Reframing housing regulation: delivering performance improvement together with affordability

Abstract: In developed economies a significant proportion of greenhouse gas emissions result from energy demand in the building sector. Many countries have recognized the need to mandate building energy performance standards as a key element of a national energy or climate change policy. The Commonwealth of Australia included energy efficiency provisions in the national Building Code early last decade. This initiative has not been without controversy or resistance from some industry stakeholders. Typically such opposition is predicated on the assertion that more stringent energy efficiency requirements, particularly in the residential sector, would detrimentally impact on housing affordability. The State of Victoria significantly upgraded its residential energy efficiency requirements in 2004. This study of the new standard [the *5 Star Standard*] investigates its effectiveness as an instrument of energy policy, testing the assumption that more stringent regulatory requirements are at odds with housing affordability. The analysis concludes that the 5 Star Standard has delivered significant greenhouse abatement; and encouraged industry innovation in a way that embodies regulatory best practice; while at the same time not compromising housing affordability for consumers or impacting negatively on the local housing market overall.

Keywords: Regulation; energy; housing; affordability

1. Introduction

A substantial body of research has demonstrated the significant role that improved building performance should play in reducing global greenhouse gas emissions particularly in developed countries where most people live in urban settings; for example the work of Urge-Vorsatz (Ürge-Vorsatz and Novikova, 2008). In Australia almost a quarter of greenhouse gas emissions result from energy demand in the building sector (Centre for International Economics, 2007). A ground-breaking report by McKinsey has also demonstrated that the building sector provides potentially the most cost-effective economic sector for greenhouse gas abatement (McKinsey Company, 2008).

The specific role of regulation as an effective government policy instrument was addressed in a report for the UN Environment Program (United Nations Environment Program, 2007). In examining the potential for mitigating greenhouse gas emissions from energy use in the world's buildings. Urge-Vorsatz (Ürge-Vorsatz and Novikova, 2008) also suggests that appliance standards and building codes are particularly cost-effective. Similarly, analysis of trends in energy use and CO_2 emissions in the Swedish building sector by Nassen and Holmborg (Nässén and Holmberg, 2005) found that stagnation in energy efficiency levels since the nineties should be addressed by policy interventions that included regulations aimed at improving the technical performance of buildings as a priority.

`

In tracking the development of energy efficiency provisions in Swiss building codes Groesser (Groesser, 2014) points out that performance levels set in building codes for both new construction and refurbishments are a "powerful lever for reducing greenhouse gas emissions".

In the Australian context the nation's Ministerial Council on Energy (Australian Building Codes Board, 2006) decided that reform of energy efficiency standards in the national building code should be a cornerstone of the National Framework for Energy Efficiency (Energy Efficiency and Greenhouse Working Group, 2003) which defined the future direction of Australia's energy efficiency policy and programs.

This Australian case study examines the application of building regulation to energy efficiency and greenhouse gas mitigation reduction objectives. Its focus is on the role and effectiveness of building energy regulations as a policy instrument. Lutzenhiser points out in his study of barriers to energy efficiency in the United States housing industry (Lutzenhiser, 1994) that a range of sociological, technological and economic factors provide such barriers. Lutzenhiser goes on to observe that markets for energy efficiency often fail because the economically rational behaviour required for effective market operation is effected to a significant degree by cultural and institutional factors.

In 1991 The State of Victoria was the first Australian jurisdiction to introduce energy efficiency regulations for buildings. Then in 2002 Victoria dramatically ramped up its residential energy efficiency standards to a level defined as 5 Stars within the framework of Australia's Nationwide House Energy Rating Scheme (Department of Industry, 2014) as part of a comprehensive Greenhouse Strategy.

Following implementation of the national 6 Star requirements a series of analyses have been conducted to assess the effectiveness of these regulatory outcomes. This case study largely draws upon information published by the Commonwealth and Victorian Governments in the course of ongoing regulatory development in order to track the incremental cost of increased energy efficiency requirements for residential buildings. The historical trajectory of projected and actual cost increases is compared with the notional increases in capital cost postulated by industry critics of energy efficiency regulations to test assertions that housing affordability would be adversely impacted by such measures.

The analysis also sheds light on the impacts of industry learning and market transformation in facilitating or obstructing the uptake of more stringent energy performance standards.

2. Regulatory Context

2.1. The National Construction Code

Australia has had a national building code since 1996. In 2010 the *Building Code of Australia* [BCA] was transformed into a *National Construction Code* [NCC] through incorporation of the *Plumbing Code of Australia*. The BCA now comprises Volumes 1 and 2 of the NCC.

