The Allen Consulting Group

The Second Plank Update: A review of the contribution that energy efficiency in the buildings sector can make to greenhouse gas emissions abatement

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Prepared for the ASBEC Climate Change Taskgroup (CCTG)

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Contents

Glossary

Australian Bureau of Agriculture and Resource Economics	ABARE
Australian Bureau of Statistics	ABS
Australian Sustainable Built Environment Council	ASBEC
Building Code of Australia	BCA
Business as usual	BAU
Carbon capture and storage	CCS
Carbon dioxide equivalent	CO_2-e
Carbon Pollution Reduction Scheme	CPRS
15th Conference of the Parties	COP15
Council of Australian Governments	COAG
Climate Change Taskgroup	CCTG
Department of Climate Change	DCC
Emissions Trading Scheme	ETS
Green Building Council of Australia	GBCA
Greenhouse gas	GHG
Gigawatt-hour	GWh
Intergovernmental Panel on Climate Change	IPCC
Million tonnes	Mt
Minimum Energy Performance Standards	MEPS
National Australian Built Environment Rating System	NABERS
Petajoules	PJ
Regulatory impact statement	RIS
Renewable Energy Target	RET
United Nations Framework Convention on Climate Change	UNFCCC

Key points

- The Australian policy environment for addressing climate change has changed significantly since the release of ASBEC's *Second Plank* report (2008) that examined the role of the built environment in reducing Australia's emissions and contributing to national abatement.
- In addition to the Carbon Pollution Reduction Scheme (CPRS), Australian Governments have recently announced a number of complementary policies to combat GHG emissions that specifically target the buildings sector.
- CPRS Complementary measures include (amongst others): the phase out of incandescent light bulbs, increased stringency in energy efficiency requirements for residential and commercial buildings, mandatory disclosure of residential and commercial buildings energy, greenhouse and water performance and subsidies for ceiling insulation and solar water systems in the residential sector. These CPRS complementary measures add to other measures that the Australian Government and State Governments have already put in place to raise energy efficiency, especially programs relating to improved energy efficiency in household appliances and the residential sector in general.
- These measures will add to energy savings and greenhouse gas (GHG) abatement and will change the role that remains for the built environment to mitigate GHG emissions and contribute to future abatement.
- This report analyses the energy efficiency savings in the building sector already captured within existing and proposed policies and estimates the potential energy efficiency opportunities that still exist within the building sector.
- The analysis shows that, while the CPRS and additional complementary policies will contribute to reduce energy consumption and GHG emissions, *there still remains potential for the buildings sector to contribute to the national mitigation and abatement effort*. In particular, this report shows that:
  - the CPRS is estimated to reduce GHG emissions in the buildings sector by 49 Mt CO2-e from the 'business as usual' scenario (BAU) in 2029-30;
  - when complementary measures are taken into account, it is estimated that emissions from the buildings sector would be reduced by an additional 14 Mt CO2-e in 2029-30. This means that the CPRS and other complementary measures would reduce emissions in the sector by 62 Mt CO2-e against the BAU in 2029-30; and
  - additional energy efficiency measures can further reduce GHG emissions from the buildings sector by 33 Mt CO2-e, reducing projected emissions in the sector by 95 Mt CO2-e against the BAU in 2029-30.
- In addition, the pursuit of additional energy efficiency in the buildings sector could contribute towards reductions in the risks involved in adjusting to GHG mitigation. This could involve:
  - Reduced costs — there is evidence that energy efficiency in the buildings sector offers a low cost approach to GHG emissions reduction. This suggests that much could be achieved on a cost neutral basis over time. If

so this would be a lower cost than technological solutions such as renewable energy or carbon capture and storage (CCS), or purchase of abatement or sequestration credits from overseas, which involve substantial costs.

  – Reducing technology risks — reducing the demand for energy reduces dependence on fundamentally uncertain technologies, especially when CCS or other low emission electricity generation technologies becomes available, or when it becomes available at economic prices. Current Treasury projections about the arrival of CCS and its cost can be best described as 'heroic' in nature. Increased reliance on known, tried and tested energy efficiency technologies could avoid expensive disappointments.
  – Delaying the need to expand electricity generation — reduced consumption of electricity in the buildings sector could flatten growth in electricity consumption in general and eliminate the need for additional generation capacity for 10 to 15 years. This would provide more time to complete R&D and devise low cost/low GHG emissions technology. It could also reduce the total cost of new energy infrastructure, including transmission and distribution networks.
  – Managing the rebound/flow-on effect — there is a need to take into account the circumstances where reduced costs from energy efficiency measures can increase spending, which can in turn raise demand for greenhouse gas intensive goods and services. Equally, it would be helpful to ensure that reducing the greenhouse gas intensity of living in buildings could limit rebound from this source.

- The report notes that a wide range of policy approaches and interventions have been proposed as a means of advancing additional energy efficiency in the buildings sector and reducing the costs and risk of adjustment to a low carbon world. The ASBEC CCTG has flagged five high priority policy approaches in their earlier contributions. They are:
  – A national white certificates scheme
  – Accelerated green depreciation
  – Public funding for building retrofit
  – Enhancement of MEPS
  – Modernisation of the building code
- While there appear to have many approaches to improve energy efficiency in the buildings sector it is not clear that all of these have been examined closely by Government. The supply of low cost and low risk greenhouse gas emissions abatement may not yet have been depleted, and there may be benefits from examining the available options from a fresh perspective.

It is important to take into account that energy efficiency in the buildings sector introduces other benefits that are worthy in their right including:

- assisting with adaptation by making buildings cope better in more extreme conditions;

- health benefits from reduced heat stress;
- productivity improvements; and
- improved resilience – buildings operate better if and when energy supplies are interrupted.

Chapter 1

About the second plank

1.1 Looking back

In August 2008 Prime Minister Kevin Rudd described energy efficiency within the built environment sector as 'the second plank' in Australia's climate change strategy. The Australian Sustainable Built Environment Council (ASBEC) released *The Second Plank: Building a Low Carbon Economy with Energy Efficient Buildings* in September 2008. The report examined the role of the built environment in reducing Australia's emissions and in contributing to national abatement.

Much has changed since the release of the ASBEC Second Plank report in late 2008. There have been substantial policy developments. The Government's Carbon Pollution Reduction Scheme (CPRS) has proceeded through green and white paper stages to Parliamentary Bills. Other policy measures, such as the Renewable Energy Target (RET) have been introduced that will change the energy and greenhouse gas (GHG) abatement environment. Additional and complementary measures have been announced and are subject to regulatory review processes.

1.2 Looking ahead — this report

This report reviews the changes in policy context and current and that shape the outlook for GHG abatement in the buildings sector. It also assesses the role that energy efficiency in the buildings sector can or should play in the light of these developments.

Chapter 2 — identifies the full potential that energy efficiency in the buildings sector could bring in terms of GHG abatement and other benefits.

Chapter 3 — reviews how changes in policy can be expected to change greenhouse gas emissions that are attributable to the buildings sector and assesses what additional roles can be played by further energy efficiency measures.

Chapter 4 — outlines where the buildings sector can play a role in reducing the risks involved in making the transition to a low carbon economy.

Chapter 5 — looks at the changes in policy directions that could help to lock in the potential gains from more energy efficiency in the buildings sector.

Chapter 2

Energy efficiency GHG abatement potential

This chapter looks at the full potential that energy efficiency in the buildings sector could bring in terms of GHG abatement and other benefits.

2.1 Energy efficiency in the buildings sector

The role that the buildings sector plays in terms of a source of demand for energy and how this drives greenhouse gas emissions is documented in Appendix C.

The Allen Consulting Group has reviewed the evidence tabled by ASBEC and others about the potential for energy efficiency in the buildings sector. Details about this potential are provided Box 2.1.

It is estimated that measures above have the technical potential to reduce energy use in the buildings sector by around 32 per cent by 2030 against the BAU energy consumption. The BAU scenario is based on ABARE 2007, which includes policies that are placed since 2007.

2.2 Emissions abatement

Reducing energy use in the buildings sector would have an impact upon greenhouse gas emissions. Greenhouse gas emissions in the buildings sector can be counted by including direct emissions in buildings as well as including the emissions necessary to supply energy to the buildings sector. This includes the emissions of electricity generators used to produce electricity as well as those involved in transmission and distribution losses. The fuller picture is obtained by adding scope 1 through to scope 3 emissions factors.

On this basis and given the estimated change in energy use in the building sector, adoption of the full potential range of energy efficiency measures could result in a substantial reduction in GHG emissions compared to the BAU scenario. Emissions are projected to be around 73 Mt CO_2-e less than the BAU by 2030. This is a reduction of around 38 per cent of the BAU projection.

Box 2.1

ENERGY EFFICIENCY MEASURES IN THE BUILDINGS SECTOR

The Allen Consulting Group reviewed evidence about a range of energy efficiency measures that could be applied in the buildings sector.

In the residential segment changes were examined including:

- 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 the commercial segment reductions in energy demand and emissions were examined that would involve:

- 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).

Most measures:

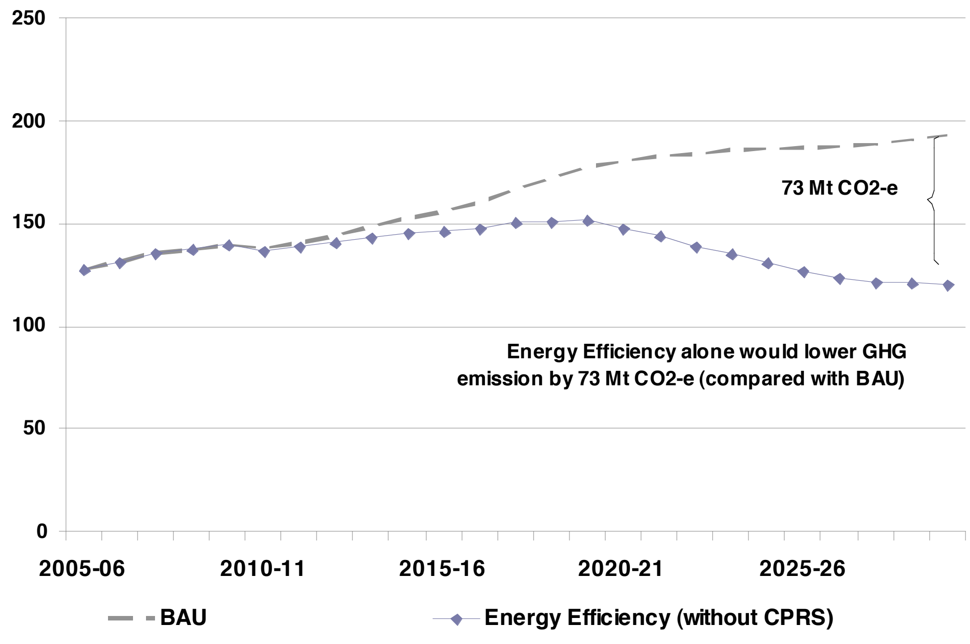
- involve replacing old inefficient technologies with tested reliable and proven more efficient systems;
- could be applied to replace existing systems when and as they have reached the end of their economic lives — suggesting that there would not be needless and costly asset destruction; and
- probably involve initial costs with offsetting benefits obtained over time from the reduced cost of electricity services.

