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AUSTRALIAN SUSTAINABLE BUILT ENVIRONMENT COUNCIL

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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Commissioned by the ASBEC Climate Change Taskgroup (CCTG)

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About ASBEC and this Report

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

ASBEC members are 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 sector's social and environmental impacts.

ASBEC's Climate Change Task Group includes representatives from the Australian Institute of Architects, Consult Australia, Green Building Council of Australia, Facility Management Association of Australia, the Property Council of Australia and Szencorp. This report has been made possible with funding from the task group members.

This report updates the findings in ASBEC's *The Second Plank Report: Building a Low Carbon Economy with Energy Efficiency Buildings*, released in September 2008.

Government policy changes and new data available since the release of the Second Plank Report is reviewed in this Update. Further, the outlook for greenhouse gas emissions (GHG) abatement potential in the buildings sector is modelled under both a Carbon Pollution Reduction Scheme (CPRS) and non-CPRS scenario.

The report demonstrates the significant potential of the buildings sector to contribute to reducing Australia's GHG emissions and deliver energy savings, and suggests government actions to achieve this.

The ASBEC Climate Change Task Group intend to use this report to support their call for government policy changes to overcome market barriers to the buildings sector reaching its full abatement potential.

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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.
- A set of key changes emerge around the progress of the Carbon Pollution Reduction Scheme (CPRS) announced by the Australian Government. The CPRS involves an emissions trading scheme, introduces a price on carbon pollution and ensures that all businesses take this into account when making their business decisions. While adoption of the CPRS has been deferred, it remains the policy of the Australian Government to implement it after the expiry of the current commitment period of the Kyoto Protocol.
- Originally intended as part of the overall CPRS strategy, the Australian Government has implemented a Renewable Energy Target (RET). The RET legislation which passed through Parliament in 2009, mandates that 20 per cent of Australia's electricity will be generated from renewable energy sources by 2020.
- In addition, Australian Governments have announced a number of complementary policies to combat GHG emissions that specifically target the buildings sector. These 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 at time of resale and reletting and subsidies for ceiling insulation and solar water systems in the residential sector. These 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 (in practice and in prospect in the case of the CPRS) 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 when taking into account the CPRS and RET and given energy efficient policies that are already in place, additional energy efficiency measures can bring GHG emissions from the buildings sector down from 162.7 Mt CO2-e to 129.5 Mt CO2-e in 2029-30. This is equivalent to a reduction of 33.2 Mt CO2-e.

- The additional reduction in buildings sector emissions beyond those that can be expected to be driven by the CPRS and RET schemes arise from technical changes in buildings and appliances used in buildings. It involves replacing old technologies, systems and appliances that tend to become locked into the fabric of buildings with more energy efficiency alternatives. The gains have been calculated on the basis of making like-with-like replacements and using known, proven and cost effective technologies.
- The prospect for energy efficiency gains beyond those stimulated by measures such as the CPRS arise from the fact that for the buildings sector, the CPRS acts essentially as a tax. Once the building sector has adjusted to higher energy costs the CPRS provides no scope or incentive to enable the buildings sector to realise or sell additional reductions or surplus savings capacity to reduce their demand for electricity and related GHG emissions even though these savings may be at lower cost than savings able to be pursued in other sectors.
- Increasing attention is being applied to the possibility that the CPRS may not be implemented, or that it may be deferred for some time. Analysis reported here suggests that energy efficiency in the buildings sector may play an even more important role if this is the case. Without the CPRS, the emission intensity factor for electricity generation would be higher and the price of electricity would be significantly lower than expected. GHG emissions from the buildings sector would increase to around 185.2 Mt CO2-e in 2030.
- Without the CPRS, additional energy efficiency measures would be more effective and could reduce GHG emissions from the buildings sector to 138.5 Mt CO2-e in 2029-30, a reduction of 46.7 Mt CO2-e. The technical capacity to reduce demand for electricity and hence reduce greenhouse gas emissions may be of strategic value if the CPRS is deferred.
- 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 lower 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 or supply side 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 reliance on when CCS or other low emission electricity generation technologies becomes available, or when they become 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 and drive amplification of abatement by applying policies that direct expenditure into areas that reduce emissions.

- While pursuit of additional energy efficiency in the buildings sector would bring many advantages, it is also clear that there are many barriers to adoption of energy efficiency measures. Much emphasis has been paid to information gaps and the owner occupier problem. Addressing these issues has been the target of many recent policy approaches. A key fundamental problem, especially for decision-makers in regard to commercial or non-residential buildings is the funding gap — that is the long period between when energy efficiency measures are invested in and when the benefits are realised in terms of energy savings and other gains.

- 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. Many of these encourage investment in energy efficiency by raising incentives to invest in it and close the funding timing gap. 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 been 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 own 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 and subject to Parliamentary debate. 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 the current policy context that shapes 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 — reviews how changes in the current policy context can be expected to change greenhouse gas emissions that are attributable to the buildings sector, identifies the fuller potential that energy efficiency in the buildings sector could bring in terms of GHG abatement and other benefits and assesses what additional roles can be played by further energy efficiency measures.

Chapter 3 — assesses how the role of the identified additional energy efficiency would change in the event that CPRS is postponed indefinitely.

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

Buildings sector energy use and energy efficiency

This chapter looks at the energy use and greenhouse gas emissions that could be attributed to the buildings sector and the role that energy efficiency could play. This is based on current official projections of energy end use and policies.

