovations, additions or alterations;
- Some equipment and building management systems, namely lighting, Heating Ventilation and Air Conditioning (HVAC), water heating systems, and energy monitoring facilities.

[6] This Issues Paper is primarily concerned with the BCA, however for simplicity we refer throughout to the NCC.
[7] ABCB, 2015 (b), p.8
[8] ABCB, 2010, p.44
[9] ABCB, 2015 (a), p. 86
[10] Starting with a 4-Star minimum. Energy performance requirements for class 1 residential buildings are described in NCC Volume 2 Part 3.12
[11] Energy performance requirements for multi-residential and commercial buildings (Class 2-9) are described in NCC Volume 1 section J

Figure 2 - Timeline of National Construction Code Energy Performance Requirements
Source: ABCB



There are two ways to comply with the NCC minimum energy performance requirements:

1. **Follow the deemed to satisfy provisions (DTS)**: The NCC provides a list of construction measures or details which are deemed to meet the performance requirements of the NCC (the 'elemental provisions). For energy performance in residential buildings, there are two Deemed to Satisfy pathways: Either the builder can satisfy all of the 'elemental provisions' or obtain a Nationwide House Energy Rating Scheme (NatHERS) energy rating that meets the required[12].
2. **Develop a performance solution[13]:** This compliance path gives the applicant the freedom to choose any technology and product for the building design, provided that they can produce evidence that the building will meet or exceed the minimum performance requirement. This can be demonstrated through modelling analysis based on the building's design.

Building owners and developers have a choice of which compliance pathway to use. Large commercial offices tend to use the performance solution compliance pathway, while smaller buildings mostly use DTS. Residential buildings largely use the DTS through NatHERS energy rating[14] to demonstrate compliance with the performance requirements.

Current energy performance requirements for residential buildings[15]

The current minimum energy performance standards for residential buildings in the NCC are:

- For Class 1 residential buildings, a 6-star NatHERS rating, or compliance with the DTS elemental provisions;
- For Class 2 multi-residential buildings, an average rating of all units in the block of at least 6 stars, and a minimum for each unit of 5 stars. Multi-residential requirements also include a series of deemed to satisfy requirements in addition to the NatHERS assessment of building fabric.

The NCC is a model building code that is given legal effect through State or Territory building legislation. States and Territories can choose to apply these provisions with or without amendments. The NCC energy provisions are applied with variations in some States and Territories[16], as outlined in the table below.

[12] For Class 2 and 4 buildings there are no elemental provisions for the building fabric and NatHERS must be used to determine compliance.
[13] Previously referred to as "alternative solutions"
[14] As explained p.14, NatHERS energy rating is a DTS compliance pathway.
[15] NCC Volume 1 section 3.12 for residential and NCC Volume 1 section J for multi-residential
[16] For both volumes of the code, a list and details of state variations and additional requirements to the base NCC requirements are contained in a series of State-specific appendices

Table 1 - Differential enforcement of NCC energy requirements for residential buildings across Australian States and Territories

Residential building Class	NCC's latest requirement	States having adopted the latest NCC requirements	States that haven't adopted the latest NCC requirements
Houses			
Class 1 Single dwellings	NCC 2010 Part 3.12 (6 Stars)	VIC[17] SA[18] WA[19] Tasmania ACT Qld	NSW - BASIX[20] NT – 5 Star
Multi-residential			
Class 2 (multi-residential buildings A building containing 2 or more sole-occupancy units each being a separate dwelling.	NCC 2010 Section J (6 stars average, 5 star minimum)	VIC WA SA ACT Tasmania	NSW - BASIX NT - NCC 2009 (5 Star) Qld - NCC 2009
Class 4 (single dwelling) A dwelling in a building that is Class 5, 6, 7, 8 or 9 if it is the only dwelling in the building	NCC 2010 Section J	VIC WA Qld	NSW - BASIX NT - NCC 2009

Current energy performance requirements for commercial buildings

The minimum energy performance standards for commercial buildings consist of an extensive series of prescriptive requirements[21]. Most jurisdictions have adopted the latest requirements.

Table 2 - Differential enforcement of NCC energy requirements for commercial buildings across Australian States and Territories

Commercial building class	NCC's latest requirements	States that haven't enforced the latest NCC requirements
Class 3 A residential building, other than a Class 1 or 2 building, which is a commonplace of long term or transient living for a number of unrelated persons. Example: boarding-house, hostel, backpackers accommodation or residential part of a hotel, motel, school or detention centre	NCC 2010	NT - NCC 2009 NSW utilises the BASIX system, which is not directly comparable to the NCC requirements
Class 5-9 Office buildings, shop, retail, carparks, wholesale and storage, industrial, public buildings (schools, buildings, aged-care facility)		

[17] Victorian Building Authority, 2014
[18] Government of South Australia, 2015
[19] Government of Western Australia, Department of finance,2014
[20] NSW Government, Planning & Environment, 2015
[21] NCC Volume 1 Section J

Where does the NCC stand against international best practice?