Conservative approaches have been used to estimate the technical potential of energy efficiencies in the building sector. Estimates about the scope for efficiencies appear to be at the mid point or at the lower end of figures reported in the literature reporting case studies within Australia and from around the world.

Source: ASBEC

Figure 2.1

PROJECTED BUILDINGS SECTOR EMISSIONS UNDER DIFFERENT SCENARIOS ($Mt\ CO_2$-e)



Note: CPRS refers to the CPRS-5 scenario in Treasury 2008.

Source: ABARE, 2009; Allen Consulting Group analysis, 2010.

This is estimated on the basis of like-for-like substitution of existing technologies used in houses and office buildings with more energy efficient alternatives using existing known technologies. The potential emerges because buildings are long-lived and many appliances and technologies used in them or fitted are less efficient than those that are available after some decades of technological change. The projected changes take some time to implement. Experience shows that it is not feasible to assess and alter every house and building in Australia in a short time (and attempting to do so can raise major safety issues).

The projections also take into account the time that it takes households and businesses to adopt new technologies. One way of looking at this is to project that change occurs when existing technologies wear out and are replaced or building systems are retrofitted in line with the existing economic life of these technologies and systems.

The projected potential greenhouse gas reductions are in line with other analysts estimates. The UN Intergovernmental Panel on Climate Change (IPCC) reports that there is a global potential to reduce approximately 29 per cent of projected baseline emissions through energy efficiency in the buildings sector (Levine 2007). Broadly similar estimates have been produced by the International Energy Agency (2003).

It is also important to note that the technical potential is an assessment of the possible changes and does not take into account behavioural changes that may change outcomes.

The energy efficiency analysis in this report is conservative, taking into account the known potential efficiency gain, as opposed to the maximum possible gains. While it may be reasonable to project bigger energy efficiency improvements over time that could be delivered through the use of recent innovations and future technological change (such as better energy–use management based on feedback from smart metering, etc.) the impact of such changes is uncertain.

2.3 Cost savings

A key facet of the identified energy efficiency technologies is that they are expected to generate cost savings over the long term. While there are often costs associated with many changes, these would be repaid over time through lower electricity costs.

Earlier estimates provided by ASBEC suggest that the average cost is a saving of $129 per tonne of GHG reduction. This has a 'levelised' value (essentially an average net present value) of a saving of $100 per tonne.

It is notable that other analysts also identify that the buildings sector offers the prospect of energy cost. In its report regarding *An Australian Cost Curve for Greenhouse Gas Reduction* McKinsey & Company (2008) identified that the building sector has the lowest average cost of abatement. They estimate that the buildings sector could reduce 60 Mt of CO2e per annum by 2030 at a negative cost of $130 per tonne (average cost basis). This adds to earlier evidence that there are significant opportunities for increased energy efficiency in Australia that are economically beneficial (Allen Consulting Group 2004).

2.4 Other impacts

In addition, it is important to acknowledge that energy efficiency in the building sector introduces other benefits that are worthy in their right. Benefits that are backed by evidence include the following.

- In the United States 'green buildings' have lower operating costs, higher building values, a higher return on investment, higher occupancy rations and higher rent ratio (GBCA, 2008)
- Surveys of investors in buildings in Australia show that investors are willing to pay more for energy efficient buildings (GBCA, 2008)

Experts in Australia (Pears, personal correspondence) note that energy efficient buildings:

- assisting with adaptation by making buildings cope better in more extreme conditions;
- bring health benefits for occupants from reduced heat stress;
- raise productivity improvements; and
- involve improved resilience – buildings operate better if and when energy supplies are interrupted.

2.5 Barriers to change

Given the advantages in increased energy efficiency in the building sector what is stoping change? A range of barriers and impediments can delay or impede the full implementation of energy efficiency enhancements.

Possibly the most substantial problem is that despite the damage that they cause greenhouse gas emissions are not priced. People and business are free to pollute and savings are not valued.

Other factors that are often identified as an impediment include the following.

- A lack of awareness and understanding of costs and savings;
- Resistance to change;
- The initial cost of the enhancement;
- The likely payback period to realise a financial return from the enhancement;
- The long lifespan of pre-existing buildings, equipment and appliances; and
- The relatively low cost of energy versus the high cost of change.

The Garnaut Climate Change Review (2008) has identified two kinds of market failures that are especially important in inhibiting the adoption of established technologies and practices. One relates to the externalities in the supply of information and skills. The second involves a principal-agent problem (or the owner occupier problem) where the person who makes a decision is not the same who is affected by it.

These factors together imply that it is unlikely that the opportunities presented by increased energy efficiency in the buildings sector will be realised unless there is appropriate policy support.

2.6 Savings potential revisited

Overall, it seems that revisions to energy use forecasts and other factors have not changed the picture greatly. There still appears to be great potential to reduce greenhouse gas emissions through energy efficiency in the buildings sector.

It is likely that these measures would make a significant contribution to GHG reductions, and at a relatively low cost or net economic benefit. Additionally, adopting energy efficient abatement opportunities would have substantial cost reductions, compared with investment in low emission energy supply infrastructure.

Chapter 3

Changes in policy and buildings sector emissions

What are the likely impacts of the CPRS and other recent policy announcements on buildings sector emissions?

3.1 The Carbon Pollution Reduction Scheme (CPRS)

The CPRS represents the 'first plank' in Australia's mitigation effort. It involves a range of policy interventions.

A key element of the CPRS is the introduction of an Emissions Trading Scheme (ETS). The ETS will use a 'cap and trade' approach, which will limit GHG emissions in regulated areas of the economy through the cap and allow market trading to set a price for carbon emissions. This mechanism would provide an economy-wide price signal, encouraging adjustment and innovation to a lower carbon economy.

The CPRS is more than just an ETS. It also provides measures to reduce the cost of adjustment for some areas of the economy and the community. The Government has included assistance to trade exposed emissions intensive industries (including free permit allocations) and assistance to households (including compensation for electricity price increases and offsets to fuel excise). The scheme also includes an expansion of renewable energy generation (to 20 per cent), measures in some states to reduce GHG emissions and continuation of the 15 per cent gas scheme in Queensland.

There is now more information about the impact of the CPRS at large compared to what was known at the time when the Government's Green Paper and ASBEC's original Second Plank document was published. The CPRS itself has evolved in recent months and the bills are still the subject of amendments in Parliament. Significant changes include:

- *Scheme commencement* — in response to the global financial crisis and concerns from industry, the Government has deferred the planned commencement of the CPRS by one year until 1 July 2011.
- *Scheme target* — the draft CPRS legislation endorses a global target of GHG stabilisation at 450ppm CO_2-e, and commits Australia to an abatement target of 60 per cent reduction in emissions from 2000 levels by 2050, as well as a reduction of emissions from 2000 levels of between 5 per cent and 15 per cent by 2020, with 5 per cent guaranteed. The Government also announced a target of 25 per cent emissions reductions if an ambitious international agreement is negotiated (dependent on stringent conditions).

- *Carbon price* — the Green Paper assumed an indicative carbon price of $20 per tonne of CO_2-e. The draft legislation indicates a flat price of $10 per tonne in the first year of the scheme, 2011-12. A $40 price cap will then be in place for four years from 2012-13, rising at 5 per cent per annum. Market trading will commence in 2012-13. Treasury modelling foreshadows a steady increase in the carbon price, reflecting progressive reductions in the cap to reach the long term reduction target. The projected price reaches $52 per tonne of CO_2-e by 2030, and $115 per tonne of CO_2-e by 2050 in the CPRS-5 scenario (in real terms, before inflation). For more aggressive emission reduction target, the projected carbon price could reach $88 per tonne of CO_2-e by 2030, and almost $200 per tonne of CO_2-e by 2050; and
- *Reduction in the GHG intensity of electricity* — the Treasury's 2008 modelling of the CPRS revealed that the Government is factoring in a remarkable transformation in electricity generation. Essentially, the GHG intensity of electricity is projected to fall by 2050 to be about one sixth of the rates that have prevailed in recent years.

These changes are quite profound. Clearly the higher permit prices and upward trend in permit prices would make a significant difference to outcomes.

Most notably, the Treasury's 2008 modelling reveals a forecast of a transformation in electricity generation that is dramatic and somewhat astonishing. The projected plunge in the GHG intensity of electricity generation is driven initially by the Renewable Energy target (RET) scheme that directly reduces the GHG intensity of electricity supply.[1]

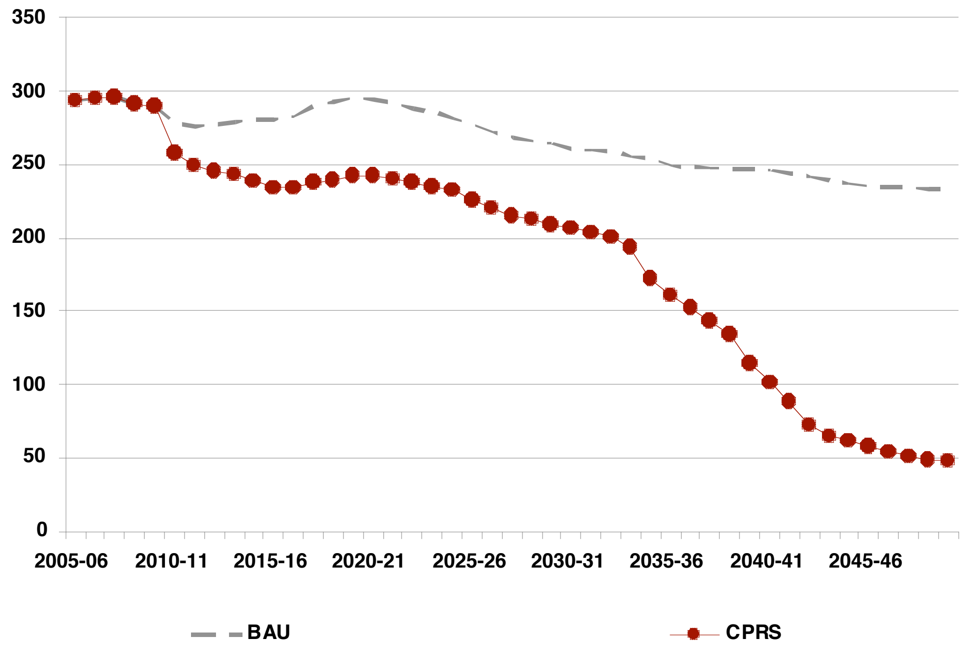
It is also apparent that the Treasury's projections include provision for the widespread application of electricity supply technologies such as Carbon Capture and Storage (CSS) throughout Australia. This becomes a major factor after 2030 and drives a deep and rapid reduction in emissions intensity in the projections used and reported by the Government.

There are many reasons to fear intervening factors that could alter and impede this change. CCS technologies have not been applied to commercial scale energy production and sale anywhere in the world. Indications are that the technology is expensive. In addition the approach requires construction of a major gas transportation network that raises the cost again and introduces further barriers to change. Given that the GHG emission reductions expected from the CPRS are largely driven by this factor it is important to highlight the many and substantial risks to this outlook. These are discussed in a chapter that follows.

[1] The RET scheme aims to raise the share of renewable electricity generation to 20 per cent by 2020 by placing a legal liability on wholesale purchasers of electricity to proportionally contribute to an increasing target of renewable energy. The CPRS bill before Parliament originally packaged the RET with the ETS and other measures. The RET and remaining CPRS measures was subsequently separated and the RET legislation has been passed by Parliament. Regretfully, the Treasury modeling does not separately identify the various component parts of the original CPRS package, limiting the analysis that can be done about the RET and CPRS.