In Australia legal responsibility for the built environment is vested in the eight States & Territories, each of which has its own individual regulatory regime to address land planning and building control matters. Further, the NCC is only given legal force in each State and Territory by being referenced in the relevant legislation of that administration. In the case of Victoria this reference to the NCC is made in the State's Building Regulations (State of Victoria, 2006).

The fundamental role of the NCC is to set uniform construction standards across Australia for all building classes that are based on building performance outcomes in key areas such as health, safety, durability. Since 2006 these goals have also included explicit reference to *Sustainability:*

> "The goal of the BCA is to enable the achievement of nationally consistent, minimum necessary standards of relevant safety, health, amenity and sustainability objectives efficiently (Australian Building Codes Board, 2011)."

The rationale for the NCC is to set the minimum acceptable standards for building performance at the design stage in its defined areas of applicability. Compliance with the Code is determined by building certifiers and surveyors at a building's design stage by establishing whether *performance objectives* prescribed in the Code have been met. The Code is quite flexible in deliberately providing a range of compliance pathways to encourage innovative, cost-effective design solutions. In the case of residential buildings the NCC prescribes the Performance Requirement for energy efficiency with which building solutions must comply in the following terms:

> "A building must have, to the degree necessary, a level of thermal performance to facilitate the efficient use of energy for artificial heating and cooling …."

2.2. Australia's Nationwide House Energy Rating Scheme

Australia's Nationwide House Energy Rating Scheme [NatHERS] provides a nationally consistent framework for assessing the thermal performance of residential buildings (Department of Industry, 2014). The scheme provides for both certification of compliant House Energy Rating software and accreditation of suitably trained Thermal Performance Assessors. NatHERS is referenced in NCC Volume 2 as an accepted route for demonstrating compliance with the mandated 6 Star stringency level.

The building design's star rating is calculated using software accredited for this purpose under the Scheme. Compliant software package simulate the performance of buildings in service by taking into account climatic and other factors about the physical characteristics of the building envelope, its location and occupancy levels. The rating scale ranges from a minimum of 1 Star to a maximum rating of 10 Stars. A 10 Star design theoretically requires no external energy inputs for heating or cooling.

From a strategic policy perspective the NatHERS structure has a threefold function:

- Providing a regulatory tool referenced in the NCC
- Facilitating improvements in performance-based design of residential buildings
- Providing consumers with a simple basis for comparing the energy efficiency of alternative

3. Victoria's residential energy efficiency regulations

When the State of Victoria introduced energy efficiency requirements for residential buildings in 1991 the regulations were subject to a regulatory impact assessment which was focused around a public consultation document that set the costs and benefit of the new regulations (Department of Planning & Urban Growth, 1990). These prescriptive insulation regulations aimed to deliver new buildings with the equivalent of a 3 Star energy rating on the NatHERS scale.

In 2000 in an extensive study sponsored by the Australian Greenhouse Office (Australian Greenhouse Office, 2000) concluded that the Victorian insulation regulations had raised the performance of new homes to a level of approximately 2 Stars on the Nationwide House Energy Rating scale. While this was a positive outcome it did not fully achieve the 3 Star policy objective originally stipulated for the 1991 regulations.

`

Estimates for additional cost to homeowners of implementing the 1991 insulation regulations for the typical new 160m^3 home being constructed at the time ranged from $1400-$2000. It was anticipated that the resulting improvement in thermal performance would reduce heat losses by 40%, saving the average homeowner around $300 on annual energy bills; and reducing greenhouse emissions from gas heating systems by 2-3 tonnes of CO_2 per annum.

Then in 2001 the Victorian Government decided to reform its decade-old insulation regulations as a key element of a formal Greenhouse Strategy (Department of Natural Resources and Environment, 2002) to be progressively implemented from 2002. This Strategy focused on reducing greenhouse gas emissions in key sectors of the state's economy such as transport, buildings, and manufacturing. A new residential energy efficiency standard was announced by the Victorian State Government which made use of house energy rating software to assess compliance (Minister for Planning, 2002); implementation was announced with a policy statement that:

> Energy use in homes is responsible for around 16% of Victoria's total greenhouse gas emissions…..residential heating and cooling account for 50% of the energy consumed each year in the average Victorian home.