There has not been a detailed study undertaken to benchmark Australia's NCC against other green building codes internationally, however, Australia as a whole does not appear amongst the 25 international best practice building energy performance codes as reported by the Global Building Performance Network.[22] New South Wales does appears on this list in relation to its use of the Building Sustainability Index system (BASIX), an alternative to the NCC.

[22] GBPN, 2013

1.3 Administration and governance of the NCC

The NCC is a joint initiative of the Commonwealth, States and Territories, administered by the ABCB under an Intergovernmental Agreement.

The ABCB administers (produces and maintains) the code

- Composition: The ABCB Board consists of ten to sixteen members including a Chair, the head of each Commonwealth, State and Territory Administrations responsible for building matters, up to five industry representatives, and a representative of the Australian Local Government Association.
- Mandate[23]: ABCB updates and maintains the NCC, as well as providing administrative and educational support for users of the NCC. The ABCB conducts regulatory impact assessments where required for significant amendments to the NCC in accordance with COAG's principles for national standard-setting bodies.
- Limitation of mandate: The ABCB is responsible to the COAG Building Ministers Forum (BMF), which it makes recommendations to and takes policy direction from. The ABCB is not a regulatory body and does not have the power to take decisions to reform the code unilaterally, but has carriage of implementing BMF decisions.

The Building Ministers Forum (COAG) is in charge of regulatory reforms of the code

- Composition: The Building Ministers' Forum (BMF) is a COAG body responsible for building regulation. The Hon. Karen Andrews MP, Assistant Minister for Science, is the current Chair of the BMF[24]. The BMF meets annually, or on a needs basis.
- Powers[25]: The BMF oversees the drafting of the NCC by the ABCB and takes the executive decision regarding regulatory reforms of the code[26].

States and Territories enforce the code

- States and Territories are responsible for adopting the NCC through building legislation and managing its enforcement through the building approval process. The NCC appendices detail State and Territories variations to the NCC and recognise that state-specific energy performance requirements[27], such as the New South Wales BASIX system, can carry the performance requirements or the method of compliance.

Compliance

The mechanisms for ensuring compliance with the NCC vary from state to state and are defined in their individual building laws and regulations.

For example, in Victoria[28] a building permit is required for all building work, including minor alterations, demolitions and repair or maintenance work. A building permit is issued to ensure that the building works comply with the State's building legislation adopts the NCC. Compliance is assessed by a building surveyor based on the plans and documentation before the construction begins, as well as during three mandatory inspections (footings, building frames, and post-construction to issue an occupancy certificate). However, no assessment of building compliance during the occupancy is required, apart from fire safety items.

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[23] Commonwealth of Australia, the States and the Territories, 2012

[24] Other BMF members include: Mr Mick Gentleman (ACT), The Hon Rob Stokes & The Hon Victor Dominello (NSW), The Hon David Tollner (NT), The Hon Mick de Brenni (Qld), The Hon John Rau & The Hon Ian Hunter (SA), The Hon Peter Gutwein (Tasmania), The Hon Richard Wynne (Vic), The Hon Michael Mischin (WA)

[25] Department of Industry, Innovation and Science, 2015

[26] For example, on the 30th of May 2014, BMF agreed to significant building code reform to reduce red tape for Australia's building industry. Source: Department of Industry, Innovation and Science, 2014

[27] NCC Vol.1, 2015, p.547

[28] Victorian Building Authority, 2014

1.4 Other code-related tools, policies and processes

Rating tools

The NCC uses the NatHERS rating tool to define the level of stringency of energy performance requirements for residential buildings and can be used to demonstrate compliance. Energy performance provisions for commercial buildings and multi residential are not tied to a particular rating tool.

Current rating tools in Australia include:

- **NatHERS**: This rating tools assesses the thermal performance of homes at the design stage. This rating tool is the most connected to the NCC as the Code defines its residential energy performance minimum standards in terms of NatHERS stars (currently 6 star).
- **NABERS** is a national rating system that measures the environmental performance (energy performance, water usage, waste management and indoor environment quality) of buildings, tenancies and homes. NABERS is not currently tied to the NCC but is used for the purpose of compliance with the Commercial Building Disclosure Program (CBD) for commercial offices over 2000m^2. The latter are required to disclose their energy performance at times of lease and sale through the NABERS rating. Outside of the scope CBD program, NABERS is a voluntary rating tool.
- **Green Star**: Green star is a national voluntary rating and benchmark tool for the design, construction, operations and fit-out of building and communities. It is not referenced in the NCC.
- In Victoria, the **Built Environment Sustainability Scorecard**[29] has been was developed by local government to assist builders and developers assess the sustainability of their design. The Victorian government is also currently developing another voluntary tool; the Residential Efficiency Scoreboard, meant to assist households in improving the performance of their property and saving money on energy bills.

Planning requirements

- Some councils have put in place guidelines and/or requirements on the development of sustainable precincts and lots design. These guidelines can be voluntary or mandated depending on councils, however they are not required by the NCC.