Figure 3.1

TREASURY ESTIMATE OF EMISSION INTENSITY FACTOR FOR ELECTRICITY GENERATION (KG CO_2-e/GJ)



Note: CPRS refers to the CPRS-5 scenario in Treasury 2008.

Source: ABARE, 2009; Allen Consulting Group analysis, 2010.

Reflecting concerns about the certainty of long term projections, especially uncertainties in the projections following 2030 and the difficulties in predicting the fuel mix in the electricity generation sector and others, the ASBEC CCTG wishes this study to focus on the period between now and 2030.

3.2 Impact of the CPRS on emissions from the buildings sector

A key difficulty in assessing the impact of the CPRS is in determining what targeted emissions abatement target will be set. At present there are 3 major scenario alternatives, CPRS-5, CPRS-15 and CPRS-25. Despite the advice from the Independent Climate Change Review after a detailed review of the science that Australia's full part for 2020 should be a reduction of 25 per cent in emissions entitlements from 2000 levels, and that deeper abatement targets than the Government's 60 per cent on 2000 levels by 2050 were necessary (Garnaut Review 2008), current Government policy is to apply the CPRS-5 target (where Australia's medium term target is 5 per cent below 2000 levels by 2020) and expand that depending on international commitments to larger scale emissions abatement.

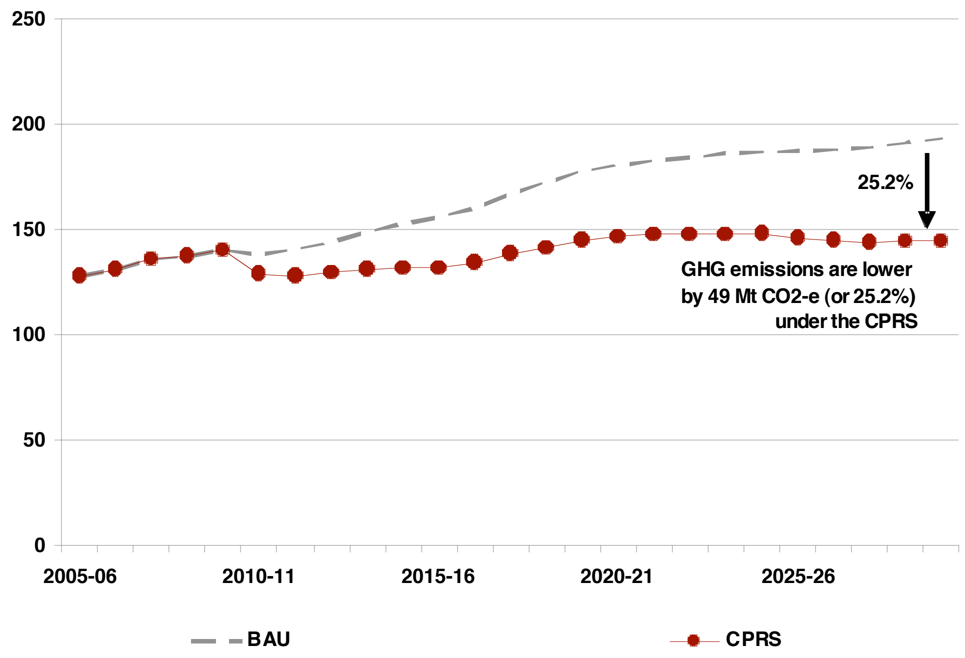
Thus, at this moment, the most certain policy target is represented by the Treasury CPRS-5 scenario. Analysis in this report therefore looks at the CPRS using Treasury (2008) projections for the CPRS-5 scenario.

The introduction of the CPRS would increase the price of electricity, which in turn would lead to lower demand for electricity. Therefore, energy consumption in the buildings sector can be expected to be lower than otherwise with the CPRS compared with the BAU scenario. Specifically, under the CPRS, the analysis shows that the buildings sector would consume around 56 PJ (or 5.4 per cent) less in 2029-30 than under the BAU.

While a fall in energy consumption in the buildings sector would contribute to lower GHG emissions (if everything else remained unchanged), a more important factor is the projected reduction in the emissions intensity of electricity. The projected emissions from the buildings sector under the BAU and the CPRS-5 scenario is illustrated in Figure 3.2.[2] As shown in this chart, under the CPRS, emissions are projected to fall relative to the BAU scenario, with divergence from the baseline — representing mitigation — beginning around 2010-11. Specifically, it is estimated that the introduction of the CPRS would reduce the growth in GHG emissions from the buildings sector from 140 Mt CO_2-e in 2009-10 to 144 Mt CO_2-e in 2029-30, compared with 193 Mt CO_2-e in 2029-30 under the BAU (equivalent to a reduction of 25.2 per cent in 2029-30).

Figure 3.2

PROJECTED BUILDINGS SECTOR EMISSIONS UNDER DIFFERENT SCENARIOS (Mt CO_2-e)



Note: CPRS refers to the CPRS-5 scenario in Treasury 2008.

Source: ABARE, 2009; Allen Consulting Group analysis, 2010.

[2] Details about the nature of the various scenarios analysed in this report are provided in Appendix B.

3.3 Additional complementary policies

Over the last year, Australian Governments have announced a number of policies to combat GHG emissions that are additional to the CPRS. Given that the Treasury modelled the expected impacts of the CPRS in mid-2008, it is likely that these policies were not taken into account within the official CPRS projections. An outline of the range of additional policy changes is provided in Box 3.1.

Box 3.1

ADDITIONAL COMPLEMENTARY POLICIES IMPLEMENTED AFTER 2007 TO COMBAT GHG EMISSIONS

This box highlights complementary policies to combat GHG emissions that are implemented after 2007. These policies are added to the CPRS scenario, and the combined effect on energy consumption and GHG emissions are referred to as the CPRS (plus complementary policies). Policies implemented before 2007 (such as the Energy Australian ENERGY STAR program, Energy Labelling program, Renewable Remote Power Generation Program, Energy Efficiency Opportunities legislation) are included in the BAU scenario.

In May 2009 the Commonwealth Government announced the establishment of the **Australian Carbon Trust**, which will support individual emissions reductions. The Australian Carbon Trust, worth $75.8 million over 5 years, will provide information and tools for households and businesses to pursue voluntary mitigation. Within the Australian Carbon Trust, the Energy Efficiency Savings Pledge Fund will provide an online portal to enable the residential sector to calculate energy use and the dollar savings resulting from energy efficiency measures. Households will be able to pledge the resulting savings (or any other amount) to the Energy Efficiency Savings Pledge Fund, which will buy and retire CPRS permits. The Australian Carbon Trust will also provide $50 million in seed funding for an Energy Efficiency Trust to promote energy efficiency in the business sector. The Energy Efficiency Trust is intended to raise awareness of the benefits of energy efficiency in the commercial sector.

The Commonwealth Government also established the $2.75 billion **Climate Change Action Fund** to provide transitional assistance to the commercial, residential and voluntary sectors. The Climate Change Action Fund will operate over between 2009-10 and 2015-16, and will, inter alia, assist small and medium enterprises in the commercial sector, as well as businesses ineligible for other forms of assistance associated with the CPRS. In May 2009 $200 million was made immediately available to support early action on energy efficiency in 2009-10, including $20 million for a business information package to provide advice to businesses on the CPRS, up to $100 million for Early Action Energy Efficiency Strategies for Business (including energy audits, investment and information programs), and $80 million for capital investment grants.

The **Electricity Sector Adjustment Scheme** is a complementary policy to the CPRS to support the coal-fired power industry. A fixed administrative allocation of permits will be provided to generators over five years (totalling $3.8 billion assistance in nominal terms. Coal-fired generators with emissions intensity above 0.86 t CO2-e per MWh and in operation on 3 June 2007 will be eligible.

A further complementary policy to the CPRS is the household assistance to be provided by the Commonwealth Government in order to compensate low-income and otherwise disadvantaged households in the face of higher electricity prices. A combination of direct cash assistance and tax offsets will be implemented from scheme commencement.

The Commonwealth Government's **Energy Efficient Homes Package** subsidises the installation of ceiling insulation and solar hot water systems in the residential sector. The package includes the **Home Insulation Program** which provides assistance of up to $1,200 to install ceiling insulation in the residential sector. Alternatively, households could choose to receive a $1,600 rebate for installing a solar hot water system or a $1,000 rebate for installing a heat pump hot water system, to replace an electric storage hot water system.

Additionally, the **Green Loans scheme**, which started in July 2009, provides home sustainability assessments for Australian families and interest-free loan for up to a maximum of four years, to make the changes recommended in the assessment.

The Commonwealth Government is also distributing $91 million over 5 years (from 2009) under the **Green Building Fund** to reduce energy consumption of existing commercial office buildings by retro-fitting and retro-commissioning the buildings and to develop technology, knowledge and capability to increase energy efficiency in commercial buildings.

The Commonwealth Government is overseeing the phase out of inefficient incandescent light bulbs. The phase-out will be implemented though the introduction of **minimum energy performance standards** (MEPS) for lighting products. The first stage of the phase-out began in February 2009 with the introduction of an import restriction on inefficient incandescent general lighting bulbs which are used for general lighting purposes.

The **Renewable Energy Target**, passed in 2009, mandates that 20 per cent of Australia's electricity will be generated from renewable energy sources by 2020. The RET imposes a legal liability on wholesale purchasers of electricity to contribute to an additional 45,000 GWh of renewable energy per year by 2020, and establishes the framework for both the supply and demand of renewable energy certificates (RECs) via a REC market. As the RET grows more stringent each year, renewable energy will play a greater role in the electricity supply, which will become less dependent on coal-fired generation. This will impact the emissions intensity of all forms of energy, including the electricity supply the built environment draws upon.

In July 2009 COAG signed the **National Partnership Agreement on Energy Efficiency**, which includes a number of energy efficiency initiatives. These include:

- assistance to the residential and commercial sectors to reduce energy use by providing information and advice, financial assistance and demonstration programs, as well as supporting industry capability to pursue cost-effective energy efficiency opportunities;
- higher energy efficiency standards for both the residential and commercial buildings sectors; the proposed 2010-11 standards for non-residential buildings could drive significant abatement.
- nationally-consistent energy efficiency standards for appliances and equipment;
- new standards for the energy performance of air conditioners from 2010, which will increase a further 10 per cent in 2011-2011 and new energy labels that allow high efficiency models to be recognised in the marketplace;
- removal of regulatory impediments to the take up of innovative demand side initiatives and smart grid technologies; and
- detailed assessment of possible vehicle efficiency measures, including carbon emission standards.

