

THE SECOND PLANK – BUILDING A LOW CARBON ECONOMY WITH ENERGY EFFICIENT BUILDINGS



“...in order to make an overall longer term impact on drawing down carbon emissions...**energy efficiency [is the] second plank.**”

Kevin Rudd, Prime Minister of Australia, 19 August 2008



This report was made possible with the generous funding of the following organisations.



**Australian
Institute of
Architects**



green building council australia



Planning
Institute
Australia



AUSTRALIAN
CONSERVATION
FOUNDATION



With funding assistance from the Building Commission, the Department of Environment, Water, Heritage and the Arts, N.T. Department of Planning & infrastructure, S.A Department of the Premier and Cabinet, W.A. Department of Housing and Works.



This report is based on findings from independent research conducted by The Centre for International Economics.

www.TheCIE.com.au

The member organisations of the ASBEC Climate Change Task Group may not necessarily have policy positions on all the measures contained in this report.

While all reasonable care has been taken in the production of this publication, the Australian Sustainable Built Environment Council Climate Change Task Group and its members accept no liability whatsoever for, or in respect of any use or reliance upon this publication by any party.

ABOUT ASBEC AND THIS PAPER

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.

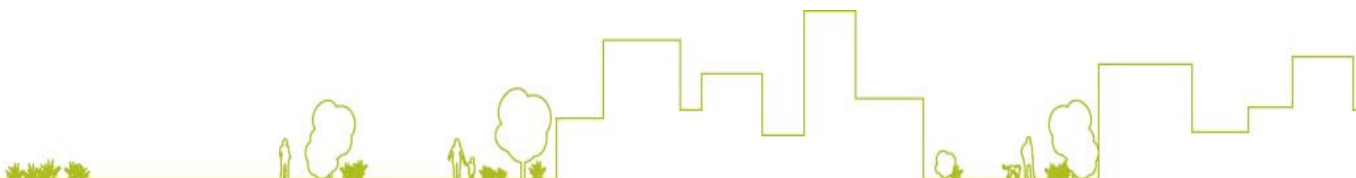
ASBEC Climate Change Task Group (CCTG) is comprised of representatives from the Australian Institute of Architects, the Property Council of Australia, the Planning Institute of Australia, the Green Building Council, the Chartered Institution of Building Services Engineers, the Australian Conservation Foundation the Australasian Energy Performance Contracting Association, the Association of Consulting Engineers Australia, Building Products Innovation Council and the Facility Management Association of Australia— joined with the Building Commission and the WA, SA, NT, VIC and federal governments. It was formed to initiate and fund key policy research projects.

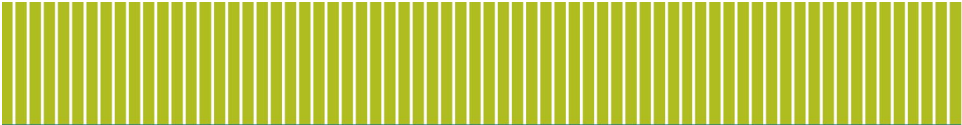
This paper has been prepared to stimulate discussion about the complementary role that energy efficiency can play supporting the Australian Government's Carbon Pollution Reduction Scheme Paper.

For further information about ASBEC and this paper please contact:

Monica Vandenberg, Executive Director
ASBEC
20 Bryant Street
Flemington, VIC, 3031
info@asbec.asn.au

Visit the ASBEC website at <http://www.asbec.asn.au>





BUILDING A LOW CARBON ECONOMY WITH ENERGY EFFICIENT BUILDINGS

CONTENTS

Acronyms and glossary	iv
EXECUTIVE SUMMARY	vii
Making GHG abatement easier under CPRS	vii
1 THE second plank	1
The CPRS Paper	1
The GHG response in the building sector	2
The additional opportunity provided by the building sector	4
2 Buildings, energy use and GHG	6
The Building sector	7
Energy use and greenhouse gas emissions	7
Growth in future emissions	9
The abatement potential	9
Other analysts' views about abatement in the building sector	13
3 The need for complementary policy measures	16
General barriers and impediments	16
Mind the gap	17
Policy tools to promote energy efficiency	19
Gap analysis	20
4 Polices to promote energy efficiency in buildings	24
A range of policy measures	24
Policy priorities	25
Proposed complementary measures	25
Other keystone measures	32
Other steps	34
5 The value of building energy efficiency	36
Direct and proximate benefits	36
Strategic significance of the buildings sector	36
Reducing economy wide costs of the CPRS	39
SIMULATION RESULTS	41
In summary	44
6 Buildings and support for other areas	45
A range of support	45
Emissions-intensive trade-exposed (EITE) industries and EE	46
Strongly affected industries and EE	46
Business, regions, workers and EE	47

Households and EE	47
7 Conclusion	49
A Policy options to promote energy efficiency in the building sector	53
Private sector incentives	53
Publically funded incentives	60
Regulated performance	62
Research generation	64
Knowledge dissemination	65
B Assessing policies to promote investment in energy efficiency – a multi-criteria analysis	70
MCA overview	70
References	76
Boxes, charts and tables	
1.1 Australia's national emissions profile — 2006	2
1.2 Estimated increase in electricity prices from the CPRS	3
1.3 Long run own-price elasticity of demand for electricity, by activity	3
1.4 GHG emissions by the building sector	4
1.5 Cumulative abatement response in the building sector	5
2.1 The building sector component parts	7
2.2 Energy consumption and greenhouse gas emissions	8
2.3 Building sector emission projections	9
2.4 GHG scenarios in the building sector	11
2.5 Building sector GHG emission projections	11
2.6 Levelised and average costs	12
2.7 Energy efficiency in the commercial building sub-sector: GHG abatement and levelised cost per tonne of CO ₂ -e abated	12
2.8 Energy efficiency in the residential building sub-sector: GHG abatement and levelised cost per tonne of CO ₂ -e abated	13
2.9 Potential and scope for energy efficiency in Australia (selected sectors)	14
2.10 Emissions reduction opportunities and cost by sector, 2030	15
3.1 Energy efficiency investment timing gap, commercial building sector	17
3.2 Energy efficiency investment timing gap, residential buildings	18
3.3 Policy gap analysis	21
4.1 Creating a white certificate credit	26
4.2 The NSW Greenhouse Gas Reduction Scheme and NSW Energy Efficiency Trading Scheme	27
4.3 The Victorian Energy Efficiency Target	28
4.4 Energy efficiency trading schemes	29
4.5 Savings of greenhouse gas emissions through green depreciation	30
4.6 Investment and energy savings over time, appliances	31
4.7 Residential per capita electricity consumption in the United States and California	33
4.8 Embedded and renewable energy systems	34

5.1	Evidence of green building benefits	37
5.2	Shifting economic supply and demand in the electricity market	38
5.3	ASBEC economywide modelling and the building sector	40
5.4	Implied cost of GHG abatement – selected years a	41
5.5	Annual real value added for electricity generation: 3 scenarios	42
6.1	Household assistance and energy efficiency in buildings	48
A.1	Creating a white certificate credit	54
A.2	Financing energy savings	55
A.3	Capital investment in alterations and additions	56
A.4	Savings of greenhouse gas emissions through green depreciation	56
A.5	U.S. Cities providing density bonuses for green buildings	58
A.6	Green density bonus in Seattle, Washington	58
A.7	U.S. Cities providing expedited permitting for green buildings	59
A.8	Chicago Green Permit Program	59
A.9	Annual financial commitments to first home owners	61
A.10	Examples of low interest green loans	62
A.11	Residential per capita electricity consumption in the United States and California	63
A.12	GHG emissions from the household sector, per capita	64
A.13	TravelSmart costs and benefits over 10 years	68
A.14	The green building council's green star rating scheme	69
B.1	Criteria	71
B.2	Scoring	72
B.3	ASBEC CCTG keystone and support policies	75

ACRONYMS AND GLOSSARY

ABARE	Australian Bureau of Agricultural and Resource Economics
ASBEC	Australian Sustainable Built Environment Council
BASIX	Building Sustainability Index
BAU	Business As Usual
CCAF	Climate Change Action Fund
CCTG	Climate Change Task Group
CGE	Computable General Equilibrium
CIE	Centre for International Economics
CO ₂	Carbon Dioxide
CO ₂ -e	Carbon Dioxide equivalent
COAG	Council of Australian Governments
CPRS	Carbon Pollution Reduction Scheme
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEWHA	Department of the Environment, Water, Heritage and the Arts
EE	Energy Efficiency
EITE	Emissions Intensive Trade Exposed
ESAA	Energy Supply Association of Australia
ETS	Emissions Trading Scheme
EU	European Union
GBCA	Green Building Council of Australia
GGAS	NSW Greenhouse Gas Reduction Scheme
GHG	Greenhouse Gases
GJ	Gigajoule – one billion joules
GSP	Gross State Product
GWh	Gigawatt hours – one billion watt-hours (or 1000 MWh)
IEA	International Energy Agency
IPART	NSW Independent Pricing and Regulatory Tribunal
IPCC	Intergovernmental Panel on Climate Change
Joule	Joule (J) is a unit of energy - defined as the energy expended in one second by an electric current of one Amp flowing through a resistance of one Ohm.
kg	Kilogram
kWh kilowatt hours	One thousand watt-hours
LEED	Leadership in Energy and Environmental Design
M	Million

(Continued on next page)

MCA	Multi Criteria Analysis
MCE	Ministerial Council on Energy
MEPS	Minimum Energy Performance Standards
MJ	MegaJoule (see joules)
MMRF	Monash Multi Regional Forecasting (model)
MRET	Mandatory Renewable Energy Target
MWh	megawatt hour = 1 million watt hours
NABERS	National Australian Built Environment Rating System
NEET	NSW Energy Efficiency Trading Scheme
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NETT	National Emissions Trading Taskforce
NFEE	National Framework for Energy Efficiency
NGACs	NSW Greenhouse Abatement Certificates
NIEIR	National Institute of Economic and Industry Research
PJ	PetaJoule = 1,000,000,000,000,000 Joules
REES	South Australian Residential Energy Efficiency Scheme
SA	Strongly affected industries
T	Tonne
TJ	TeraJoule = 1,000,000,000,000 Joules
USGBC	United States Green Building Council
Watt	A watt (W) is a measure of electricity. 1 watt = 1 volt x 1 amp = 1 joule/second.



EXECUTIVE SUMMARY

It is vital for government and the community at large to recognise the evidence showing the valuable role that demand side management and energy efficiency in the building sector can play in GHG abatement. The Australian Sustainable Built Environment Council (ASBEC) Climate Change Task Group (CCTG) research shows that better designed commercial and residential buildings provide some of the most affordable forms of greenhouse gas (GHG) abatement in the economy. *Significant gains are available now without the need to invent and apply new technologies.* They do not involve substantial risk or uncertainty and would provide significant gains now and into the future.

Importantly, the building sector's role *complements* the Government's proposed Carbon Pollution Reduction Scheme (CPRS). Stimulus for transforming the building sector's energy efficiency would immediately enhance any carbon price signal that emerges from CPRS and lessen the adjustment costs across the economy as a whole.

This paper proposes methods and policy approaches to realise the full potential of the building sector to contribute to the abatement of GHG emissions that pose considerable risk of dangerous climate change.

MAKING GHG ABATEMENT EASIER UNDER CPRS

CPRS alone would not be the lowest cost way of reducing emissions. Modelling using the same tools currently being used by the Government indicates that encouraging substantial investment in energy efficiency in the building sector would make the job of the CPRS easier.

- With less demand for emissions as a result of investing in the energy efficiency potential of the building sector, the price for emissions permits would be lower by around 14 per cent.
- Fully realising the building sector's potential saves the economy, annually, around \$38 billion by 2050 – that is, it reduces the economy adjustment costs foreshadowed in the CPRS paper.

These gains come about because increasing energy efficiency in the building sector reduces the level of abatement required from other sectors in order for Australia to meet its emissions targets, essentially freeing resources such as labour and capital for which can be use by other industries. This is of particular benefit to emissions-intensive, trade exposed industries and strongly affected industries which were shown to face lower reductions in real value added under a carbon pricing scheme.

- Reducing greenhouse gas emissions through substantive investment in energy efficiency in the building sector, with the potential to make emission savings at low or no economic cost, would mean that the Government could reduce the amount of emission reductions needed from the CPRS cap.
- Emissions-Intensive Trade-Exposed Industries would face lower costs and a reduced threat to their competitiveness. The cost of government assistance to these industries in the CPRS could be reduced by around \$460 million per annum.
- The risks faced in Strongly Affected industries would be reduced. Given substantial reductions in electricity demand and curtailment of growth in demand there would be less need to seek investment in electricity generation, transmission and distribution.

Households and small business also benefit. The burden of adjustment to carbon constraints faced by households would be reduced particularly in terms of the expected rise in the cost of living. This would also reduce the amount of direct assistance necessary for lower income groups and those on fixed incomes such as pensioners, as outlined in the CPRS.

Substantial abatement opportunities in the building sector

The Prime Minister recently indicated that energy efficiency forms the 'second plank' in the Government's strategy to reduce greenhouse gas emissions. It reinforces the message in the CPRS paper which notes that there is no single solution to winning the fight against climate change.



ASBEC CCTG calculates that:

- without complementary measures the building sector is expected to reduce emissions by around 8 Mt a year from the price signal received from the CPRS (that is, increased electricity prices); and
- with complementary measures and encouragement to achieve the fuller energy efficiency potential of the building sector, GHG savings of around 60 Mt per annum are achievable in the longer term (by 2030). This is an abatement of around 27-31 per cent against the baseline emission projections (without change) for the building sector.

Importantly, these GHG reductions are come at either a net benefit to the economy or at no cost.

These findings are consistent with those of independent expert studies overseas and within Australia. The comprehensive Garnaut Climate Change Review assessed the evidence and identified that energy efficiency in the buildings sector offered significant opportunities for low-cost reductions in emissions through the deployment of existing technologies and practices and that this could be achieved relatively early. Similar findings were reported by McKinsey & Company, the International Energy Agency (IEA) and the UN Intergovernmental Panel on Climate Change (IPCC).

The policy solutions

Government has already deployed a range of policies to encourage energy efficiency in the building sector. These policies mostly focus on closing information gaps and raising awareness about opportunities. A key shortfall in the policy mix is in providing effective incentives for those in the building sector to invest greater resources in raising energy efficiency.

The ASBEC CCTG proposes in this paper specific policy measures that would enable the energy efficiency in the building sector to fulfil a role complementing the Government's CRPS and policies that have been implemented or are currently being developed:

- a national white certificate scheme;
- provision of green depreciation; and
- public funding for building retrofit – aimed at both the retail (residential and commercial buildings) and wholesale (energy retailer) sectors.

A **national white certificate scheme** would be very timely. Several states are in the process of implementing variants of a white certificate scheme. Having a national scheme that applies to residential and commercial elements of the building sector could minimise differences and enable a broad market on a larger, more efficient scale.

A national white certificates scheme can be applied in many ways, but an approach already tested in Australia (in NSW) works by applying energy efficiency targets to the electricity retailers. They would then be given flexibility in achieving this target by either implementing their own efficiency arrangements or purchasing efficiency certificates based on the performance of electricity customers in raising efficiency beyond a benchmark. These arrangements essentially make energy efficiency an asset that is able to be traded like a commodity and provide the building sector with an incentive to invest in additional energy efficiency. White certificates would provide a signal that would help overcome problems with bounded rationality and would place a price on externalities (where electricity savings and GHG savings are associated).

Green depreciation involves the provision of accelerated depreciation allowances for building investments that involve specific energy efficient fittings, fixtures and fabric or raise the overall energy performance of the building to a specific standard. Much of the infrastructure needed to apply this approach is already in place. It would play a key role in overcoming timing gap problems, allowing investors to defer tax payments (in exchange for bringing forward energy efficiency and GHG reductions).

Green depreciation provides one of the few ways to influence investment in existing buildings. Targeting, existing buildings is essential to obtain a substantial change in the building sector (given that new buildings represent only 2-3 per cent of the stock of buildings). Analysis suggests that green depreciation would only need to influence a relatively small proportion of refurbishment investment to be brought forward, over that which is already projected to occur in the normal refurbishment cycle to make a significant reduction in energy demand and greenhouse gas emissions.

Public funding of energy efficiency retrofits would require a range of government-funded financial assistance mechanisms (that is grants, subsidies and rebates) for improvements undertaken by households and the commercial

sector. Funding should be made available for and limited to investment opportunities with a proven ability to reduce energy consumption.

Public funding of building retrofit reduces the investment cost for energy consumers, therein closing the 'payback gap' and providing an additional incentive to undertake investment in energy efficiency. Public funding of retrofit also would help to overcome the split incentives issues faced by rental markets in both the residential and commercial sectors. This should assist in overcoming other barriers.

Additionally, the ASBEC CCTG draws attention to the merits of specific regulatory measures – including enhancement of Mandatory Efficiency Performance Standards (MEPS) and modernising the building code – in promoting energy efficiency in this sector. These generally combat key market failures such as information gaps, information asymmetries and bounded rationality issues. When such measures are proportionate, simple and sufficiently flexible they can provide a robust basis for directing investment into greater energy efficiency. They generally raise the baseline for energy efficiency in new buildings or when new fittings and fixtures are applied.

1 THE SECOND PLANK

Key points

- The Prime Minister has indicated that energy efficiency forms the second plank in the Government's strategy to reduce greenhouse gas emissions.
- Without complementary measures the building sector is expected to reduce emissions by around 8 Mt a year from the price signal received from the CPRS.
- With complementary measures and encouragement to achieve the fuller energy efficiency potential of the building sector GHG savings of around 60 Mt per annum are achievable in the longer term.

At the 4th Australia & New Zealand Climate Change and Business Conference Prime Minister Kevin Rudd acknowledged the importance of energy efficiency in achieving the government's greenhouse gas abatement strategy. The Prime Minister said:

...we recognise fully that there is a much broader set of measures to be embraced by both households and by businesses in order to make a significant contribution to drawing down overall energy usage, and therefore greenhouse gas emissions.

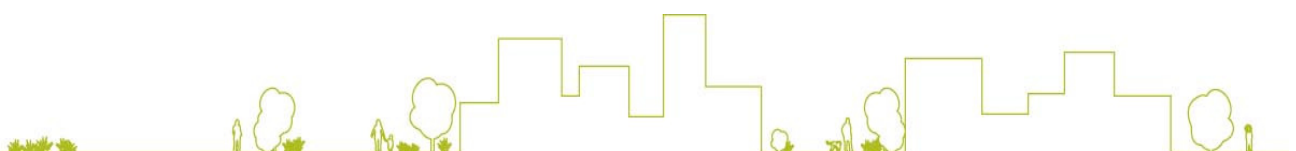
The Prime Minister went further, describing energy efficiency as the 'second plank' of the government's climate change efforts.

This chapter explains why the second plank involving complementary measures to promote energy efficiency in the building sector is crucial to helping Australia achieve its emissions targets at the lowest possible cost.

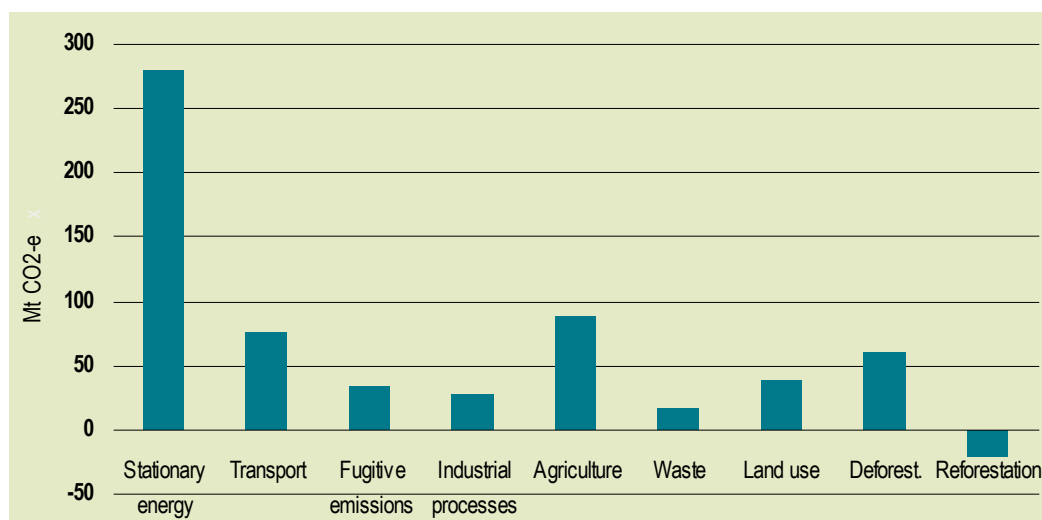
THE CPRS PAPER

The first plank of the Australian Government's approach to combating greenhouse gas (GHG) emissions and the threat of dangerous climate change is the Carbon Pollution Reduction Scheme (CPRS) proposed in the Government's recent paper. This paper canvasses options and preferred approaches on issues, such as which industry sectors will be covered and how a cap on emissions will be set. It also includes ways to address the impacts on Australian households, emissions-intensive trade-exposed industries and other strongly affected sectors.

The Government proposes that the scheme would apply to domestic emission sources and sinks that are counted in Australia's Kyoto Protocol emissions account. Australia's emissions profile is portrayed in chart 1.1



1.1 Australia's national emissions profile — 2006



Data source: National Greenhouse Gas Inventory (2006), Department of Climate Change.

A key aim of emissions trading is to apply a price to GHG emissions. A further aim is to apply pricing for emissions as broadly as practicable.¹ That is, seeking to ensure that a high proportion of total emissions, if not all, are subject to the scheme that applies a price. This has parallels with taxation where broadening the base helps to lower the tax rate for everybody and reduces scope for economic distortions and inequities that would arise if similar activities were treated differently.

Practicalities require some deviation from the ideal scheme. The Government proposes to exclude agriculture initially, reflecting complexities in accounting for emissions in that sector. It is also proposed that the price impact on transport fuels would be offset by changes on the excise applied to fuels in the first year. On this basis it is expected that around 70-75 per cent of the supply of emissions would be included within the scheme initially.

While the proposed arrangements seem broadly based, which should therefore result in a lower cost scheme whatever reductions are imposed through the cap and whatever the pace of change (which are still to be determined by the Government), it is notable that the CPRS does not directly include the building sector.

THE GHG RESPONSE IN THE BUILDING SECTOR

Even though not directly in the CPRS the building sector will also obtain a price signal encouraging the sector to reduce its demand for energy and therefore GHG emissions. 'Up stream' producers such as electricity generators will pass on the higher costs resulting from an emissions constraint through increasing prices to their customers. Thus, the CPRS for energy consumers in the building sector will act as a proxy tax on GHG consumption.

A key question arises about the extent to which the price signal in the CPRS will encourage the building sector to reduce demand for energy consumption and therefore GHG emissions.

The impact that the CPRS will have on GHG emissions attributable to energy consumption in the building sector will depend on two key factors:

- how much energy prices are likely to increase under the scheme; and
- how responsive energy consumers are to any price increase.

¹ The fact that greenhouse gas emissions are unpriced or free at the moment is a key reason why there are unsustainable amounts of GHG emissions into the atmosphere. A key step to changing this is to ensure that emissions have a price. With emissions trading the right to buy and sell is exercised in a market.

The increase in energy prices depends on the price of GHG emissions that emerges out of the scheme. The price of permits under the CPRS will be determined by the market. Reliable forecasts of this price are not available yet. As a guide, the Government's Green Paper uses an indicative price of about \$20 per tonne of GHG emissions (CO₂-e). At \$20 per tonne, it is estimated that retail electricity prices are likely to increase by around 14 per cent in the residential sector, and 15 per cent in the commercial sector.

Table 1.2 reports these calculations. Indicatively, if the price of carbon is twice as high as is reported here, then the effect will be approximately twice as large. And similarly, if the carbon price is half, then so too will be the impact on price. Note that the table reports estimates on the impact of the CPRS on electricity prices – it is not attempting to forecast future electricity prices. Future electricity prices will be influenced by a range of factors, including other policy measures (such as an expansion of the Mandatory Renewable Energy Target (MRET)). These factors are not considered when calculating this price impact. To properly forecast this effect requires the use of a computable general equilibrium (CGE) model.

1.2 Estimated increase in electricity prices from the CPRS

	<i>GHG intensity Kg CO₂-e/MWh (a)</i>	<i>Average retail price \$/MWh (b)</i>	<i>Increase in price \$/MWh (c)</i>	<i>Change in price %</i>
CO₂-e at \$20 per tonne				
Commercial	1.07	143.3	21.4	15.0
Residential	1.07	152.7	21.4	14.1

Notes: (a) Australia-wide average indirect emission factors for the consumption of purchased electricity from the grid published from the Department of Climate Change. (b) Average retail prices calculated from unweighted averages of medium sized consumers in the residential and commercial sectors, as reported by IPART (2007). (c) Price changes calculated with an assumption that the full value of CPRS emissions permits are passed onto consumers.

Sources: IPART (2007), Department of Climate Change (2008) and ASBEC CTG estimates.

The likely demand response to this price increase in the buildings sector is shaped by the own price elasticity of demand for electricity. Estimates of the demand elasticity for various electricity customer industries are reported in table 1.3. These estimates imply that for the residential sector, a 1 per cent increase in the price of electricity will lead to a 0.25 per cent decrease in the quantity consumed. For the commercial sector, this responsiveness is slightly higher, the same price increase leading to a 0.35 per cent decrease in demand.

1.3 Long run own-price elasticity of demand for electricity, by activity

<i>Sector</i>	<i>Own price elasticity</i>
Residential	-0.25
Commercial	-0.35
Industrial	-0.38
National Electricity Market	-0.35

Source: NIEIR (2007).

Notably, the estimates above suggest that the demand for electricity (in both sub-sectors of the building sector) is inelastic. That is, the proportional decrease in demand is less than the proportional increase in price. Or, put another way, to produce a 1 per cent decrease in consumption requires a greater than 1 per cent increase in the price of electricity.

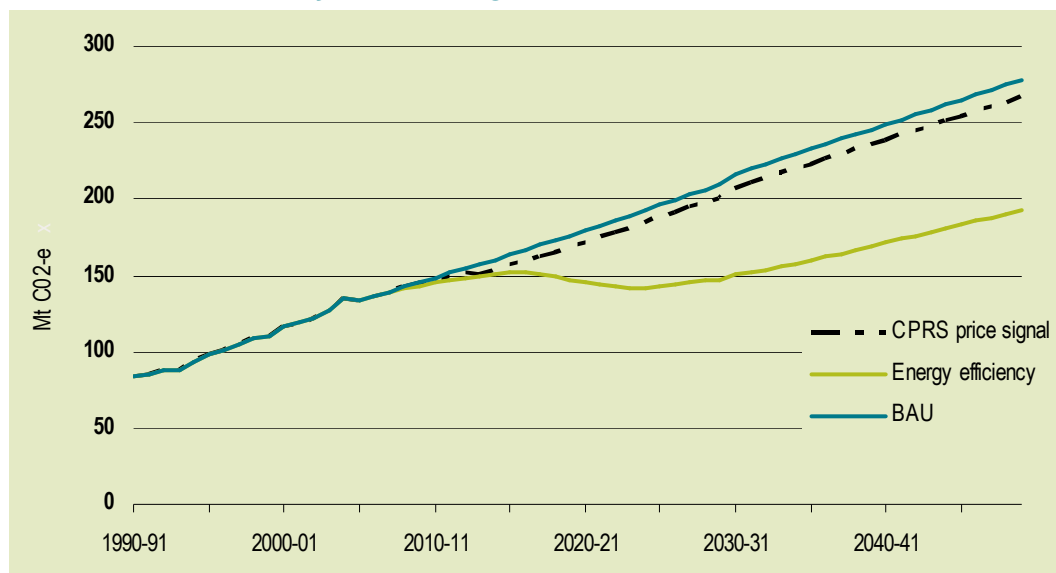
Using the estimates above, the average response to the CPRS will be a reduction in the consumption of electricity:

- by 5.1 per cent in the commercial sector; and
- by 3.4 per cent in the residential sector.

How the price signal translates into expected GHG abatement in the building sector is reported in chart 1.4. As a result of the CPRS price signal, the building sector will on average reduce emissions by an estimated 8 Mt of CO₂-e a year (about 3-4 per cent of the sector's total emissions each year in the Business-As-Usual (BAU) or baseline projection).

Cumulatively, this reduction sums to 135 Mt of CO₂-e emission in the period to 2029-30, and 335 Mt cumulatively between 2010 and 2049-50.