Regulatory stringency was significantly increased from a nominal 2 Star to an explicit 5 Star rating; which translated to a 40% reduction in permissible energy usage for heating and cooling as defined by the Building Code.

Victorian legislation requires that major regulatory reforms must be preceded by a transparent public consultation process underpinned by a Regulatory Impact Statement which incorporates economic analysis of costs and benefits. The Victorian Building Commission published a comprehensive regulatory consultation document (Victorian Building Commission, 2002) whose cost benefit analysis was formally endorsed by the Victorian State Cabinet.

This regulatory document advised that the proposed 5 Star Standard would deliver a range of significant economic, environmental and social benefits to the citizens of Victoria:

- Addition of $570M to the Gross State Product
- Creation of up to 1100 new jobs
- Annual energy savings by consumers growing to $124M - within the 20 year time horizon of the study
- Greenhouse gas abatement of 8Mt CO_2 over twenty years

The regulatory document also estimated that the additional cost of redesigning and re-specifying a typical new home to comply with the Standard would be in the order of *$1100 - $3300* [2002 dollars]. Which represented an increase of 0.7% - 1.9% in the cost of the average new home at that time.

3.1. Regulatory pushback

During the subsequent period of public consultation following release of the 5 Star *Regulatory Information Bulletin* (Victorian Building Commission, 2002) the housing industry undertook a protracted political lobbying campaign opposing the proposed regulatory reform.

Industry criticism was founded on the assertion that these mandatory energy efficiency requirements for new homes would cause excessive increases in the cost of construction with deleterious impacts on housing affordability. Critics also alleged that price sensitive first homebuyers would be particularly hard hit by such an unwarranted cost impost. For example, the position of peak

housing industry group the Housing Industry Association [HIA] was outlined in a contemporary newspaper article (Angela O'Connor, 2002):

> The Housing Industry Association's Victorian executive director, John Gaffney, is fighting to delay the rules, arguing they are too much, too soon and impose undue burdens on builders. He says the standard should not be mandatory until 2005 or 2006, and claims it could cost up to $10,000 per house to implement, which could cut out a significant section of the population from home ownership. 'The added cost on a basic $150,000 house would be about $8000 - enough to cut 4000 to 5000 prospective buyers out of home ownership' he said.

In effect the HIA was asserting that a cost increase of over 5% could be attributed to the 5 Star requirements when applied to entry-level homes in the market. The HIA CEO further claimed that (Kate Jones (a)):

> 'Energy efficiency for homes now is at about a two-star rating and by jumping up to a five-star rating, many home deals will fall over'. He said that the new measures would dampen the property market, predicting that up to 10 per cent of buyers would have difficulty purchasing.

3.2 Regulatory effectiveness criteria

The following criteria are proposed in this paper as appropriate for evaluating the effectiveness of the 5 Star Standard from a policy perspective:

- Did the standard represent *good regulatory practice*?
- To what extent have Government *policy objectives* been met?
- How valid were claims of *excessive compliance costs* and consequent impacts on the price of new homes?
- Were industry concerns about significant *damage to the new home market* well founded from an evidence-based perspective?

3.2.1 Good regulatory practice

In its *Victorian Guide to Regulation* (Department of Treasury and Finance, 2011) the Victorian Treasury notes that factors to be considered in good regulatory design should include:

- Clear articulation of the nature and extent of the problem being addressed
- Prior quantification of the costs and benefits of the proposed regulatory measures
- Performance-based approach in preference to prescriptive compliance requirements
- Effective, but not unduly burdensome enforcement regime

The outdated and prescriptive 1991 insulation regulations had been replaced with the performance based 5 Star Standard; enacted through the Building Code of Administered and administered through the robust, well established Victorian building control regime (Victorian Government, 1993); following a transparent regulatory impact assessment process. Through this process the Government's market intervention would appear to effectively address applicable criteria for good regulatory practice.

The Victorian Competition and Efficiency Commission [VCEC] is an independent statutory body reporting to the State Treasurer whose mandate encompasses reviewing regulatory impact statements

`

to advise on the economic impacts of new legislation; and undertaking reviews of matters referred by Government. In 2005 the VCEC was directed by the Government to undertake a comprehensive review of the state's housing regulations. This review included an investigation of the recently enacted 5 Star Energy Efficiency Standard.