Source: Source: http://www.climatechange.gov.au/government/initiatives.aspx

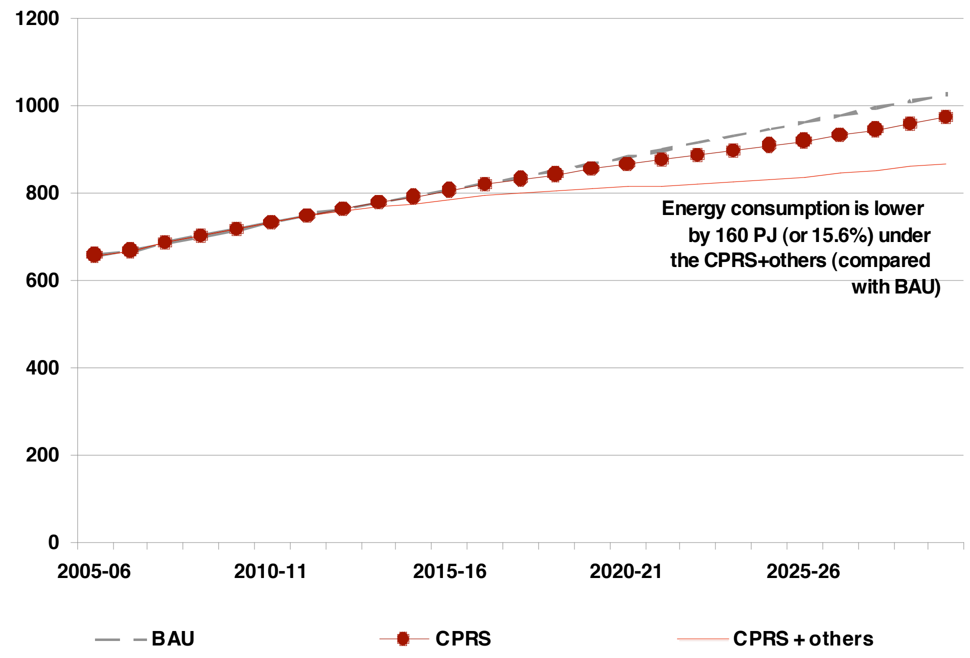
There are other energy efficiency programs that have been announced or implemented after 2007, but are not explicitly included in the CPRS (plus complementary policies) scenario. One example, is the National Energy Efficiency Initiative which involves the Smart Grid Smart City program where the Government would invest up to $100 million in partnership with the energy sector for the development of a smart grid technology pilot. A purpose of the pilot program is to reduce uncertainty about the expected impact of this intervention. Reflecting lack of information about this and other initiatives, and their effect, they are not included in the BAU or other scenarios analysed in this report.

It is possible that many of the additional complementary measures do not add to emissions abatement, but work by accommodating or enabling changes stimulated by the CPRS. Equally, many of the complementary measures target specific changes in buildings that may not happen without a significant prompt. To simplify the analysis and ensure that the major issues are brought into clear focus this study starts the calculations with the viewpoint that complementary measures adds to energy savings and GHG abatement. This assists in identifying if there is the possibility that further energy efficiency actions in the buildings sector could increase GHG abatement.[3]

The potential for reduced energy consumption in the buildings sector is illustrated in Figure 3.3. The CPRS (plus complementary policies) reduces energy consumption by around 15.6 per cent from 1027 PJ under the BAU scenario in 2029-30 to 867 PJ.

Figure 3.3

TOTAL BUILDINGS SECTOR: ENERGY USE (PJ)



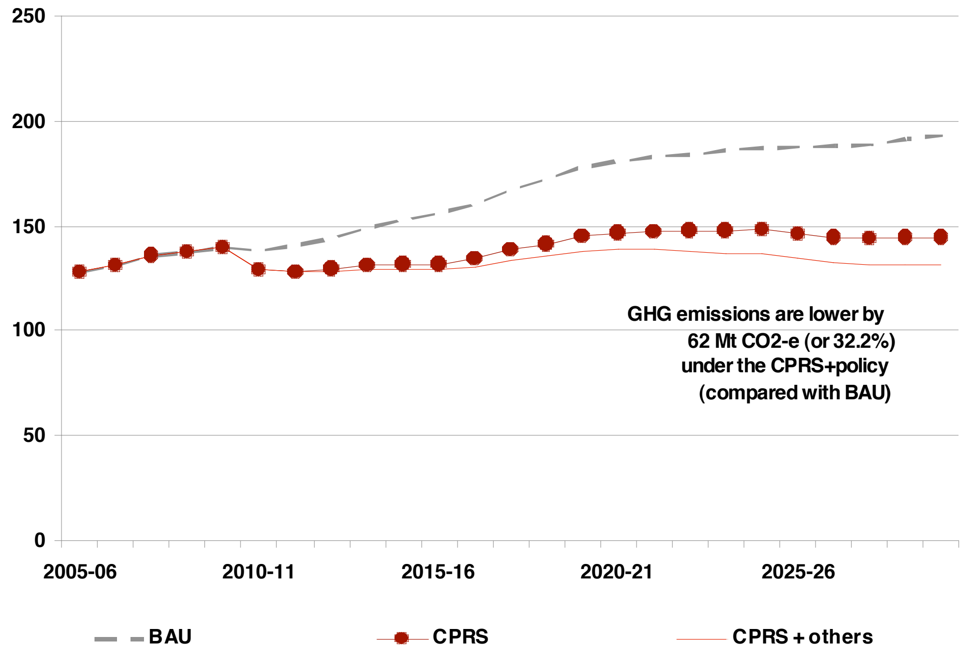
Source: Allen Consulting Group analysis, 2009.

3 This analysis is restricted to assessing implications for the buildings sector. It does not look at changes in emissions in the economy at large. Of course to assess changes in emissions in the economy at large it would be necessary to know what would happen to the cap on emissions in the ETS. Unless the cap is reduced additional emissions reductions in the buildings sector would be offset by increased emissions in other sectors. It may also be the case that the CPRS and the additional complementary measures work together to drive the same emissions reductions.

Lower energy consumption reduces total emissions from the buildings sector in both the residential and the commercial segments (see Figure 3.4). Under the BAU scenario, the buildings sector is expected to consume 1027 PJ of energy and produce 193 Mt CO_2-e of greenhouse gas in 2029-30. Lower energy consumption under the CPRS (plus complementary policies) scenario is estimated to reduce building sector energy consumption to 867 PJ and GHG emissions to 131 Mt CO_2-e in 2029-30. While GHG emission under the CPRS (plus complementary policies) scenario is lower compared to the BAU in 2030, the amount of GHG emissions is relatively unchanged from the current level of around 130 Mt CO_2-e.

Figure 3.4

TOTAL BUILDINGS SECTOR: GHG EMISSIONS (Mt CO_2-e)



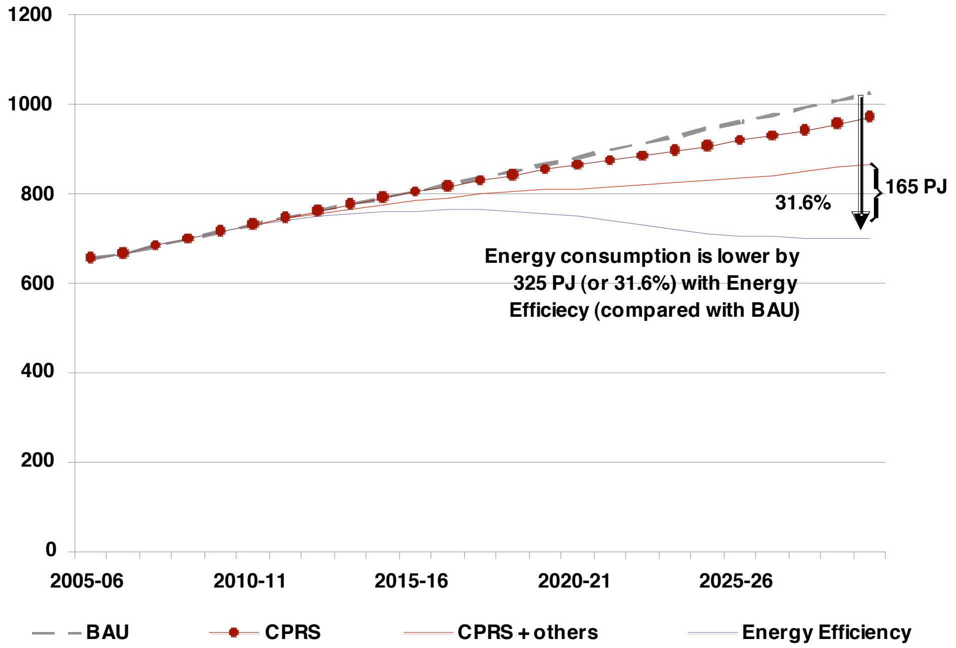
Source: Allen Consulting Group analysis, 2010.

3.4 Remaining energy efficiency savings

There is a still significant potential for energy efficiency in the buildings sector to reduce buildings sector emissions. The chart below plots the energy savings that could be expected in total, in addition to those that are expected to be encouraged by the CPRS and the additional energy efficiency complementary measures. It shows there is still a substantial gap.

Figure 3.5

ENERGY CONSUMPTION BY THE BUILDINGS SECTOR (PJ)



Source: Note: CPRS refers to the CPRS-5 scenario in Treasury 2008.

Source: ABARE, 2009; Allen Consulting Group analysis, 2010.

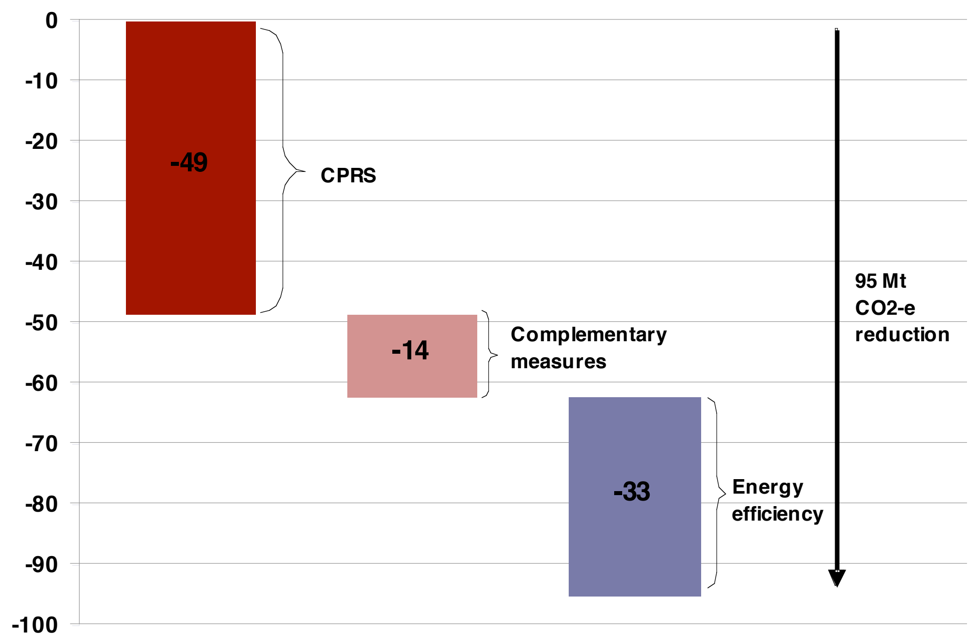
Our analysis suggests that around 50 per cent of the technological energy efficiency potential in the buildings sector would be absorbed by the recently announced policy measures. That is, while the policy measures would encourage much change and increase energy efficiency in the building sector, they do not provide sufficient incentive to bring forward all of the potential energy savings.

If all of the technological potential were harnessed the buildings sector could make a further significant contribution to greenhouse gas reductions. In addition to encouraging reduced energy use (the effect of higher electricity prices) it should be noted that the CPRS also reduces the GHG intensity of electricity use. This magnifies the greenhouse gas abatement potential from reductions in energy use from energy efficiency in the buildings sector if energy efficiency and the CPRS are applied at the same time.