1.4 GHG emissions by the building sector



Note: The series 'CPRS price signal' plots only expected effect of the CPRS price signal on electricity demand. It has not attempted to account for other influences on the price of electricity (such as other policy measures), nor the supply side response to the CPRS. This series reports the impact on GHG emissions that results from an increase in electricity prices.

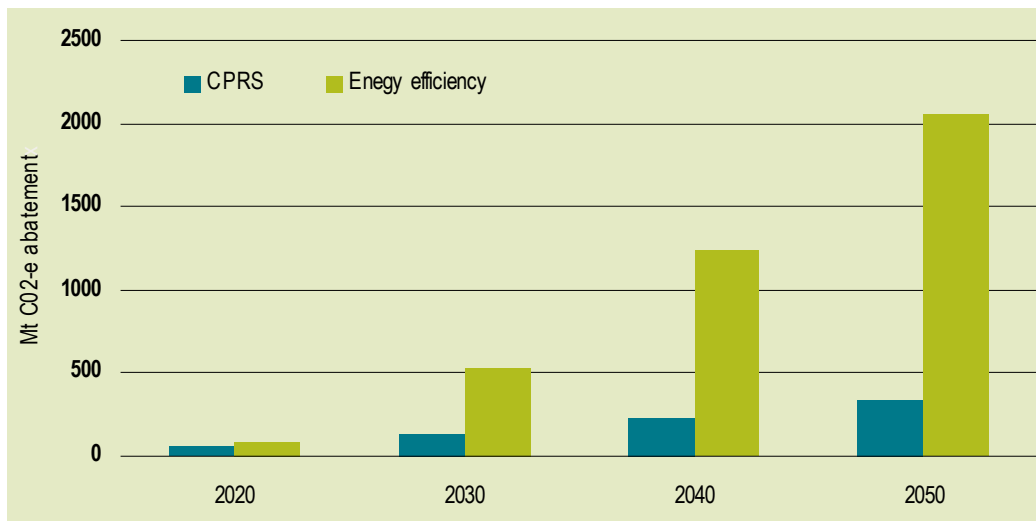
Data source: CIE (2007) and ASBEC CCTG estimates.

THE ADDITIONAL OPPORTUNITY PROVIDED BY THE BUILDING SECTOR

Chart 1.4 also plots the reduction in GHG emissions that could be achieved in the building sector from substantial energy efficiency measures. The ASBEC CCTG (CIE 2007), in conjunction with energy efficiency experts, has identified energy efficiency investments for the building sector that can significantly reduce energy consumption using available technologies. Many of these investments provide an economic return (that is, they have a negative economic net cost) or break even. The ASBEC CCTG (CIE 2007) estimates that given substantial and appropriate incentives, the building sectors investment in energy efficiency would have the effect of reducing the sector's GHG emissions by between 30 and 35 per cent by 2050. (Chapter 3 examines the abatement potential of the building sector in greater detail.)

The focus of the government's first plank GHG abatement strategy, the CPRS, is focussed on the GHG emissions arising from supply side activities in the stationary energy sector. That approach alone would overlook the full abatement potential of the building sector through demand side management. Chart 1.5 reports the cumulative abatement in GHG that is achieved from the CPRS price signal and when energy efficiency measures are included. This shows that energy efficiency measures in the building sector have the potential to abate nearly 2 billion tonnes of CO₂-e in total over the period from 2010 to 2049-50. The price signal of the CPRS, as currently configured, will abate less than one fifth of this amount.

1.5 Cumulative abatement response in the building sector



Data source: ASBEC CCTG estimates.

The additional contribution that substantial demand side management in the building sector can make to the abatement effort is striking. Given that there is the potential for the building sector to achieve substantially more abatement and that this abatement would be at little or no net economic cost, the CPRS alone would impose higher economy wide costs than is necessary. This is why the Government's second plank and the additional complementary measures that will enable the building sector realise its potential are crucial.

This chapter substantiates the potential role to be played by the building sector. It sets out the evidence about the energy used by the building sector and its potential to reduce GHG by reducing the demand for energy.

2 BUILDINGS, ENERGY USE AND GHG

Key points

- Research conducted for the ASBEC Climate Change Task Group has shown the following.
- The building sector accounts for a significant share of energy use and around a quarter of Australia's current greenhouse gas emissions.
- There is substantial untapped potential for greater energy efficiency in the building sector with GHG reductions of between 57 Mt to 66 Mt by 2030. This is an abatement of around 27-31 per cent against the baseline emission projections (without change) for the building sector.
- These GHG reductions are economic, involving net savings or breaking even looking at the technical factors.
- The findings of the analysis conducted for the ASBEC CCTG is consistent with the findings of independent expert studies overseas and within Australia.
- The UN's IPCC has found that around 29 per cent of the building sector's emissions can be saved on an economic basis.
- The IEA foreshadows that some 30 per cent of emissions in the building sector could be saved through energy efficiency.
- McKinsey & Company view that energy efficiency in the building sector could reduce emissions by around 60 Mt per annum by 2030. They report that energy efficiency in the building sector presents the lowest cost abatement technology available in the economy.
- The comprehensive Garnaut Climate Change Review assessed the evidence and identified that energy efficiency in the buildings sector offered significant opportunities for low-cost reductions in emissions through the deployment of existing technologies and practices and that this could be achieved relatively early.



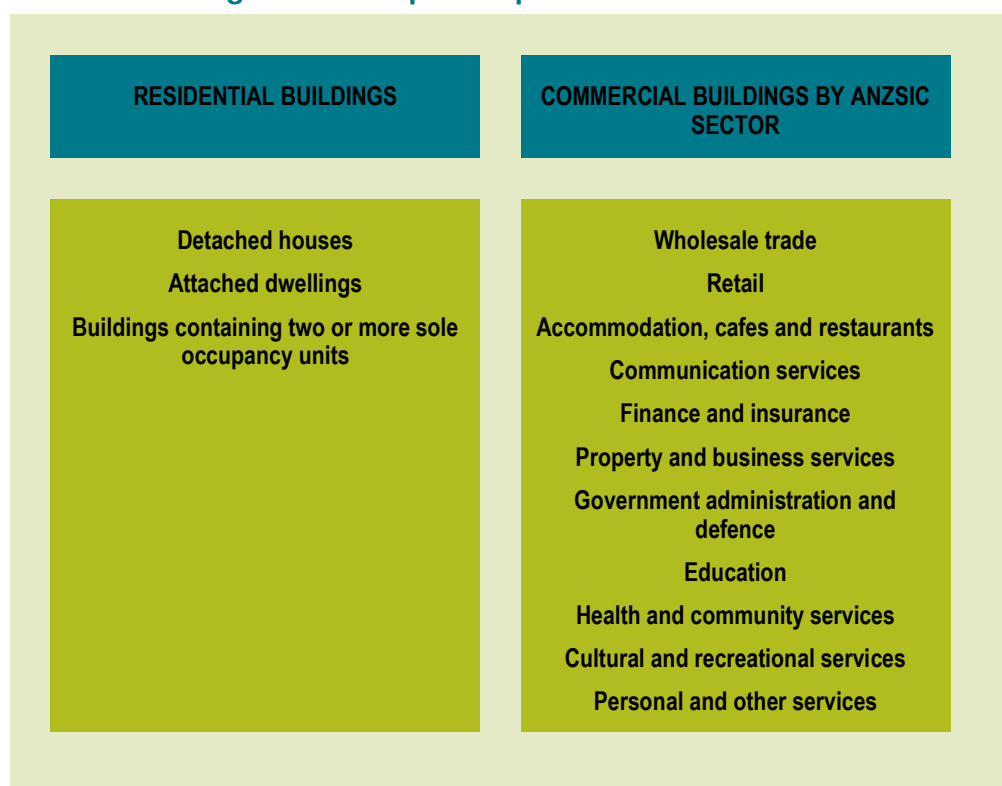
THE BUILDING SECTOR

The building sector can be viewed as being comprised of two broad elements:

- residential buildings — housing the population; and
- commercial buildings — housing a range of activities including retail trade, accommodation, business services, government and government agencies, recreation and cultural services and industry, which represents around two thirds of national employment.

Component parts of the building sector are noted in chart 2.1.

2.1 The building sector component parts



Source: The CIE (2007).

Agriculture, transport, mining and most utilities are not viewed as being in the building sector. Most of the value added by these activities happens outside of buildings.

ENERGY USE AND GREENHOUSE GAS EMISSIONS

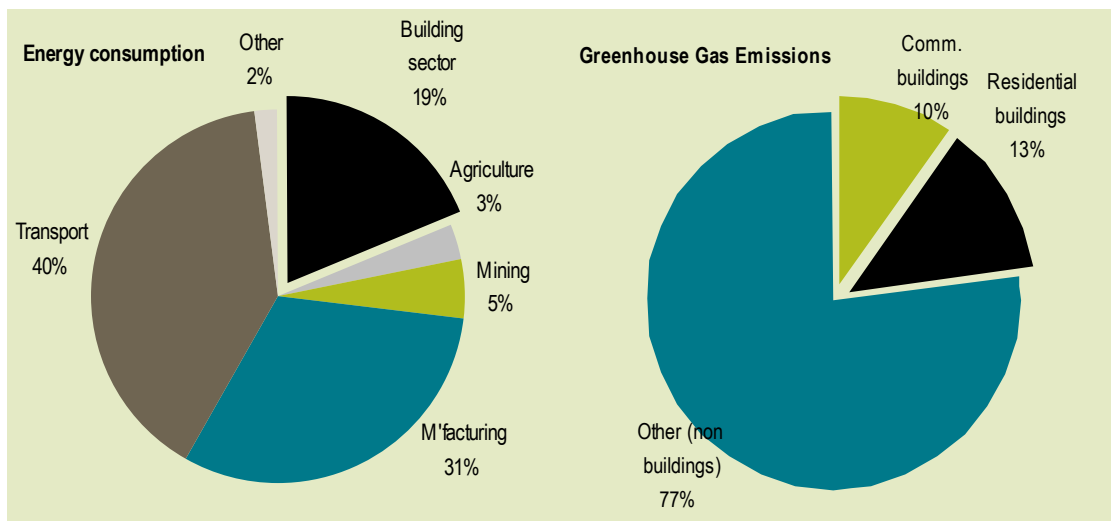
Using the above classifications and drawing upon the data about energy use prepared by ABARE (the Australian Bureau of Agriculture and Resource Economics), and other data from energy analysts energy consumption by the buildings sector amounts to 19 per cent of Australia's total energy consumption or end use.²

² The data in this chapter relates to analysis conducted for the ASBEC CCTG in 2007. It draws upon energy end use figures and forecasts of energy end use that were prepared by ABARE and published in 2006. Greenhouse gas emission estimates and projections reflect official data published by the AGO in 2007.

Taking into account the amount of energy used in the building sector and different fuel types ASBEC CCTG found that 23 per cent Australia's greenhouse gas emissions are attributable to the building sector. That is, energy use from activities within buildings is the source of demand which when met produces nearly a quarter of national greenhouse gas emissions.

The shares of energy use and greenhouse gas emissions are portrayed in chart 2.2.

2.2 Energy consumption and greenhouse gas emissions



Source: CIE (2007).

Based on energy consumption data from ABARE (2006) and Australia's National Greenhouse Accounts: National Inventory Economic Sector (2005). AGO (2007).

The estimate of greenhouse gas emissions due to energy consumption in the building sector takes account of:

- the amount of energy consumed;
- the mix of fuels used;
- the average greenhouse gas emissions from the different fuels (electricity is treated as a fuel); and
- upstream emissions from transmission and other activities.

The electricity consumed within a building is only a part of the energy used to support that demand. A large amount of electricity and greenhouse gas emissions is also involved in distribution, transmission and generation. When reducing demand for electricity it is practical to eliminate the need for this upstream energy use and GHG emissions.

A larger proportion of GHG emissions are attributable to the building sector than its share of energy use because the building sector uses greenhouse gas intensive energy. Notably the building sector energy end use is dominated by electricity consumption which is dominated by coal fired generation located at the end of long transmission networks.

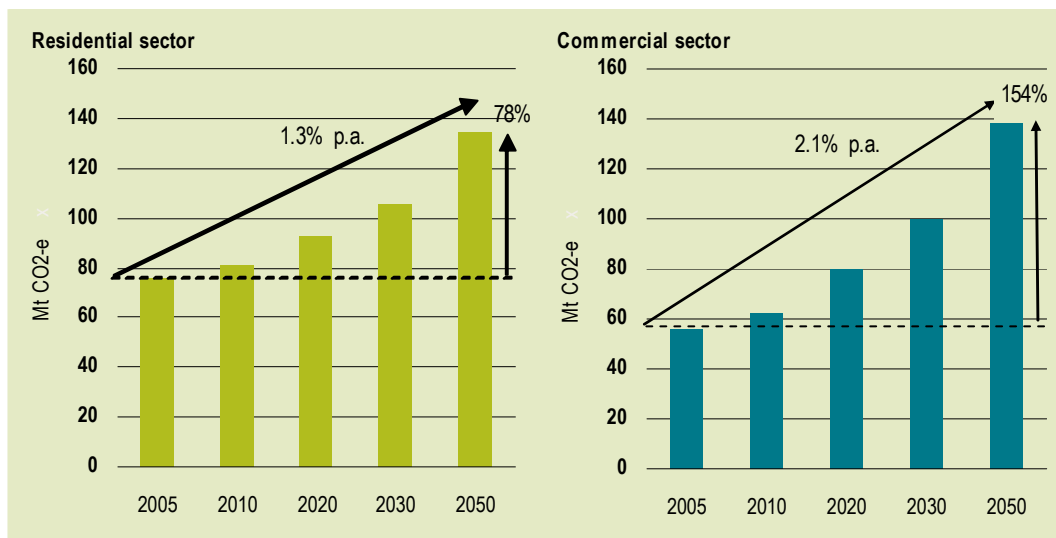
Emissions from the building sector are broadly of the same scale as emissions produced by the entire transport sector.

GROWTH IN FUTURE EMISSIONS

Building sector greenhouse gas emissions are projected to grow from 130 Mt pa in 2005 to 210 Mt by 2030 based on official government energy end use projections (ABARE 2006a).³

They are then projected to grow to 280 Mt by 2050 (CIE 2007). This can be seen in chart 2.3 below.

2.3 Building sector emission projections



Data source: CIE (2007) based on ABARE (2006).

The commercial sector emissions are expected to grow at a faster pace than residential sector emissions. Commercial sector emission projections have an average annual growth rate of 2.1 per cent compared with 1.3 per cent for the residential sector. The projected residential growth rate is linked to underlying population growth and household formation, while commercial emission projections are linked to economic growth.⁴

Of course, these growth rates reflect the projected outcome for a Business As Usual (BAU) scenario without substantial new measures to combat the threat of climate change.

Clearly, without changes in the way that buildings are designed and used, the building sector will drive unsustainable levels of GHG emissions and be a major contributor to the risks associated with climate change. Cost-effective and readily available options for abatement will continue to go on being unrealised.

THE ABATEMENT POTENTIAL

The building sector could reduce its GHG emissions by 30–35 per cent by 2050 on an economic basis. Economic in this context means that the initial costs would be offset — and in many cases be more than offset — by subsequent energy savings over time.

³ Greenhouse gas emission forecasts for the building sector are largely based on official projections of energy end use, the fuel mix and emission intensities of different fuels. It is notable that the data does not remain static in the forecasts for any of these. The resulting GHG emission forecasts are sensitive to changes in these factors. Thus, unexpected changes in the fuel mix, for example, or in the emissions intensity of some fuels, could alter the results materially

⁴ It is notable that subsequent to the analysis undertaken for ASBEC CCTG in 2007 the Department of the Environment, Water, Heritage and the Arts (DEWHA) published its report Energy Use in the Australian Residential Sector: 1986-2020 in 2008. This also conducted a bottom up analysis of energy end use model that tracks energy consumption. While the DEWHA study does not calculate greenhouse emissions it noted that the observed rate of growth in energy use in the residential sector would result in a significant growth in greenhouse gas emissions. The report is able to be accessed on the DEWHA website at the following address <http://www.environment.gov.au/settlements/energyefficiency/buildings/publications/pubs/energyuse-part1.pdf>

The potential for increased energy efficiency in the building sector has been estimated through a bottom up analysis to identify energy efficiency opportunities in the building sector. This analysis:

- examined like-with-like replacement of energy inefficient appliances and building services with more energy efficient equivalents;
- focused on additional application of existing technologies;
- took into account the costs of change and the expected benefits from reduced energy costs; and
- factored in expected population growth and sustained economic growth which tends to bring pressure for increased energy use.

The potential energy efficiency investments that were analysed do not represent a complete list. A much wider range of options exists. This set, however, generally represents the diversity of existing, mature technologies.

In the residential sector changes can be achieved through:

- substitution for more energy efficient light fittings;
- greater use of natural light;
- substitution for more efficient refrigeration;
- adoption of more efficient hot water appliances with solar where possible;
- adoption of appliances with a low standby energy use;
- the introduction of more efficient heating and cooling mechanical systems; and
- better insulation.

In commercial buildings substantial savings to both costs and greenhouse gas emissions could be generated by:

- improving air conditioning systems efficiency and including 'economy' cycles;
- use of natural ventilation where possible;
- the use of more efficient office appliances;
- better insulation;
- improved heating and ventilation;
- the use of efficient light fixtures;
- upgrading to more efficient water heating systems; and
- where possible use of co-, and tri-generation (that is, using heat discharged from on-site power generation for water heating, and for absorption air-conditioning etc).

Energy efficiency measures would take time to be adopted by households and business. The approach used to estimate the potential rate of adoption used in the study relates to variables such as the expected replacement of appliances and refurbishment of buildings based on the current economic lifespan of assets. This produces an abatement curve that grows over time.

Analysis of the technical possibilities suggests the potential for GHG abatement is between 57 Mt and 66 Mt per annum by 2030. This would increase to between 86 Mt and 98 Mt by 2050. The difference between the high and low scenarios relates largely to uncertainty about the potential magnitude of energy efficiency take up in office buildings. The low scenario involves average energy efficiency gains of around 27 per cent, while the high scenario involves additional energy efficiency gains in offices of around 50 per cent. The potential for change is summarised in table 2.4.

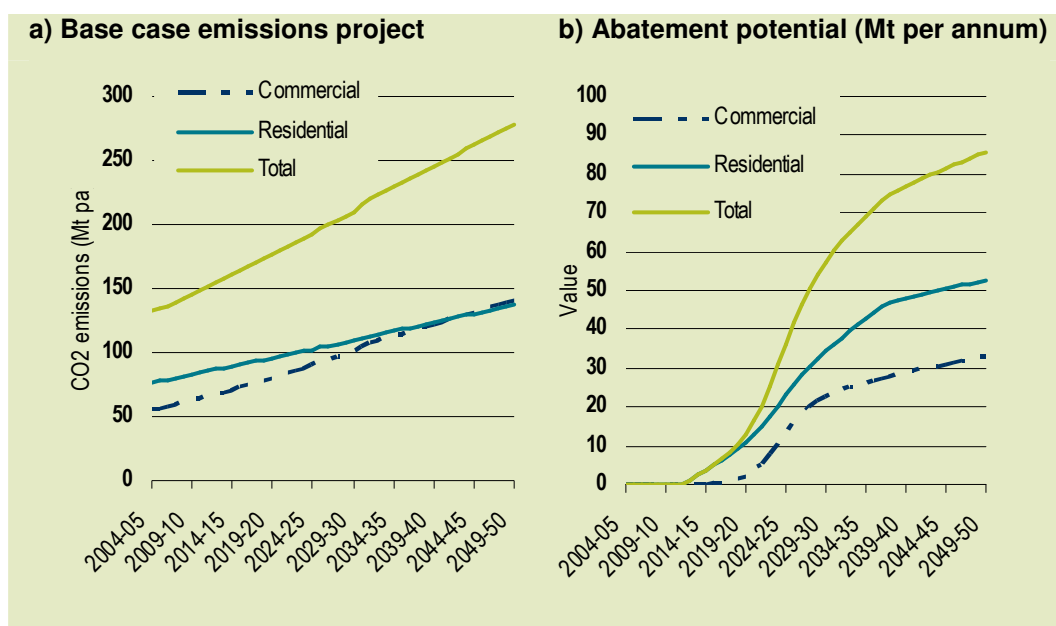
2.4 GHG scenarios in the building sector

Scenario	2005	2030	2050
Mt CO ₂ -e p.a.			
Base case	133	210	278
Efficiency — low	133	153	192
Efficiency — high	133	144	180
% change (reduction on base case)			
Efficiency — low	na	27	31
Efficiency — high	na	31	35

Source: CIE (2007) based on ABARE (2006).

Forecast emissions due to energy use in the building sector and the potential savings from increased energy efficiency (efficiency – low scenario) are shown in the chart 2.5.

2.5 Building sector GHG emission projections



Data Source: CIE (2007).

The analysis estimates that through the adoption of these changes the building sector could deliver a reduction in greenhouse gas emissions at a negative cost. That is, for each tonne of CO₂-e abated by the building sector, the economy could save an average of \$116 through increased energy efficiency in residential buildings; an average of \$147 per tonne in commercial buildings; and an average of \$129 per tonne overall.

The cost of GHG abatement in the buildings sector varies according to the mix of services relied upon in each sub-sector of the building sector and the specifics of a sub-sector's technical opportunities to make changes. Notably the cost is projected to be negative in all sub-sectors and over the buildings sector at large — see chart 2.6.

2.6 Levelised and average costs

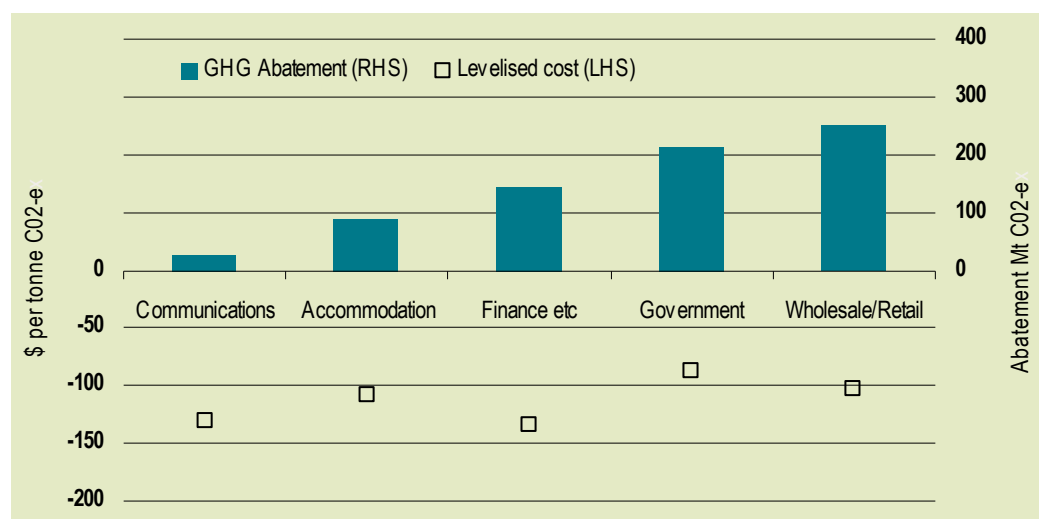
	Average cost \$/tonne CO ₂ -e	Levelised cost \$/tonne CO ₂ -e
Commercial Buildings		
Communications	-152	-131
Accommodation	-147	-108
Finance etc	-145	-134
Government	-150	-87
Wholesale/Retail	-141	-104
Residential Buildings		
Cooling	-120	-100
Space heating	-112	-29
Standby	-133	-124
Light	-99	-98
Refrigeration	-87	-87
Hot Water	-133	-103
Total		
Average	-129	-100

Note: Analysts commonly use two indicators to compare the cost of abatement. One is the average cost. This is essentially the total amount of abatement achieved over a period divided by the total costs over the same period. A second approach is to measure the levelised cost. The levelised cost can be calculated in a number of different ways. The approach used here is to calculate the present value of costs divided by the total amount of GHG emissions saved. See Institute of Sustainable Futures <http://www.isf.uts.edu.au/publications/faneetal2002uselevelisedcost.pdf>. Figures reported in the table relate to the period from 2010 up to 2050.

Sources: CIE (2007) and ASBEC CCTG estimates.

The anticipated cost of abatement and the amount of abatement potential in the different parts of the buildings sector are portrayed in charts 2.7 and 2.8 below.

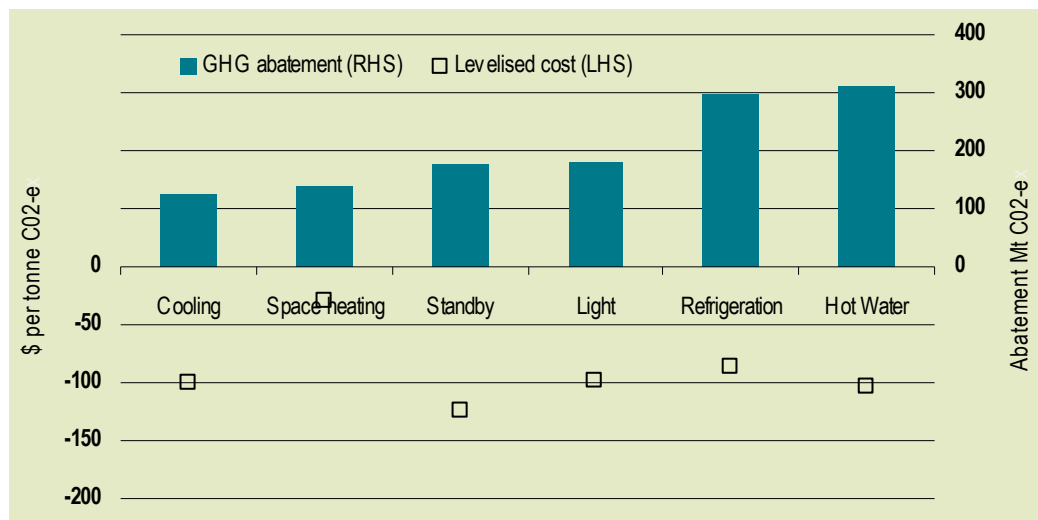
2.7 Energy efficiency in the commercial building sub-sector: GHG abatement and levelised cost per tonne of CO₂-e abated



Note: Cost estimates relate to technical costs only. This includes the direct cost of capital and subsequent energy savings.

Data source: CIE (2007) and ASBEC CCTG estimates

2.8 Energy efficiency in the residential building sub-sector: GHG abatement and levelised cost per tonne of CO₂-e abated



Note: Cost estimates relate to technical costs only.

Data source: CIE (2007) and ASBEC CCTG estimates

These estimates include the technical costs including new appliances or the refurbishment required to change energy use (essentially the capital cost) and the value of the expected energy savings. Other costs, such as the cost of R&D to identify what can be done in a building and how, transaction costs, administrative costs, or the costs of measures that may be necessary to encourage widespread adoption of change including enforcement costs, the costs of implementation and compliance, are not included in the analysis. It is also notable that the analysis reflects the economic or resource use impacts. It does not trace out who benefits or the net commercial impact upon profits and returns.

OTHER ANALYSTS' VIEWS ABOUT ABATEMENT IN THE BUILDING SECTOR

International experts point to significant potential to reduce energy demand in the building sector. Key reviews of global energy needs and options to combat climate change broadly agree that energy efficiency will make a very significant proportion of the GHG abatement needed and it will form the lower cost means of achieving that abatement (Stern 2006).

The Forth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) examined the potential GHG abatement from the building sector in considerable detail. That report included a specific chapter devoted to Residential and Commercial buildings. It is worth quoting the key conclusion of that chapter.

... substantial reductions in CO₂ emissions from energy use in buildings can be achieved over the coming years using mature technologies for energy efficiency that already exist widely and that have been successfully used (*high agreement, much evidence*). A significant portion of these savings can be achieved in ways that reduce life-cycle costs, thus providing reductions in CO₂ emissions that have a net benefit rather than cost. However, due to the long lifetime of buildings and their equipment, as well as the strong and numerous market barriers prevailing in this sector, many buildings do not apply these basic technologies to the level life-cycle cost minimisation would warrant (*high agreement, much evidence*).

Our survey of the literature (80 studies) indicates that there is a global potential to reduce approximately 29 per cent of the projected baseline emissions by 2020 cost-effectively in the residential and commercial sectors, the highest among all sectors studied in this report (*high agreement, much evidence*). Additionally at least 3 per cent of baseline emissions can be avoided at costs up to 20 US\$/tCO₂ and 4 per cent more if costs up to 100 US\$/tCO₂ are considered. (Levine et al 2007:389, *italics original*).