[29] Municipal Association of Victoria, 2015

2. POTENTIAL AREAS FOR IMPROVEMENT TO THE NCC

This section outlines issues related to standard setting and suggestions about how the NCC could be improved. These have been raised by various stakeholders in recent years or have been drawn from review of alternative approaches taken internationally. The suggestions are not recommendations but rather aim at providing context for discussion and input from interested stakeholders.

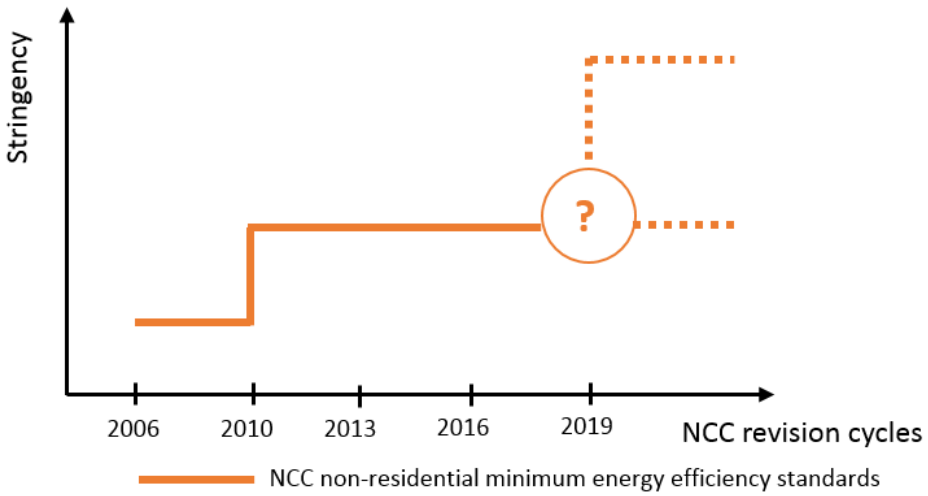
The potential areas for improvement discussed in this section include:

1. Establish a trajectory for future upgrades
2. Review and improve the NCC compliance mechanisms
3. Review and upgrade the stringency for minimum standards in the short term
4. Other potential improvements

Option 1: Establish a trajectory for future upgrades and reduced building emissions

Currently, the NCC is on a three year publication cycle. Each 3-yearly publication is a window of opportunity to review and upgrade the minimum energy performance standards. However, there is no established plan or trajectory for future upgrades of the energy performance requirements. This creates an ad hoc process with no set timeline for the next upgrade, creating uncertainty for industry and additional regulatory burden with the need for an extensive consultation process every time a potential upgrade is proposed. It also creates the risk that the minimum performance standard in the NCC could lag behind technological developments and creates uncertainty about the extent to which the NCC can and will contribute to national energy and emissions targets.

Figure 3 - NCC's ad hoc minimum standards upgrade process, source: ClimateWorks Australia



Establishing a trajectory for future upgrades could enable faster and less burdensome revision over time as technology and design approaches improve. It would also provide greater regulatory certainty to the building industry and allow them to prepare better for upcoming changes in regulation.

Setting a trajectory would include setting a long-term goal, establishing metrics for measuring progress towards that goal, and defining the upgrade process.

Setting a long-term goal

Setting a trajectory would require defining its end goal, and establishing long-term and interim targets for future minimum standards upgrades.

Although further investigation would be required to determine these, targets could be set based on a long-term trajectory towards zero net emissions nationally, as required under the Paris Climate Change Agreement. Trajectories with medium to long-term goals for buildings' energy performance have already been applied internationally: in 2010, the EU set the target for all new builds to be Nearly Zero-Energy buildings (NzEB) by 2020[30]. In 2007, the UK introduced a target in 2007 (since removed) requiring all new homes to be zero carbon by 2016, which relied on the progressive tightening of building regulations[31].

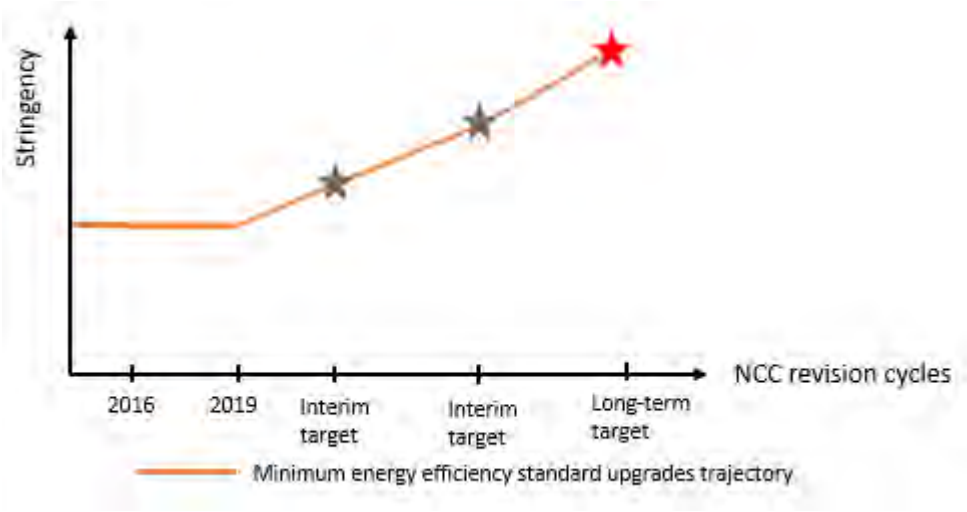
Metrics

Metrics would need to be agreed for measuring the end goal and progress towards it. For example, NCC requirements could be expressed in terms of emissions, or energy productivity or both.