Figure 3.6 shows the reduction in GHG emissions that could be achieved. This shows emission reductions of 95 Mt CO_2-e in 2030. Of this, 49 Mt CO_2-e comes from the CPRS, 14 Mt CO_2-e comes from the additional complementary measures and 33 Mt CO_2-e comes from additional energy efficiency. Given Treasury's estimated carbon prices of $52 per tonne, the additional savings in GHG emissions from energy efficiency would have a value of $1.7 billion in 2030.

Figure 3.6

CHANGES IN GHG EMISSIONS FROM THE BUILDINGS SECTOR IN 2029-30 RELATIVE TO BAU (MT CO2-E)



Source: The Allen Consulting Group analysis, 2010.

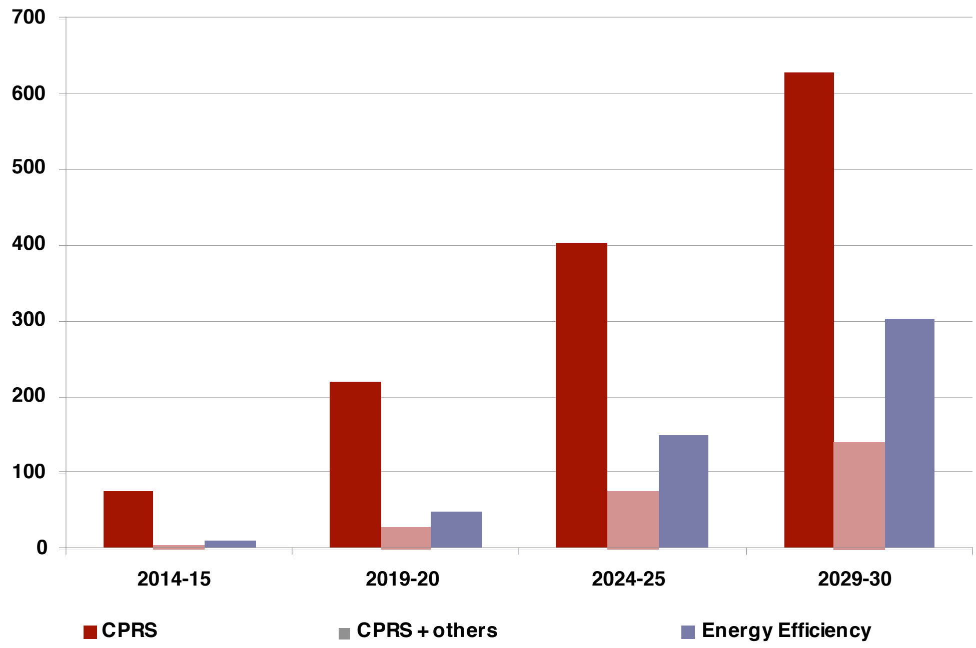
When considering the emissions reductions it is important to note the following:

- The figures relate to possible emissions reductions in the buildings sector and this may differ from emissions reductions in the economy as a whole.
- Once a cap is set under an economy-wide emissions trading scheme it limits savings as well as containing additions in emissions. Thus, reductions in GHG emissions in the buildings sector due to increased energy efficiency may not result in economy wide emissions savings because the cap and trade system allows other sectors to increase their emissions. The end effect in this case is that the economy would adjust to the cap in emissions with a lower cost. The cost would be lower because more use would be made of the low cost emissions abatement potential in the buildings sector which frees up scope for more emissions in higher value areas of the economy (most likely to be in trade exposed emissions intensive industries such as aluminium or coal exports).

The chart below shows the cumulative savings in GHG emissions in the buildings sector from the 3 sources. The cumulative savings refers to the estimated amount of GHG emissions saved from each program from now to the year shown in the chart.

Figure 3.7

CUMULATIVE SAVINGS IN GHG EMISSION FROM THE BUILDING SECTOR RELATIVE TO BAU (MT CO2-E)



Source: The Allen Consulting Group analysis, 2010.

3.5 The CPRS revisited

New information about policy approaches has changed the expected impact of the CPRS upon GHG emissions due to the energy demand of the buildings sector. Key changes in the Government's outlook include the following.

- The price of emissions is projected to be higher than had been assumed previously.
- Electricity consumption is projected to be substantially less GHG intensive.
- Recent policy announcements, many targeting reductions of emissions in the buildings sector, are also expected to play a significant role. These are projected to result in an additional 14 Mt CO_2-e of greenhouse gas abatement from the BAU scenario.

Together these measures are projected to reduce emissions that could be attributable to the buildings sector by 63 Mt CO_2-e in 2030.

Further analysis suggests that even though the CPRS and additional complementary measures may reduce emissions in the buildings sector, there are still gains from energy efficiency measures in the buildings sector could make a further contribution to emissions reduction in the buildings sector. It is estimated that additional savings of up to 33 Mt CO_2-e could be achieved in 2030.

Clearly there is value in finding out more about how to provide sufficient incentive to obtain the most of the potential energy efficiency gains in the buildings sector and the broader role that this can play in combating GHG emissions.

Chapter 4

The buildings sector and risk management

Pursuit of additional energy efficiency in the buildings sector may contribute more than merely encouraging additional greenhouse gas emission savings. This chapter looks at the role it may play in reducing the risks in adjusting to greenhouse gas mitigation.

4.1 The building sector and risk management

In addition to reducing the cost of transitioning towards a low carbon economy, it is likely that the building sector could contribute towards reductions in the risks involved.

Reducing technology risks

Reducing demand for GHG emissions by raising energy efficiency in the buildings sector applies known and proven technologies, reducing reliance upon the widespread rapid adoption of untested, uncertain, and probably expensive technologies, especially upon carbon capture and storage.

The potential arising from energy efficiency in the buildings sector is to apply known, proven workable and generally cost effective technologies over the whole building stock. The technical side of the opportunity in the buildings sector appears to be clear cut. Many analysts have reviewed the facts, and have arrived at the same conclusion. If adopted on a widespread basis, there is scope to substantially reduce energy consumption in existing and new buildings.

In contrast, there are many significant uncertainties with the arrival of low emissions technologies in the energy sector. Renewable energy sources are relatively expensive and many have issues with baseload reliability (this is not to say that the role that they will play is less significant and that this should not be explored further). The alternative of carbon capture and storage (CCS) technology does not yet exist on a commercial basis or scale within Australia, and is, at best, still in exploratory stages elsewhere and dependent upon substantial public subsidies.

Investing in known technologies that deliver energy efficient efficiencies could be a form of insurance policy against the delay of new technologies that may bring in less emissions intensive electricity generation. Indeed, some energy efficient measures could be lower cost than renewable energy.

4.2 Deferral of expansion in electricity generation

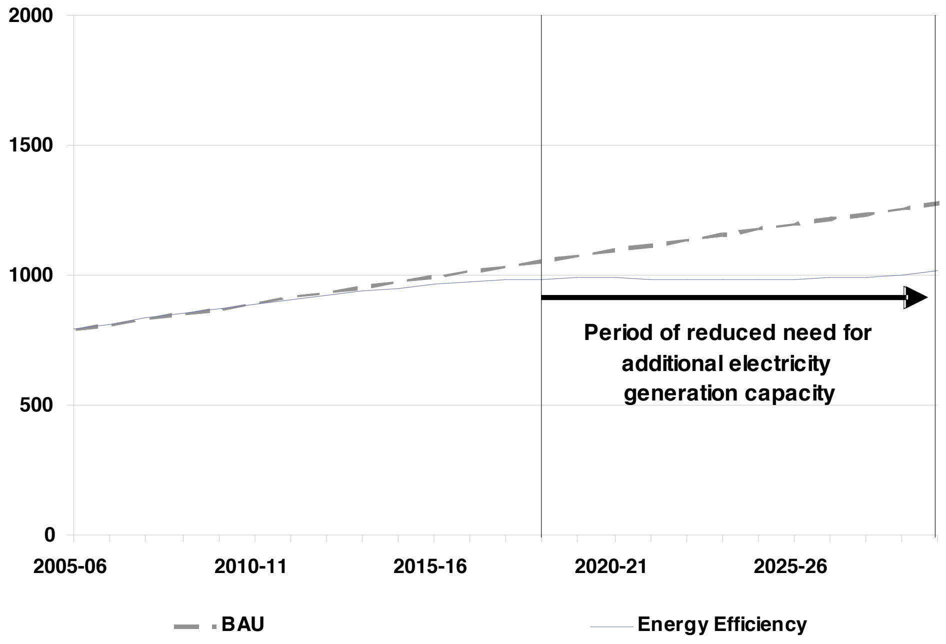
The need to build new electricity generation stations is a key pressure point. Even with the CPRS it is expected that electricity demand will grow. Building additional generation capacity entails many risks at present. Further, the current uncertainties about implementation of (and ongoing commitment to) the CPRS and future carbon prices could undermine energy supply investment. It takes a long time to obtain approvals and actually construct large scale electricity stations. Power stations are expensive, generally requiring billions of dollars in investments. Power stations also have a relatively long service life, so once a decision is made to build a station it can be expected to remain in productive use for years and decades. Even if generation assets become 'stranded' (built and not used, or used only lightly) substantial costs would still be incurred, both for shareholders and the community (via tax deductions for losses).

Given significant policy and technological uncertainty, it is not a good time to commit to any particular generating technology. For instance, development of the mainstream technology, coal fired power stations, would probably commit to greenhouse gas intensive electricity for some time to come, or could be overtaken by a new technology that has a better greenhouse gas emissions profile. The CPRS and other policy measures may be about to change market fundamentals, and a far less risky option would be to await developments in the electricity market before committing to new major investments.

Energy efficiency in the buildings sector could reduce the need to develop additional electricity generation capacity. The technical capacity for energy efficiency in the buildings sector reported in the previous chapter amounts to a significant proportion of total energy consumption. In fact, the reduction in energy consumption is sufficient to reduce net growth in electricity consumption in Australia for many years up to around 2030 That is, if the technical capacity for energy efficiency in the buildings sector were realised, there would be no need to add any additional electricity generation capacity in Australia for around 10-15 years.[4] Electricity consumption projections with and without energy efficiency measures in the building sector are illustrated in Figure 4.1.

[4] This may not mean that there is no need to build new electricity generation stations. While the overall level of electricity consumed may fall, there is evidence that electricity demand peaks are increasing. Many analysts note that a key climate change adaptation action will be to determine how to deal with higher and longer peaks that flow on from expectations of more hot days, or longer period of hot days in major population centres. It may be necessary to build capacity to meet increases in peak demand. This may also be reduced by introducing effective peak demand management strategies – such as smart meter roll-out, time of use pricing and possibly changes in payment models used by regulators.

Figure 4.1
ELECTRICITY CONSUMPTION, AUSTRALIA WIDE (PJ)



Source: The Allen Consulting Group analysis, 2010.

In Figure 4.1 the growth in predicted electricity consumption with energy efficiency measures flattens in the period to around 2025 and then resumes after that time. The subsequent growth phase is attributable to the full utilisation throughout the buildings sector (that is, existing and new buildings) of higher standard energy efficiency measures and underlying population growth. The full utilisation of energy efficiency measures is a concept that results in a conservatively low estimate of the effect of energy efficiency savings in the future. It is akin to assuming that the housing stock reaches saturation of a certain standard — say 5 stars in terms of the Building Code of Australia — and that higher energy standards are not introduced. To the extent that higher standards are applied to new buildings it is possible that growth in energy electricity demand could be suppressed for longer.