The International Energy Agency (IEA, 2003) reviewed the experience of developed countries and concluded that there was substantial scope for GHG abatement in the building sector. It is valuable to quote the IEA at length.

There is substantial potential to reduce electricity consumption and greenhouse gas emissions from residential appliances and equipment cost-effectively... Targeting the least life-cycle cost for residential appliances could achieve up to 30 per cent of OECD Member countries' target under the Kyoto Protocol on climate change... Most importantly, these savings can be achieved at negative cost to society. This is not to say that the savings are *free*, but rather that the extra cost of improving appliance energy efficiency are more than offset by savings in running costs over the appliance's life. In the US, each tonne of CO₂ avoided in this way in 2020 would save consumers around \$65; while in Europe, each tonne of CO₂ avoided would save consumers some EURO169. Significant savings appear to be available in all IEA regions despite widely diverging situations...(2003:14-15).

Further deeper investigations by the IEA are confirming its view that unexploited energy efficiency offers the single largest opportunity for GHG emissions reductions. The IEA now observes that new buildings could be made up to 70 per cent more efficient than some existing buildings through a range of measures such as the use of existing technologies in window design, improved heating and ventilation technologies, use of more efficient air conditioners and more efficient lighting.

Looking at the United States, the Pew Centre estimates that the building sector accounts for around 40 per cent of GHG emissions. They also found that applying existing technologies could reduce between 30 to 40 per cent of new buildings' energy use and GHG emissions on a cost effective basis (Brown et al 2005).

Studies undertaken in Australia to assess the potential for energy efficiency gains and related greenhouse gas emissions abatement report the existence of considerable untapped cost effective energy efficiency opportunities. While there are aspects of these studies that draw comment and criticism (regarding assumptions about discount rates, future energy prices, business as usual projections, investment costs necessary to achieve energy efficiency improvements, adoption rates of best practice and administration costs) consistencies in the key results are striking. A summary of the estimated energy efficiency potential in commercial and residential buildings as, reported in selected Australian studies is provided in table 2.9.

2.9 Potential and scope for energy efficiency in Australia (selected sectors)

Sector	Energy efficiency potential (%)				Clean Energy Future Group
	SEAV-NFEE Phase 1 – low scenario	SEAV-NFEE Phase 1 – high scenario	SEAV-NFEE Phase 2	SEAV-NFEE general equilibrium study	
Commercial	27	70	10.4	10.4	39
Residential	34	73	13	13	21

Note: SEAV = Sustainable Energy Authority Victoria. NFEE = National Framework for Energy Efficiency
 Source: McLennan Magasanik Associates Pty Ltd (2008).

In its report *An Australian Cost Curve for Greenhouse Gas Reduction* McKinsey & Company (2008) identified that the building sector has the lowest average cost of abatement. They estimated that the building sector could reduce 60 Mt of CO₂e per annum by 2030 at a negative cost of \$130 per tonne (economic average cost basis).⁵ That is, reducing emissions and saving resources for use by the economy.

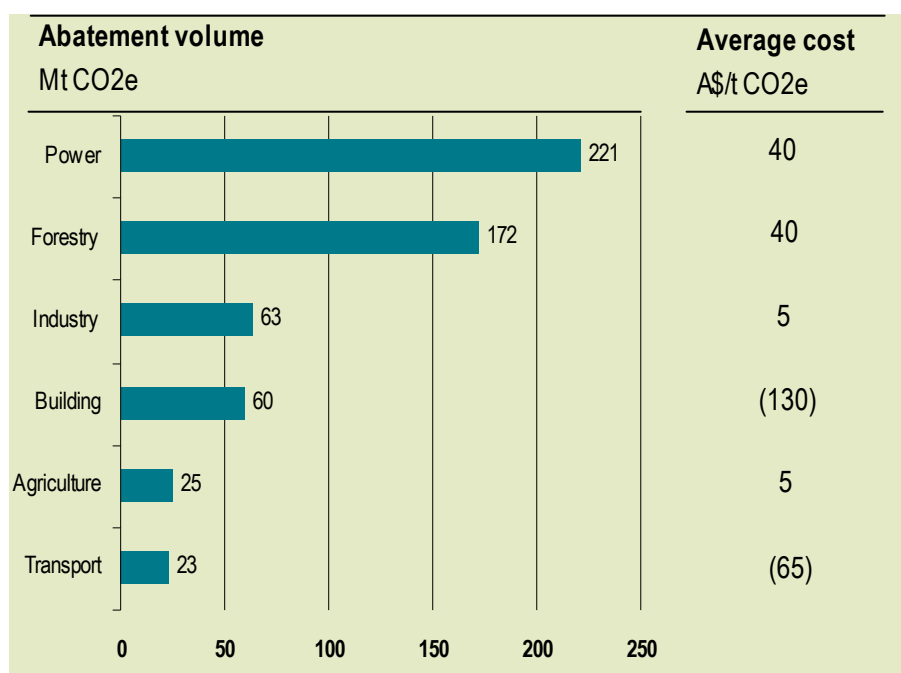
The situation of the building sector contrasts with other emitting sectors. The average cost of reducing CO₂-e by the power sector for instance, has been estimated at \$55 a tonne. Similarly, reducing emissions produced in the forestry sector attracts a cost of \$40 a tonne (McKinsey & Company 2008).

⁵ It is important to acknowledge that McKinsey & Company's study has attracted some criticism. Most notably in a study by Pifer et al (2008). Pifer et al highlight the likelihood that 'bottom up' engineering cost studies, like McKinsey & Company's, often fail to account for the hidden costs of energy efficiency measures that actual adopters would be likely to experience, and therefore under estimate the costs of the investment. Nonetheless, there still remain several magnitudes of difference between the costs of abatement through energy efficiency, and the costs of abatement through other means, for which this might be accommodated.

Recently, in a presentation prepared for the NSW Government, McLennan Magasanik Associates identified a range of energy efficiency options in the residential and commercial sectors in NSW. From the figures presented, some 20 Mt of CO₂-e emissions could be abated within a no net cost package. In most indicators NSW represents about a third of the Australia. It would be reasonable to extrapolate an estimate for Australia at large from the NSW estimate, suggesting a national abatement figure of around 60 Mt per annum, comparable to the estimate produced by McKinsey & Company and earlier ASBEC CCTG research.

After its exhaustive investigations and consultations, the Garnaut Climate Change Review broadly endorsed the ASBEC CCTG findings that residential and commercial buildings account for 23 per cent of Australia's emissions. Adding urgency to the case for immediate change the Review added that 'buildings can have a life of more than 50 years. Decisions that are made now will have consequences for future emissions.' (Garnaut 2008:460). The Garnaut Review also observed that if some specific barriers to change were overcome much of the mitigation potential in the low-cost areas could be achieved relatively quickly.

2.10 Emissions reduction opportunities and cost by sector, 2030



Notes: Costs are volume weighted costs to the economy, and do not necessarily represent loss of profit to individual businesses. Opportunities in the building sector, and a proportion of those in industry, are measures to reduce energy demand and thereby indirectly reducing emissions in the power sector.

Data source: McKinsey&Company (2008).

3 THE NEED FOR COMPLEMENTARY POLICY MEASURES

Key points

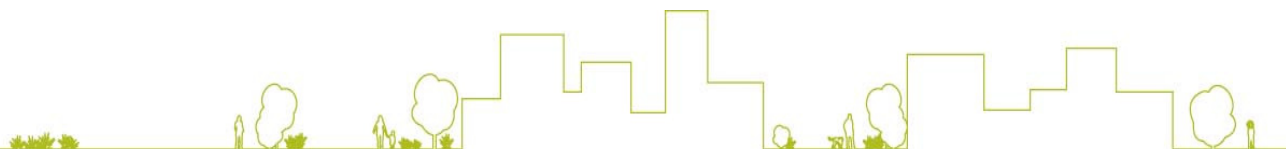
- The presence of market and non-market barriers prevents the building sector from investing in opportunities to improve energy efficiency.
- A core problem is the gap in time between the cost of making the substantial investment required to bring about efficiencies and point at which energy efficiency savings provide a return.
- There are a range of policies that Government has already deployed that encourage energy efficiency in the building sector, mostly focusing on closing information gaps and raising information about opportunities.
- The key shortfall in the policy mix is in providing greater incentive for those in the building sector to invest greater resources energy efficiency.

The building sector has potential to improve the way it consumes energy. Replacing equipment with more energy efficient models or upgrading the performance of the building shell can both significantly increase a building's energy efficiency and produce a positive payback within a number of years. However, the adoption of such cost effective technologies has not been the great success that policy makers would hope it to be. Institutional barriers and the presence of market failures have so far prevented the building sector from realising much of its potential. In order to combat these hurdles, policy makers have employed various mechanisms with varying success.

GENERAL BARRIERS AND IMPEDIMENTS

The literature on the gains of improving energy efficiency in the building sector is matched in volume by the documented barriers to change (Stern 2007, PC 2005, EEWG 2004, DCC 2008, Garnaut 2008). The presence of market failures and persistent behavioural norms tends to punitively overshadow incentives to invest in energy efficiency. The existence of these market and non-market barriers imposes a significant challenge in unlocking the abatement potential of the building sector. The sources of these failures are discussed below.

- **Information gaps** — generally speaking, both consumers and producers have low levels of awareness and understanding about energy efficiency. The availability and accessibility of information regarding the cost effective opportunities to improve energy efficiency is often cited as a major (if not the major) obstacle to investment. Simply put, consumers and firms are unaware of the options before them.
- **Information asymmetries** (adverse selection) — investment in energy efficiency is rife with risk. Deciphering which investments are 'good' and which are 'bad' requires information beyond the usual scope of a firm's expertise. When the costs of making poor choices are sufficiently high, this may lead a firm to make no choice at all.
- **Split incentives** - in some instances, the costs and benefits of an energy efficiency investment may accrue to different agents. This problem has been coined the landlord-tenant problem. In this problem the landlord is deemed responsible for the property's capital, while the tenant for its operating costs. Increasing the building's energy efficiency benefits the tenant, but the costs of this investment will be borne by the landlord. This situation is likely to result in under investment of energy efficiency opportunities.



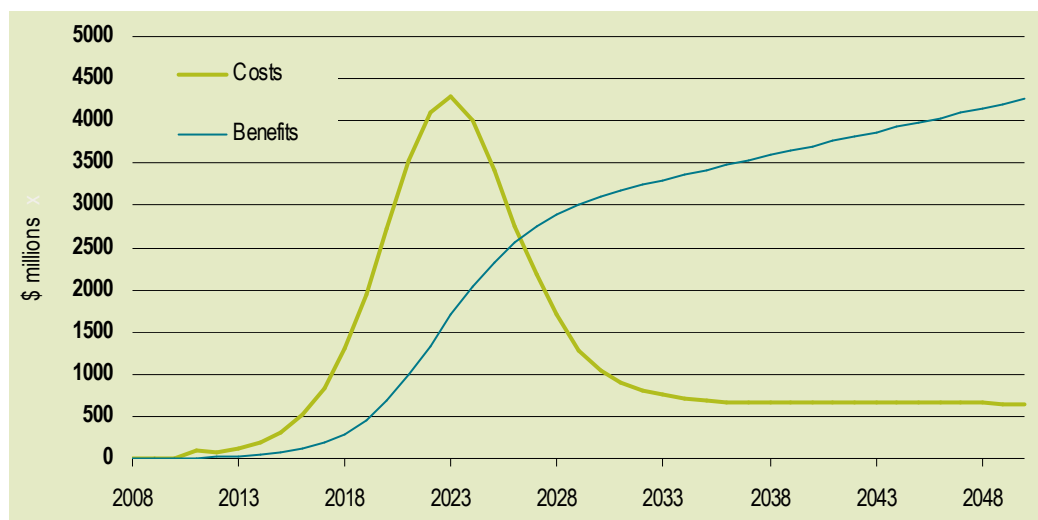
- **Unpriced externalities** — an externality occurs when an economic activity causes costs or benefits to third parties. Markets can fail to allocate resources in the way that is best for the community where the producers and consumers in a particular market either do not bear all of the costs or do not reap all of the benefits of the economic activity. Examples are where manufacturing causes air pollution and imposes costs on others, while planting forests (rather than other agricultural activities) may improve the water quality of those downstream. Applying a price to externalities is a key part of mitigating their adverse effects. If electricity were priced 'correctly,' including the scarcity value of using the atmosphere as a sink for GHG, then the gains from improving energy efficiency would be greater and so too would be the incentives to undertake energy efficiency.
- **Bounded rationality** — the opposite problem of incomplete information is having too much information. Individuals and firms are limited in their ability to use, store and analyse the vast quantities of data before them. 'Rules of thumb' are often used in place of more complete decision making processes, despite the gains they can produce. Bounded rationality is not irrational. The cost that arises from a rule of thumb decision is generally lower for the decision maker than other approaches. Problems may arise where the small potential gains that are overlooked accumulate and add up to a large cost for the community or economy at large when everyone applies the rule of thumb. In the case of energy efficiency, the gains from additional investment may be just below the threshold where they are worth an individual manager's time to pursue, yet when added across the whole building sector would generate a substantial resource saving and reduction in GHG emissions.
- **Regulatory problems** — some rules may in fact favour energy inefficiency. Some regulatory programs may advantage energy from distant and fixed producers at the expense of embedded generation and demand management options. Inappropriate pricing policies and market structure regulations have great potential to distort the incentives to invest in energy efficiency.

MIND THE GAP

A key factor in addition to those identified above is the gap in time between when a substantial investment is required to bring about energy efficiency gains and when those efficiencies provide financial returns.

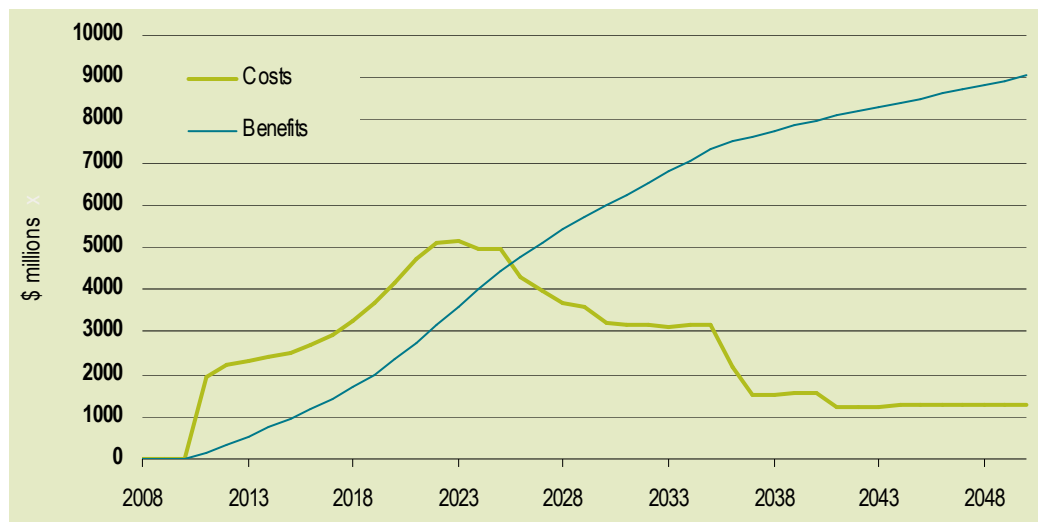
The energy efficiency timing gap in the elements of the building sector is portrayed in charts 3.1 and 3.2. This looks at the changes in finances of the sub-sectors as a whole drawing upon the data used in the analysis reported by the ASBEC CCTG earlier in this report. Together the savings in these sub-sectors contribute to those reported earlier (that is, GHG reductions of around 60 Mt pa).

3.1 Energy efficiency investment timing gap, commercial building sector



Data source: CIE (2007) and ASBEC CCTG estimates

3.2 Energy efficiency investment timing gap, residential buildings



Data source: CIE (2007) and ASBEC CCTG estimates

In the commercial sector, while there are some relatively low cost energy efficiency measures that can be pursued, achievement of substantial efficiencies generally involves a substantive cost. Many of the major measures require alterations to the fabric of buildings including windows, lighting systems, air-conditioning and heating systems and the thermal envelope. To make significant changes to emissions these changes have to be made to existing buildings already in use and so there would be substantial disruption. Essentially, to achieve the expected energy efficiency gains the commercial sub-sector would purchase an asset that provides returns over time reflected in lower energy expenditure. The cost line in chart

3.1 illustrates a trajectory of commercial sector investments necessary to achieve the energy consumption savings. Spending over the period in the chart has a value today — a Net Present Value (NPV) — of \$13 billion.

Clearly when looking at the commercial sector as a whole there would be a significant imbalance between when costs are incurred and when the benefits are obtained. The data underpinning charts 3.1 and 3.2 suggests a payback period of around 11 years using a relatively low discount rate (reflecting interest rates that were prevailing in early 2007). More recent research undertaken by quantity surveying firm David Langdon is reported to indicate that it would take up to 15 to 22 years to pay back the cost of upgrading a two-star energy rating building to a four-star rating (Chong 2008). Ultimately, commercial building owners would upgrade their buildings only if it made economic sense to do so and if they are able to accommodate the timing gap.

The residential sub-sector also exhibits a gap in time between when costs are incurred and when the pay-back from energy efficiency gains is obtained. One difference between the commercial and residential sub-sectors is that there seems to be greater temporal alignment in the residential sub-sector. This reflects differences in the underlying technologies and energy use patterns. It seems that a higher proportion of the investments in residential energy efficiency can be expected to provide a shorter payback period. An example could be in the area of replacement of incandescent light globes with more efficient alternatives where the evidence suggests a payback period within a year. Not all of the technologies examined have this characteristic and there is still a gap in time. While the gap may be relatively shorter in the residential sub-sector, it may still be significant. Many households may not have the capacity to spend now on energy efficiency in order to reduce energy bills later. Low income households and retirees on fixed incomes, for example, may be 'liquidity constrained' and the gap may present an absolute barrier.

A further difference between the residential and commercial sub-sectors is the magnitude of the investment required. The cost curve reflected in chart 3.2 for the residential sub-sector has a NPV of \$31 billion. This is larger than the cost required for the commercial sub-sector. This mainly reflects the larger size of residential energy use and emissions and to a lesser extent, results of calculations where achievement of energy efficiency is slightly lower cost in the commercial sub-sector than the residential sub-sector.

It is notable that providing information about the opportunities available to invest in energy efficiency, or how to actually undertake energy efficiency projects, or reducing the 'principal-agent'/landlord-tenant problems is unlikely to substantially close the gap in time between the initial costs and eventual savings. Closing the gap in time between the benefit and the costs generally comes down to raising the incentive to invest in energy efficiency.

In order to realise the energy efficiency gains that the building sector offers, the building sector will have to effectively invest in creating or altering assets that have a net present value of around \$44 billion. Even though these are genuine assets in the sense that it is expected that they will have a positive and real value (not a net cost), the magnitude of investment required is sobering.

POLICY TOOLS TO PROMOTE ENERGY EFFICIENCY

Barriers to energy efficient investment exist because of adverse incentives and market failures. These underlying factors provide grounds for government intervention to promote investment in this area. Importantly, there is no single remedy to overcome all the barriers to investment. Under-investment in energy efficiency is due to a number of adverse incentives and market failures, and each of which requires a tailored policy response to be rectified.

The broad types of policy responses available to address these barriers include the following:

- **Education** — there is a strong sentiment that the commercial sector would like to invest in energy efficiency, but just lacks the sufficient knowledge required to do so. The first step to overcoming this barrier is through education. An education campaign can raise the awareness of the opportunities available, and close many of the persistent information gaps. Energy audits can provide this education at a firm specific level.
- **Information to assist choice** — choosing between opportunities can require specialist or technical knowledge. Without this knowledge, a project may contain too much risk and be overlooked. Governments sometimes seek to address this problem by attempting to provide knowledge to assist buyers to make "correct" choices. There are limitations in the approach where Governments lag innovation in the market. Another approach in this area is to encourage disclosure of the key elements of information that assist the making of informed decisions.
- **Funding** — improving the financial appeal of a course of action can increase the rate of change. Governments can provide incentives through directly funding or subsidising investment in energy efficiency, providing tax credits and cheaper loans. Funding can 'close the gap' between investment outlays and investment returns.
- **Penalties** — the opposite side of the incentives coin are penalties. The difference being: where funding rewards for 'good' behaviour, penalties punish for 'bad' behaviour. To avoid paying fines, taxes and levies on their energy inefficiencies, a firm may seek to pursue energy efficiency investment.
- **Externality trading** — externalities will often produce market failure when property rights are unclear. If property rights are well defined, then externalities can be appropriately priced and even traded. By creating a 'market' for externalities efficiency can be restored. To be a successful policy instrument however, this market requires support from an appropriate regulatory framework.
- **Regulatory reform** — regulatory measures and government policies can be useful tools in achieving particular outcomes but can sometimes produce unintended outcomes such as rebound effects. It is important that the full impact of any policy instrument be explored and understood, and where possible, alternatives and/or adjustments to policies should be pursued which address these unintended consequences.
- **Prohibition and minimum standards** — Can serve as a useful means of leveling the playing field by lifting practices and incorporating new thinking and technologies across the board. At best it limits worse practice and helps to set standardised requirements across jurisdictions. By prohibiting undesirable production and operating practices, and by imposing a minimum standard, an impetus is placed on a firm to adopt more energy efficient practices and hopefully combined with incentives can drive innovation and best practice.
- **Command and control regulation** — different to a standards approach, command and control regulation mandates the set of operating and production practices that a firm must employ. That is, regulations of this type act as directives from the regulator to a firm, often of a highly technical and specific nature. Rather than just limiting the set of options a firm can pursue, command and control regulations specify exactly what must be done.

GAP ANALYSIS

Commonwealth and state governments are with varying success, already attempting to address barriers to adoption. In their submission to the Garnaut Report, the National Emissions Trading Taskforce (2008) identified around 40 government programs aimed specifically at improving energy efficiency. The next step in this analysis is to evaluate how appropriate the current policy environment is in addressing persistent market and non market barriers. In particular:

- are there any gaps in the policy effort? and
- is there any evidence of duplication?

A report by the Green Building Council of Australia (GBCA) provides the starting point to answer these questions. In 2007 the GBCA compiled an inventory of state and territory policies (both in place and future commitments) to promote energy efficiency in buildings. The report found that the states' policy attention in this space focussed on the following areas (GBCA 2007):

- production of a policy statement;
- leadership by example;
- demonstration projects;
- regulation and standards; and
- support for voluntary standards and ratings.

Notably, the GBCA report was only intended to be an initial audit of state and territory programs, with a more comprehensive report that evaluates state policies is due to follow in 2008. The table below builds on the GBCA analysis (as well as other reports) to assess the scope for policy gaps and duplication.

To construct this table, major state and commonwealth energy efficiency policies were sorted into different policy approaches and then categorised by the barrier they are *primarily* attempting to address. In some cases it is difficult to see how certain policy tools can be used to overcome market barriers. Where this occurs in the table, the cell has been appropriately blacked out.

3.3 Policy gap analysis

	<i>Education</i>	<i>Information to assist choice</i>	<i>Funding</i>	<i>Penalties</i>	<i>Externality trading</i>	<i>Regulatory reform</i>	<i>Prohibition and minimum standards</i>	<i>Command and control regulation</i>
<i>Information gaps</i>	State and Commonwealth media campaigns, for general and targeted audiences Tertiary training provided by some states and territories to improve energy efficiency skills of service providers	Substantial policy activity from all levels of government promoting information about specific energy efficiency opportunities	Support provided for energy efficiency research at the Commonwealth level, and by some states and territories				Minimum performance standards and efficiency benchmarks apply in all jurisdictions	
<i>Information asymmetries</i>	Mandatory rating and reporting systems introduced in some states and territories, for both the commercial and residential sectors	Substantial policy activity from all levels of government promoting information about specific energy efficiency opportunities					Minimum performance standards and efficiency benchmarks apply in all jurisdictions	
<i>Split incentives</i>			Some state funding programs aimed at addressing split incentives				Innovative green leasing arrangements introduced at the Commonwealth level	

Sources: Adapted from PC (2005), DCC (2008) and NETT (2008).

(Continued on next page)

3.3 Policy gap analysis (continued)

	Education	Information to assist choice	Funding	Penalties	Externality trading	Regulatory reform	Prohibition and minimum standards	Command and control regulation
Unpriced externalities					Market based energy efficiency trading scheme operating in NSW since 2003, and to be introduced in Victoria (residential sector) in 2009 CPRS to be introduced in 2010		Mandatory energy efficiency improvements imposed on energy retailers in a number of the states and territories	
Bounded rationality		State activities mostly involving demonstration and providing energy audits						
Regulatory problems						Wilkins review and COAG agreement currently under way Ongoing policy development in each jurisdiction		
Energy efficiency investment gap			Commonwealth and state funding provided for some specific energy efficiency investments – mostly aimed at the residential sector (particularly hot water)		Market based energy efficiency trading scheme operating in NSW since 2003, and to be introduced in Victoria (residential sector) in 2009			

Sources: Adapted from PC (2005), DCC (2008) and NETT (2008).

From the table it is evident that some impediments have received substantially more attention than others. This is in part a function of governments' capacity to respond to the issues in question. For example, some policy responses, such as education, can be provided with little constraint while more complex market failures may require more complicated solutions.

Governments at all levels have devoted considerable resources to education campaigns and the provision of information. The states and territories each have educational programs that conduct demonstrations and provide instructions for firms and households. These programs help fill the information gaps, and to a lesser extent overcome some information asymmetries.

Information gaps can alternatively be resolved with a standards approach. With insufficient information customers are unable to identify which energy efficient investments are likely to produce a positive payback, and which will not. Similarly, producers (such as electricians or builders) may also be unaware of the energy saving services they can provide. Applying standards, ratings and accreditation can remove much of the ambiguity and risk from the consumer's choice, and provide minimum benchmarks for producers to operate from. The Australian Building Code, the National Appliance and Equipment Energy Efficiency Program and NSW's BASIX are examples of programs in this space.

The other barrier where governments have made a significant contribution is the funding of research and development (public goods). The private sector is often unwilling to invest in research and development when it cannot protect the knowledge it obtains or obtain value from the investment because of problems in excluding others from using the information created. There has been considerable funding of energy efficiency research through a number of state and Commonwealth partnerships with industry and academia.

Areas, however, which appear to have received less policy attention include:

- split incentives;
- bounded rationality; and
- the energy efficiency investment gap.

Notably, by their nature, these specific barriers will often require either more sophisticated or more costly responses to be rectified, and consequently, it might not be surprising that these areas have received less attention to date. Moreover, where the states and the Commonwealth have made their contributions here, their focus has predominately been on the residential sector. For example, rebates are provided in NSW, Queensland, South Australia, Western Australia and the ACT for the installation of energy efficient hot water systems, but few provisions are made to finance investment in the commercial sector.

Looking forward, it is clear that additional policy effort is still required in this space. Those policies which can provide the most opportunity for *additional* abatement will add the most value. This may require either the strengthening of existing government policies, or adding to the policy portfolio. In either case, policy effort will be required to specifically address those barriers still outstanding.

The next chapter describes the CCTG's analysis of potential policies to promote energy efficiency in the building sector, and keystone policies that will provide the most additional support to achieve the Commonwealth's emissions abatement target.

4 POLICES TO PROMOTE ENERGY EFFICIENCY IN BUILDINGS

Key points

- ASBEC has identified a range of additional policy measures that would bring about both increased energy efficiency in the buildings sector and greenhouse gas abatement.
- The ASBEC CCTG advances three policies as necessary to motivate the long term structural change and significant level of investment required to achieve greater energy efficiency in the building sector. These policies are:
 - a national white certificate scheme;
 - green depreciation; and
 - public funding for building retrofit – aimed at both the retail (residential and commercial buildings) and wholesale (energy retailer) sectors.
- Additionally, the CCTG recognises the merits of specific regulatory measures – including higher standards and expansion of MEPS and higher standards and modernising the building code – in promoting energy efficiency in this sector.

This chapter identifies the policy measures that are best placed to fill earlier identified policy gaps and address key market failures that act as a barrier to increased investment in energy efficiency in the building sector.