In its subsequent report (Victorian Competition & Efficiency Commission, 2005) the VCEC included only a relatively mild critique of the 5 Star regulation, in its finding that:

> "Victoria's energy efficiency regulation [embodied in the 5 Star scheme] could be improved to better deliver at least cost against its objectives, including in the future as technology changes. Some improvements that should be considered are: implementation of the 5 Star scheme be more clearly related to the Victorian Government's energy efficiency objectives ……the scheme should incorporate more flexibility through the accreditation and use of more contemporary software".

3.2.2 Government policy objectives

The Victorian Government's policy objectives for 5 Star were discussed earlier in the context of the State's formal Greenhouse Strategy (Department of Natural Resources and Environment, 2002). A primary policy deliverable in this context is would certainly include cost-effective greenhouse gas abatement. For which the desired outcome was articulated out in an article in the Building Commission's Inform publication (Victorian Building Commission, 2003) stating that:

> In its first year, 5 Star will cut greenhouse gas emissions by 40,000 tonne, and save over $6 million on household energy bills. Over the next 5 years, the 5 Star standard is expected to reduce greenhouse gas emissions by 600,000 tonnes

This projection actually underestimated the regulation's benefits as it was based on parameters that proved to be conservative in practice due to:

- A significantly higher rate of new home construction than originally assumed
- Extension of 5 Star Standard home renovations in 2008
- Subsequent mandating of solar water heater installation as part of the standard

Based on updated historical data for housing starts (Australian Bureau of Statistics, 2010) the author's calculations suggests that the regulation will deliver aggregate greenhouse abatement to the levels set out in Table 1.

Table 1: Aggregate greenhouse gas abatement attributable to the 5 Star Standard

Year	Cumulative abatement 5 Star building fabric	Cumulative abatement solar water heating	Aggregate abatement	Nominal policy target
2009	0.8 Mt CO_2	0.18 Mt CO_2	0.98 Mt CO_2	0.6 Mt CO_2
2014	3.0 Mt CO_2	0.4 Mt CO_2	3.4 Mt CO_2	NA
2024	11.4 Mt CO_2	0.8 Mt CO_2	12.3 Mt CO_2	7.6 Mt CO_2

It is evident from the table that Government's key policy objective as originally articulated in its Greenhouse Strategy (Department of Natural Resources and Environment, 2002) and subsequently documented in detail by the Building Commission (Victorian Building Commission, 2003) was achieved through implementation of the 5 Star regulation.

In 2003 national residential energy efficiency provisions were introduced in the BCA at a nominal 4 Star stringency. Then in 2006 the stringency of national BCA provisions was increased to 5 Stars following Victoria's lead. A further step up to a 6 Star minimum performance level was included in the BCA 2010 Amendment following policy endorsement by national Building Minsters in 2009.

Once again in 2006 and 2009 major building industry bodies strenuously questioned the case for reforming BCA residential energy provisions on the basis of negative impacts on housing affordability, particularly in the sensitive first home market segment.

3.2.2 Regulatory compliance costs

All national residential energy efficiency provisions are subject to formal Regulatory Impact Assessment and Cost Benefit Analyses prior to their introduction in the Building Code of Australia. Thus analyses undertaken at a national level for progressive increase in the stringency of BCA energy efficiency requirements to the 4 then 5 Star performance levels provide an important source for quantifying compliance costs.

In addition a number of publically available independent studies have now been undertaken since implementation of the 5 Star residential energy efficiency standard in Victoria in 2004. These studies also allow the incremental cost of mandated energy efficient requirements to be tracked with a degree of confidence over the last decade as stringency has been progressively increased. In this way not only can the evidence for building costs be compared with government projections in support of proposed regulatory measures, but also with industry assertions that such costs would be so excessive as to threaten housing affordability for consumers and even the prosperity of the housing industry. Table 2 summarizes this historical cost data as collected from the range of sources now available in order to define the trajectory of compliance costs.

Table 2: historical perspective on 5 Star standard cost trajectory

Year	Source document	Star rating cost increment	Context for costing	Remarks: Percentage increase [base cost where available]
1991	(Department of Planning & Urban Growth, 1990)	$1400 - $2000	Victorian housing stock	Prescriptive insulation regulations
2002	(Victorian Building Commission, 2002)	$1100 - $3300	Base case Vic housing stock [5 Star target]	0.7 – 1.9% [$160,000]
2005	(Jetarree Limited, 2005)	$1500	5 Star rating outcome Base case Vic housing	0.4% [$230,000]
2005	(Australian Building Codes Board, 2005)	$653	Stringency increase: 2-4 Stars	Melbourne climate zone
2006	(Australian Building Codes Board, 2006)	$400	Stringency increase: 4-5 Stars	Melbourne climate zone
2013	(CSIRO, 2013, p.69)	-$5000 cost reduction	Redesign base case to suit climate zone	Performance based design approach yields cost savings