Of course, this analysis is based on all else staying equal. It is important to also consider other factors that may be at play — especially the rebound/flow-on effect discussed below.

4.3 Accelerated emissions abatement

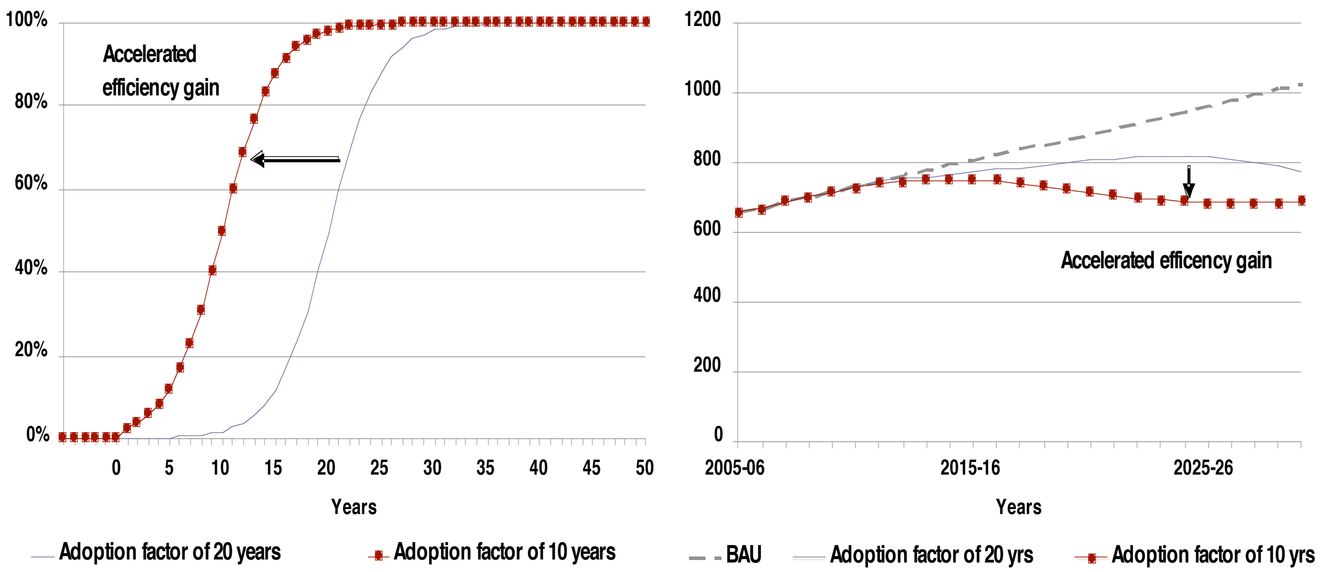
The CPRS and the potential emissions abatement from the buildings sector have been analysed on the basis of long term policy changes. The CPRS scenarios examined are modelled around the CPRS-5 scenario, which starts off with a relatively modest abatement target while Australia awaits coordinated international policy action. Indeed, as noted earlier, the CPRS-5 scenarios would be the minimum target, in the event there is no international agreement on emission reduction (DCC 2009b). The building sector energy efficiencies project a pace of change in line with projections about the arrival of new buildings and the replacement or refurbishment of the existing stock over time.

What would happen if it becomes apparent from climate adversity that emissions must be stabilised more rapidly? Can deeper cuts be made sooner? Drawing on the amount of assistance that has been involved in obtaining industry acceptance of the CPRS to date, it would seem that faster, deeper cuts in emissions using the CPRS would entail even greater costs. And the 'locking-in' of free permit allocation and the 5 year gateways seriously constrain the capacity of CPRS to drive faster, deeper cuts. In contrast, it is not clear that it would be as expensive to accelerate abatement in the building sector. Essentially, on average, for the buildings sector, the main costs would be associated with bringing forward the refurbishments of existing buildings. While commercial buildings have office and shop fit-out cycles (somewhere between 3 and 15 years), refurbishment of residential buildings tends to happen at a lower pace.

Accelerated energy efficiency measures could bring about a major reduction in energy demand and subsequent GHG emissions. This is particularly the case over the period before about 2030 where electricity supply is still projected to be relatively GHG intensive. Likely accelerated energy efficiency scenarios are portrayed in the diagram below.

Figure 4.2

ACCELERATING ADOPTION OF ENERGY EFFICIENCY IN THE BUILDINGS SECTOR AND ENERGY USE



Source: Allen Consulting Group analysis, 2010.

Australia has some experience with measures that accelerate change. In periods of economic recession the Government has provided allowances to investors who bring forward their investment plans. From an economy wide perspective this has the effect of more rapidly replacing old assets with new assets. These policies appear to have been effective in stimulating additional investment which is often associated with macro economic imperatives (to 'kick start' the economy). There is no evidence that the effect of early retirement for many assets involves significant or measurable long term costs to the economy.

4.4 The rebound/flow-on effect

Energy efficiency improvements predicted by simple engineering models are often not achieved due to what have been called 'rebound effects' (Engineers Australia, 2008). Research from overseas and in Australia shows that energy efficiency improvements often make energy services cheaper, and that rebound effects occur when the resulting savings are used to purchase more of the energy service (a direct rebound effect). In addition the savings can be redeployed to purchase other energy intensive goods or services (an indirect rebound effect). These effects may absorb a significant portion or much of the expected savings from energy efficiency measures (Sorrell 2007, Dey 2008). In extreme cases, a so called 'backfire' effect can occur, resulting in more energy being used than before the efficiency measure was introduced.[5]

In practical terms, the rebound effect would be experienced where savings in electricity bills due to better insulation allow households to buy and use bigger flat screen televisions using more electricity and being a source of demand for more greenhouse gas emissions. There are grounds to expect that many decisions made by households and businesses do not take into account energy consumption factors. Pears (2010, personal correspondence) reports on a survey that shows that in office-based businesses, 77 per cent of energy related decisions involved no consideration of the energy consequences. Likewise, in various focus groups meetings for studies examining consumer behaviour, consumers explained that 'large television sets must not use much energy, because if they did the government would have introduced energy labels to warn buyers' (Pears, personal correspondence). The government has subsequently introduced energy labelling on electronic products.

There is a need to manage the risks posed by the rebound effect. Interventions intending to reduce greenhouse emissions through energy efficiency need to allow for and possibly control the scope for rebound effects. Comprehensive policy frameworks are needed. At one level, this may be as simple as adjusting for the extent to which engineering predictions are reduced by rebounds. A more substantive approach involves linking energy efficiency policies with energy and carbon emissions pricing policies. This puts a signal to energy users and others to slow spending on carbon and energy intensive goods and services and to divert demand to less carbon intensive goods and services.

[5] Some energy efficiency experts view that this is a biased perspective. They view that the reality is that the flow-on impact relates to the relative greenhouse intensity of what the 'freed-up' money is spent on relative to investment in energy. A scenario where the 'freed-up' money is invested in additional energy efficiency measures (either in response to regulation or voluntary action) leads to an amplification of the savings rather than a rebound. In this sense, a more balanced term for this effect is a 'flow-on effect'. Indeed, concern about rebound effects provides a case for measures such as increasing taxation on energy (subject to assistance for low income groups), tougher regulation and/or incentives to encourage investment in long-payback energy efficiency measures, so that the rebound effect is converted into an efficiency amplification effect.

The dangers of the rebound effect are not confined to energy efficiency measures alone. The government has promised to ensure that most households are not disadvantaged from the introduction of the CPRS. While electricity prices will be higher as a result of the CPRS, the Government has announced plans to compensate households for higher electricity prices. For many households the Government foreshadows that the compensation will be more than the increase in electricity prices. There is a danger that this would also induce a rebound effect. Households may in fact consume as much electricity as before, or even more.[6]

Raising the energy efficiency in buildings may also be an important means of constraining the rebound effect. If dwellings (and commercial buildings) are inherently efficient, any additional income (either from energy bill savings or an assistance cheque from the Government) that is spent on or in housing would have a lower greenhouse gas profile.

4.5 Key points

Energy efficiency in the buildings sector could reduce the risks associated with the transition to the low carbon economy. Managing demand through energy efficiency in the buildings sector should be seen as being something akin to an insurance premium, involving a cost that avoids payment of higher costs if things go wrong. However, the need to avoid (undesirable) secondary effects, such as the rebound effect, and replace them with forces that amplify savings should also be factored into the overall policy framework.

[6] Under the cap and trade arrangements in the CPRS increased household expenditure on electricity may not necessarily increase greenhouse gas emissions. In principle the cap will still place a binding limit on emissions. Increased demand form households would mean that some other sector, would probably buy less electricity (or some other emissions intensive commodity). The effect is really to shuffle the economic costs of adjustment and possibly to raise the economic costs of adjustment. That is, if households adjust less, it is likely that some other major source of energy demand, such as export oriented aluminium production, would adjust more. In practice what happens is that the costs of meeting the target are shifted and possibly raised. If the costs of meeting the target are higher for say export intensive high emission sectors than households the overall cost of adjustment would increase.

Chapter 5

What needs to be done?

What actions can be taken to raise the prospects of locking in the potential gains from energy efficiency in the buildings sector?

5.1 Filling the gaps

There are already a wide range of policy measures in pursuit of increased energy efficiency and management of the demand side of greenhouse gas emissions. Nonetheless, the previous quantitative analysis has shown that there is still scope for energy efficiency to reduce the demand for energy and emissions beyond the potential of the existing and proposed measures.

This Chapter outlines the general nature of the additional scope for change.

Step beyond new buildings to broaden the scope to existing buildings

Most of the current CPRS complementary policy measures target raising the efficiency of new buildings and assets (such as appliances). Raising energy star requirements in the building code is an example of this broad thrust.

Altering new buildings is a very slow means of bringing about change. On average new buildings represent around 1-2 per cent of the building stock. With this rate of change it would take 50 years or longer to alter the entire stock.

To bring about a meaningful amount of energy efficiency in the building sector, it is necessary to bring about changes in the existing stock of buildings.

Reach out to include commercial and industrial buildings in addition to residential

A key thrust of many of the complementary measures being developed or applied at present relate to changing energy use in residential buildings. This thrust is typified in terms of measures subsidising insulation or the use of solar technologies in homes. A challenge in dealing with households is that there are high costs in contacting or communicating with large numbers of households in return for relatively small amounts of energy savings for each action or intervention. Nonetheless, more effective targeting — particularly on households in non-gas areas, in areas where there are network constraints, are where there are extreme climates — would potentially achieve better results in emission abatement.

Where commercial buildings are concerned, it is at present not clear how much greenhouse gas emissions will actually be reduced as a result of current measures. An example of this ambiguity can be found in the context of requirements for commercial leases to disclose the energy/emissions performance of a building. Clearly the measure raises transparency in negotiations, but unless it actually changes the existing stock (which is not clear) it will not alter the overall level of energy demand and emissions from the occupancy of those buildings. Indeed, application of a model based on the National Australian Built Environment Rating System (NABERS) Commitment Agreement to new buildings, to ensure they work as intended could be a useful complement to BCA and mandatory disclosure.

In contrast, energy use is expected to be faster in the commercial segment of the buildings sector than in the residential segment. There are a smaller number of commercial energy users than households, which generally use more energy than households, and bigger savings could be obtained per action or intervention.