A RANGE OF POLICY MEASURES

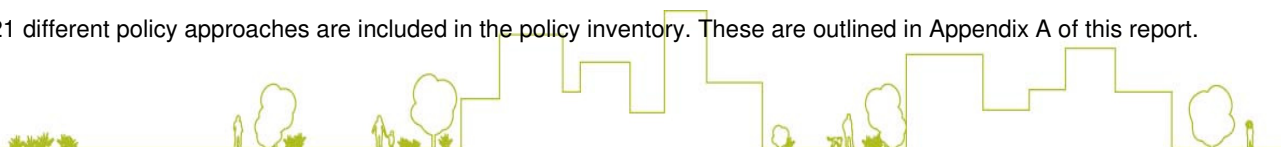
The Garnaut Climate Change Review states that a 'variety of policy responses will be required in the building sector to address the multiple and interacting market failures' (2008:462). Measures the review discussed included:

- mandatory labelling for equipment and buildings;
- education, tools and certification for specialists;
- improved contracting;
- research and demonstration programs; and
- building and appliance standards.

ASBEC recently compiled an inventory of additional policy measures based on the experience and expertise of its members spanning many facets of sustainable buildings. The measures are considered 'additional'. In other words, they either expand or add to the range of initiatives that are already in place or are currently in the pipeline. These additional policies are expected to stimulate a significant amount of additional energy efficiency in the building sector and greenhouse gas emissions abatement. The ASBEC compilation can be sorted according to the underlying nature of the policy approach. Five categories are identified.

- command and control regulation;
- market based solutions;
- standards and prohibitions;
- knowledge provision; and
- basic research.

Some 21 different policy approaches are included in the policy inventory. These are outlined in Appendix A of this report.



POLICY PRIORITIES

In order to identify relative priorities between policy approaches, ASBEC recently conducted a multi criteria analysis (MCA) of the policy options. This analysis reviewed and assessed policies from a range of dimensions. Essentially each approach was evaluated according to how well it performed against key criteria. That is, it is viewed to be:

- effective at reducing GHG emissions/improving energy efficiency;
- economically efficient, imposing minimal net private costs or delivering positive net benefits;
- institutionally compatible with existing policy approaches;
- credible, that is, having good governance arrangement; and
- innovative by opening pathways to greater positive impacts and promoting learning by doing.

This process resulted in the identification of seven keystone policies.

Those policies not deemed 'keystone policies' were classified as 'support policies'. Many of these policies complement keystone policies and indeed they may be vital to ensuring their effectiveness (especially during the transition phase). In their own right, these policies are able to make significant contributions to increasing energy efficiency in the building sector. It was apparent from the assessment however, that the building sector's potential in this space could not be completely realised without adopting keystone policies.

The key results and insights from this analysis are documented in Appendix B of this report.

PROPOSED COMPLEMENTARY MEASURES

The ASBEC CCTG proposes the adoption of three of the ASBEC keystone policies now as a complementary measure to the Government's CPRS. These policies are necessary to motivate the structural change required to achieve greater energy efficiency in the building sector. These policies are (not any particular order):

- a national electricity retailer efficiency requirement or 'white certificate' scheme;
- accelerated depreciation for energy efficiency in buildings or 'green depreciation'; and
- public funding for building retrofit – aimed at both the retail (residential and commercial buildings) and wholesale (energy retailer) sectors.

In addition, specific regulatory measures – including enhancement of MEPS and modernising the building code – also ranked highly in the MCA. Together, these policies form what the CCTG have categorised as the 'keystone policies' necessary to enhance energy efficiency in the building sector and raise sustainability.

Key points about each of these measures are provided below.

A national white certificate scheme

A white certificate scheme improves energy efficiency by applying an obligation on energy retailers to reduce energy consumption. A retailer is able to satisfy this obligation by either:

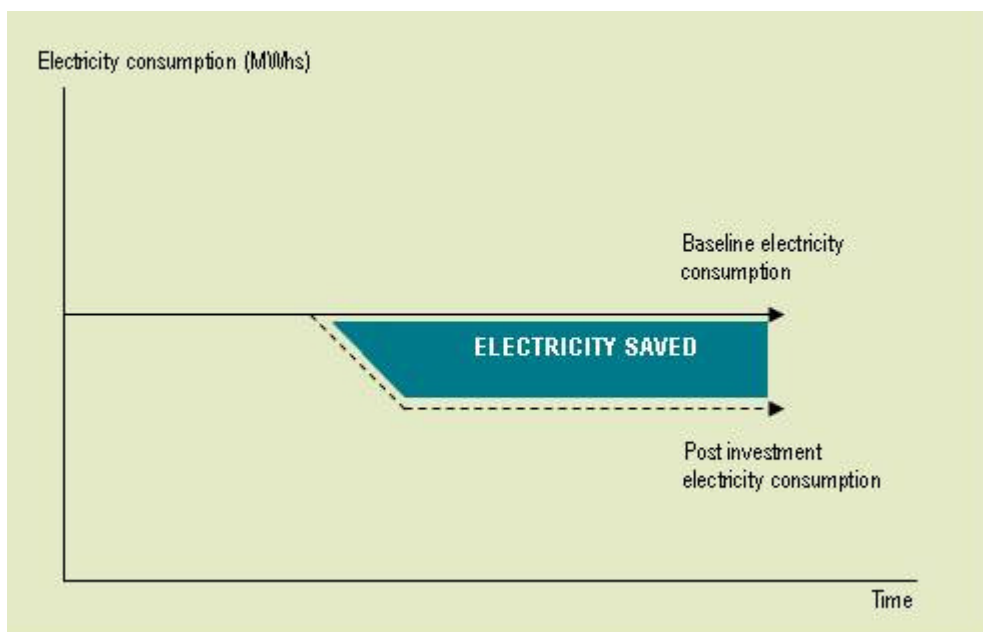
- improving their own energy efficiency;
- obtaining energy efficiency from their customer base – by providing incentives and energy solutions; or
- by purchasing 'out performance' of other energy retailers in the scheme.

Precisely how energy savings are achieved under the scheme is unimportant, so long as the savings can be verified. This gives the scheme a high degree of flexibility, and provides participants with an incentive to pursue the lowest cost means of achieving energy savings.

A white certificate scheme commodifies energy efficiency as an asset, represented by a white certificate, which can be traded (similar to permits in the CPRS). The certificate represents a reduction in energy use and is issued in return for verified improvements in energy efficiency over and above an agreed standard. Chart 4.1 illustrates what a white certificate represents. The diagram plots the baseline level of energy consumption for a hypothetical consumer. Now suppose an investment opportunity exists that could increase energy efficiency and thereby reduce electricity consumption. The lifetime value of the electricity saved as a result of the investment would entitle this electricity

consumer to an amount of white certificates (denominated in either saved MWhs or the equivalent CO₂-e emissions saved).

4.1 Creating a white certificate credit



Data source: CIE (2008).

By commodifying energy savings, a white certificate scheme is able to bring energy efficiency to the forefront of a manager's decision making set. Energy consumption is generally only a small component of a firm's annual expenses, and thus receives a low priority. The value attached to a white certificate however, will assist in making the business case to increase a firm's energy efficiency.

White certificate schemes are able to achieve broad based participation from both the commercial and residential sectors. Any energy consumer that can produce an increase in energy efficiency can participate as a producer of white certificates. Participation does not need to be limited to a particular sector of the economy, or to a particular segment in the value chain. This gives the scheme considerable breadth and scope to enhance energy efficiency.

A white certificate scheme is not a new idea. Developed countries around the world — including Australia — have experience in operating variants of a white certificate scheme. In Australia, New South Wales has overseen the operation of Greenhouse Gas Abatement Scheme (GGAS) since 2003 (see box 4.2). Italy, France and the United Kingdom each have a white certificate scheme, as do a number of states in the USA.

4.2 THE NSW GREENHOUSE GAS REDUCTION SCHEME AND NSW ENERGY EFFICIENCY TRADING SCHEME

The New South Wales government introduced the Greenhouse Gas Reduction Scheme (GGAS), the world's first energy efficiency certificate trading scheme in 2003. Participants in GGAS include major producers and consumers of electricity (mostly electricity retailers). GGAS requires that participants reduce the average emissions of their electricity consumption/production or face a penalty per tonne of carbon dioxide above the benchmark.

Participants buy and sell NSW Greenhouse Abatement Certificates (NGACs). Each NGAC represents one saved tonne of carbon dioxide emissions and can be sold on the open market to other participants. NGACs are produced by:

- reducing consumption of electricity (facilitating demand side abatement) via:
 - modifying installations resulting in reduced electricity consumption;
 - replacing installations with other installations that consume less energy;
 - substituting towards an more efficient source of energy; and
 - on-site energy generation.
- generating electricity in a way that reduces the greenhouse gas emissions per megawatt hour; or
- capturing carbon from the atmosphere with forests (that is carbon sequestration).

The emissions trading component of GGAS will be soon be superseded by the Commonwealth's CPRS. The energy efficiency component of GGAS will be continued under a new scheme, the NSW Energy Efficiency Trading Scheme (NEET), from January 1, 2009. Similar to GGAS, entities that improve the efficiency of electricity use in the residential, commercial and industrial sectors in NSW would be allowed to create new 'NEET certificates.'

Source: NSW Department of Energy and Climate Change (2008)

Two states will introduce white certificate schemes in 2009. These being:

- the NSW Energy Efficiency Trading Scheme (NEET) which will replace the GGAS as a dedicated energy efficiency trading program that targets energy efficiency gains made in the residential, commercial and industrial sectors; and
- the Victorian Energy Efficiency Target Scheme (VEET), which will require electricity retailers to induce energy savings in the Victorian residential sector).

South Australia and Queensland will implement programs that will impose mandatory energy efficiency requirements on energy retailers. Mandatory minimum energy efficiency targets have the same foundations as a white certificate scheme, but do not permit the trading of outperformance (that is, no trading). These programs are mentioned here as they could be developed into white certificate schemes.

Importantly, there are significant differences between the state programs across the key areas of coverage, liabilities and eligibility. The table below summarises the proposed schemes for each of the jurisdictions.

A national white certificate scheme would supersede state based schemes and capitalise on the advantages of a nationally run scheme. It would also reduce the costs that are likely to arise from having inconsistent rules and regulation in each state and raise the potential for investment in energy efficiency as a single national market. A national white certificate scheme should aim to be as inclusive as possible. Currently, white certificate and mandatory energy efficiency target schemes in some jurisdictions are starting with a narrow base – including for example, only residential consumers, or households and small businesses.

A national white certificate scheme addresses policy gaps and adds to abatement effort in three distinct ways:

- it prices the externality associated with excessive energy consumption (CIE 2008);
- it provides an incentive for managers and decision makers to actively seek out energy solutions, thereby reducing the constraints of bounded rationality; and
- it provides an immediate monetary incentive to undertake investment in energy efficiency, thereby closing the gap between investment outlays and returns.

4.3 THE VICTORIAN ENERGY EFFICIENCY TARGET

The Victorian government will introduce a Victorian Energy Efficiency Target (VEET) scheme to reduce GHG emissions through energy conservation in January 2009. The scheme would be a market based scheme that would place an obligation on energy retailers to meet specific energy conservation targets, and require them to assist households in reducing their energy demands. It is hoped that VEET will provide a key mechanism for driving reduction in household greenhouse gas emissions through improvements in household energy efficiency (VDPI 2007).

VEET will require energy retailers with more than 5000 Victorian customers to either surrender certificates proportional to their share of the Victorian energy market. Certificates will represent an imputed reduction in greenhouse gas emissions from a decrease in energy consumption at a set conversion rate. A target of 2.7 million certificates per year from 2009 to 2011 has been set as the initial target. The quantity of emissions reductions will continue to grow as the scheme extends forwards.

It is proposed that Victorian households will be able to produce certificates through a variety of activities. These activities might include:

- replacing electric hot water systems with solar or gas systems;
- replacing electric heating with gas heating;
- installing energy efficient appliances; and
- improving the thermal efficiency of the building shell.

The Victorian government has flagged that this scheme might be extended to include small and medium businesses over the medium to long term.

Source: Victorian Department of Primary Industries (2008),

4.4 Energy efficiency trading schemes

<i>Jurisdiction</i>	<i>Scheme</i>	<i>Commencement</i>	<i>Nature of scheme</i>	<i>Comments</i>
C'wealth	Nil			
NSW / ACT	NSW Energy Efficiency Trading Scheme (NEET)	January 1 2009	White certificate scheme	Entities that improve the efficiency of electricity use in the residential, commercial and industrial sectors in NSW will create NEET certificates. These certificates can be traded to 'liable' parties which will include holders of NSW electricity retail licences, electricity generators that supply directly to retail customers, and direct market customers in the National Electricity Market.
Victoria	Victorian Energy Efficiency Target Scheme (VEET)	January 1 2009	White certificate scheme	The VEET scheme sets a target for energy savings, initially in the residential sector, and requires energy retailers to meet their own targets through energy efficiency activities, such as providing households with energy saving products and services at little or no cost.
Qld	Smart Energy Saving Program	July 1 2009	Mandatory minimum energy efficiency target (no trading)	The Smart Energy Savings Program will operate on a five-yearly cycle. To complete the Smart Energy Savings Program cycle, a business will be required to: calculate its baseline energy use; audit energy use and identify energy savings measures; produce an Energy Savings Plan of measures to implement and publish a public commitment on the actions to be taken.
SA	Residential Energy Efficiency Scheme (REES)	January 1 2009	Mandatory minimum energy efficiency target (no trading)	No allowances are made for outperformance. Energy retailers operating in South Australia are required to achieve targets for: - delivering energy audits to low income households; and - implementing energy efficiency improvements in households, such as ceiling insulation, draught proofing and more efficient appliances. A proportion of these must be delivered to low income households. Trading is not likely to be a feature of REES, outperformance can be saved to secure against future obligations.
WA	Mandatory energy efficiency scheme	tba	Unknown	The WA Government has announced a policy to introduce a mandatory energy efficiency scheme applicable to large and medium sized power consumers. Few details have been released as to what this will encompass, but indications are that it will be consistent with schemes being implemented in other States.
Tas	Nil			
NT	Nil			

Source: NSW Department of Energy and Climate Change (2008), Victorian Department of Primary Industries (2008), Queensland Department of Minerals and Energy (2008), SA Department of Transport, Energy and Infrastructure (2008) and WA Department of Environment and Conservation (2007).

Green depreciation

Green depreciation would provide accelerated depreciation for buildings that meet a specified environmental standard. Green depreciation would allow the deferment of tax by reducing taxable income in early years in exchange for bringing forward investment. By allowing investors to defer tax payments, green depreciation can significantly reduce the timing gap problems of energy efficiency investments.

Accelerated depreciation would apply to capital expenditure on refurbishments that 'green' commercial buildings. Only substantial refurbishments, generally requiring local government approval, would be eligible. Both plant fixtures and fittings and capital works would be eligible for accelerated rates of depreciation under the proposed scheme. It would be

necessary to establish a standard of performance or quality of inputs to be achieved in order for expenditure to qualify for green depreciation (CIE 2007).

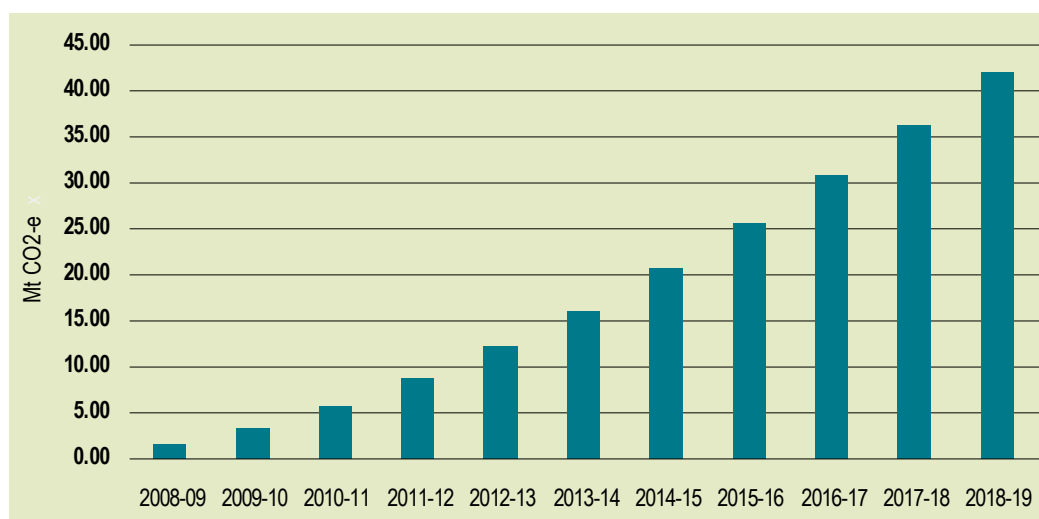
Currently, retrofitting is costly. Market information suggests that it currently takes up to 15 years to obtain a pay back on the cost of upgrading a two star energy rating building to a four star rating. Green depreciation would shorten the payback period. Ultimately, building owners would still only upgrade their buildings if it made economic sense to do so (Chong, 2008). It is unlikely that green depreciation would stimulate excess investment in building refurbishment.

The cost to government is also the value of the deferment of tax. This policy could reduce GHG at a relatively low cost estimated to be approximately \$11 per tonne of CO₂-e (CIE 2007). In the short term deferment appears as a revenue loss in government accounts. This would be offset in the longer term by increases in revenue.

The annual investment in property alterations and additions in Australia is substantial. Reflecting the large size of the existing stock of property, the large scope to achieve energy efficiency gains in older buildings and the capacity of commercial building owners to finance the changes, large scale changes should be achievable through this approach.

It is estimated that some 203 Mt of CO₂-e could be reduced in the first 11 years of the scheme or an average of 18 Mt per annum. Chart 4.5 shows the hypothetical abatement potential if the amount of investment in building refurbishment projected by the Construction Forecasting Council is realised.

4.5 Savings of greenhouse gas emissions through green depreciation



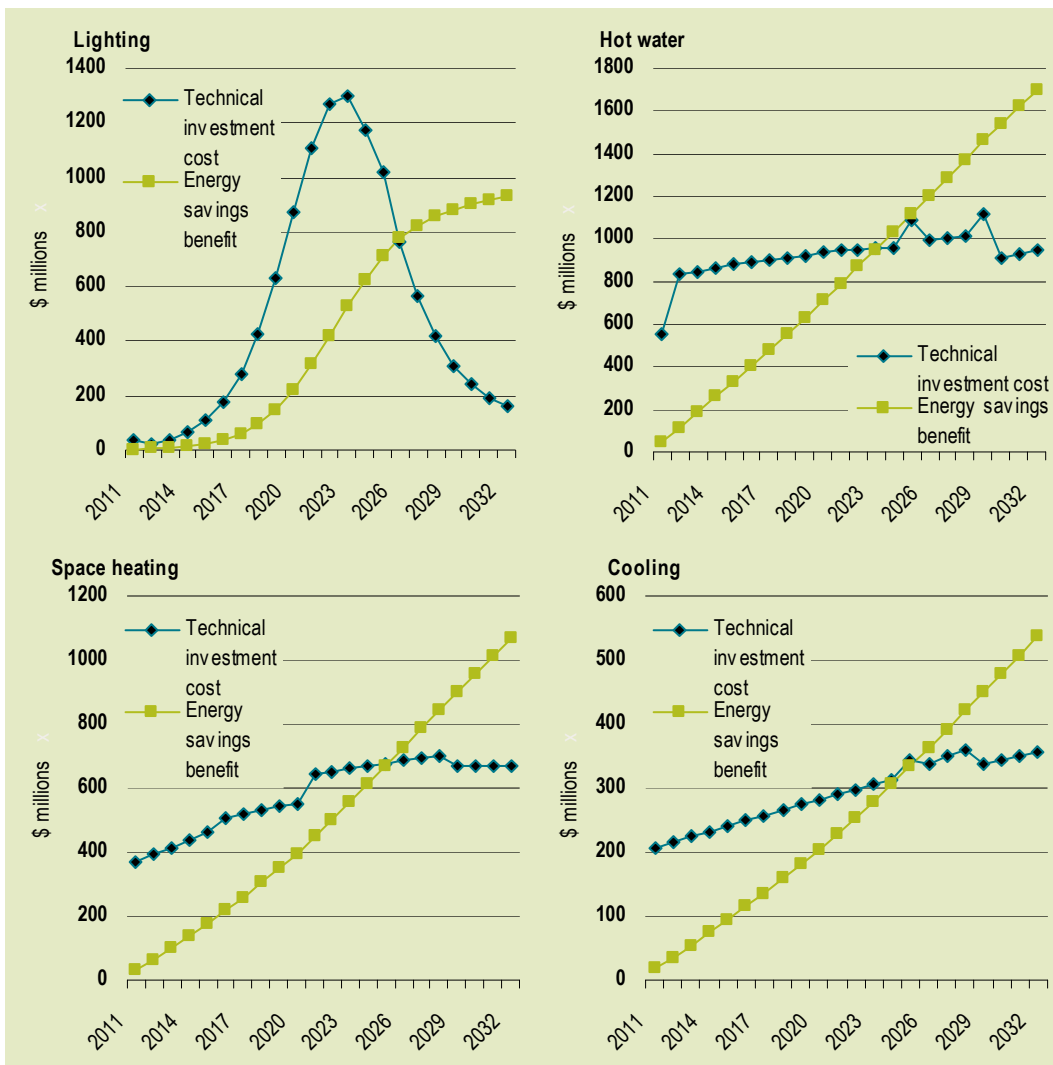
Data source: CIE (2007).

Additionally and similar to white certificates, green depreciation will provide building managers with incentives to *investigate* options for green investment. These incentives will encourage the building sector to learn about opportunities, arming decision makers with a better greater information set. This learning process helps to overcome investment barriers that stem from bounded rationality.

Public funding of building retrofit

Often investment in building retrofit can be cost effective from the community's point of view, but not from the individual's. For example, investment is 'break even' for each of the exhibits below (chart 4.6), but the investment's outlays are not paid back for several decades. Coupled with the existence of strong market failures, the 'gap' between investment and energy savings over time produces a strong disincentive to invest in energy efficiency.

4.6 Investment and energy savings over time, appliances



Data source: CIE (2007) and ASBEC CCTG estimates

Public funding of building retrofit reduces the investment cost for energy consumers, therein closing the 'payback gap' and providing the necessary incentives to undertake investment in energy efficiency.

Public funding of energy efficiency investment would require a range of targeted government-funded financial assistance mechanisms (ie grants, subsidies, rebates) for improvements undertaken by households and the commercial sector. Funding should be made available for and limited to investment opportunities with a proven ability to reduce energy consumption. Examples of energy efficiency improvements that might qualify for public funding include:

- the installation/upgrade of insulation;
- energy efficient lighting;
- window glazing;
- heating measures;
- energy efficiency appliances;
- reduction of air conditioning electricity appliances;
- louvers; and
- installation of high efficiency gas/solar hot water systems.

The Government's CPRS Green Paper refers to investment in energy efficiency as a 'household assistance measure,' flagging several Commonwealth residential energy efficiency programs to be introduced in 2008-09. These include:

- subsidising the installation of insulation in rental properties; and
- incentives to encourage domestic use of solar and heat pump hot water systems, and phase out inefficient hot water systems.

Public funding of building retrofit is common throughout the OECD, with many countries having developed ambitious schemes since as early as the 1970s (WEC 2008). Ex-post evaluations of grant and subsidy schemes throughout Europe identified a number of drawbacks that reduced the effectiveness of these programs (Urge-Vorsatz et al 2007). However, these drawbacks have not prevented the use of subsidy schemes, but have instead led to more careful implementation. Grants are now better targeted and often restricted to specific types of investments and technologies (WEC 2008).

Notably, while most public programs across the OECD target energy consumers directly, funding can also be provided up stream. Providing grants and subsidies to those that provide retrofitting services, or to energy retailers can often lead to greater and faster program adoption (WEC 2008). Providing incentives at the 'wholesale' level (that is, energy retailers) can utilise existing relationships and access economies of scale in doing so.

By providing funding incentives for specific activities, the government will reduce much of the decision making effort required by the building sector. Essentially, grants and subsidies will guide decision makers about investment opportunities. In turn, this guidance will somewhat reduce the problems of bounded rationality and information gaps. This is particularly true for those areas which are otherwise proving to be a challenge to promote, where a specific grant can be used to promote activity.

OTHER KEYSTONE MEASURES

Two regulatory measures were also ranked highly by the ASBEC CCTG multi criteria analysis. These being:

- the enhancement of MEPS; and
- modernisation of the building code.

These policies are both regarded as keystone policies of the CCTG.

Increase minimum energy efficiency/thermal performance

The Building Code of Australia needs to be updated and modernised with higher standards on the design and materials of buildings. The existing Code offers compliance with minimum performance targets or more conventional construction which is 'deemed to comply' with the Code. This initiative would involve a combination of both approaches.

Building codes are an important driver for improved energy efficiency in new buildings (OECD 2003). Building codes in the United States, Europe and Australia have all been linked to successfully reducing energy consumption in new developments. In the United States, requirements of the code reduced energy use by some 15-16 per cent (Nadal 2004). In the European Union, dwellings built since 1973 out performed older buildings on average by a cumulative 60 per cent (WEC 2004). Still, the OECD (2003) considers that there remains significant room for improvement in this space.

In Japan, compliance with the building code has been difficult to enforce leading to mixed outcomes. The Building Code of Australia, which makes use of more prescriptive requirements and separable performance levels, is able to side step these compliance issues (AGO 2000).

Notably, to remain effective, the building code must be regularly upgraded as technologies improve and the costs of energy efficient features and equipment decline (Urge-Vorsatz et al 2007).

Enhance performance standards in MEPS

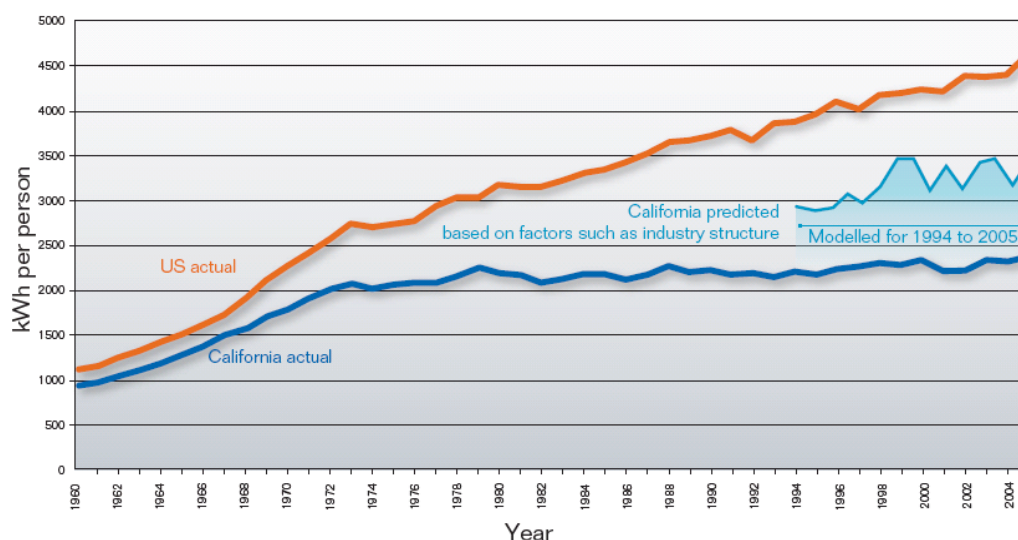
Accelerating and increasing minimum standards for energy efficiency of appliances (such as a 1-watt standard for stand by-mode) through MEPS would hasten energy efficiency gains. Compliance would be required for appliances that are sold in Australia and information about energy efficiency performance would be coupled with a consistent (eg star) rating.

Standards are necessary to remove certain inefficient but inexpensive products from the market – which cannot be achieved by labelling programs alone. Performance labelling can stimulate technological innovation and the introduction of more efficient products, but standards are needed to impact on the gradual removal of the least energy efficient products from the market (WEC 2008).

Appliance standards are among the most commonly used instruments for increasing building energy efficiency, with a long track record of achieving results. For example, Japan's Top Runner program, launched in 1998, is set to reduce household energy consumption by 17.5 per cent of 2006 levels, by 2010. Top Runner requires all new products to meet the efficiency level of the most efficient product at the time the standard is set. Efficiency improvements for some products have been in the order of 50 per cent (Urge-Vorsatz et al 2007).

California has been particularly successful in improving energy efficiency, with electricity sales per capita remaining steady at the same time as output per person grew strongly. A substantial proportion of the state's higher level of energy efficiency has been linked directly with Californian energy policies, with building and appliance standards accounting for around half of these savings (Garnaut 2008). Chart 4.7 reports the actual and predicted electricity consumption in California, had these policies not been implemented.

4.7 Residential per capita electricity consumption in the United States and California



^a The gap between California Predicted and California Actual represents the possible savings from energy efficiency policies.

Data source: Garnaut 2008.