It is evident from Table 2 that the original estimate for the incremental cost of complying with the 5 Star Standard was not only accurate but also possibly conservative. The CSIRO study (CSIRO, 2013) confirms that rational design that responds to NCC performance requirements can now deliver energy

`

performance at a 5 Star level at costs below a less efficient business-as-usual base case. Moreover, this evidence does not support industry claims of excessive regulatory compliance costs.

A clear trend has emerged over time for compliance costs to progressively diminish in magnitude. To the point where the most recent and sophisticated studies demonstrate that well-considered design changes can actually deliver highly energy efficient passive solar homes at a reduced base cost. This encouraging scenario sits comfortably with the fundamental tenet of Australia's Building Code: setting performance based standards to encourage an industry response that takes the form of innovation in both design and provision of building products and services.

3.2.3 The role of industry learning

A 2012 study undertaken for the national Department of Climate Change and Energy Efficiency examined the role of "industry learning" in responding to energy efficiency standards mandated through the national Building Code (AECOM, 2012).

This AECOM study concluded that different sectors of the building industry responded in markedly different ways to energy efficiency improvement opportunities, whether voluntary or mandated:

- The commercial sector had a positive response, often going beyond regulatory requirements
- Volume home builders were not pro-active in embracing energy efficiency opportunities but were able to rapidly adopt cost effective design changes in response to mandatory standards
- Small residential builders were risk averse, only introducing energy performance improvements when compelled by regulation
- Importantly, small residential builders typically responded to regulation through expensive increases in building specifications rather than more cost-effective design changes

3.3 Impacts of regulation on the housing market

Residential building approvals in Victoria for the five-year period following implementation of the 5 Star Standard on 1 July 2004 are compared with the national market in Figure 2 (Australian Bureau of Statistics, 2010).

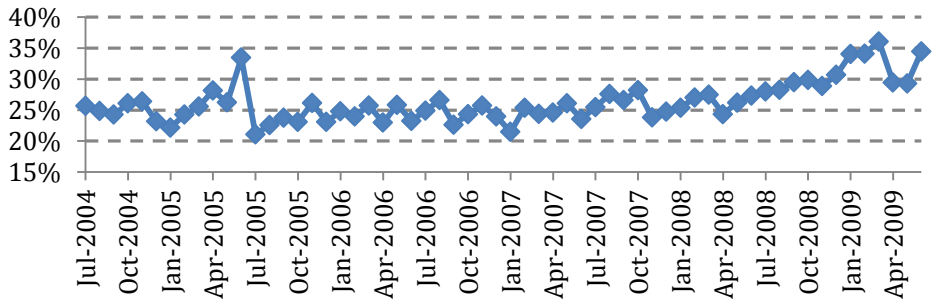

Figure 2: Victoria's share of national dwelling construction

Apart from a slight dip in 2005/2006, the proportion of residential building activity taking place in Victoria during this period hovers around the 25% level. At this time Victoria's population remained

steady at just below 25% of the national population (Australian bureau of Statistics, 2014) so the level of residential building activity was commensurate with the State's share of national population.

4. Discussion

The paper has analyzed the 5 Star Energy Efficiency Standard for Victorian residential buildings and shown that it was indeed an "effective regulation". It achieved the government's policy objective of energy efficiency and greenhouse gas abatement without significant detriment to housing affordability. Furthermore, its introduction paved the way for subsequent reform of NCC energy provisions. This review of residential energy efficiency regulation using Victoria's 5 Star Standard as a case study has reached a number of conclusions concerning the role and effectiveness of building regulation as a government policy instrument.

- Research over the last decade suggests that government policy objectives for greenhouse gas abatement that led to regulatory intervention in 2002 were shown to have been met
- The regulatory process itself would seem to demonstrate good regulatory practice when assessed against objective criteria
- Formal regulatory impact assessment reports tended to underestimate both the capacity for industry adaptation to new energy requirements and the rapidity of such adaptation
- Claims by the housing industry that mandatory energy efficiency requirements for new home construction would have a deleterious impact on housing affordability are shown to have been ill-founded on the basis of the historical cost trajectory of energy efficiency costs
- Evidence for larger scale impacts on the whole local housing market as a whole was lacking

Acknowledgements

This research is funded by the CRC for Low Carbon Living Ltd supported by the Cooperative Research Centres program, an Australian Government initiative. I also wish to acknowledge the guidance provided by my PhD supervisors at Curtin University Professor Peter Newman and Dr Anne Matan.