It is likely that further large scale improvements in energy efficiency could be achieved by broadening the focus of measures to more substantively involve commercial buildings, and also the industrial buildings. This should include measures that actually target energy efficiency and greenhouse gas emission savings in commercial and industrial buildings. And in the first instance, to ensure that adequate sub-metering and energy consumption monitoring/feedback is provided to commercial and industrial buildings.

Move beyond prescriptive approaches to providing an incentive for outcomes

Many measures in the current mix of policies intended to raise energy efficiency and reduce greenhouse gas emissions are prescriptive in their effect. The assistance to households to purchase insulation is an example. Here the only flexibility is in the choice between taking assistance and buying a prescribed product or not. This is managing inputs rather than outcomes. In practice there may be many circumstances where a household may achieve better results with an investment in measures other rather than roof insulation. Also, households who have already insulated their roof are effectively penalised, since they are not offered assistance. While insulation is a basic feature, which is important in helping to manage heat stress and there can be efficiencies in economy of scale of roll-out of simple measures, a 'one size fits all' approach does not actually provide the best match for every circumstance. There is little incentive or scope to innovate under such approaches.

Rather than continue with mandatory or prescriptive piecemeal solutions, the next stages of policy development should focus upon providing incentives that encourage particular outcomes, in terms of increased efficiency and lower greenhouse emissions, rather than specifying how this is achieved. Indeed, the existence of incentives, in many cases, reinforces the belief that these are 'good things to do' and enhances acceptance.

Additionally, market intermediaries (such as sales people, designers, installers, tradespeople, office and shop fit-out industries) could also have pivotal roles in GHG abatement. Comprehensive policies approach, coupled with the appropriate incentives mechanism for market intermediaries, could raise the effectiveness of the GHG abatement policies.

5.2 Measures to drive further change

Groups that have considerable expertise with the building sector and energy efficiency have identified a wide range of further measures that could progress change and greenhouse gas emissions abatement in the buildings sector.

The main categories of additional actions that are likely to bring additional change fall into 5 categories including:

i) Private sector incentives

ii) Funded incentives

iii) Regulated performance

iv) Research generation

v) Knowledge dissemination

A range of policy ideas have been identified and reviewed in the original ASBEC *Second Plank* report (2008). This includes:

- a national white certificate scheme;
- accelerated green depreciation for buildings;
- public funding of building retrofit;
- modernise and update the Building Code of Australia with higher standards; and
- enhance performance standards in MEPS. It is not clear that the policy ideas outlined there have been examined in detail and either discarded as being impractical and ineffective or adopted.

The amount of change, including greenhouse gas abatement potential, and the cost and benefits of such change would naturally depend upon the specifics of a policy approach. The key point is that there are many approaches that have been proposed, and that raise the prospect of encouraging better outcomes. These deserve to be examined in more detail to assess if the prospect can in fact be converted into tangible improvements efficiently.

Appendix A

References

Australian Bureau of Agricultural and Resource Economics (ABARE), 2007, *Australian energy national and state projections 2029-2030*, Research Report 07.24, December 2007, Commonwealth of Australia.

Australian Bureau of Agricultural and Resource Economics (ABARE), 2009, *Energy update 2009*, Commonwealth of Australia.

Australian Bureau of Statistics (ABS), 2009, 'Building Approvals, Australia', September 2009, Catalogue 8731.0, Commonwealth of Australia.

Australian Bureau of Statistics (ABS), 2008, 'Population Projections, Australia, 2006 to 2101 ', Catalogue 3222.0, September 2008, Commonwealth of Australia.

Australian Bureau of Statistics (ABS), 2004, 'Household and family projections, Australia 2001 to 2026', Catalogue 3236.0, June 2004, Commonwealth of Australia.

Allen Consulting Group, 2004, *Economic Impact Analysis of Improved Energy Efficiency Phase 2 Report*, report to the Sustainable Energy Authority of Victoria, Allen Consulting Group, Canberra.

Australian Sustainable Built Environment Council (ASBEC), 2008, *The second plank: building a low carbon economy with energy efficient buildings*, July 2008, by the Centre for International Economics.

Carbon Pollution Reduction Scheme Bill 2009, draft legislation, Commonwealth of Australia, see <parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;query=Id:"legislation/billhome/r4127">.

Department of Climate Change (DCC), 2009a, *National Greenhouse Inventory by Economic Sector 2007*, Commonwealth of Australia.

Department of Climate Change (DCC) 2009b, *Australia's action on climate change*, Commonwealth of Australia.

Department of Climate Change (DCC), 2008a, *Carbon Pollution Reduction Scheme: Green Paper*, July 2008, Commonwealth of Australia.

Department of Climate Change (DCC), 2008b, *Carbon Pollution Reduction Scheme: White Paper*, December 2008, Commonwealth of Australia.

Department of Environment, Water, Heritage and the Arts (DEWHA), 2008, *Energy use in the Australian residential sector 1986-2020*, Commonwealth of Australia.

Department of Environment, Water, Heritage and the Arts (DEWHA), 2000, *Impact of minimum performance requirements for class 1 buildings in Victoria*, (formerly the Australian Greenhouse Office), Commonwealth of Australia.

Dey, C. 2008, 'Carbon Footprints: Consumption, Production and Sharing', presentation to the Sustainable Future Workshop 3, downloaded from http://www.actpla.act.gov.au/topics/significant_projects/change/sustainable_future/workshop_three/presenters_menu, 7 December 2009.

Engineers Australia 2008, Australian Climate Change Policies: Submission to the Garnaut Review, January 2008.

Garnaut Climate Change Review (Garnaut Review), 2008, *Garnaut Climate Change Review Final Report*, September 2008.

George Wilkenfeld and Associates, 2005, *Guide to Preparing Regulatory Impact Statements for the National Appliance and Equipment Energy Efficiency Program (NAEEEP)*, May 2005, prepared for the Australian Greenhouse Office.

George Wilkenfeld and Associates, 2009, *Regulation Impact Statement: for Consultation — Specifying the Performance of Water Heaters for new Class 1 Buildings in the Building Code of Australia*, July 2009, prepared for DEWHA.

Green Building Council of Australia (GBCA) 2008, *Valuing Green*.

Kruk, Robyn, AM, 2009, 'Encouraging greater energy efficiency', 20 August 2009, see <www.environment.gov.au/about/media/secretary/2009/sp20090820.html>.

McKinsey & Co, 2009, *Unlocking Energy Efficiency in the U.S. Economy*, July 2009, see <www.mckinsey.com/clientservice/electricpowernaturalgas/US_energy_efficiency>.

Pears, A. 2007, *Residential sector energy efficiency scenario: Background*, Royal Melbourne Institute of Technology, Melbourne,

Sorrell, S. 2007, *The Rebound Effect: An Assessment of the Evidence for Economy-wide Energy Savings from Improved Energy Efficiency*, UK Energy Research Centre, October 2007, downloaded from www.ukerc.uk/Home.aspx 7 December 2009.

Syneca Consulting 2008, *Regulatory Impact Statement: Consultation Draft — Proposal to Phase-Out Inefficient Incandescent Light Bulbs*, September 2008, prepared for DEWHA.

Treasury, 2008, *Australia's Low Pollution Future: The Economics of Climate Change*, October 2008, Commonwealth of Australia.

Appendix B

Greenhouse policy scenarios

Five scenarios are considered in this report — business as usual (BAU), CPRS-5, CPRS (plus complementary policies) and energy efficiency potential. The most significant long-term change to be factored into the modelling for this report involves the CPRS, which is expected to substantially reduce electricity emission factors over time. The effectiveness of the buildings sector to provide abatement through reduced energy consumption is ultimately dependent on the carbon intensity of the electricity that it purchases and utilises, and as electricity become 'cleaner', the energy savings that can be achieved from the buildings sector will become less effective.

The **BAU** scenario used in this report is based on the Treasury's reference scenario, modelled in July 2008. It provides a useful reference against which to compare other policies, including the CPRS.

The **CPRS-5** scenario considers the impacts of higher electricity prices and the impacts of substantially lower electricity emission factors over time. Specifically, the Treasury expects the implementation of CPRSS to lower electricity emission factors by almost 80 per cent.

CPRS (plus complementary policies) is the fourth relevant scenario where a range of additional policies (leading to greater abatement) are considered. These include policies to:

- phase out incandescent light bulbs;
- subsidise insulation;
- provide rebates for solar water heating systems; and
- revise the energy efficiency requirements of the Building Code of Australia for residential and commercial buildings.

The implementation of various government policies would encourage a faster take up rate at which households and businesses adopt new technology. In this report, these policies would shorten the timeframe for 50 per cent of the residential and commercial buildings to adopt new energy efficient technologies from 12 years to 11 years.

The final scenario, **energy efficiency potential**, forecasts the abatement potential of energy efficient investments to significantly reduce energy consumption using available technologies. Potential energy efficiency investments that are not covered within previous scenarios include:

- greater use of natural lights;
- use of more efficient appliances;
- better insulation; and
- use of natural ventilation.

Appendix C

The buildings sector and greenhouse

The buildings sector is a major source of demand for energy particularly electricity that translates into significant greenhouse gas emissions. Decisions being made about buildings now can lock in energy needs and emissions for many years into the future.

C.1 The buildings sector

The buildings sector can be viewed as being comprised of two broad segments — a residential and a commercial segment (ASBEC 2008). Buildings in the residential sector represent the main space of residence for the population and include detached houses, attached dwellings, and flats or units. The commercial segment comprises many services that have become the backbone of the economy (see Table C.1).

Table C.1
THE BUILDINGS SECTOR SEGMENTS

Residential	Commercial
Detached houses	Wholesale trade
Attached houses	Retail
Buildings containing two or more sole occupancy units	Accommodation, cafes and restaurants
	Communication services
	Finance and Insurance
	Property and business services
	Government administration and defence
	Education
	Health and community services
	Cultural and recreational services
	Personal and other services

Source: ASBEC 2008, ABARE 2007 and ABS, ANZSIC 1993 Industrial Classifications

The buildings sector should not be confused with the construction sector. Buildings, of course, include the existing stock of buildings as well as new buildings.[7]

[7] Potentially, the construction sector could be included as part of the buildings sector. Official government statistics and forecasts (such as those prepared by ABARE) separately identify the construction sector rather than include it within commercial or non-residential building and therefore within the overall building sector. The focus of this study is upon emissions that derive from activities within buildings and that are shaped by the use and design of those buildings. This area is less well studied than many of the others areas. In addition, broader consideration of emissions from within buildings could include industry at large. Industry would include many human activities that is not limited to the provision of housing and shelter to households. Many of the activities within industry pose special challenges for greenhouse gas abatement and are studies in detail elsewhere.