Appliance standards are among the most cost-effective and widespread instruments to reduce the demand GHG emissions. Typically, GHG abatement is achieved with large negative costs (that is, positive benefits). Across the globe, estimates of the GHG abatement cost of appliance standards range between -\$US190 in and -\$US65 per tonne of CO₂-e (Urge-Vorsatz et al 2007).

The Australian experience with MEPS has been successful (WEC 2008), labelling and energy standards striking an appropriate balance. However, the incentive to innovate has largely diminished with most appliances in the best efficiency class.

OTHER STEPS

The ASBEC CCTG, similarly to the Garnaut Climate Change Review, notes that a variety of policy approaches will be needed to combat the intersecting challenges and barriers to change in the building sector. A mix of measures will always be required.

There are also a number of measures that are not strictly directed at raising energy efficiency in the building sector, but which would generate momentum for greater sustainability through other changes in the building sector. One issue, for example relates to embodied energy within building materials. Another surrounds the access arrangements for embedded electricity generation and feed in tariffs — see box 4.8.

4.8 EMBEDDED AND RENEWABLE ENERGY SYSTEMS

Small-scale renewable energy generation systems provide consumers with a means of producing their own electricity and contributing to reductions in greenhouse gas emissions from electricity generation. Due to their embedded nature, these energy systems play a significant role in avoiding network augmentation costs and reducing infrastructure costs of upgrades to the network. Additionally, renewable energy generation has the capacity to supply electricity at times of peak load, providing significant economic benefit by reducing the wholesale cost of electricity at these times and reducing both TUOS and DUOS network charges.

Embedded generation (including small-scale systems such as domestic solar photovoltaic –PV– electricity systems) can have a number of advantages over centralised generation, including (Strbac and Jenkins 1998, ESCOSA 2003, PB Power 2004, and ATA 2005):

- improved reliability of supply through diversifying generation options;
- reduced transmission losses through generation close to the point of use;
- greater control by individuals and communities over their electricity generation; and
- improved employment opportunities, with small-scale renewable projects providing more jobs per MWh of electricity produced than conventional energy sources.

Despite these benefits, potential investors in this technology face significant obstacles. Obstacles regularly reported by potential investors include:

- The inability to capture the benefits to the electricity network which arises from the adoption of renewable energy technologies embedded within the electricity grid. For instance, solar PV system owners are not rewarded for electricity they export during periods of peak demand.
- Issues associated with the buy-back rate for electricity generated from small embedded generators.
- A lack of information to assist system owners and complex technical regulation.
- Minimal consistency in the treatment of system owners negotiating grid connection.
- The absence of guidelines relating to embedded generation has been noted in a number of reports as being a barrier to entry for embedded generation. For instance, almost ten years ago, The Allen Consulting Group and McLennan Magasanik Associates (1999, pp. 66) stated that:

There are inherent biases in the operation of the National Electricity Code against renewable energy producers. Factors such as administrative charges, transmission charges and pricing issues act in favour of the larger incumbent generators. The NEC does not account for the embedded nature of much renewable energy, and hence acts against the interest of the smaller operators in the NEM.

(Continued on next page)

4.8 EMBEDDED AND RENEWABLE ENERGY SYSTEMS (CONTINUED)

Although the efficiency gains and the impediments for the development of embedded generation have been identified and analysed⁶, the current economic regulatory framework still provides little incentive for retail or distribution businesses to actively encourage small renewable embedded generation.

To address these barriers, a number of measures have been proposed:⁷

- Recognition of the full benefits of small-scale embedded generations via pricing structures that reflect those benefits. For instance, the introduction of a mandated feed-in tariff for the production and supply of electricity from renewable has been proposed. A feed-in tariff is a premium tariff paid for electricity fed back into the electricity grid from a designated source of electricity generation, typically renewable energy. Currently, almost all Australian states have a 'net feed in tariff' (also known as export metering), which pays the system owner for surplus energy they produce (i.e. not for each kilowatt produced by a grid connected system).⁸ The development of a national regulatory framework that recognises investment in small renewable embedded generation as being equivalent to other demand management initiatives.
- The adoption of standard grid connection agreements aimed at developing the simplest, easiest and lowest cost process possible for connection of small embedded generators.

Development of 'How-to-guides' that provide system owners with information and guidance to inform and simplify the grid connection process. In 2004, the Ministerial Council on Energy established the Renewable and Distributed Generation Working Group to provide strategic advice on policy directions for removing impediments to, and promoting the commercial uptake of renewable and distributed generation technologies and practices in the energy market. In response to the issues relating to embedded generation highlighted above, the following actions are being undertaken:

- The Utility Regulators Forum is developing a consistent and comprehensive Code of Practice for distributors across the NEM.
- The Energy Market Reform Working Group is reviewing the proposed electricity distribution rules with regard to network incentives and impacts for non-network alternatives such as distributed generation and demand side response.
- The Ministerial Council on Energy Standing Committee of Officials engaged NERA Economic Consulting and Allen Consulting Group to provide expert advice in reviewing the proposed electricity distribution rules on network incentives for distributed generation and demand side response.

⁶ Examples of the benefits and market potential of demand side management technologies can be found in Sustainable Energy Development Authority (SEDA) 2001 and 2002.

⁷ CRA 2004, ATA 2005 and 2006, and Moreland Energy Foundation and ATA 2007.

⁸ Tasmania, Queensland, the Northern Territory, ACT, and South Australia already have a net feed in tariff. Victoria will have a net feed in tariff from 2009. Western Australia recently announced (26 August 2008) the introduction of a gross feed in tariff program. NSW does not have any kind of feed in tariffs.

5 THE VALUE OF BUILDING ENERGY EFFICIENCY

Key points

- Reducing greenhouse gas emissions through substantive investment in energy efficiency in the building sector, with the potential to make emission savings at low or no economic cost, would reduce the economy wide cost of achieving deep cuts in GHG emissions.
- Modelling using the same tools currently being used by the Government indicates that:
 - with less demand for emissions the price for emissions permits would be lower — the emission permit would be around 14 per cent lower than otherwise; and
 - the expected loss in economic activity required to reduce emissions would be lower —the annual saving is estimated to be \$38 billion by 2050.
- The gains from increased energy efficiency in the building sector would not be confined to the building sector alone. Additional energy efficiency gains in the building sector would essentially free resources such as labour and capital which can be used by other industries. This is of particular benefit in Aluminium and Alumina, Coal, Gas and Iron Ore production. Reductions in these industries would shrink with increased energy savings in the building sector.

Earlier chapters of this report have established that: there is evidence of considerable potential to raise energy efficiency in the building sector, that this would reduce greenhouse gas emissions, and that there are practical ways of providing incentives for change. This chapter establishes the value in pursuing change within the broader context of reducing carbon pollution.

DIRECT AND PROXIMATE BENEFITS

Improved energy efficiency that reduces energy consumption in buildings offers many advantages. There is mounting evidence of this from overseas and more recently from Australian experience. Reports of the practical benefits from increased energy efficiency in buildings that flow to building owners and their occupants are becoming commonplace — see box 5.1.

STRATEGIC SIGNIFICANCE OF THE BUILDINGS SECTOR

Improving energy efficiency in the building sector could also play a strategic role within the overall plan for 'decarbonisation' of the economy. In particular it could ease the task of achieving the reduction in GHG emissions the scientific community advise is necessary to stabilise the earth's climate.

It is expected that applying a cap on GHG emissions under an emissions trading scheme would raise the price of energy, particularly electricity. One intended effect of such a scheme would be to shrink demand for GHG intensive energy sources (such as electricity until electricity production technologies are developed that involve greater use of low emissions options). Raising energy efficiency in the building sector in conjunction with an economy wide emissions trading approach to reducing GHG emissions would:

- reduce the amount of energy consumed in the buildings sector and in the economy at large (that is, the remainder of the economy beyond the building sector including transport, other utilities, agriculture and mining etc);
- reduce energy consumption costs for energy users in the buildings sector;
- reduce the cost of energy consumption for everyone purchasing energy (especially in the electricity market) offsetting the costs induced from the emissions trading scheme; and



- reduce the demand for energy and emissions permits under a given emissions cap and therefore reduce the costs of achieving an emissions reduction target for participants in the trading scheme and for the economy at large.

Aspects of the economics of additional energy efficiency and demand side reductions are detailed in box 5.2.

5.1 EVIDENCE OF GREEN BUILDING BENEFITS

The Green Building Council's report *Valuing Green* (2008) analyses how a Green Star rating can affect property value. The report is based on an extensive literature search, case studies of eight recently completed Green Star buildings and interviews with some 50 Australian property owners, valuers and developers. The key findings of the report are summarised below.

- The majority of investors surveyed would pay more for a Green Star building. The improved marketability of these buildings is their main current competitive advantage: they are easier to sell and lease, which reduces vacancy times and hence income losses.
- While some tenants are willing to pay the rental cost of achieving Green Star, a rental premium is not yet proven in all cases. However, according to the report, in the longer term the industry expectation is that rental growth, tenant retention and operating cost savings will become the key drivers for the market value of Green Star buildings.
- Green Star buildings improve productivity, wellbeing, and occupational health and safety, but market acceptance of these intangible values is limited.
- Case study findings suggest that construction costs of Green Star buildings were equal to, and in two instances lower than, budget expectations. A slight cost premium still exists for delivering buildings with a 6 Star Green Star rating.
- From examples in Canberra and Adelaide, Green Star buildings have achieved a reduced capitalisation rate to the order of 0.25 – 0.50 per cent when compared with the rest of the market.
- The potential benefits of green buildings are starting to be quantified in the literature. For instance, a study of the US market by McGraw Hill found that green buildings delivered the following added value:
 - operating costs decreased by 8 to 9 per cent;
 - building values increased by 7.5 per cent;
 - return on investment (ROI) improved by 6.6 per cent;
 - occupancy ratio increased by 3.5 per cent; and
 - rent ratio increased by 3 per cent.

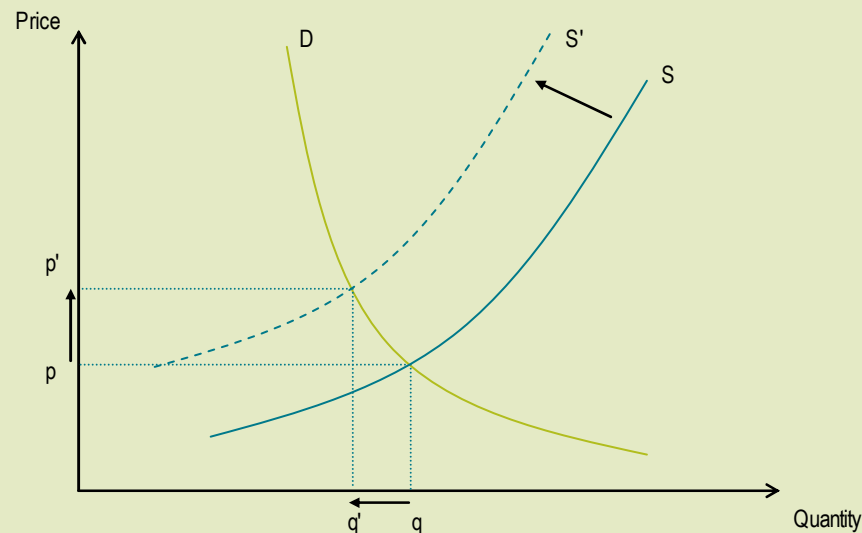
In this respect, the Green Building Council's report notes that, while this US study and other studies provide tangible evidence of the value of green buildings, they are not numerous enough to extrapolate general rules from. The different technologies that might be deployed, and trade-offs with other building features, make it difficult to 'commodify' green.

Source: GBCA (2008)

5.2 SHIFTING ECONOMIC SUPPLY AND DEMAND IN THE ELECTRICITY MARKET

Market analysis using standard economic conceptual tools helps to explain the benefits of complementary measures that shape supply and demand influences for electricity consumption and resultant greenhouse gas emissions.

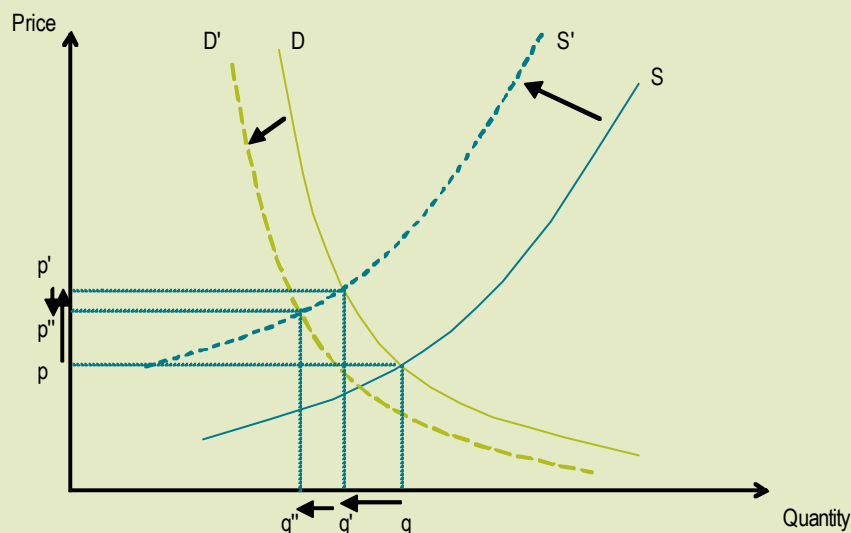
The chart below sets out a representation of the supply and demand for electricity. The introduction of the Government's CPRS, or broadly similar measures, would have the effect of factoring in the cost of GHG emissions upon the supply of electricity. Because the supply of electricity in the future would either involve the producer paying for emissions permits, or paying the higher costs of low or zero emission alternative electricity sources, there is an upwards (or leftward) shift in the supply curve from S to S' . (An upward shift in the supply curve reflects the fact the costs of supplying electricity are now higher at each quantity.) After a transition phase it would be expected that the market would arrive at a new equilibrium point which involves a reduction in the quantity consumed (from q to q') and an increase in the prices paid (from p to p').



The picture changes with the introduction of additional energy demand side management measures in the buildings sector. These have the effect of reducing the amount of electricity needed — a leftwards (or downward) shift in the demand curve from D to D' . (A leftward shift in the demand curve here reflects the fact that each price, consumers are wanting to purchase less electricity). This enables an overall reduction in demand and a reduction in the market price (from p' to p''). The price of electricity is still higher than it would be without measures to decarbonise, but it is lower than it would be with price measures such as the CPRS alone

(Continued on next page)

5.2 SHIFTING ECONOMIC SUPPLY AND DEMAND IN THE ELECTRICITY MARKET



Put another way, the contraction in the demand curve has offset the price increase caused by the upward shift in the supply curve. The outcome of this exercise is identical if the shifts were pursued in reverse order (that is, shifting demand first, and supply second).

This analysis is partial in character. It examines what happens in the market being analysed. There are many other changes that occur at roughly the same time that are not reflected in the diagram above. It does not take into account, for example, the income effect when the amount spent on electricity changes. Energy efficiency can raise the amount of income that households can allocate to other goods.

One further complexity is the possibility that households use the savings to purchase more goods associated with greenhouse gas emissions (and therefore increase overall greenhouse gas emissions). This raises the paradox where savings from energy efficiency could be offset by increased emissions in a 'rebound effect'. This is likely to be a factor where energy efficiency is applied by itself. It is less likely to be an issue in an environment where there are additional measures that raise the relative price of GHG intensive goods such as the CPRS proposed by the Government. This highlights the value of having complementary measures to combat GHG emissions.

Clearly, however, there are limitations when examining the issues within a partial framework alone. For these reasons it is essential to conduct a full analysis of the impacts of change that takes into account the many interconnections in the economy.

REDUCING ECONOMY WIDE COSTS OF THE CPRS

The broader role and impact of demand side GHG abatement in the building sector has been analysed for ASBEC CCTG using economy wide modelling conducted by the CIE and the Centre of Policy Studies (part of Monash University).

The ASBEC analysis draws on the capacity of Computable General Equilibrium (CGE) modelling. This approach has its drawbacks, especially regarding model complexity and the black box nature of results. ASBEC CCTG selected the approach because it viewed that despite limitations it provided insights not available from other approaches. This approach was essentially later endorsed by the Garnaut Review (2008) which also elected to use the same model operated by the same independent experts. It is worthwhile noting what the Garnaut Review said.

Computable general equilibrium (CGE) modelling is capable of capturing the economy-wide inter-sectoral reallocation of resources that may result from climate change. This type of modelling is useful when direct change or impacts, at either the specific industry or regional level, are expected to have economywide implications.

Climate change impacts will have diverse effects on a range of industries and sectors of the economy. Within this context, CGE modelling is considered the most useful and appropriate framework currently available to undertake a comprehensive assessment of the economic costs of climate change in Australia. Of these models, the Monash Multi Regional Forecasting Model, described in section 9.2.3, has advantages because of its capabilities for environmental analysis as well as its rich sectoral and regional detail. (2008: 9).

Details about the analytical framework are provided in the box 5.3.

5.3 ASBEC ECONOMYWIDE MODELLING AND THE BUILDING SECTOR

The model — MMRF-Green

MMRF-Green is a general equilibrium model of the Australian economy. It is operated by the Centre for Policy Studies (COPS) at Monash University in Melbourne. MMRF-Green is a multi-regional model that has been tailored to specifically examine greenhouse gas policy. It provides a highly disaggregated specification of the electricity generation sector by traditional fuel sources, such as coal fired and gas-fired) and renewable energies, such as hydro, biomass, biogas and wind. MMRF-Green also allows for the explicit forecasting of GHG emissions. It also provides considerable detail about how change impacts upon all of the industries within the economy, households and Commonwealth and state governments.

The ASBEC CCTG study builds upon, and extends, the analysis contained in a report, Deep Cuts in Greenhouse Gas Emissions, released by the Business Roundtable on Climate Change (BRCC) in March 2006. That study provided the first substantive analysis of long run projections of greenhouse gas emissions (out to 2050) while also tracking underlying economic activity. It assessed the cost of achieving a 60 per cent reduction in greenhouse gas emissions on the 2000 level of emissions. The original BRCC analysis did not factor in the capability of the building sector to reduce its demand for energy at a lower cost than the cost of emissions permits in the deep cuts scenario.

The scenarios for the ASBEC CCTG study

The analysis uses three projections or scenarios:

- Baseline — projections based on no additional restrictions on greenhouse gas emissions.
- Deep cuts — Australian economy reducing GHG emissions by 60 per cent from year 2000 levels by 2050. This scenario takes into account current policy settings and technological change options including the introduction of carbon capture and storage and improvements in efficiency in the production of energy. Most importantly, it introduces a limit on emissions applied throughout the community and to every industry.
- Deep cuts plus — the deep cuts scenario but explicitly factoring in the building sector's abatement potential through enhancing its energy efficiency and reducing total electricity demand.

The baseline and 'deep cuts' scenarios are consistent with those used in the earlier BRCC analysis. The deep cuts plus scenario is needed because energy efficiency in the buildings sector was not explicitly factored into the BRCC analysis.

(Continued on next page)

5.3 ASBEC ECONOMYWIDE MODELLING AND THE BUILDING SECTOR (CONTINUED)

Policy changes

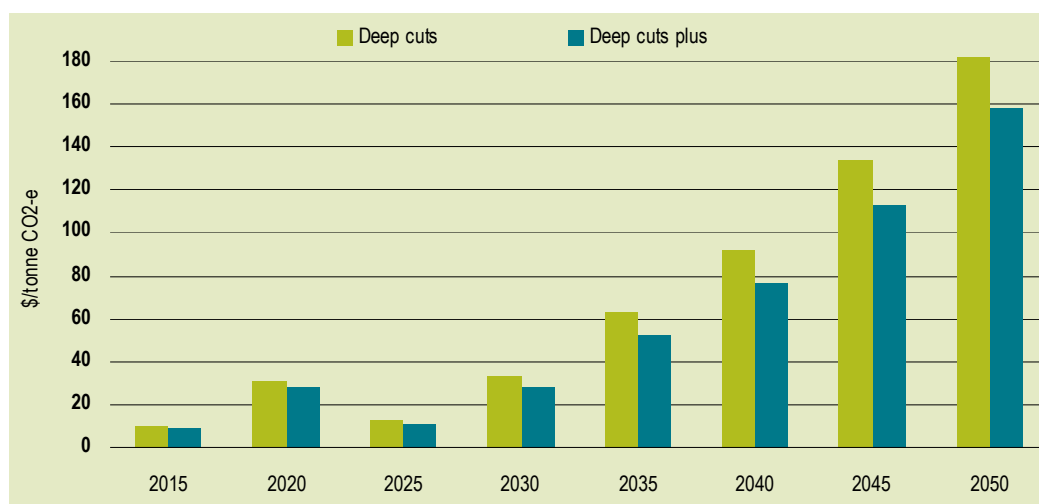
The analysis has been designed to isolate the effect of key changes such as the advent of an economy wide constraint upon emissions and the difference that introducing greater energy efficiency may make to the economy. It is notable that the Government's proposed CPRS introduces additional changes and variations, such as well developed assistance measures and other arrangements specific to the cap and trade system. In addition the Government has announced that it will make other changes such as the expansion of the Mandatory Renewable Energy Target (MRET). These will alter the overall outcomes for the economy. These changes have not been taken into account in the ASBEC CCTG analysis.

The modelling results are still of value even though the full range of possible policies under consideration at present are not included. It is likely that the differences that changes in energy efficiency in the building sector would make will be largely the same with or without the other policy changes that the Government is planning to deliver. That is, even if energy market prices rise because of an expanded MRET, there would still be savings if a larger share of emissions abatement were achieved with greater reliance upon energy efficiency.

SIMULATION RESULTS

The targeted GHG reduction (60 per cent on 2000 emissions by 2050) is achieved in both the deep cuts and deep cuts plus scenarios. The point of significance is how these reductions are achieved. A key difference is that the implied GHG emission price or the price of measures that people would pay to avoid making emissions — is lower with the deep cuts plus scenario. That is energy efficiency in the building sector would complement the cap in emissions which means that it does not increase overall abatement, but instead helps to reduce the cost of transition — see chart 5.4.

5.4 Implied cost of GHG abatement – selected years A

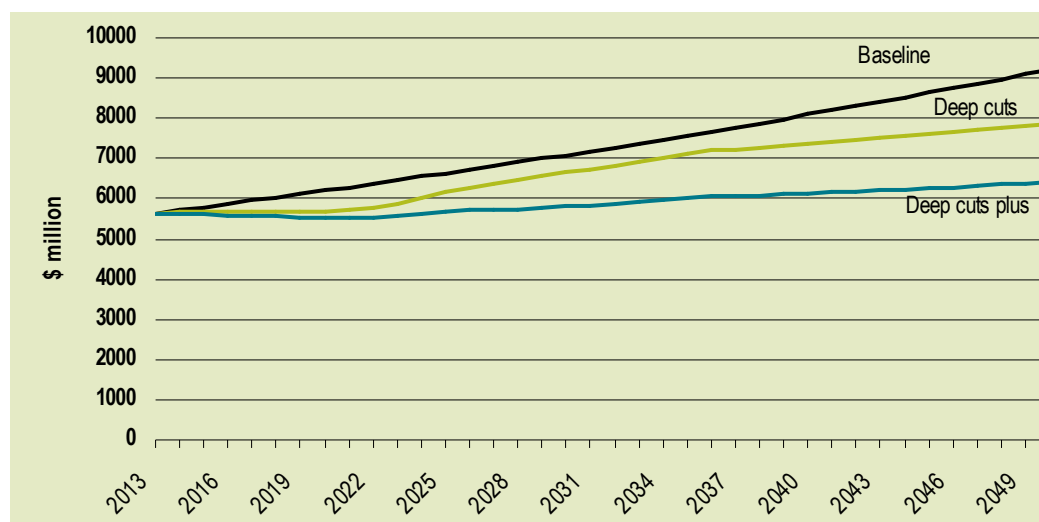


^a 2005 prices.

Data source: MMRF-Green simulation results.

Suppressing GHG emissions (through an emissions cap) has the effect of suppressing growth in electricity production and consumption. The measures in the 'Deep cuts' scenario trims the value added in electricity generation because competitive electricity production can be expected to remain a GHG intensive good. The 'Deep cuts plus' scenario results in a further reduction in quantity and the price of electricity, reflected in the lower trend in the trajectory of electricity value added in the chart below. (It is notable that value added is a multiple of price and quantity). The deep cuts plus scenario projects a commercial environment of largely stagnant value added for electricity generation for many decades — see chart 5.5.

5.5 Annual real value added for electricity generation: 3 scenarios



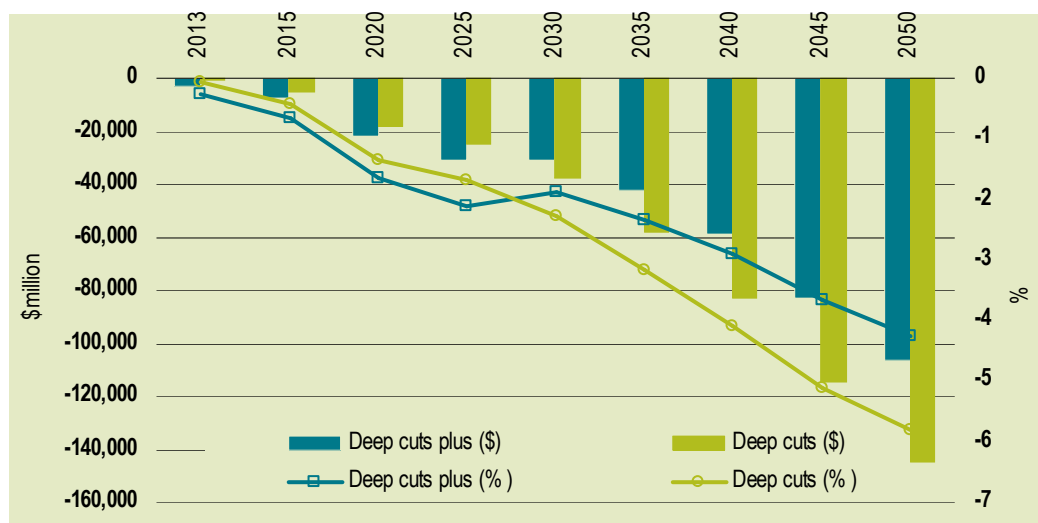
^a 2005 prices

Data source: MMRF-Green simulation results

This is broadly in line with the suggestion of reduced demand discussed in box 5.2 from a shift in the supply curve and the demand elasticity analysis conducted in Chapter 2. What is notable is that the 'Deep cuts plus' scenario involves an even deeper reduction in the value of electricity purchased and produced. That is, the energy efficiency measures in the 'Deep cuts plus' scenario produces a substantial reduction in electricity consumption.

The MMRF-Green analysis shows that suppressing greenhouse gas emissions to meet the deep cuts target comes at a cost. The benefits which relate to the avoidance of the costs of dangerous climate change have not been analysed in the research commissioned by the ASBEC CCTG. The model results suggest an increase in costs over time as progressively deeper emission cuts are sought. Within the 'Deep cuts' scenario the economic cost is some 6 per cent of the level of GDP that would have been achieved without change (in the base case or business as usual scenario) by 2050. Under the 'Deep cuts plus' scenario — incorporating additional energy efficiency through improved design and fit out throughout the buildings sector — there is still a cost by 2050 but this has a value of a little over 4 per cent of baseline GDP. See chart 5.6.

5.6 Deviation from baseline annual GDP — selected years



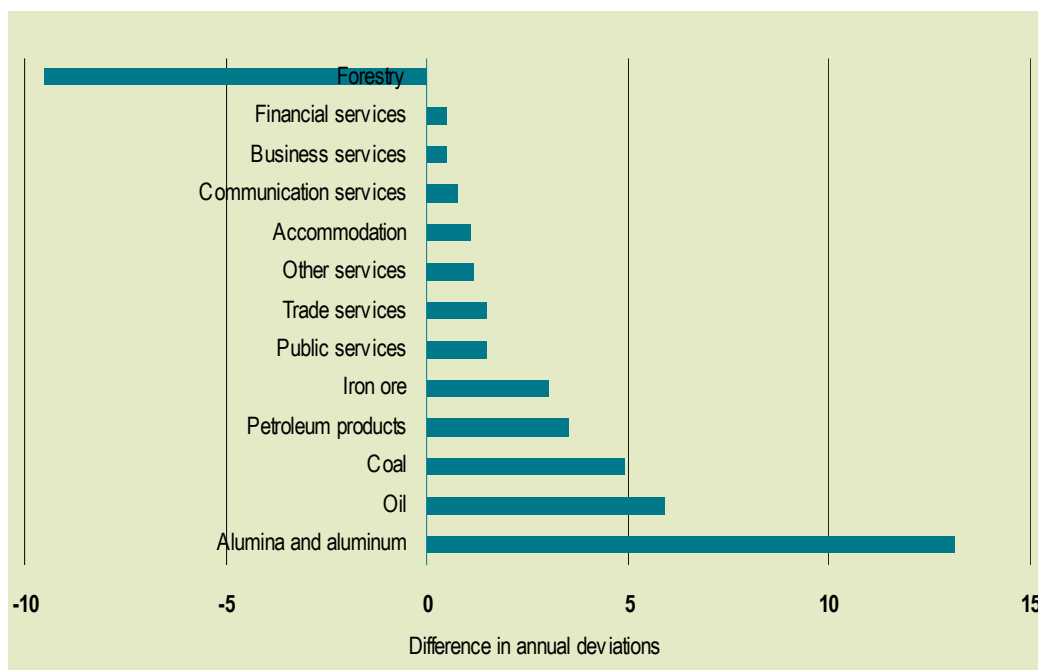
^a 2005 prices.