Process

Establishing a trajectory would include the establishment of a clear process for future upgrades. For example, this might involve replacing the current ad hoc / opt-in approach to standard upgrades by establishing an automatic increase of minim standards at regular intervals with an opt-out available, for example if technology failed to develop at the expected rate.

Figure 4 - Illustrative rising trajectory for minimum energy performance standards upgrades



Source: ClimateWorks Australia

Depending on the intended long-term goal, there may need to be adjustments to the process for energy performance standard upgrades. Currently, any proposed changes to the NCC must undergo a regulatory impact assessment (RIA), including a cost-benefit analysis based on parameters defined by the Office of Best Practice Regulation for national standards setting bodies. It is understood that the ABCB has its own Protocol for undertaking these cost-benefit analyses and it is understood that it is in the process of reviewing them. There have been suggestions that some of the parameters on which the cost-benefit calculations are based may lead to an undervaluation of the benefits of energy performance, including:

[30] A nzEB is a "building that has a very high energy performance... [ ]. The nearly zero or very low amount of energy required should to a very significant extent be covered by energy from renewable sources, including renewable energy produced on-site or nearby." Source: European Parliament and of the Council, 2010

[31] Zero Carbon Hub, 2013

- **Discount rates**: The level of the discount rate used in a regulatory impact assessment has a very significant impact on the value that is placed on benefits accumulated in the future over a long time. Energy efficiency projects fit this description, with energy and emission savings accumulating over the decades in which the building or equipment is in operation. The lower the discount rate, the higher the value of future benefits. There is concern[32] that the discount rate used in RIAs for minimum energy performance standards could underestimate the value of future energy efficiency benefits. The ABCB uses a discount rate of 5 per cent, and reports outcomes at both 3 per cent and 7 per cent[33]. This differs from most RIAs which use a 7 per cent discount rate and a sensitivity analysis at 3 per cent and 10 per cent, as required by the Office of Best Practice Regulation[34]. There is a debate about the appropriate discount rate to use, especially to evaluate climate mitigation measures. The Intergovernmental Panel on Climate Change recommends using a 3.5 per cent rate for 1-30 years, a 3 per cent rate for 31-75 years, a 2.5 per cent rate for 76-125 years, a 2 per cent rate for 125-200 years, 1.5 per cent for 100-300 years, and 1 per cent for longer period"[35]
- **Industry learning rates:** Reflect how rapidly the real incremental cost of complying with the performance requirements declines through time. This is a result of market adaptation and economies of scale. For example, in other markets, builders have reported that the cost of double glazing lowered substantially after the introduction of regulations mandating them. Not taking this parameter into account in a RIA will overestimate the costs of increased energy performance standards. There are concerns that the current RIA methodology used to assess the cost effectiveness of new energy performance standards may take insufficient account of industry learning rates. For example, the RIA for the proposed 6 star housing standard in 2009 did not include any learning rates[36].
- **Co- benefits**: Research suggests that improved energy efficiency, alongside enhanced indoor environmental quality in buildings, can also improve health, comfort and productivity. These are more difficult to quantify than other benefits, which can contribute to the underestimation of the benefits of increased energy performance standards.

Questions for discussion:

- *Should a trajectory for future upgrades be established? If so, what should the end goal of this trajectory be?*
- *What metrics should be used to define the end goal and progress towards it?*
- *What should the upgrade process be?*
- *Should changes be made to the process for upgrades to take better consideration of long-term benefits of energy efficiency?*
- *What further work is required to help determine the above?*

[32] Isaacs, T. and Pears, A., 2016
[33] Isaacs, T. and Pears, A., 2016
[34] Department of the Prime Minister and Cabinet, 2014, p.7
[35] IPCC, 2007
[36] ABCB, 2009, p.56: "Although the proposed BCA amendments are indeed likely to induce a market response — in say the design, orientation and construction of new dwellings — the impact analysis in this report has deliberately assessed the amendments as if there is no market response whatsoever. The intent of the assessment is to reflect on the change in the cost and benefits of current choices and practices"

Option 2: Review and improve the NCC compliance pathways

Internationally, there exist two broad types of building codes:

1. *Prescriptive or U-value building codes:* Set energy performance requirements for individual parts of the building. Within this category there are variants of prescriptive requirements[37]. In the traditional prescriptive method, energy performance requirements are set for each component of the building, whether they are thermal values for roofs, walls or windows, or other efficiency values for building orientation, ventilation, etc (e.g. the current 'elemental' method). Alternatively, the Trade-off Method varies slightly from this traditional approach in that although efficiency values are set for individual building parts, trade-offs can be made between the excess of efficiency in some parts and the underperformance of others, which provides more flexibility (e.g. the NSW BASIX energy and water approach).
2. *Performance-based codes:* Take a whole-building approach by setting an overall energy consumption (energy performance method) or energy loss (energy frame method) target for an entire building gives the designer broader scope to use prescription, trade-off and alternative technologies to formulate a design which can be shown to achieve the target.