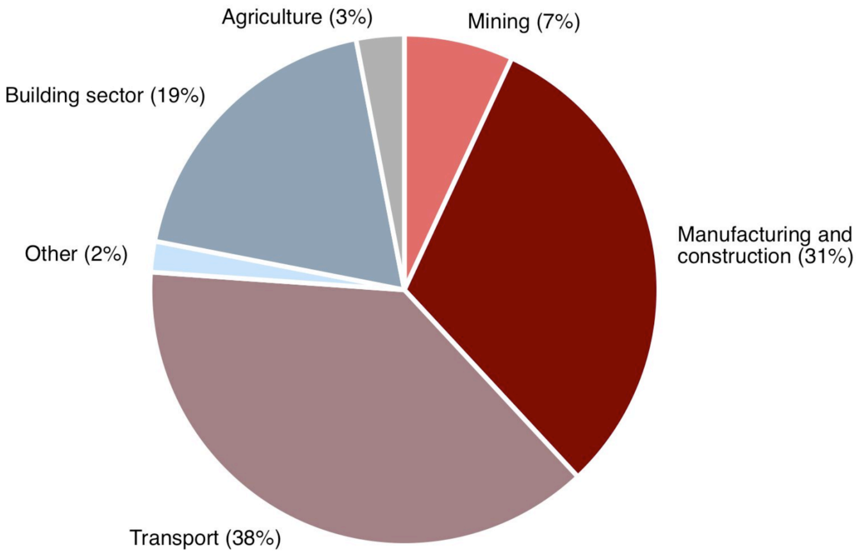
The buildings sector additionally excludes many activities that may also involve buildings or structures. These excluded activities span activities such as agriculture (farm buildings), manufacturing (factories) transport (train stations, bus terminal and airports etc) and construction. Excluded activities typically involve direct GHG emissions from the burning of fuels (that is, in the terms of GHG inventories and accounts, they are stationary and non-stationary point sources) or other specific activities or processes (such as the making of materials. Emissions from these other sources are important and are the subject of many other studies.

C.2 Energy use

The buildings sector is a major source of demand for energy. Indeed, according to the most recent ABARE data, the buildings sector (that is, the operation of buildings and the equipment within them) consumed 685 PJ in 2007-08. This is equivalent to approximately 19 per cent of total energy consumption (or energy end use) in Australia.

Figure C.1

ENERGY CONSUMPTION SHARE BY SECTOR 2007-08 (%)



Note: the 'other' includes solvents, lubricant, bitumen and greases.

Source: ABARE, 2007.

As illustrated in Figure C.1, the built environment is the third largest sector in terms of energy consumption, behind transport (38 per cent), and manufacturing and construction (31 per cent).

C.3 GHG emissions

The buildings sector is not a large direct emitter of greenhouse gases. Based on the latest greenhouse accounts, direct emissions (known as scope 1 emissions from actual combustion of fuels within the sector) from residential (non-transport) and commercial services and construction accounted for 29 Mt CO_2-e in 2007, while Australia's total emissions amounted to 597 Mt CO_2-e (DCC, 2009).

Indirect emissions from the building sector

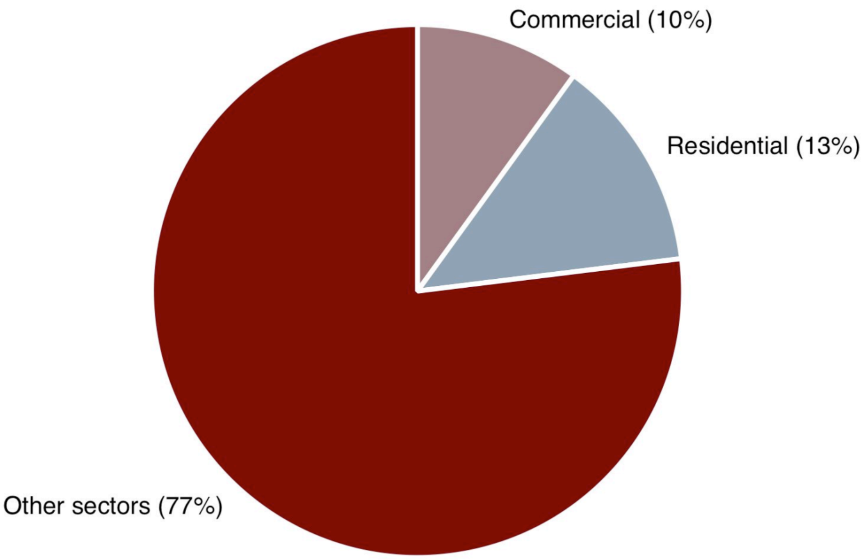
The key issue with the buildings sector is that it is a major consumer of energy that is supplied by upstream sources (such as coal burning electricity generators), which in turn produce the direct GHG emissions. This indirect source of emissions is accounted for as scope 2 emissions within the national greenhouse accounts. These emissions are a consequence of the buildings sector's demand for energy, and they can be altered. As such, it is reasonable and useful to look at emissions from the perspective of their source of demand rather than their source of supply.

Additionally, in estimating the GHG emission from consumption of purchased electricity, it is important to consider indirect emission that occur during the extraction, production and transportation of fuel burned at generation as well as the indirect emission attributed to the loss in electricity in the transport and distribution network. These scope 3 emissions will also contribute to the GHG emission by end-users of electricity such as the building sector.[8]

Taking into account energy consumption and scope 2 and scope 3 emission factors, the indirect GHG emissions from the buildings sector are estimated to amount to 135.7 Mt CO_2-e in 2007-08. This represents 23 per cent of Australia's total emissions (see Figure C.2).

Figure C.2

GREENHOUSE GAS EMISSIONS BY BUILDINGS SECTOR SEGMENT 2007-08 (%)



Note: 'Other sectors' includes the rest of the Australian economy.

Source: ABARE, 2007 and Allen Consulting Group 2010. Note: 23 per cent of national GHG emissions represent 135.7 Mt CO_2-e. The residential sector contributes 76.0 Mt CO_2-e, and the commercial sector 59.7 Mt CO_2-e.

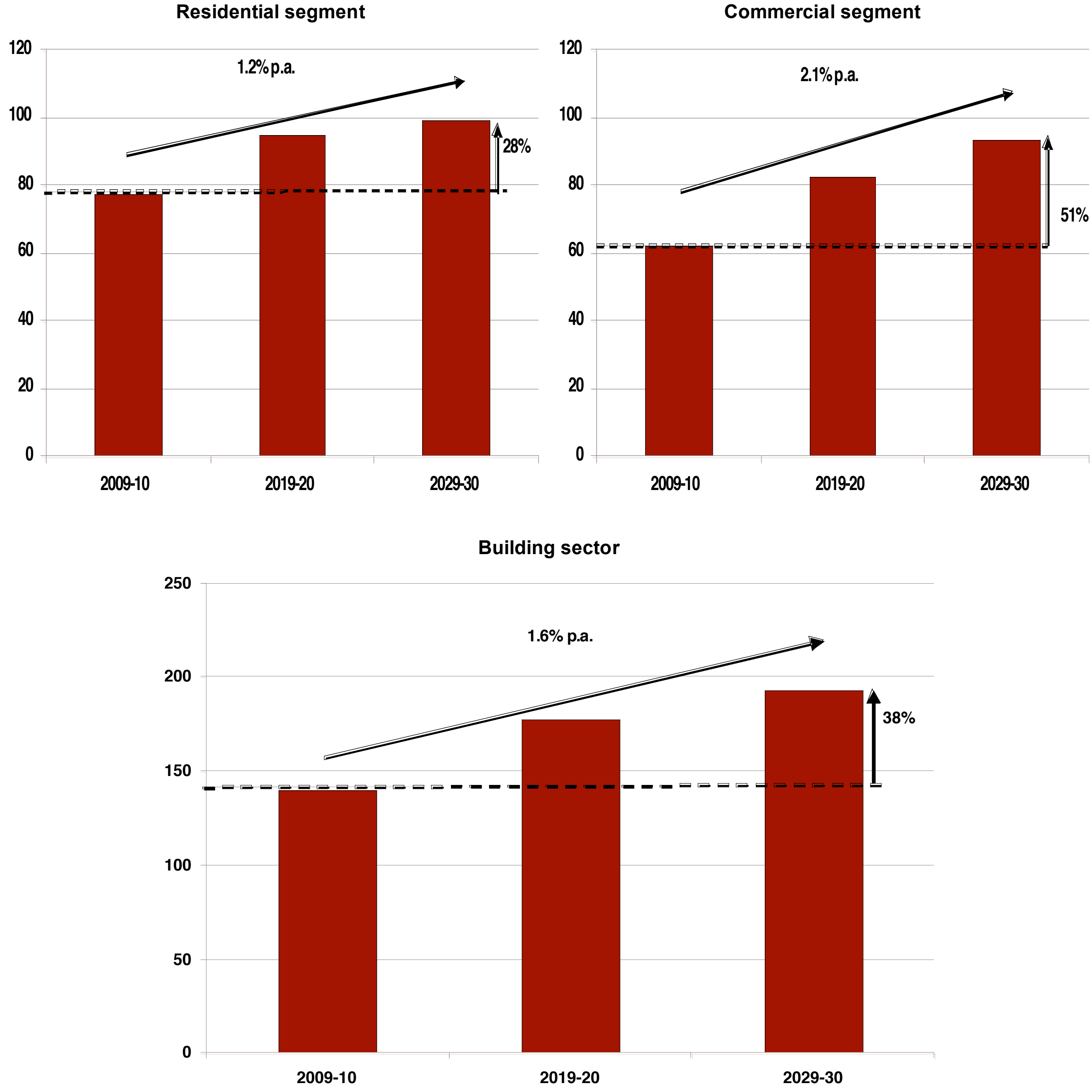
[8] Note that scope 3 emissions in one industry includes emissions that would be counted as scope 1 or 2 emissions in other industries. Thus adding up every sector's scope 3 emissions would result in a figure that is larger than the economy's actual emissions as some emissions are counted more than once. It is not clear that governments would generally set policy targets or base regulations for a specific industry with scope 3 emissions accounting, but they are important because they can show that decisions taken in regard to an industry have implications beyond that industry and for the bigger picture.

The 'Business As Usual' outlook for emissions

The 'Business As Usual' (BAU) scenario is based on ABARE 2007, which includes policies that are placed since 2007. Under the BAU scenario, GHG emissions are expected to increase by approximately 38 per cent, from 140 Mt CO_2-e in 2009-10 to 193 Mt CO_2-e in 2029-30 (see Figure C.3).

Figure C.3

BAU PROJECTED EMISSIONS IN THE BUILDINGS SECTOR (Mt CO_2-e)



Source: ABARE, 2009; Allen Consulting Group analysis, 2009

Notably, the expansion in emissions is largest in the commercial segment, where emissions are estimated to grow by 1.8 per cent per annum reflecting the impact of growth in economic activity. In comparison, emissions by the residential segment are forecast to increase at a lower rate of 1.2 per cent per annum, broadly in-line with current projected population growth (ABS 2008).

These BAU projections are based largely upon forecasts produced by ABARE for residential and commercial services energy consumption to 2030, with emissions to 2030 based on extrapolations of ABARE's growth rates.

C.4 The buildings sector revisited

The situation and outlook for the buildings sector is not materially different today from when the *Second Plank* report was published. ABARE has revised its outlook, so that GHG emissions are forecast to be slightly slower over the long term than previously estimated.[9] However, current data indicates that the buildings sector accounts for a significant share of energy use and 23 per cent of related GHG emissions. Without major policy change, the long term outlook is for buildings sector GHG emissions to grow at a relatively rapid pace.

[9] ABARE projections do not include many recent policy measures such as the introduction of the 20 per cent Renewable Energy Target that was passed by Parliament in late 2009. The BAU projections therefore overstate emissions intensity of electricity and GHG emissions compared to what can be expected following the implementation of this and other policies. These measures are included in analysis that follows to assess the likely outlook and impact of policy changes in the buildings sector.