Data source: MMRF-Green simulation results.

The dollar amounts in an analysis of this sort when looking many decades into the future are subject to considerable and unavoidable forecasting errors. They should be regarded as being indicative rather than definitive. With this caveat it is noted that the 'Deep cuts' scenario suggests a reduction in GDP from the baseline of around \$145 billion per annum. The 'Deep cuts plus' scenario involves a reduction of around \$107 billion per annum by 2050. That is energy efficiency in the buildings sector in the 'Deep cuts plus' scenario reduces the lost production by roughly \$38 billion a year by 2050.

The analysis shows that the building sector is not the only beneficiary of increased energy efficiency. Industries such as alumina and aluminium production, energy producing industries and others face lower contractions in the level of output in the deep cuts plus scenario— see chart 5.7

5.7 Industry impacts: deviation from base – difference between deep cuts and deep cuts plus scenarios



Note: a positive value in the chart above measures the extent to which the reduction in an industry's output is lower in the deep cuts plus scenario than in the deep cuts scenario. That is that the adjustment costs are smaller.

Data source: MMRF-Green simulation results.

Industries benefit from greater energy efficiency in the buildings sector where this effectively reduces the demand for electricity and GHG emissions. This essentially frees resources for use by those sectors. Some sectors are not advantaged by greater energy efficiency in the buildings sector. In the chart above forestry is one of these. This is because there is less demand for the GHG absorbing role that forestry can play when there is greater energy efficiency and reduced electricity emissions.

IN SUMMARY

The key findings are that including the building sector in a national broad based GHG abatement strategy to achieve 'deep cuts', that is a 60 per cent reduction on 2000 emissions by 2050, would:

- reduce the price of each tonne of GHG emissions — using the conservative assumptions in the modelling suggests a reduction of around 14 per cent;
- substantially reduce the expected loss in economic activity required to reduce emissions — with an estimate of the annual saving amounting to roughly \$38 billion by 2050 with the assumptions used in the analysis; and
- lower adverse impacts on employment — with model results using the simplifying assumptions halving the predicted job losses that would otherwise be involved in meeting the deep emission cuts without the involvement of additional energy efficiency savings in the buildings sector.

The strategic point is that tapping into the lower cost GHG emission abatement potential in the building sector reduces the costs of meeting deep cuts in GHG emissions. It can do this through making the cost of abatement lower for everyone in the system, not just the building sector.

6 BUILDINGS AND SUPPORT FOR OTHER AREAS

Key points

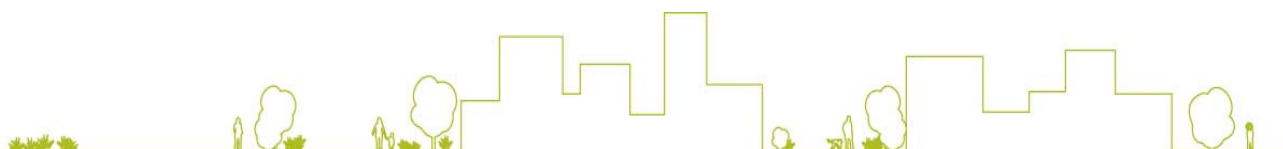
- Reducing greenhouse gas emissions through substantive investment in energy efficiency in the building sector, with the potential to make emission savings at low or no economic cost, would mean that the Government could reduce the amount of emission reductions needed from the CPRS cap.
- Emissions-Intensive Trade-Exposed Industries would face lower costs and a reduced threat to their competitiveness. The cost of government assistance to these industries in the CPRS could be reduced by around \$460 million per annum.
- The risks faced in Strongly Affected industries would be reduced. Given substantial reductions in electricity demand and curtailment of growth in demand there would be less need to seek investment in electricity generation, transmission and distribution.
- The burden of adjustment to carbon constraints faced by households would be reduced particularly in terms of reductions in the expected rise in the cost of living. This would also reduce the amount of assistance that the government plans to provide to lower income groups and those on fixed incomes such as pensioners.

This chapter reviews the implications for substantive energy efficiency measures in the building sector for the range of support measures that the government has proposed.

A RANGE OF SUPPORT

The draft report of the Garnaut Climate Change Review (2008) and the Government's Green Paper acknowledge significant structural change and transition costs from the shift to a low carbon economy. These papers identify key groups that are expected to confront challenges and costs. These are listed below:

- emissions-intensive trade-exposed (EITE) industries — industries that may choose to leave Australia when confronting policy changes here with no consequent reduction in global greenhouse gas emissions resulting in 'carbon leakage' and reduced economic wellbeing for zero gain;
- strongly affected industries — businesses that are currently highly emissions intensive, unable to fully pass on their carbon costs, owners of long lived assets with limited alternative uses and able to access few, if any, financially viable abatement options. The Government has indicated that the firms most likely to fall into this category are coal-fired electricity generators;
- business, regions and workers — some key groups will face particular structural adjustment costs and others could make a faster transition to a cleaner economy if the cost of R&D, innovation and dissemination of information were lower; and
- households — households are expected to confront higher prices for some goods although the overall increase in the cost of living is expected to be small. The changes are viewed as being likely to be disproportionately large for those on low and medium incomes. The price of fuel is a key concern as there is evidence that low to medium income households are particularly dependant upon car transport and there are few transport alternatives for those that live on the outskirts of major cities and in rural areas.



The Government foreshadows a considerable effort in transferring resources and welfare to offset the costs of its proposed Carbon Pollution Reduction Scheme. It provides this promise:

Every cent raised by the Australian Government from the Carbon Pollution Reduction Scheme will be used to help Australians — households and business — adjust to the scheme and to invest in clean energy options. (CPRS Green Paper, 2008:25).

Specific measures proposed by the Government in the Green Paper and implications of the encouragement of additional energy efficiency (EE) measures in the building sector are discussed in the following sections.

EMISSIONS-INTENSIVE TRADE-EXPOSED (EITE) INDUSTRIES AND EE

The Government's preferred position is to allocate up to around 30 per cent of carbon pollution permits to EITE activities (Green Paper 2008:28). Based on the indicative price for a permit used in the Green Paper of \$20 per tonne, and given total emissions of around 560 Mt reported in Australia's national GHG inventory (DCC, 2008), this involves a 'revenue expenditure' of around \$3.3 billion each year.

If the full potential for energy efficiency in the building sector is able to be realised, making it easier for the Australian economy as a whole to reach the emission reduction targets or caps set by the Government, the emission permit price should be lower — the ASBEC CCTG MMRF-Green results indicate that the price may be lower by 14 per cent.⁹ In this case, the revenue expenditure cost of assistance to EITE industries would be lower by some \$460 million each year.

The economy wide analysis undertaken for ASBEC CCTG showed that achievement of additional energy efficiency gains in the building sector would ease the pressure of adjustment in specific EITE activities. Aluminium and Alumina, Coal, Gas and Iron Ore production were shown to face lower reductions in real value added with increased energy efficiency.

The modelling reveals some key relationships. Increased energy efficiency in the building sector substantially reduces demand for goods and services such as electricity.¹⁰ This is in addition to the effect of reducing demand for emissions permits and therefore reducing the price of permits. This means that the price of economic inputs are lower for EITE industries such as alumina and aluminium. That is, increased energy efficiency in the building sector reduces the demand for electricity which in turn frees resources such as labour and capital which would otherwise be required to produce electricity. Essentially, energy efficiency raises the amount of resources available for industry. This is akin to an economic resource dividend.

The reduced scarcity of key economic resources from increased energy efficiency means that many industries should obtain a smaller reduction in their competitiveness when adjusting to changes involved in decarbonising the economy. The MMRF results show that this is valuable for those industries that are engaged in the most intensely competitive areas such as those reliant upon export markets.¹¹

STRONGLY AFFECTED INDUSTRIES AND EE

The Government proposes to provide a limited amount of direct assistance to existing coal fired electricity generators. This would be in addition to the \$500 million Clean Coal Fund already provided to help ensure the long term viability of domestic coal fired electricity generation and of Australia's coal producing regions.

The Government acknowledges that a key risk in its approach is the extent to which the CPRS raises perceptions of risk for potential investors in electricity generation, potentially delaying new investments in the generation sector. It has also been acknowledged that emissions trading may raise commercial risks for the additional investment that would be needed in order to connect new, more sustainable sources of electricity generation to transmission and distribution networks.

⁹ The potential for greenhouse gas emissions abatement in the building sector was reported in Chapter 2 of this report. The scope to reduce the price of emissions permits by raising energy efficiency gains in the buildings sector was discussed in Chapter 5 of this report.

¹⁰ Details about the reductions in the demand for electricity are provided in chapter 5 of this report.

¹¹ The impact of increased energy efficiency and the expected circumstances of key industries is reported in chapter 5 of this report.

A significant advantage of the encouragement of substantial energy efficiency gains in the building sector is that they would substantially reduce the future demand for electricity. There would be less need for new generators and less investment tied up in electricity transmission and distribution.

Much of the remaining increase in demand in the future could be met from more sustainable generation options which face considerably less risk. There would be less need to provide assistance for producers operating in a commercial environment that may be perceived to be exposed to more risk. Thus substantial energy efficiency gains would substantively reduce major risks in the Government's strategy.

BUSINESS, REGIONS, WORKERS AND EE

The Government proposes to establish the Climate Change Action Fund (CCAF) to assist business to make the transition to a cleaner economy by providing in partnership funding for a range of activities. The CPRS Green Paper indicates that this could include industrial energy efficiency projects with long payback periods and the dissemination of best and innovative practice among small to medium sized enterprises. The specific arrangements await the outcomes of the Wilkins Review and the COAG assessment of complementary measures.

Earlier analysis conducted for ASBEC CCTG shows that reduced energy use from the building sector above that stimulated by changes in prices is likely to allow a larger cap in the CPRS reducing the transition costs. This would reduce the need for transition assistance to particular workers and communities.

A key indicator of the magnitude of transition costs is the amount of output lost due to the imposition of deep cuts in emissions. The ASBEC CCTG economy wide modelling indicated that achieving deep cuts using a straightforward pricing signal (similar to that likely to be achieved with the CPRS) would reduce GDP by \$145 billion in 2050. Including additional GHG savings through increased energy efficiency in the building sector would reduce that indicative cost to around \$107 billion. That is, there would be a \$38 billion (or 26 per cent) reduction in the transition costs each year of moving to a cleaner economy with more substantive energy efficiency in the building sector.

Having a stronger economy in the future, with the same level of greenhouse gas abatement, would raise the capacity to provide assistance.

HOUSEHOLDS AND EE

The government has provided commitments to offset increases in the overall cost of living of the CPRS upon households. Key commitments are summarised in table 6.1

A theme of the Governments approach is that it sees a major role for energy efficiency to reduce the cost of the scheme to households. The Green Paper mentions measures such as information provision, education and advice to the community about how energy efficiency can best be implemented. The role that these play is somewhat akin to welfare measures.

Energy efficiency positioned as welfare measures are unlikely to achieve substantive change. Substantive change involves investment in assets or the refurbishment of assets that inevitably involve relatively large 'upfront' costs. Cash constrained low income households, or pensioners in particular are unlikely to be willing or able to make such investments.

An alternative perspective, as advanced in this report, starts from energy efficiency changes being an investment and providing sufficient incentive to overcome existing barriers. Given substantive incentive substantive energy efficiency could be achieved. This would also change the dynamics of the assistance that is proposed to be provided to households. Key factors are reviewed in table

6.1 Household assistance and energy efficiency in buildings

Government commitment

Increase payments above automatic indexation, to people in receipt of pensioner, carer, senior and allowance benefits and to provide other assistance to meet the overall increase in the cost of living from the scheme.

Increase assistance to other low-income households through the tax and payment system to meet the overall increase in the cost of living.

Provide assistance to middle-income households to help them meet any overall increase in the cost of living.

Review annually in the budget context the adequacy of payments to beneficiaries and recipients of family assistance to assist households with the overall impacts of the scheme, noting that these payments are automatically indexed to reflect changes in the cost of living.

Provide additional support through the introduction of energy efficiency measures and consumer information to help households take practical action to reduce energy use and save on energy bills so that all can make a contribution.

Impact of substantive energy efficiency

Reduce the changes in the overall cost of living and reduce the amount of assistance needed.

Negative cost energy efficiency gains may result in pensioners and seniors who are generally owner occupiers being better off in relation to electricity bills.

Reduce the increases in the cost of living.

May need particular measures to encourage investment in energy efficiency for low income households who are tenants.

As above.

As above.

A substantive scheme would essentially wholesale energy efficiency gains – reducing the burden of households to become technically proficient and reduce transaction costs.

Source: Government commitment commentary based on DCC (2008).

7 CONCLUSION

This Paper seeks to engage discussion about how best to use the capacity of the building sector to invest in energy efficiency and combat greenhouse gas emissions. The Government has already indicated that policies complementing CPRS are necessary and that the energy efficiency improvement in the building sector is an ideal candidate for constructing a second plank in Australia's approach to combating climate change. Rather than act merely as a full stop upon the content of the paper, this part seeks to flag some of the key ideas and issues that have been posed for further discussion.

Key background facts have been presented that raise confidence about the GHG abatement contribution that the building sector could make. They show that with substantive investment in energy efficiency the building sector would reduce its emissions by roughly 30 per cent which saves around 60 Mt of GHG emissions by 2030. It has also been shown that there is a remarkable consistency in the views of independent analysts about the magnitude of savings from this source. The IEA, the IPCC and organisations such as McKinsey & Company have arrived at similar figures in their research.

Industry figures and independent experts suggest that the large tranche of emissions reductions available through investment in energy efficiency in the building sector. Significantly, this potential would use technologies that are available now and could be implemented now. More importantly there is evidence that suggests that the savings in this sector could be achieved at negative cost, or zero net cost to the economy.

Many additional factors reinforce the rationale for pursuing additional energy efficiency investments in the building sector. A key point is that achieving this investment would reduce the work that will have to be done by the Government's proposed emissions trading scheme. Fully realising the building sector's abatement potential reduces the costs of combating greenhouse gas emissions for everyone, not just the building sector. Additional energy efficiency measures in the building sector would mitigate the difficulties faced by Emissions Intensive Trade-Exposed (EITE) industries, Strongly Affected (SA) industries and households under the Government's proposed CPRS. Economy wide modelling shows that the reduced costs would be significant and substantial growing to more than \$38 billion each year in the long run.

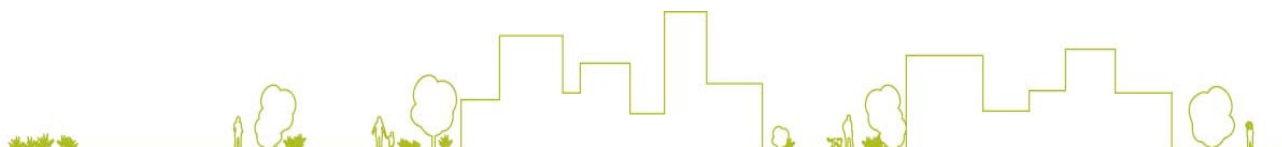
Despite the possibility that energy efficiency investments appear to offer lower costs of GHG abatement than many other abatement technologies or abatement in other industries and are probably economic in their own right, there appear to be many substantial barriers. The ASBEC CCTG analysis indicates that without complementary measures the price signal factored in to the Government's proposed CPRS would stimulate only modest reductions in the building sector's demand for energy – equating to GHG abatement averaging around 8 Mt per annum. In other words, CPRS alone would not provide adequate incentive to encourage the investment necessary to achieve the much larger rates of abatement that are technically feasible (of around 60 Mt per annum).

The limited ability of CPRS to encourage GHG abatement through energy efficiency arises due to many existing market barriers and failures. ASBEC has identified a range of additional policy measures that would combat the barriers and encourage greater sustainability in the building sector. Some 21 policies have been identified that could fill gaps left in the mix of existing measures.

Given the breadth of the policies under consideration, the CCTG undertook careful analysis to identify three policies that should be given priority. These policies are:

- a national white certificate scheme;
- green depreciation; and
- public funding for building retrofit – aimed at both the retail (residential and commercial buildings) and wholesale (energy retailer) sectors.

Variants of a white certificate scheme are being developed and implemented in a number of states. However, this policy would be more effective and economically enhancing if it was pursued as a national scheme – rather than state-based scheme. The feasibility and effectiveness of a white certificate scheme have already been tested in Australia (in NSW). It works by applying energy efficiency targets to the electricity retailers.



They would then be given flexibility in achieving this target by either implementing their own efficiency arrangements or purchasing efficiency certificates based on the performance of electricity customers in raising efficiency beyond a benchmark. These arrangements essentially make energy efficiency an asset that is able to be traded like a commodity and provide the building sector with an incentive to invest in additional energy efficiency. They would provide a signal that would help overcome problems with bounded rationality, split incentives and would place a price on externalities (where electricity savings and GHG savings are associated).

White certificates could apply incentives to invest in energy efficiency in the residential and commercial elements of the building sector, although proposals sometimes focus on the residential sector. As already noted, early action on developing a national white certificate scheme would be very timely. Several states are in the process of implementing these kinds of arrangements. Having a national scheme could minimise differences and enable a broad market on a larger, more efficient scale.

Green depreciation involves the provision of accelerated depreciation allowances for building investments that involve specific energy efficient fitting and fixtures and fabric or raise the overall energy performance of the building to a specific standard. This would be limited to the refurbishment of existing buildings. Much of the infrastructure needed to apply this approach is already in place. It would play a key role in overcoming timing gap problems, allowing investors to defer tax payments (in exchange for bringing forward energy efficiency and GHG reductions).

Green Depreciation relates to business assets and therefore the stimulus to investment in energy efficiency is likely to be largely confined to the commercial elements of the building sector. Green depreciation provides one of the few ways to influence investment in existing buildings and achievement of change in existing buildings is essential to obtain a substantial change in the building sector (given that new buildings represent only 2-3 per cent of the stock of buildings in any year). Analysis suggests that green depreciation would only need to influence a relatively small proportion of refurbishment investment that is projected to occur in any case to make a significant reduction in energy demand and greenhouse gas emissions.

Public funding of energy efficiency retrofits would require a range of government-funded financial assistance mechanisms (that is grants, subsidies and rebates) for improvements undertaken by households and the commercial sector. Funding should be made available for and limited to investment opportunities with a proven ability to reduce energy consumption.

Public funding of building retrofit reduces the investment cost for energy consumers, therein closing the 'payback gap' and providing additional incentive to undertake investment in energy efficiency. This should assist in overcoming other barriers.

Additionally, the ASBEC CCTG draws attention to the merits of specific regulatory measures – including enhancement of Mandatory Efficiency Performance Standards (MEPS) and modernising the building code – in promoting energy efficiency in this sector. These generally combat key market failures such as information gaps, information asymmetries and bounded rationality issues. When such measures are proportionate, simple and sufficiently flexible they can provide a robust basis for directing investment into greater energy efficiency. They generally raise the baseline for energy efficiency in new buildings or when new fittings and fixtures are applied. They are not as strongly endorsed by the CCTG because the other measures are viewed as providing more valued attributes such as greater flexibility and encouragement for innovation greater potential to provide strengthened incentives and overcoming the time gap problem.

The ASBEC CCTG suggests that it is vital for government and the community at large to recognise the evidence provided in this discussion paper showing the valuable role that demand side management and energy efficiency in the building sector can play in GHG abatement.

Better designed buildings appear to provide the most affordable form of GHG abatement in the economy. Significant gains are available now without the need to invent and apply new technologies. Actions necessary to bring about better residential and commercial buildings do not involve substantial risk or uncertainty and would provide significant gains now and into the future.

It is also important to acknowledge that these opportunities are unlikely to be realised through an emissions trading scheme without complementary policies of the sort proposed in this discussion paper. Significant market failures are

likely to obstruct progress if the government were to rely solely upon economy wide price signals contained in an emissions trading scheme alone, but they can be overcome with appropriate, targeted and multiple policy measures.

Initiatives in this area will assist Australia to meet meaningful GHG emission reduction targets, reduce the economy wide costs of change and promote improvements in the design, construction, and management of the building sector to a level of international leadership.

APPENDIXES

A POLICY OPTIONS TO PROMOTE ENERGY EFFICIENCY IN THE BUILDING SECTOR

Below is a compendium of 21 policy options identified by ASBEC's members to promote energy efficiency in the building sector.

The policy options share a number of key features.

- The policies respond to a range of barriers – both market and nonmarket. They also target the players from the initial design and construction of buildings to the final occupiers in both the residential and commercial sectors.
- While policies can involve primary administration by government or private sector, they all require government action in some form or another.
- All policies focus on elements directly controlled by the building sector. That is, the considered policies focus on energy efficiency investments and technologies that are directly in the control of developers and occupiers of building stock. They do not include supply side options (e.g. green energy, enhancements to the electricity network or delivery of electricity), nor do they include transport options.
- The considered policies must involve 'doing more'. Current policies or programs are considered only where the proposal involves an expansion or enhancement (e.g. increased stringency of performance standards).

Broadly policies can be categorised into one of the following five categories:

- private sector incentives;
- publically funded incentives;
- regulated performance;
- research generation; and
- knowledge dissemination.

A summary of each of the policies is listed below.

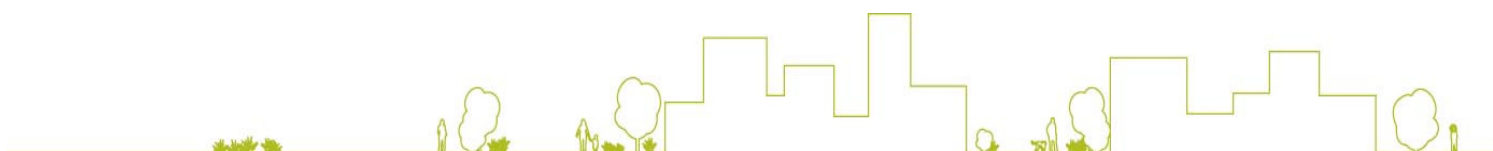
PRIVATE SECTOR INCENTIVES

For most agents in the private sector, energy efficiency investment remains a low priority. Included in this category are those policies which provide the private sector with incentives to actively seek out opportunities to invest in energy efficiency.

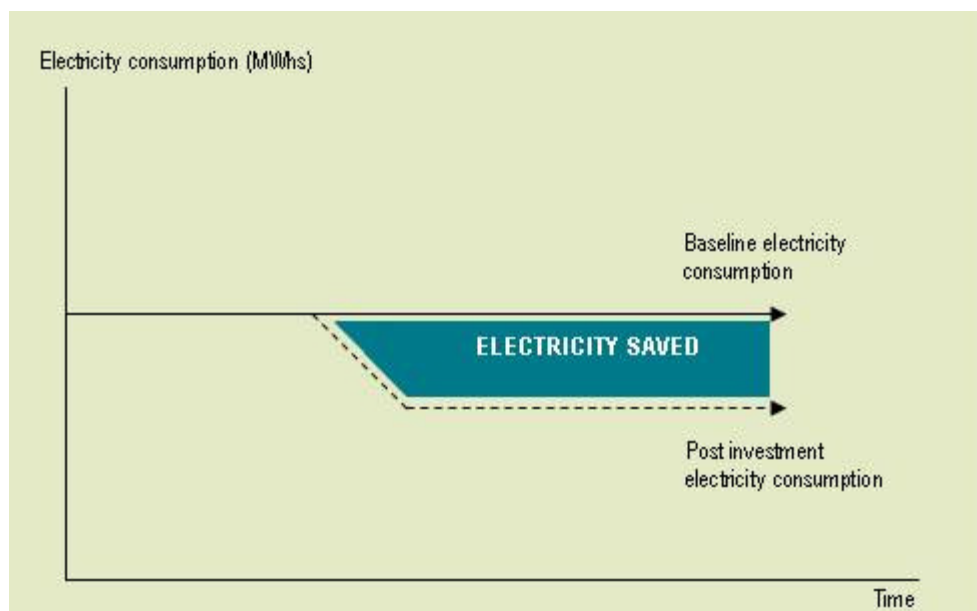
White certificates

A white certificate scheme extends the logic of market based approaches, such as an emissions trading scheme, to encourage demand side management in the building sector. The certificate represents a reduction in energy use and is issued in return for verified improvements in energy efficiency. By commoditising 'energy savings' as a certificate, these savings become a tradable commodity and can sit within a broader strategy to reduce GHG emissions.

Chart A.1 illustrates what a white certificate represents. The diagram plots the baseline level of energy consumption for a hypothetical consumer. Now suppose an investment opportunity exists that could increase energy efficiency and thereby reduce electricity consumption. The lifetime value of the electricity saved as a result of the investment would entitle this electricity consumer to an amount of white certificates (denominated in either saved MWhs or the equivalent CO₂-e emissions saved).



A.1 Creating a white certificate credit



Data source: CIE (2008).

A white certificate scheme is not a new idea. Developed countries around the world — including Australia — have experience in operating variants of a white certificate scheme. In Australia, New South Wales has overseen the operation of Greenhouse Gas Abatement Scheme (GGAS) since 2003. The Victorian government has also committed itself to the establishment of a similar scheme with a focus on households to commence in 2009. Italy, France and the United Kingdom all have a white certificate scheme, as do a number of states in the United States.

All of the schemes target the energy retail market. They impose an obligation or target on electricity/energy retailers to encourage energy efficiency among their customers. The target is measured in energy units (rather than CO₂-e). To meet the target, energy retailers must bring about efficiencies in their own operations or purchase them from others (i.e. energy consumers).

As a major consumer of energy, the building sector presents an additional set of abatement technologies not currently included in the proposed CPRS. These consumers have the potential to provide low cost emission reductions (through more efficient energy use) either in addition to, or in conjunction with a CPRS.

Under this framework, any energy consumer that can produce an increase in energy efficiency can participate as a producer of white certificates. Participation does not need to be limited to a particular sector of the economy, or to a particular segment in the value chain. Any energy consumer — be it commercial, industrial or residential — that can identify a cost-effective reduction in energy consumption can choose to opt-in as a producer of white certificates.

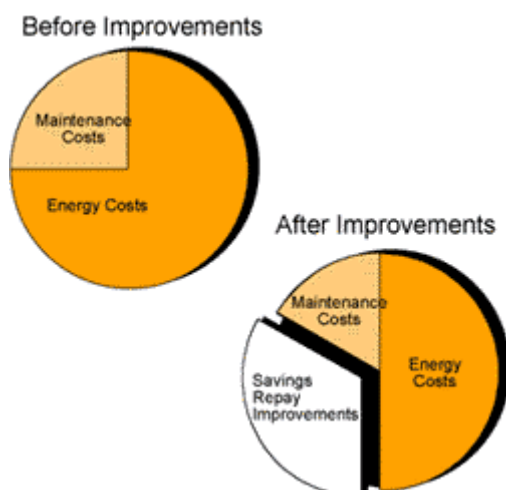
Energy retailer financed improvements

Placing a requirement on energy retailers to finance energy efficiency improvements to buildings would overcome the hurdle of the difference in timing of private costs and 'payback' associated with energy efficient investments (ie up-front expenditure and medium term cost recovery through lower electricity bills). Electricity retailers would finance the upfront cost of investment in energy efficiency and recoup the cost by retaining the resulting savings.

Energy Service Companies (ESCO) exist across the globe already provide a function similar to this proposal. An ESCO is a professional firm that provides designs and implementation of energy savings projects for buildings. The ESCO performs an in-depth analysis of the property, designs an energy efficient solution, installs the required elements, and maintains the system to ensure energy savings during the payback period. Energy savings are usually in the vicinity of 15-30 per cent (ESC 2008).