References

AECOM (2012) Understanding how the Building Industry Responds to Energy Efficiency Standards, DCCEE, Canberra, Australia, 106.

Angela O'Connor (2002) Five-star wars over efficient houses, Sunday Age, The (Melbourne), 1.

Australian Building Codes Board (2005) Draft Regulation Impact Statement (RIS 2005-02): Proposal to amend the Building Code of Australia to increase the energy efficiency requirements for houses, Australian Building Codes Board,, Canberra, 107.

Australian Building Codes Board (2006) Proposal to Amend the Building Code of Australia: Energy Efficiency Requirements for Houses, Commonwealth of Australia, Canberra, Australia, 127.

Australian Building Codes Board (2011) National Construction Code series 2011, ed., ABCB, Canberra.

Australian Bureau of Statistics (2010) 8731.0 - Building Approvals, Australia, Oct 2010, Commonwealth of Australia, Canberra, Australia.

Australian bureau of Statistics (2014) Australian Historical Population Statistics,, Canberra.

Australian Greenhouse Office (2000) Energy research for the building code of Australia, ed., Australian Greenhouse Office, Canberra, A.C.T.

Centre for International Economics (2007) Capitalising on the building sector's potential to lessen the costs of a broad based GHG emissions cut, Sydney, 39.

CSIRO (2013) Evaluation of the 5 Star Energy Efficiency Standard for Residential Buildings, CSIRO, Canberrra.

`

Department of Industry (2014) "Nationwide House Energy Rating Scheme". Available from: Commonwealth of Australia <http://www.nathers.gov.au/about> (accessed 18/6/2015).

Department of Natural Resources and Environment (2002) Victorian Greenhouse Strategy, State of Victoria, Melbourne, Australia.

Department of Planning & Urban Growth (1990) Insulation Regulations: A Step Towards Building Energy Efficiency Standards, Melbourne, Australia.

Department of Treasury and Finance (2011) Victorian Guide to Regulation, in Department of Treasury and Finance (ed.), State of Victoria,, Melbourne, Australia, 102.

Energy Efficiency and Greenhouse Working Group (2003) National Framework for Energy Efficiency, EEWG, Canberra, Australia, 20.

Groesser, S. N. (2014) Co-evolution of legal and voluntary standards: Development of energy efficiency in Swiss residential building codes, Technological Forecasting and Social Change, 87(0), 1-16.

Jetarree Limited (2005) 5 Star Cost Study, Victorian Building Commission,, Melbourne, Australia.

Kate Jones (a) Green Homes Dearer,Herald Sun, Herald Sun Melbourne Australia.

Lutzenhiser, L. (1994) Innovation and organizational networks Barriers to energy efficiency in the US housing industry, Energy Policy, 22(10), 867-876.

McKinsey Company (2008) An Australian Cost Curve for Greenhouse Gas Reduction.

Minister for Planning (2002) Government and Industry Reach for the Stars, Victorian State Government, Melbourne, Australia.

Nässén, J. and Holmberg, J. (2005) Energy efficiency—a forgotten goal in the Swedish building sector?, Energy Policy, 33(8), 1037-1051.

State of Victoria (2006) Victorian Building Regulations, in S. Parliament. (ed.), Government of Victoria., Melbourne, Australia.

United Nations Environment Program (2007) Assessment of Instruments for Reducing Greenhouse Gas Emissions from Buildings, Nairobi, Kenya, 14.

Ürge-Vorsatz, D. and Novikova, A. (2008) Potentials and costs of carbon dioxide mitigation in the world's buildings, Energy Policy, 36(2), 642-661.

Victorian Building Commission (2002) Regulatory Information Bulletin: 5 Star Standard, Building Commission, Victoria, Melbourne, 50.

Victorian Building Commission (2003) 5 Star Homes,Inform, Building Commission, Melbourne, Australia, 16.

Victorian Competition & Efficiency Commission (2005) Housing Regulation in Victoria, in V. S. Treasury (ed.), Government of Victoria, Melbourne, Australia, 506.

Victorian Government (1993) Building Act 1993, Melbourne, Australia.