The NCC is a performance-based code, but in practice operates as a hybrid by offering users two pathways to verify a design meets the performance requirements: the prescriptive pathway (DTS provisions) and modelled performance pathway or 'alternative' solution for both residential and commercial.

In practice, most building permit applicants for large offices use the modelled performance / 'alternative solution' compliance pathway. The prescriptive DTS compliance pathway is preferred in the residential sector (DTS compliance is mostly demonstrated through NatHERS ratings for Class 1 buildings and is the only option for DTS in Class 2 and 4 buildings). This may in part be because the DTS provisions are a more straight-forward way to comply with the code and because there is no standardised approach to undertaking the modelled performance required to show compliance.

Prescriptive requirements in the NCC

The table below outlines what is covered by prescriptive requirements/DTS provisions for commercial and residential buildings:

Table 3 - NCC's prescriptive requirements for residential, multi-residential and commercial buildings

Prescriptive requirements	Commercial and multi-residential	Housing
Building fabric (Insulation of roof, walls and floor)	yes	yes
Glazing (Measures to control unwanted heat gain or loss through glazing)	yes	yes
Building sealing (measures to reduce air leakage through the envelope)	yes	yes
Measures to facilitate air movement for cooling	no	yes
Artificial lighting and power minimum energy performance standards	yes	yes
HVAC minimum energy performance levels	yes	no[38]
Measures to reduce GHGs from supply water heaters and central heating and cooling systems	yes	yes
Measures affecting heating, pumping and covers of swimming pools and spas	yes	yes
Measures mandating the use of facilities for energy monitoring	yes	no

[37] Laustsen, J.,2008

[38] Covered by Greenhouse and Energy Minimum Standards and energy rating labels

For commercial buildings, compliance with the DTS provisions is achieved by complying with every elemental provision above. For residential buildings, there are two possible options to comply with the DTS: through an energy rating (mandated DTS compliance route for Class 2 buildings); or by complying with the above mentioned elemental provisions.

Modelled performance solutions in the NCC

Compliance with the NCC can also be achieved through performance solutions ('alternative solutions') to the DTS pathway. Based on modelled performance at the design stage, verification methods vary for each building class:

- For commercial and multi-residential buildings: There are various assessment methods possible, including the NCC verification method referred to as JV3. The latter uses a reference building, which is a hypothetical building that has the same design as the applicant building but modelled using the prescriptive deemed-to-satisfy provisions. The NCC verification method requires a commercial or multi-residential building to show, through a modelling of its future energy consumption, that the latter does not exceed the energy consumption of the reference building[39].

- For residential buildings: The verification method for performance solutions in housing is similar to the verification method for commercial buildings, as it is also based on comparing the modelled future performance of the applicant building to a reference building. It differs from the commercial verification method because instead of being focused on energy consumption, it requires a building to not have its annual heating and/or cooling loads exceed the reference building heating and cooling loads[40].

Potential improvements

A number of potential changes have been proposed to the compliance pathways, including:

- Shifting away from the hybrid compliance pathway approach (see pros and cons table below);
- Adjusting the modelled performance / alternative solutions compliance pathway, for example by:
    - Creating and mandating a standardised and fixed modelling methodology to ensure modelling approaches deliver compliant designs;
    - Creating an accreditation system to regulate the skills needed to undertake the modelling analysis.

[39] ABCB, 2010
[40] South Australian Government, 2012

Table 4 - Advantages and disadvantages of the different compliance pathways

Prescriptive energy performance requirements		**Performance-based / alternative solutions**	
+	**-**	**+**	**-**
Easy to understand and to comply with	Does not encourage the most recent and cost-effective technologies, especially in the absence of a dynamic revision process	Offers flexibility and wider range of choices Allows for the adoption of the most recent and cost-effective technologies	More effort required in demonstrating compliance Costly to put in place as it requires the establishment of a standard and common methodology for modelled performance. In the absence of such a common methodology, regulatory uncertainty is created and insurance premiums can increase.