Savings in energy costs to the building owner are used to pay back the capital investment of the project over a five- to twenty-year period. If the project does not provide returns on the investment, the ESCO is often responsible to pay the difference. Chart A.2 is illustrative of the financial arrangement between a building owner and an ESCO.

A.2 Financing energy savings



Data source: <http://www.energyservicescoalition.org/resources/whatis.htm>

Energy Service Companies are very popular in the United States, where they emerged from the oil crisis, but also exist throughout Europe and Australia. In the United States, ESCO services have been supported by both State and Federal government programs.

Green depreciation

Green depreciation would provide accelerated depreciation for buildings that meet a specified environmental standard. Green depreciation would allow the deferment of tax by reducing taxable income in early years in exchange for bringing forward investment. By allowing investors to defer tax payments, green depreciation can significantly reduce the timing gap problems of energy efficiency investments.

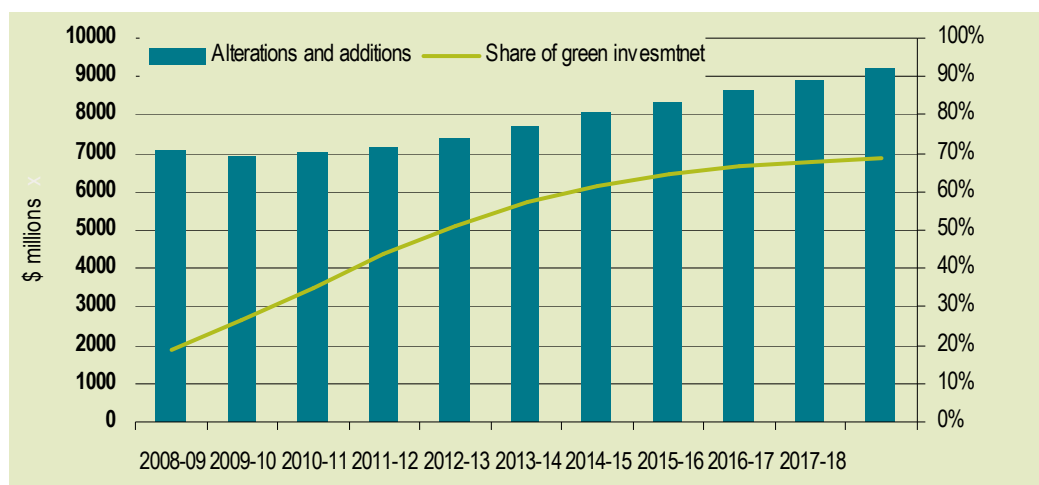
Accelerated depreciation would apply to capital expenditure on refurbishments that 'green' commercial buildings. Only substantial refurbishments, generally requiring local government approval, would be eligible. Both plant fixtures and fittings and capital works would be eligible for accelerated rates of depreciation under the proposed scheme. It would be necessary to establish a standard of performance or quality of inputs to be achieved in order for expenditure to qualify for green depreciation (CIE 2007).

Currently retrofitting is costly. Market information suggests that it currently takes up to 15 years to obtain a pay back on the cost of upgrading a two star energy rating building to a four star rating. Green depreciation would shorten the payback period. Ultimately, building owners would still only upgrade their buildings if it made economic sense to do so (Chong, 2008). It is unlikely that green depreciation would stimulate excess investment in building refurbishment.

The cost to government is also the value of the deferment of tax. This policy could reduce GHG emissions at a relatively low cost estimated to be approximately \$11 per tonne of CO₂-e (CIE 2007). In the short term deferment appears as a revenue loss in government accounts. This would be offset in the longer term by increases in revenue.

The annual investment in property alterations and additions in Australia is substantial. Reflecting the large size of the existing stock of property, the large scope to achieve energy efficiency gains in older buildings and the capacity of commercial building owners to finance the changes, large scale changes should be achievable through this approach. Chart A.3 below reports both the annual investment in property alterations and additions to 2018-2019, and the estimated share of 'green investment.'

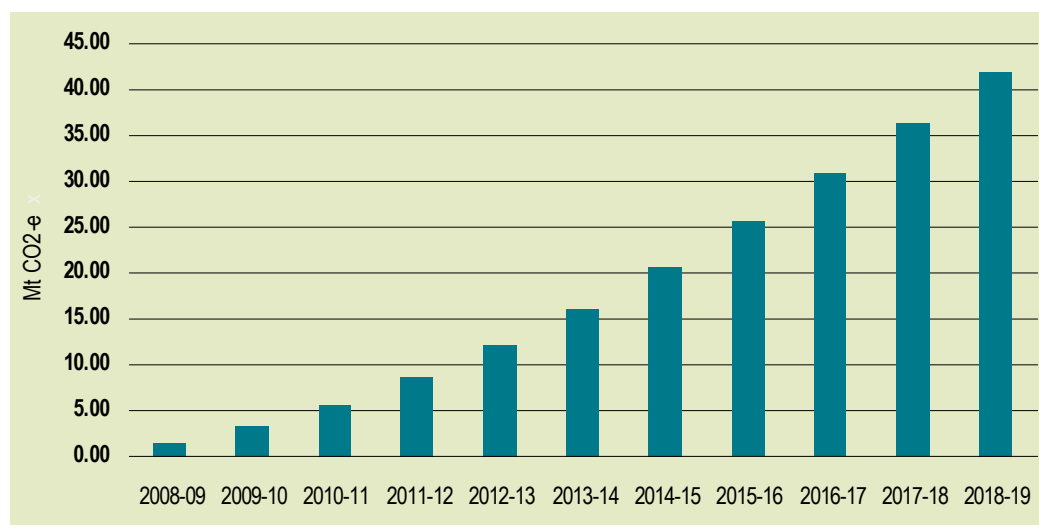
A.3 Capital investment in alterations and additions



Data source: CIE (2007)

It is estimated that some 203 Mt of CO₂-e could be reduced in the first 11 years of the scheme or an average of 18 Mt per annum. Figure A.4 shows the hypothetical abatement potential if the amount of investment in building refurbishment projected by the Construction Forecasting Council is realised.

A.4 Savings of greenhouse gas emissions through green depreciation



Data source: CIE (2007).

Green depreciation is modelled on accelerated depreciation allowances that were introduced by the Hawke/Keating Government. Those provisions stimulated investment in what had previously been a moribund property market (Chong, 2008).

Rates and charges relief

Reducing rates and charges for those buildings which satisfy an energy efficiency benchmark would encourage efficient retrofitting of existing buildings and investment in efficient new buildings. If properly structured, rate/charge/tax exemptions can yield better results than the direct impact of taxation, and play a valuable role in stimulating the introduction and sales of energy efficient buildings (Urge-Vorsatz et al 2007).

'Rate relief' might be applied to:

- council rates;
- development applications;
- stamp duties on property transfer; and/or
- land taxes.

An early effort by the United States to promote energy conservation in new housing developments met with mixed success. A 15 per cent tax credit, up to a maximum of \$300, for residential energy conservation activities failed to significantly increase the adoption of energy efficiency measures across the country. The policy's downfall however, has been attributed to the small size of the tax credit.

New tax credits introduced as part of the US National Energy Policy, which are intended to promote the development of highly efficient homes is expected to achieve much greater success (Quinlan et al 2001).

Similar to green depreciation, this approach would apply across the building sector including both investment property and owner-occupied buildings.

Density bonus

Traditionally, density bonus programs are used to achieve affordable housing objectives. These programs offer developers an increase in the permitted density of residential projects in exchange for lower house prices. A density bonus offers an opportunity for governments to shift the substantial direct expenditures of providing affordable housing to the private sector. The success of a density bonus, however, depends on the willingness of builders to accept the tradeoff between obtaining a higher density of land use and selling some units at below market prices.

These types of incentives that allow property development at higher densities could be expanded to address desired energy efficiency performance objectives of residential and commercial development. A 'green density bonus' would encourage construction of more environmentally-friendly buildings and provide increased flexibility in the development approval process to projects that satisfy a given environmental performance threshold. For example, the 'bonus' might offer exemptions to restrictions on building height or permissible floor space ratio in exchange for buildings that provide access to public transport and produce better thermal comfort performance.

Importantly, when a bonus is awarded policy makers should ensure that development does not disrupt urban biodiversity or promote the formation of 'heat islands.'

Bonus density programs can be particularly attractive to developers and owners in cities that have capacity shortfalls. Additional space allowances increase profits for developers and building owners and reductions in transfer costs can translate into incentives for the buyer.

In order for these programs to be effective, bonus density must maintain comprehensive green requirements and therefore preserve the exclusivity of the incentive. As green building becomes more commonplace, governments may need to re-examine the stringency of the requirements for density bonuses and increase them accordingly.

A green density bonus is not a new idea. The American Institute of Architects identified ten US cities across eight states that give density bonuses for green buildings (see table A.5 for details). To receive the density bonus, buildings must receive certification through the Leadership in Energy and Environmental Design (LEED), a program from the non-profit US Green Building Council (USGBC). That certification requires developers to design the building so that it uses less energy, frequently emphasizing natural light and efficient mechanical systems.

In Australia the Green Building Council of Australia (GBCA) is the equivalent organisation to the USGBC, and both are members of the World Green Building Council. The GBCA's *Green Star* rating schedule could provide the same qualifying role as does LEED certification in an Australian density bonus program.

An example of the use of a green bonus scheme is presented in box A.6.

A.5 U.S. Cities providing density bonuses for green buildings

State	Cities
California	Glendale Sunnyvale
Indiana	Bloomington
Minnesota	Minneapolis
Ohio	Cuyahoga Falls City
Oregon	Portland City
Tennessee	Nashville-Davidson
Virginia	Arlington CDP
Washington	Seattle

Source: American Institute of Architects, 'Local Leaders in Sustainability- Green Incentives', pp. 19-20.

A.6 Green density bonus in Seattle, Washington

Seattle downtown zoning legislation provides that projects achieving a LEED Silver rating or higher and that contribute to affordable housing and other public amenities may receive greater heights and/or floor area for commercial and residential buildings. After developers/ owners submit a letter of intent, the city will issue a permit and Certificate of Occupancy based on a good faith commitment. Applicants must submit documentation demonstrating LEED certification within 90 days or face a \$500/day penalty for late entries. Failure to demonstrate performance will also result in a penalty. All penalties contribute to the Green Building Fund, which is dedicated to supporting market adoption of green buildings.

Source: American Institute of Architects, 'Local Leaders in Sustainability- Green Incentives'.

Green doors

Expedited or prioritised review and approval of development applications ('expedited permitting') associated with green buildings could be offered for buildings that satisfy a given threshold of energy efficiency/thermal comfort performance.

Streamlining the permitting process for buildings can save green developers substantial time and money. Further, permit streamlining programs have the potential to generate additional revenue for local governments as projects that move forward quickly can increase revenue from the community.

The potential downside of these programs is that they could impose initial costs to local governments. This is because:

- The governments may need to enhance and augment their permitting staff in order for these programs to work at their full potential.
- In order for expedited permitting programs to be successful, staff would need to have a fairly comprehensive understanding of the green rating systems used within a determined local government area. Third party approval systems can also be used to ensure that the permitting process is handled properly, but this may require additional funding.

Additionally, to minimise the cost for developers that operate across states, it would be desirable to have a common green rating system across Australia.

Expedited permitting is not a new idea. Construction projects that are registered with the U.S. Green Building Council for certification under the LEED Green Building Rating System, are given first priority for plan checks. This incentive applies to both new construction and major renovations. According to the American Institute of Architects, at least fourteen U.S. Cities across six states give expedited permitting for green buildings (see table A.7 for details).

An example of an expedited permitting program is presented in box A.8.

A.7 U.S. Cities providing expedited permitting for green buildings

State	Cities
Arizona	Scottsdale
California	Anaheim
	Mission Viejo
	Oakland
	Riverside
	San Buenaventura (Ventura)
	San Diego
	San Francisco
	Santa Barbara
	Santa Cruz
Florida	Gainesville
Illinois	Chicago
Ohio	Cincinnati City
Washington	Seattle

Source: American Institute of Architects, 'Local Leaders in Sustainability- Green Incentives', pp. 19-20.

A.8 Chicago Green Permit Program

This program reduces the permitting process for developers and owners who build green to less than 30 business days and, in some cases, less than 15 days. The length is determined by the number of green building elements, the LEED certification level, and the project complexity.

Source: American Institute of Architects, 'Local Leaders in Sustainability- Green Incentives'.

Sector-wide procurement of green buildings

There has been commitment by government and particular sectors to purchase/lease only 'green buildings'. The Commonwealth's Green Leases program is one example of this policy. The likely success of the policy is highly dependent upon market conditions. Although there have been examples of government procuring efficient new buildings, it is important that government also leads by example in taking ownership of existing non-performing building stock, and commissioning high performing retrofits.

Internationally, procurement regulations have mostly focussed on public sector. Provisions for energy efficiency are typically cost effective for this sector, and represent monies that would have been spent regardless. Looking forward, procurement regulations for the public sector should be built into procurement legislation and energy efficiency specifications should be ambitious (Borg et al, 2003 and Harris et al 2005).

European experiences in cooperative procurement programs in the private sector have been quite successful, although these programs have mostly focussed on the purchase of appliances. Buyers of large quantities of appliances and equipment work collaboratively with manufacturers and suppliers to achieve an energy efficiency target. Some companies in Germany have reduced their energy use by as much as 60 per cent through this cooperative approach (Borg et al 2003).

PUBLICALLY FUNDED INCENTIVES

Publically funded incentives assist directly with the capital outlays of an investment. By providing grants, subsidies or low interest loans, the 'gap' between energy efficiency investment outlays and returns is reduced. Initiatives included in this section can require a substantial ongoing public commitment.

Public funding of retrofits

Often investment in building retrofit can be cost effective from the collective's point of view, but not from the individual's. Public funding of building retrofit reduces the investment cost for consumers, and therein provides the incentives to undertake the investment. Public funding of energy efficiency retrofits would require a range of government-funded financial assistance mechanisms (ie grants, subsidies, rebates) for improvements undertaken by households or small businesses. Examples for qualifying energy efficiency improvements include:

- the installation/upgrade of insulation;
- energy efficient lighting;
- louvers; and
- gas/solar hot water systems.

The Green Paper flags several Commonwealth residential energy efficiency programs to be introduced in 2008-09. Included in this list of policies were schemes that used public funds to:

- subsidise the installation of insulation in rental properties; and
- incentives to encourage domestic use of solar and heat pump hot water systems, and phase out inefficient hot water systems.

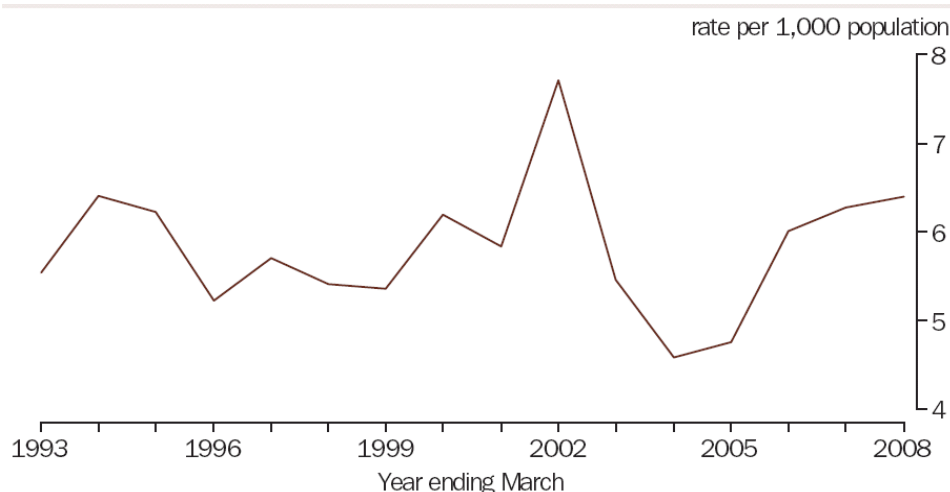
Public funding of building retrofit is common throughout the OECD, with many countries having developed ambitious schemes since as early as the 1970s (WEC 2008). Ex-post evaluations of grant and subsidy schemes throughout Europe identified a number of drawbacks that reduced the effectiveness of these programs (Urge-Vorsatz et al 2007). However, these drawbacks have not prevented the use of subsidy schemes, but have instead led to more careful implementation. Grants are now better targeted and often restricted to specific types of investments and technologies (WEC 2008).

Notably, while most funding is awarded directly to consumers, funding can also be provided to those that provide the retrofitting service. Providing funding to service providers can lead to greater and faster program adoption (WEC 2008).

Environmental qualifier for first owner's grants

Currently the Commonwealth's First Home Owner Grant (FHOG) Scheme applies to all new entrants in the property market, purchasing a residential property for the first time. The residential property must be owner occupied for a period of at least six months. In the year to March 2008, there were 135 000 first home owners entering the market (a rate of approximately 6.4 per 1000 persons) (ABS 4102.0). Chart A.9 tracks the number of first home buyers since 1993.

A.9 Annual financial commitments to first home owners



Note: From significant lenders, for owner-occupier dwellings, excluding alterations and additions.

Data source: ABS 4102.0.

To promote the purchase and development of energy efficient buildings, the FHOG could be increased for those first-time buyers that satisfy a minimum energy efficiency/performance standard. Such a policy would be similar to 'rates relief' but for a much more targeted audience.

Additionally, this could also be linked to other social qualifiers or objectives that increasing the density/efficacy of or existing suburbs such as building attached houses or house with a granny flat onto existing dwellings.

Green banks

Green banks refer to a program that provides low interest loans (or 'soft loans') for renovations to buildings used for community services or by Non-Government Organisations (NGO). Renovations would need to meet specific environmental standards in order to qualify. Government could directly provide financing or alternatively subsidise loans that would cover works. This policy has the potential to expand to new building stock.

Green banks is just one variant of a broader category of policies, financial incentives (e.g. subsidies, grants), which can play an important role in promoting the adoptions of energy efficiency technology in the building sector. Innovative examples of financing mechanisms for energy efficiency or 'green' upgrades exist around the world. Investments in subsidies have been in place since the 1970s or early 1980s and are common in most OECD countries (WEC 2008). They can target particular investments or technology (e.g. solar gas water heaters) or users (e.g. low income households, residential households, commercial businesses) or buildings (existing versus new stock).

The WEC (2008) notes that soft loans (or low interest loans) tend to be less popular than subsidies but were equally used across sectors (industry, services, households). That said, the market currently provides quite a few low (or no) interest, energy efficiency loan products. Box A.10 provides some examples.

Financial incentives can have great appeal. They help overcome market barriers, such as transaction costs (that is, time and resources involved in search and learning activities) that are often involved in making energy efficiency investment decisions. Additionally these incentives can assist with housing affordability as increasing requirements of other energy policies (such as building codes and mandatory performance) can suppress demand for housing.

The WEC (2008), however, notes that past financial incentives (eg grant schemes) have had some challenges to overcome. First, they require reasonable promotion to ensure that targeted users are aware of the financial instruments. Second, they can be unnecessarily complex or burdensome for both the administrator and applicants. Lastly, they are susceptible to problems of potentially appealing to individuals who would have made the investment regardless of the incentive.

The CPRS Paper (2008) proposes establishing several mechanisms to help households and businesses cope with the rising costs associated with the scheme's implementation. Among these assistance measures will be low interest loans for energy efficiency.

A.10 EXAMPLES OF LOW INTEREST GREEN LOANS

The Carbon Pollution Reduction Scheme Green Paper (2008) establishes several funds to help households and businesses cope with the rising costs associated with the scheme's implementation. Among these assistance measures will be low interest loans for energy efficiency.

- Overseas, countries like the US and UK, provide examples of the market already providing low interest loan program that target energy efficiency investments. Examples include:
- Energy-Efficiency Loans from the Carbon Trust (UK). Qualifying small or medium-sized enterprises can borrow from £5 000 to £100 000. The loan is unsecured, interest free and repayable over a period of up to 4 years.
- Energy Revolving Fund administered by the Missouri Department of Natural Resources's Energy Center (US). Since 1989, the Energy Center has loaned more than \$80 million throughout Missouri to finance 478 energy loan-financed projects at schools, local governments, colleges and universities. The cumulative energy savings are estimated at more than \$146 million.

Power Save Program (US). Austin Energy Company provides its residential customers with low-interest loans that are unsecured and do not require a loan on the property for improving the energy efficiency of the home (e.g. insulation, weather-stripping around doors, new energy-efficient air conditioner or heat pump, solar screens and awnings, etc).

REGULATED PERFORMANCE

Control and regulatory instruments are institutional rules and requirements with the purpose of directly influencing environmental performance.

Increase minimum energy efficiency/thermal performance

The Building Code of Australia needs to be updated and modernised with higher standards on the design and materials of buildings. The existing Code offers compliance with minimum performance targets or more conventional construction which is 'deemed to comply' with the Code. This initiative would involve a combination of both approaches.

Building codes are an important driver for improved energy efficiency in new buildings (OECD 2003). Building codes in the United States, Europe and Australia have all been linked to successfully reducing energy consumption in new developments. In the United States, requirements of the code reduced energy use by some 15-16 per cent (Nadal 2004). In the European Union, dwellings built since 1973 out performed older buildings on average by a cumulative 60 per cent (WEC 2004). Still, the OECD (2003) considers that there remains significant room for improvement in this space.

In Japan, compliance with the building code has been difficult to enforce leading to mixed outcomes. The Building Code of Australia, which makes use of more prescriptive requirements and separable performance levels, is able to side step these compliance issues (AGO 2000).

Notably, to remain effective, the building code must be regularly upgraded as technologies improve and the costs of energy efficient features and equipment decline (Urge-Vorsatz et al 2007).

Enhance performance standards in MEPS

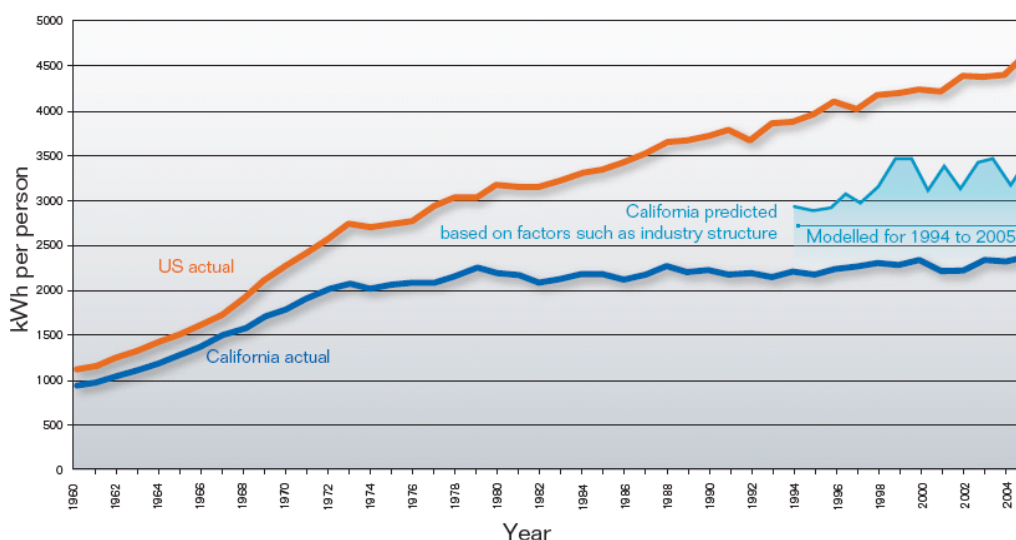
Accelerating and increasing minimum standards for energy efficiency of appliances (such as a 1-watt standard for stand by-mode) through MEPS would hasten energy efficiency gains. Compliance would be required for appliances that are sold in Australia and information about energy efficiency performance would be coupled with a consistent (eg star) rating.

Standards are necessary to remove certain inefficient but inexpensive products from the market – which cannot be achieved by labelling programs alone. Performance labelling can stimulate technological innovation and the introduction of more efficient products, but standards are needed to impact on the gradual removal of the least energy efficient products from the market (WEC 2008).

Appliance standards are among the most commonly used instruments for increasing building energy efficiency, with a long track record of achieving results. For example, Japan's Top Runner program, launched in 1998, is set to reduce household energy consumption by 17.5 per cent of 2006 levels, by 2010. Top Runner requires all new products meet the efficiency level of the most efficient product at the time the standard is set. Efficiency improvements for some products have been in the order of 50 per cent (Urge-Vorsatz et al 2007).

California has been particularly successful in improving energy efficiency, with electricity sales per capita remaining steady at the same time as output per person grew strongly. A substantial proportion of the state's higher level of energy efficiency has been linked directly with Californian energy policies, with building and appliance standards accounting for around half of these savings (Garnaut 2008). Chart A.11 reports the actual and predicted electricity consumption in California, were these policies not implemented.

A.11 Residential per capita electricity consumption in the United States and California



Note: The area between California Predicted and California Actual represents the possible savings from energy efficiency policies.

Data source: Garnaut 2008.

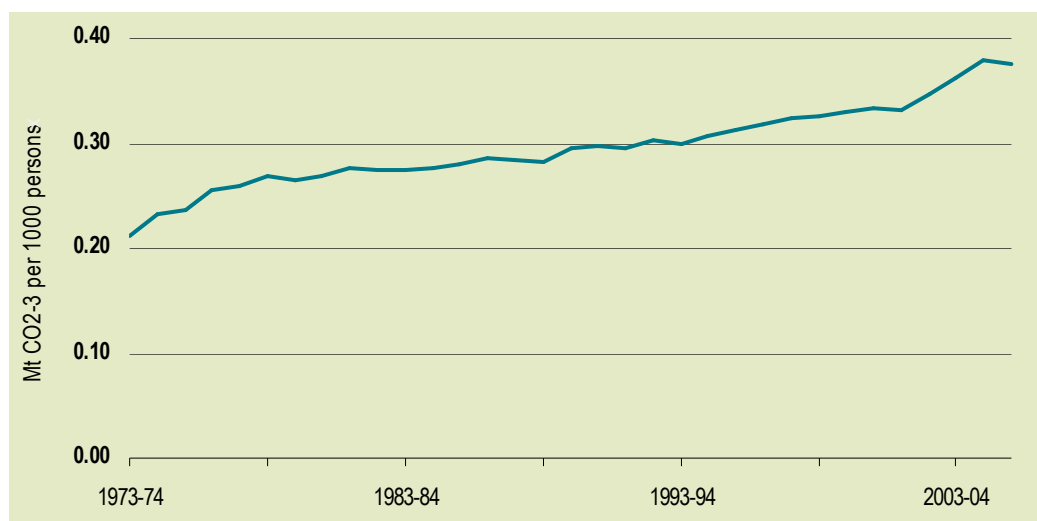
Appliance standards are among the most cost-effective and widespread instruments to reduce the demand for GHG emissions. Typically, GHG abatement is achieved with large negative costs (that is, positive benefits). Across the globe, estimates of the GHG abatement cost of appliance standards range between -\$US190 in and -\$US65 per tonne of CO₂-e (Urge-Vorsatz et al 2007).

The Australian experience with MEPS has been successful (WEC 2008), labelling and energy standards striking an appropriate balance. However, the incentive to innovate has largely diminished with most appliances in the best efficiency class.

Benchmarking and capping CO₂-e of new residential buildings

GHG emissions in the household sector have steadily grown (per capita) since the 1970s (see chart A.12). In 2003/04 per capita emissions from the household sector were 25 per cent higher than they were just a decade prior, and nearly 40 per cent higher than they were two decades prior.

A.12 GHG emissions from the household sector, per capita



Data source: Pears 2006 and ABS 3105.0.

The increase in household GHG emissions has been linked to the increase in the number of 'McMansions' across the country. Although household occupant numbers have trended downwards in recent times, house sizes have increased. Larger houses have greater energy requirements and consequently cause greater GHG emissions.

Imposing a GHG benchmark on new residential buildings, with an annual maximum budget of 20 tonnes of CO₂-e per house will reverse the growth in this trend by deterring the further development of McMansions. This policy would focus on actual energy usage for compliance, and arrangements, including penalties would have to be made for non-compliance.

This approach could also be expanded to commercial buildings.

Red tape review and streamlining regulator regimes

A comprehensive review of regulatory requirements for commercial and residential buildings may find scope to remove significant barriers. These requirements may be imposing unnecessary or onerous compliance and transaction costs — particularly for smaller scale energy efficiency upgrade such as retrofits.

Notably the Commonwealth and state governments are currently involved in a number of reviews of policies in this space. This includes:

- The Strategic Review of Climate Change Policies (the Wilkins Review) which is assessing whether existing Australian Government programs will complement the scheme;
- The Council of Australian Governments' (COAG) Working Group on Climate Change and Water which is developing a streamlined set of climate change measures across jurisdictions to complement the introduction of the scheme, and options to accelerate the uptake of energy efficiency; and
- The Australia's Future Tax System Review which will be an important factor in any consideration of direct income support measures.

RESEARCH GENERATION

Research has the potential to produce significant reductions in GHG and plays an important role in innovation, but R&D is several steps back from actual market realisation.

There is no comprehensive testing program or database of building information in Australia. For the increased energy efficiency of buildings to be quantified, a national coordinated comprehensive testing program is needed. This program should include the measurement of existing buildings, contemporary 'business as usual' construction and best practice new constructions; for all significant building types (relative to energy use) in Australia.

The lack of a cohesive research program means access to quantified building performance data is sporadic. Having a comprehensive program which responded to a gap analysis and supported by government and industry would allow for greater efficiency in the generation of knowledge, add certainty and allow for research organisations to avoid duplicious work and focus their effort on research rather than sporadic funding rounds.

KNOWLEDGE DISSEMINATION

The lack of information is often flagged as the key barrier to investment in energy efficiency. A number of instruments can be used to provide this information. This section collates those policies which seek primarily to overcome this information gap.

Education and awareness campaigns

It seems imperative that a large scale education campaign is required to motivate the building sector to invest in energy efficiency. The required education campaigns would take on range of forms from awareness raising events to skills development and capacity building activities and materials. They would be tailored to different segments of the buildings sector: building occupants (households and businesses), property managers, architects, builders, etc to highlight the role each had in achieving energy and water efficiency.

Garnaut (2008) writes that information and education programs need to be targeted and tailored to ensure that the right individuals receive suitable knowledge and skills. Moreover, target groups for programs should include:

- the general public—for programs that raise awareness of the benefits of energy efficiency, provide basic information on low-emissions practices, and educate consumers on how to identify the costs and benefits of different low-emissions options;
- market intermediaries such as retailers and estate agents—for basic education programs;
- managers and other non-specialists in business—for programs that raise awareness of practices for energy and carbon management; and
- specialists—for programs that cover practical skills in the installation and maintenance of low-emissions options for trades such as building and plumbing, and a mixture of theory, knowledge and skills for professions such as engineering.

Programs also need to be tailored around the information needs and structures of sectors. Where there are already suitable bodies such as outreach programs in the agricultural sector, these may be valuable in diffusing skills and knowledge. (Garnaut 2008).

The direct effect of educational campaigns across the globe has been difficult to assess, but these programs are usually cost effective. More importantly however, is that the cost effectiveness of almost all the other programs being proposed in this report are largely enhanced when accompanied by an awareness campaign (Urge-Vorsatz et al 2007).

Mandatory information disclosure strategies

The policy traction for developing and implementing a mandatory disclosure scheme has been growing over time. Mandatory disclosure is one of the key policies under Stage 1 of the National Framework for Energy Efficiency which aims to provide foundation measures upon which future policies and initiatives can be built. The Garnaut Review Draft Report (2008) featured mandatory disclosure as a policy option that complements an emissions trading scheme (directly responding to market barriers that would persist despite a clear carbon price signal).

Mandatory disclosure is a policy concept that directly addresses market barriers to energy efficiency investments. Consumers currently do not have access to information on the performance of buildings that they might lease or purchase. Providing information about the electricity use associated with a building when buildings are rented, leased or sold would allow for market forces to respond to building performance. The Garnaut Review (2008) writes 'it [*mandatory disclosure*] should be the first policy that governments consider when information asymmetry market failures are identified' (p. 453).

As a policy, it has a range of variants regarding applicability to segments of the building sector (commercial/residential, purchase/lease, etc). However, at minimum it would involve reporting predicted or historical energy use of a building and

the GHG emissions associated with that electricity use. Numerous examples exist regarding voluntary disclosure which link back to building rating schemes (eg Australian Building Greenhouse Rating Scheme and Green Star).

Examples domestically or internationally of mandatory schemes are relatively limited. Various European Union countries (eg United Kingdom) intend to introduce mandatory requirements, in the form of Energy Performance Certificates which show a rating of buildings when they are constructed, rented or sold. In Australia, the Australian Capital Territory has had a mandatory disclosure scheme that applies to residential homes at the time of sale.

Use of smart metering

Smart metering is an example of a policy that has its origins in a national reform agenda regarding energy markets and policy but has strong complementarity to GHG abatement initiatives.

The key objective of smart metering is to improve the price signals for energy consumers and investors (MCA 2007). It involves the installation and use of electricity meters that provide users with information about real-time (or short interval) consumption. As a result, consumers can relate electricity use to: (i) the use of particular appliances; and/or (ii) activity patterns to during particular times of the day (eg peak, off peak).

Darby (2000) reviewed over 38 studies (conducted between 1975 and 2000) on the role of feedback in the learning process (that is, leading to an altering of behaviour) specifically relating to energy consumption. The author concludes that strategies such as design and location of meters and display panels, energy billing and disclosure information can reduce consumption by about 10 per cent.

The Council of Australian Governments (COAG) committed to a national rollout of smart meters, subject to a cost benefit analysis for each jurisdiction and for various classes of customers. The smart meter rollout will begin in NSW and Victoria, with pilot programs to be established in Queensland and WA. There will be no rollout for South Australia or Tasmania due to a negative cost-benefit result. The business case for smart meters will be further reviewed in 2012.

A benefit-cost analysis supporting the development of the smart meter program estimates that it will deliver significant benefits (MCE 2008). The net present value of benefits (over 20 years) is estimated to range from \$4.8 billion to \$7.5 billion nationally. The range of estimated costs for this period is between \$2.8 billion and \$4.6 billion). The emissions abatement potential is sizable. The MCE (2008) reports:

The quantified benefits also included potential benefits arising from changes in consumer energy use, through both response to price signals and direct load control services. Emissions abatement potential was estimated and ranged from 597 000 to 31 million tonnes over the 20 year period, depending on the different scenarios for direct load control and customer energy conservation response.

Certified carbon assessors/efficiency experts

There are significant information asymmetries when investing in energy efficiency. It is very difficult for non-experts to determine the ongoing energy use of an appliance, for example, without outside assistance. This allows opportunism, as a product manufacturer could mislead a buyer on the efficiency of a product, which the buyer is unable to verify (Garnaut 2008).

Market participants may attempt to gather or verify information to reduce information asymmetries through such expedients as hiring an energy-efficiency auditor to examine a house before they buy it. The World Energy Council (2008) regards energy audits as essential for all sectors of the economy to promote a better understanding of the current status of end-use energy efficiency.

However, this can be costly, and without a national accreditation scheme in place to certify energy assessors, the quality of information purchased may be at risk. Consequently, individuals may choose not to invest in further information gathering, avoid the transaction or place a risk premium on the transaction (Garnaut 2008).

ASBEC supports a certification scheme that qualifies individuals/companies to assess carbon abatement/energy efficiency potential (e.g. auditors) are needed. Certification reduces risk to consumers in identifying appropriately qualified service providers.

The Garnaut (2008) draft report flags the issue of a skills shortage in this area. The report notes that the building sector is already an area of skills shortage, and responding to carbon constraints is likely to exacerbate this skills gap. There is a case therefore, for governments to assist in training new workers and reskilling existing workers.

This policy complements a number of initiatives, including audits and mandatory information disclosure.

Early intervention strategy

Early intervention strategies are based on the idea that externalities in the provision of information inhibit the use of energy efficiency measures. Hence, a policy that provides information about energy-saving opportunities can address this information failure and achieve significant gains from better utilisation of known technologies, goods and services.

An early intervention strategy for the building sector would involve promoting energy efficiency measures and low-emissions practices using conventional marketing methods (eg telemarketing, home visits, and brochures) and giving advice to households and companies about energy efficiency opportunities that are tailored to their specific circumstances. These programs could also eventually be expanded to cover different policy areas such as health, transport and water.

An example of an early intervention strategy is Perth's TravelSmart Household Program. TravelSmart is a community-based program that aims to overcome information failures through tailored information provision, including:

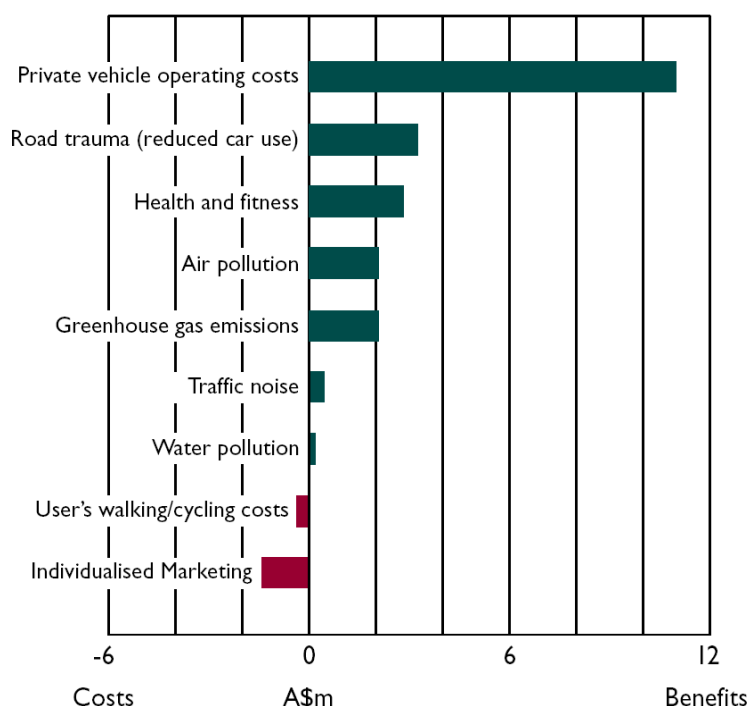
- localising and simplifying information to make it relevant to people's needs;
- providing motivation through dialogue and personalised communication; and
- assisting new users of public transport to navigate the system.

Through these activities, the TravelSmart program aims to change travel behaviour and influence travel demand.

Chart A.13 shows the projected benefits of TravelSmart. According to the Department for Planning and Infrastructure of Western Australia, a conservative benefit cost analysis of a TravelSmart expanded program in South Perth, showed a ratio of 13 to 1 (ie for every dollar spent on TravelSmart, there is a resulting benefit of 13 dollars). In comparison, transport infrastructure projects traditionally have a benefit cost ratio in the range of 5 to 1 up to 7 to 1 (Transport WA 1999).

Despite the potential benefits of the use of education and information programs (such as TravelSmart) as an early intervention strategy, they will not always be effective. This is because individuals may not pay attention to information, may forget information rapidly and, even where they are sufficiently aware and have incentives to make a decision, may not act on the knowledge (McKenzie-Mohr and Smith 1999). In addition, information programs may be less effective when they attempt to convey complex information to individuals, where habits or practices are entrenched, or where other market failures are in operation (Garnaut 2008). In these cases other policy options should be considered.

A.13 TravelSmart costs and benefits over 10 years



Data source: Transport WA, 1999, *TravelSmart 2010: A 10 year plan*.

National calibration of rating schemes

The minimum energy performance standards for buildings across the states and territories have developed at different paces. A national scheme that calibrates the existing and new rating schemes which measure the energy and water efficiency of buildings is required to ensure best practices are being achieved across the country.

A national rating scheme should allow for multiple programs to conform to minimum prescribed standards, and should be able to cater for regional variations. Tools that reward national and international innovation could offer a second tier rating that would overlay a quantifiable performance standard with a qualitative rating.

Studies have shown that building rating schemes are translating into an appropriate price signal. In the ACT for example, the government has introduced a mandatory energy efficiency rating scheme for houses at the point of sale. A study has shown that there was a statistically significant correlation between house prices and energy efficiency ratings (Garnaut 2008). Modelling results suggest that, for a house worth \$365 000, increasing the rating by half a star would, on average, increase its market value by \$4 489.

Criticisms levelled at the ACT study largely pointed towards the accuracy of building rating schemes (Williamson 2004). Garnaut (2008) however, points out that these criticisms correctly raise the issue that efforts need to be made to ensure that rating tools are as accurate, flexible and useful as possible. And, overall, there appears to be a case for a national mandatory energy efficiency rating scheme for buildings.

The National Australian Built Environment Rating System (NABERS) and the GBCA's *Green Star* rating tools are two examples of national schemes that 'score' building energy efficiency. Both these schemes are voluntary but have enjoyed considerable success. For example, the average Green Star certified building reports a reduction in energy use of up to 85 per cent compared to conventional office buildings (GBCA 2007). The GBCA's Green Star rating scheme is discussed further in box A.14.

A.14 THE GREEN BUILDING COUNCIL'S GREEN STAR RATING SCHEME

To facilitate the transition of the property industry to sustainable development, the Green Building Council of Australia (GBCA) developed a suite of environmental rating tools called Green Star.

Green Star evaluated the environmental initiatives of designs, projects and/or buildings based on eight categories, including energy, water, management, indoor environment quality, transport materials, land use and ecology, emissions, plus innovation.

Source: GBCA (2007).

B ASSESSING POLICIES TO PROMOTE INVESTMENT IN ENERGY EFFICIENCY – A MULTI-CRITERIA ANALYSIS

- The objective of this multi criteria analysis (MCA) is to identify high priority policies that target unlocking the GHG abatement potential in the building sector.

MCA OVERVIEW

Table B.1 outlines the proposed criteria for assessing policy options that specifically address energy efficiency in the building sectors (commercial and residential). At an aggregate level, priority policies should be:

- effective at reducing GHG emissions/improving energy efficiency;
- economically efficient, imposing minimal net private costs or delivering positive net benefits;
- institutionally compatible with existing policy approaches;
- credible, that is, having good governance arrangement; and
- innovative by opening pathways to greater positive impacts and promoting learning by doing.

The complexity of considerations that influence the extent to which a policy meets any one of these features varies. Most of these desirable characteristics are multi-dimensional. As a result, the number of specific criteria defining each ranges from one to five. Across these five broad categories of desired features are 13 specific criteria. Table B.2 presents these criteria, providing general descriptions.

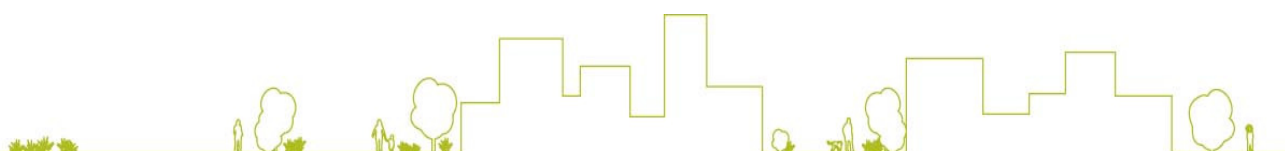
Not all of the desired features are necessarily equally important. As a result, each is given a 'weight' that communicates its relative importance. In other words, the higher the weighting a category receives, the greater is its importance to the assessment. An equal weighting implies that each assessment category is of equal concern to the ranking.

Finally, each policy needs to be appropriately judged and consistently scored against these criteria. The MCA applies a rating scale for evaluation that assigns a score between 1 and 4 for each of the criteria. In all cases, the higher the score, the better the expected performance or positive impact. (A 'negative' or 'zero' cannot be entered.) Table B.2 presents the rating scale with guiding descriptions.

A policy's score is computed in the following way:

- First, weights are assigned to each broad category of criteria (e.g. effectiveness, economic, governance, etc);
- Then each policy is rated (on a scale of 1 to 4) against each individual criteria;
- The sum of the scores within each category are weighted (e.g. score for effectiveness is the sum of the five criteria then multiplied by the weight assigned to the effectiveness category;
- The weighed score for each category are summed to give a final 'score';

On the basis of a policy's score, policies are then ranked against one another. The policies are arrayed from highest to lowest score indicating relative priority. Important to note is that the scores are *ordinal* not *cardinal*. They indicate relative ranking of priority. While the higher the score, the better the policy performed against the criteria (given the weightings we have set), the scores do not imply actual net performance. That is, if a policy receives twice the score of another, it does not imply that it is twice as good, or should have twice the priority.



B.1 Criteria

<i>Criteria</i>	<i>Description</i>
Effectiveness	Weight = 40 per cent
Impact	How great an impact is the policy likely to have on environmental outcomes? This includes and assessment of the risks associated with the policy.
Timeliness	Is the policy able to bring forward cuts in greenhouse gas emissions?
Coverage	How “appropriate” is the target audience? Who is the policy aimed at? Is this “fair”?
Longevity of policy	How long is the policy likely to remain relevant and effective?
Cultural acceptance	How likely is the policy to be embraced by stakeholders and the community at large?
Economic	Weight = 25 per cent
Gaps	Does this policy address a market failure or non-market barrier? Does this policy “fill a gap” (or strengthen) and assist in correcting market failures?
Cost to stakeholders	What is the likely private cost impact on individual firms/households?
Institutional Compatibility	Weight = 10 per cent
NETS	Is the policy complementary to the proposed national emissions trading scheme?
Policy environment	How does the proposed policy “fit” within broader government policies objectives, e.g. building codes?
Governance	Weight = 15 per cent
Verification	Can the target’s “output” be credibly identified?
Engagement	How is the policy likely to be received by the community? What measures are in place for the community and stakeholders to provide input into the policy?
Administration and enforcement	What is the likely cost impact on government’s in administering and enforcing this program?
Innovation	Weight = 10 per cent
Innovation	To what extent does the policy encourage innovation in achieving energy efficiency?

Source: CIE.

B.2 Scoring

Criteria	★	★★	★★★	★★★★
Economic				
Gaps	Does not address market or nonmarket barriers to investment.	Addresses market and/or nonmarket barriers at a superficial level.	Addresses barriers and strengthens existing policy, but does not fill policy gap(s).	Addresses barriers, fills policy gap(s); and positively adds to the overall effort.
Costs to Stakeholder	Policy is considerably burdensome; requires significant outlay by affected participants.	Policy imposes moderate initial fee and/or ongoing costs; may incur moderate compliance costs.	Policy imposes small up front fee and/or low ongoing cost.	Cost to participants is negligible.
Effectiveness				
Impact	Policy makes a negligible contribution to GHG abatement through EE.	Policy is able to make a moderate contribution to GHG abatement through EE – with low to moderate certainty.	Policy is able to make a moderate contribution to GHG abatement through EE– with moderate to high certainty.	Policy is able to make a substantial contribution to GHG abatement through EE.
Timeliness	Policy does not bring forward EE investment.	There is moderate risk that policy will not be able to bring forward EE investment.	There is low risk that policy will not be able to bring forward EE investment.	Policy will bring forward EE investment.
Coverage	Policy targets the “wrong” audience and/or has a very narrow base.	Policy coverage is moderate but audience is inappropriate.	Potential target base is large, but large component likely to be inactive.	Policy has a large active base and targets the “right” audience.
Longevity of policy	Policy is effective in the immediate term only.	Policy will be effective in the short term.	Policy will remain relevant and effective for the medium term.	Policy will remain relevant and effective for the long term.
Cultural acceptance	Adoption likely to be highly resisted.	Adoption likely to be met with some resistance.	Adoption likely among only “motivated” stakeholders .	Adoption likely among all stakeholders.

(Continued on next page)

B.2 Scoring (continued)

Criteria	★	★★	★★★	★★★★
Institutional Compatibility				
NETS	Policy works in opposition to the proposed NETS.	Policy works independently of the proposed NETS.	Policy is somewhat complementary to the proposed NETS.	Policy is highly complementary to the proposed NETS
Policy environment	Policy works in opposition to other policy concerns.	Policy works independently to other policy concerns.	Policy is somewhat complementary to other policy concerns.	Policy is highly complementary to other policy concerns
Governance				
Verification	Participant's "output" cannot be verified.	Individual participant's "output" cannot be disaggregated from broader, measurable and verifiable "outputs".	Participant's "output" can be measured but supporting verification is poor.	Participant's "output" can be accurately measured and verified.
Engagement	Policy is intrusively administered, and the community is unlikely to be supportive of the policy.	Policy is administered from the "top down", and community has little opportunity for input.	Some opportunities for community input, but community response likely to be tempered.	Policy is likely to be embraced and supported by the community.
Administration and enforcement	Requires substantial reporting and/or monitoring effort by government.	Incurs substantial initial cost, and moderate ongoing monitoring cost.	Incurs moderate initial cost, and low to moderate monitoring cost.	Requires minimal reporting and/or ongoing monitoring effort by government.
Innovation				
Innovation	Policy stifles innovation.	Policy has little to no expected impact on innovation.	Polices moderately encourages affected parties to search for low cost abatement strategies (e.g. learning by doing).	Polices greatly encourages affected parties to search for low cost abatement strategies (e.g. learning by doing).

From this analysis, the CCTG was able to identify a set of 'keystone' policies. Keystone policies are those policies which the CCTG consider necessary to motivate the long term structural change required to achieve greater energy efficiency in the building sector.

Those policies not deemed 'keystone policies' by the MCA were classified as 'support policies'. Many of these policies complement keystone policies and indeed they may be vital to ensuring their effectiveness (especially during the transition phase). In their own right, these policies are able to make significant contributions to increasing energy efficiency in the building sector. It was clear from the assessment however, that the building sector's potential in this space could not be completely realised without adopting keystone policies.

The distinction between keystone and support policies is depicted in chart B.3.

B.3 ASBEC CCTG keystone and support policies

	KNOWLEDGE	PRIVATE SECTOR	FUNDED INCENTIVES	REGULATION	RESEARCH
KEYSTONE POLICIES		I. White certificates II. Energy retailer financed Improv. III. Green Dep'tion IV. Rates and charges relief	VIII. Public funding retrofit	XI. Increase min EE/ thermal performance XII. Enhance MEPS	
SUPPORT POLICIES	XXI. Education and awareness campaigns	V. Density bonuses VI. Green doors VII. Sector wide procurement	XX. Green banks IX. Qualifiers for FHOG	XIII. Mandatory information disclosure XIV. Benchmarking and emissions capping of new residential buildings XV. Smart metering XVI. Red tape review	XX. R&D funding

Source: ASBEC CCTG

REFERENCES

ABARE (Australian Bureau of Agricultural and Resource Economics) 2006a, Australian energy national and state projections 2029–30, ABARE research report 06.26, December, Canberra.

— 2006b, 'Energy update', Australian energy consumption and production, 1974–75 to 2004–05, June, Canberra.

AGO (Australian Greenhouse Office) 1999a, Australian Residential Building Sector Greenhouse Gas Emissions 1990–2010, Canberra.

— 1999b, Australian Commercial Building Sector Greenhouse Gas Emissions 1990–2010, Executive Summary Report 1999, Canberra.

— 2000, Impact of Minimum Performance Requirements for Class 1 buildings in Victoria, Canberra.

— 2006, AGO Factors and Methods Workbook, December 2006: for use in Australian greenhouse gas emissions reporting, Canberra.

Allen Consulting Group and McLennan Magasanik Associates 1999, *Energy Market Reform and Greenhouse Gas Emission Reductions*, report to the Department of Industry, Science and Resources.

Alternative Technology Association (ATA) 2005, *Impediments to Grid Connection of Solar Photovoltaic: the Consumer Experience*.

Alternative Technology Association (ATA) 2006, *Submission by the Alternative Technology Association, Public Consultation on a National Framework for Energy Distribution and Retail Regulation*.

American Institute of Architects 2008, 'Local Leaders in Sustainability- Green Incentives', available from: http://www.aia.org/release_061708_GreenInce

Borg, N., Blume, Y., Thomas, S. 2003, Harnessing the Power of the Public Purse: Final Report from the European PROST Study on Energy Efficiency in the Public Sector, Borg & Co, Stockholm.

Brown, MA, Southworth, F, Stovall, TK, Oak Ridge National Laboratory, 2005, 'Towards a Climate-Friendly Built Environment', Pew Centre on Global Climate Change, Arlington, downloaded from www.pewclimate.org.

Charles River Associates 2004, *Codes of Practice for Embedded Generation*, Submitted to the Ministerial Council on Energy Standing Committee of Officials.

Green Building Council of Australia 2008, *Valuing Green*.

IEA (International Energy Agency) 2003, Cool Appliances: Policy Strategies for Energy Efficient Homes, OECD, Paris.

IPART (Independent Pricing and Regulatory Tribunal of NSW) 2007, Promoting retail competition and investment in the NSW electricity industry – regulated electricity tariffs and charges for small consumers 2007 to 2010, IPART, Sydney.

Levine, M., D. Ürge-Vorsatz, K. Blok, L. Geng, D. Harvey, S. Lang, G. Levermore, A. Mongameli Mehlwana, S. Mirasgedis, A. Novikova, J. Rilling, H. Yoshino, 2007: Residential and commercial buildings. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

McKenzie-Mohr, D. & Smith, W. 1999, 'Fostering Sustainable Behaviour: An introduction to community-based social marketing', New Society Publishers, Gabriola Island, British Columbia.

McKinsey & Company, 2008, An Australian Cost Curve for Greenhouse Gas Reduction.

McLennan Magasanik Associates, 2008a, Opportunities for Energy Efficiency in NSW, presentation, available from http://www.dwe.nsw.gov.au/energy/pdf/sustain_neet_gerardi.pdf

McLennan Magasanik Associates, 2008b, Defining a National Energy Efficiency Strategy: State 1 Report, July, a report prepared for the Climate Institute.

Moreland Energy Foundation and the Alternative Technology Association 2007, *The Case for a Feed-In Tariff for Solar Micro-Generation*.

Nadel, S. 2004, Supplementary information on energy efficiency for the National Commission on Energy Policy, American Council for an Energy-Efficient Economy, Washington D.C.

NIEIR (National Institute of Economic and Industry Research) 2007, The own price elasticity of demand for electricity in NEM regions, prepared for the National Electricity Market Management Company, June.

NSW Department of Energy and Climate Change 2008, *NSW Energy Efficiency Trading Scheme Discussion Paper*, NSW Department of Energy and Climate Change, Sydney.

OECD 2003, *Environmentally Sustainable Buildings- Challenges and Policies*, OECD, Paris.

Pears, A. 2006, *Energy efficiency improvement in the commercial sector*, Draft, Melbourne.

— 2007, *Residential Sector Energy Efficiency Scenario — Background, framework and rationales*, Melbourne.

PB Power 2004, *Costs and Benefits of Embedded Generation; Micro-Generation Addendum*, Report prepared for Sustainable Energy Ireland.

PC (Productivity Commission) 2005, *The Private Cost Effectiveness of Improving Energy Efficiency*, Productivity Commission Inquiry Report No. 36, August 2005, AGPS, Canberra.

Public Transport Authority of WA 1999, *TravelSmart 2010: A 10 year plan*, Perth.

Queensland Department of Minerals and Energy 2008, *Smart Energy Savings Program*, Queensland Department of Minerals and Energy, Brisbane.

Quinlan, P., Geller, H. and Nadel, S. 2001, Tax incentives for innovative energy-efficient technologies. Report No. E013, ACEEE, Washinton DC.

SA Department of Transport, Energy and Infrastructure 2008, *South Australian Residential Energy Efficiency Scheme*, Consultation Paper, Department of Transport, Energy and Infrastructure, Adelaide.

Stern, N. 2007, *The Economics of Climate Change: The Stern Review*, Cambridge University Press

Strbac, G. and Jenkins, N. 1998, *Calculation of Costs and Benefits to the Distribution Network of Embedded Generation*, UMIST Department of Electrical Engineering, Manchester Centre for Electrical Energy, Accessed via IEEE Xplore.

Sustainable Energy Development Authority 2001, *Demand Side Management: Evaluating Market Potential in NSW*.

Sustainable Energy Development Authority 2002, *Distributed Energy Solutions, Cost and Capacity Estimates for Decentralised Options for Meeting Electricity Demand in NSW*.

Victorian Department of Primary Industries 2008, *Victorian Energy Efficiency Target (VEET) scheme fact sheet*, Victorian Department of Primary Industries, Melbourne.

WA Department of Environment and Conservation 2007, *Premier's climate change Action Statement*, WA Department of Environment and Conservation, Perth.

WEC (World Energy Council) 2004, *Energy Efficiency: A worldwide review*, WEC, London.

— 2008, *Energy Efficiency: A worldwide review*, WEC, London.

Urge-Vorsatz, D. Koepfel, S. and Mirasgedis, S. 2007, 'Appraisal of policy instruments for reducing buildings CO₂ emissions,' *Building Research and Information*, vol. 35(4), pp. 458-477.

To reduce our impact on the environment, ASBEC used recycled paper and had this report printed by Fishprint, a waterless, carbon neutral, whole of life cycle certified printer using 100% renewable energy.