Questions for discussion:

- *Should the hybrid compliance pathway approach of the NCC be revised? If so, why and how?*
- *Should the modelled performance / alternative solutions compliance pathway be improved?*
    - *How can it be improved for commercial?*
    - *How can it be improved for residential?*
- *What further work is required to better understand and determine the above?*

Option 3: Increase the stringency of the NCC energy performance requirements in the short term

There is considerable amount of consensus around the need to increase the levels of stringency of minimum energy performance standards for commercial buildings. Recent research has shown that standards for commercial buildings[41] lag significantly behind technological development. On average, in 2012, Green Star office buildings emitted 45 per cent fewer emissions than new office buildings built to the 2010 efficiency standards[42]. There is a divergence of views about whether there is an immediate need to increase the stringency of minimum energy performance standards for residential buildings.

If the next NCC upgrade in 2019 fails to include improved energy performance requirements, buildings will be using the 2010 minimum standard until 2021. There is therefore some urgency to addressing this issue. Delay in upgrading the minimum standard would lock in poor performing building stock for many decades, resulting in unnecessarily high expenditure on energy, unproductive working environments for businesses, poorly conditioned homes and lost opportunities for low-cost emissions reductions.

Question for discussion

- *For both residential and commercial buildings:*
  - *Should the minimum standards for commercial be increased in 2019? If so, by how much?*
  - *Should additional prescriptive requirements be set?*
  - *What further work is required to determine whether, and by how much, the minimum energy performance standards for commercial should be adjusted?*

[41] See introduction

[42] ClimateWorks Australia, 2013

Option 4: Other potential improvements

A number of other potential improvements that could be made – either within or outside the NCC – to improve the minimum energy performance standards achieved in buildings are identified below.

Option 4.1. Improve the design of the code to improve compliance

Recent reports have concluded that there is significant under-compliance with energy performance minimum standards in residential[43] and commercial buildings[44]. The National Energy Efficient Building Project, co-ordinated by the South Australian Government, is focused on improving code enforcement.

The scope of this project does not include issues relating to enforcement of the NCC. However, it does investigate options to improve the design of the NCC to make it clearer and more user friendly, thereby helping to improve compliance. Some of these options include:

- Introducing post-construction requirements into the NCC, for example meeting a certain maximum level of air leakage through a post-construction air leakage test.
- Making code compliance useful for other purposes
    - NCC compliance proven through a rating which can then be used to promote the building's energy performance.
    - NCC compliance and modelling can be used by building managers to optimise performance
- Mandate whole building commissioning, which would improve compliance at the operational stage. It is currently mostly used in large commercial buildings in the high-end of the market.
- Making the code easier for service providers to understand, use and comply with, for example:
    - Online/smartphone guides or cloud-based smartphone apps that require contractors to take photos of key building elements, which could link with a building passport project;
    - Reframe minimum requirements for commercial buildings based on a user-friendly rating tools (e.g. US ENERGY STAR (see below), NABERS);
    - Improvement, harmonisation and simplification of residential rating tools[45];
    - Creation of a best practice code with simpler language, making it easier for industry to comply with the NCC minimum requirements and easily go beyond them. AIRAH and GBCA are currently working on this by developing an Australian Green Building Construction Code.
    - Set up a voluntary certification of compliant products to make compliance during the construction stage easier for service providers (e.g. Product certification in New Zealand)

[43] Ambrose M & Syme M, 2015
[44] State of South Australia, 2016
[45] Implementing this recommendation would help code compliance but will be outside the scope of the NCC

International Best Practice example - US ENERGY STAR

ENERGY STAR is a voluntary program developed by the US Environmental Protection Agency (EPA), which promotes voluntary labelling and communication of the energy standards of products and buildings. It has increased the adoption of energy efficient products, practices, and services through partnerships, measurement tools, and consumer education. ENERGY STAR has over 18,000 partnership agreements across every economic sector in the US, 4.5 billion products sold in 20 years, 1.4 million certified new homes and 20,000 certified facilities. Over 85 per cent of Americans recognise the ENERGY STAR label and 75 per cent credit the label as an important factor in decision making.46

To earn an ENERGY STAR rating, new residential buildings must be verified by a third-party organisation. This can be done through a prescriptive path (based on a predefined package of improvements) or a performance path (based on a customised package of upgrades). Both paths involve inspection checklists that cover comfort, indoor air quality and durability. Commercial buildings must be verified by a licensed professional who verifies: all energy use is accounted for accurately; the building characteristics have been properly reported; the building is fully functional in accordance with industry standards; and each of the indoor environment criteria has been met.47

Option 4.2. Amend the goals of the NCC

NCC goals could be amended to include potentially:

- Providing regulatory certainty for industry;
- Delivering consumer protection and other benefits to Australian households and businesses;
- Contributing to national emission reduction and productivity targets;
- Achieving reduced costs of products, services and equipment through economies of scale;
- Avoiding the lock in of emissions in carbon intensive assets;
- Other sustainability goals such as IEQ (Indoor Environmental Quality).

Option 4.3. Harmonise and broaden the scope of requirements for existing buildings

This could be done by potentially:

- Harmonising the definition of renovation across States. The NCC covers existing buildings undergoing major renovations and new construction work. This includes refurbishments but excludes alterations and additions that are so minor that they are exempted from seeking formal building approval. The line that distinguishes between refurbishments and minor additions and alterations is determined by the provisions of each State & Territory's individual building regulations, and the applicability of the code to renovations differs therefore significantly between jurisdictions.

  Example: In the case of Victoria the so-called "50% rule" defines which alterations are subject to the energy performance requirements and which are not: "*If the proposed alterations, together with any other alterations completed or permitted within the previous 3 years, represent more than half the original volume of the building, the entire building must be brought into conformity with these Regulations*[48]."

- Introducing standards for existing buildings without renovation, for example for rental properties.

[46] US EPA, undated
[47] US EPA, undated
[48] Victorian Government, 2006

Option 4.4. Require building information modelling

- Building modelling established at the beginning of the building design process and can be used throughout design and construction to help ensure good execution of the design. There have been suggestions that this could be introduced in the NCC as a requirement.

Questions for discussion:

- *What other options exist to improve the minimum energy performance requirements for buildings?*
- *Which of these are a priority?*
- *What further work is required to better understand and help determine the above?*

APPENDIX

Table 5 - List of the NCC Building Classes, Source: Queensland Building and Construction Commission

	Classes of buildings		
NCC Vol. 2	**Class 1**	**Class 1a**	A single dwelling being a detached house or one or more attached dwellings.
		Class 1b	Boarding/guest house or hostel not exceeding 300m2 and not more than 12 people reside.
		Which is not located above or below another dwelling or another Class of building other than a private garage.	
NCC Vol. 1	**Class 2**	A Building containing 2 or more sole occupancy units each being a separate dwelling.	
	Class 3	A resident building, other than a class 1 or 2, which is common place of long term or transient living for a number of unrelated persons.	
	Class 4	A dwelling in a building that is Class 5, 6, 7, 8 or 9 if it is the only dwelling in the building.	
	Class 5	An office building used for professional or commercial purposes, excluding buildings of Class 6, 7, 8 or 9.	
	Class 6	A shop or other building for the sale of goods by retail or the supply of services direct to the public.	
	Class 7	A building which	
		Class 7a	Is a carpark
		Class 7b	Is for storage or display of goods or produce for sale by wholesale
	Class 8	A laboratory, or a building in which a handicraft or process for the production, assembling, altering, repairing, packing, finishing, or cleaning of goods or produce is carried on for trade, sale or gain	
	Class 9	A building of a public nature	
		Class 9a	A health care building
		Class 9b	An assembly building in a primary or secondary school, but excluding any other parts of the building that are of another class.
		Class 9c	An aged care building
NCC Vol. 2	**Class 10**	A non-habitable building or structure	
		Class 10a	A private garage, carport, shed or the like.
		Class 10b	A structure being a fence, mast, antenna, retaining or free standing wall, swimming pool or the like.

SOURCES

ABCB, 2009, Final Regulation Impact Statement for decision, Proposal to Revise the Energy Efficiency Requirements of the Building Code of Australia for Residential Buildings - Classes 1, 2, 4, and 10, Canberra, Australia

ABCB, 2010, Energy Efficiency Provisions for BCA 2010 Volume 1 - Information handbook

ABCB, 2015 (a), National Construction Code Series, Volume 2, Building Code of Australia (Class 1 and 10)

ABCB, 2015 (b), National Construction Code Series, Volume 1, Building Code of Australia (Class 2-9 Buildings)

Ambrose M & Syme M, 2015, House energy efficiency inspections project, final report. CSIRO. Available at: http://www.nathers.gov.au/sites/prod.nathers.gov.au/files/files/pdf/research/House%20Energy%20Efficiency%20Inspections%20Project.pdf

ClimateWorks Australia, 2014, *Pathways to Deep Decarbonisation in 2050,* available via: http://www.climateworksaustralia.org/sites/default/files/documents/publications/climateworks_pdd2050_initialreport_20140923.pdf

ClimateWorks Australia, 2013, Tracking Progress Towards A Low Carbon Economy - Buildings, p.3, available at: http://climateworks.com.au/sites/default/files/documents/publications/climateworks_trackingprogress_buildings_full_report_july2013_1.pdf

COAG Energy Council, December 2015, *National Energy Productivity Plan 2015–2030 Boosting competitiveness, managing costs and reducing emissions*, p.17, available at: https://scer.govspace.gov.au/files/2015/12/National-Energy-Productivity-Plan-release-version-FINAL.pdf

Commonwealth of Australia, the States and the Territories, 2012, Inter-governmental Agreement , available at: http://www.abcb.gov.au/Resources/Publications/Corporate/Inter-Governmental-Agreement

Department of the Prime Minister and Cabinet, 2014, *Guidance Note: Cost-benefit analysis*, p.7

Department of Industry, Innovation and Science, 2014, Building ministers' forum agrees to National Construction Code reforms, available at: http://www.minister.industry.gov.au/ministers/baldwin/media-releases/building-ministers-forum-agrees-national-construction-code-reforms

Department of Industry, Innovation and Science, 2015, Building Minister's Forum, available at: http://www.industry.gov.au/industry/IndustrySectors/buildingmetalsandconstruction/Pages/Building-Ministers-Forum.aspx

ENERGY STAR, undated. About ENERGY STAR. [Online] Available at https://www.energystar.gov/about

European Parliament and of the Council, 19 May 2010, Directive 2010/31/EU on the energy performance of buildings

GBPN, 2013, Compare dynamic energy efficiency policies for buildings, available via: http://www.gbpn.org/databases-tools/purpose-policy-tool-new-buildings

Government of South Australia, 2015, Six stars energy efficiency requirement for new homes. [Online] [Available at:https://www.sa.gov.au/topics/water-energy-and-environment/energy/saving-energy-at-home/energy-efficient-home-design/Six-star-energy-efficiency-requirements]

Government of Western Australia, Department of finance (2014) Residential Buildings Energy Efficiency. [Online] [Available at: http://www.finance.wa.gov.au/cms/Public_Utilities_Office/Energy_Initiatives/Residential_building_energy_efficiency.aspx]

IPCC, 2007, Climate Change 2007: Working Group III: Mitigation of Climate Change, viewed on 30/04/2015 at: https://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch2s2-4-2-1.html

Isaacs, T. and Pears, A., 2016, How cautious policy analysis could lead to radical 'do nothing' policy conclusions: a case study of the 6 star housing regulatory impact statement

Laustsen, J., 2008, *Energy Efficiency requirements in building codes, energy efficiency policies for new buildings*, OECD/International Energy Agency, (online) (Available at: https://www.iea.org/publications/freepublications/publication/Building_Codes.pdf)

Municipal Association of Victoria, 2015, Built Environment Sustainability Scoreboard, available at: http://www.bess.net.au/

New Zealand Ministry of Business, Innovation and Employment, 2014, New Zealand Building Code Handbook. [Online] Available at: http://www.building.govt.nz/assets/Uploads/building-code-compliance/handbooks/building-code-handbook/building-code-handbook-3rd-edition-amendment-13.pdf

NSW Government, Planning & Environment, 2015, About BASIX. [Online] [Available at: https://www.basix.nsw.gov.au/basixcms/about-basix.html]

Pitt & Sherry (2012) *Pathway to 2020 increased stringency in new building energy efficiency standards: benefit cost analysis*. (Online) (Available at: http://www.industry.gov.au/Energy/Energy-information/Documents/pathwayto2020newbuildingenergyefficiencystandards.pdf)

Pitt & Sherry, 2014, National Energy Efficient Building Project - Final Report, available at: https://www.sa.gov.au/__data/assets/pdf_file/0004/135544/NEEBP-final-report-November-2014.pdf

Queensland building and construction commission, Classification summary of buildings and structures, available at: https://www.qbcc.qld.gov.au/sites/default/files/BCA%20Classes%20of%20Building.pdf

Queensland Government, Department of Housing and Public Work, 2014, 5-star energy efficiency rating for residential units. [Online] [Available at: http://www.hpw.qld.gov.au/SiteCollectionDocuments/FiveStarEnergyEfficiencyRatingFactSheet.pdf]

Queensland Government, Department of Housing and Public Works (2014) 6-star energy efficiency rating for new houses and townhouses. [Online] [Available at:http://www.hpw.qld.gov.au/SiteCollectionDocuments/SixStarEnergyEfficiencyRatingFactSheet.pdf]

South Australian Government, 2012, Advisory Notice - Buildings: Alternative methods for complying with the six star energy efficiency requirements, available via: https://www.sa.gov.au/__data/assets/pdf_file/0007/22786/Building_advisory_notice_Alternative_methods_for_complying_with_the_six_star_energy_efficiency_requirement.pdf

South Australia Government, 2016, National Energy Efficient Building Project (Online) Available at: https://www.sa.gov.au/topics/water-energy-and-environment/energy/government-energy-efficiency-initiatives/national-energy-efficient-building-project

Victorian Building Authority (2014) Six Star Standard. [Online] [Available at: http://www.vba.vic.gov.au/consumer-resources/other/standard-pages/6-star-standard]

Victorian Building Authority, 2014, Permits & paperwork before, during and after building, available at: http://www.vba.vic.gov.au/__data/assets/pdf_file/0018/25209/Permits-paperwork-before-during-and-after-building.pdf

Victorian Government, 2006, Building Regulations 2006 S.R. No. 68/2006, Part 6 - Building Work, Regu. 608, p.71, available at: http://www.legislation.vic.gov.au/Domino/Web_Notes/LDMS/PubStatbook.nsf/b05145073fa2a882ca256da4001bc4e7/79D66077DE4827BCCA2571850013458E/$FILE/06-068sr.pdf

Zero Carbon Hub, 2013, ZERO CARBON HOMES AND NEARLY ZERO ENERGY BUILDINGS, available via: http://www.zerocarbonhub.org/sites/default/files/resources/reports/ZCHomes_Nearly_Zero_Energy_Buildings.pdf