2.3 Official forecasts and the buildings sector

The Australian Bureau of Agricultural and Resource Economics (ABARE) released the *Australian energy national and state projections 2029-2030* in March 2010. These projections form an official view about energy use in Australia. In addition to normal updating of regular projections, including making allowances for the most recent projections for growth in the economy and the population, they incorporate recent and expected policy settings. Most importantly these projections include the RET scheme which has become law and the proposed CPRS and ETS which is yet to become law, although this forms the Australian Government's current policy.

Box 2.1

CHANGED POLICY AND OTHER FACTORS IN ABARE ENERGY PROJECTIONS

The ABARE 2010 projections take into account the following policy settings.

- The Renewable Energy Target (RET)
- Application of an emissions trading scheme (ETS) as proposed within the Carbon Pollution Reduction Scheme (CPRS) and related measures sufficient to achieve a 5 per cent carbon emissions reduction below 2000 levels by 2020 (the CPRS-5 policy). The design of the carbon emissions reduction target modelled is consistent with the proposed CPRS as specified in the White Paper on the CPRS released on 15 December 2008 and amended on 4 May 2009; and
- Other existing government initiatives such as the Clean Energy Initiative and National Strategy on Energy Efficiency (ABARE 2010).

Other key parameter changes include the following factors.

- Economic growth — The GDP assumptions were based on the modelling undertaken by the Australian Treasury for the 5 per cent emissions reduction target, adjusted with the revised GDP assumptions as presented in Mid-Year Economic and Fiscal Outlook 2009-10 in November 2009. Average annual GDP growth in Australia is forecast to be 2.9 per cent. This is higher than the 2.6 per cent average annual GDP growth used in the ABARE 2007 report.
- Population growth — Population is expected to increase from 21.6 million in 2008 to 28.5 million in 2030.

Source: ABARE 2010

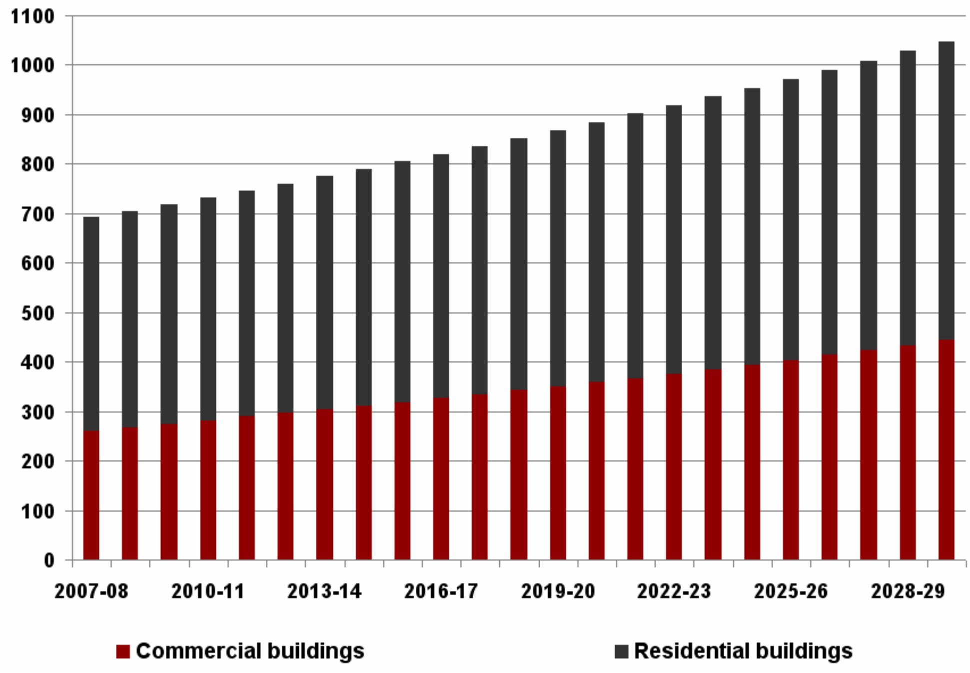
The ABARE projections provide much information about energy use in the buildings sector. They essentially provide the current baseline for energy use (termed 'ABARE 2010' in this report).

Based on ABARE 2010 it appears that the building sector accounts for 19 per cent of total energy consumption (that is, final consumption or end use) in Australia (in 2007-08, the opening year of the ABARE 2010 projections). More information about the composition and role that the buildings sector plays in terms of a source of demand for energy is documented in Appendix B of this report.

Energy consumption in the buildings sector is projected to grow steadily. Figure 2.1 shows that energy consumption in the buildings sector is expected to increase from 692 PJ in 2007-08 to 1048 PJ in 2029-30. This increase is particularly notable as it is expected to occur despite an expected increase in electricity prices rising by around 30 per cent (in real terms in 2007$) over current electricity prices by 2029-30.[1]

Figure 2.1

TOTAL BUILDINGS SECTOR: ESTIMATED ENERGY USE (PJ)



Note: ABARE 2010 projections take into account the Renewable Energy Target (RET), other policies to drive a 5 per cent reduction in GHG emissions below 2000 levels by 2020 packaged within the CPRS, as well as existing government initiatives.

Source: Allen Consulting Group 2010, ABARE 2010 and ABARE 2009.

The ABARE 2010 projections do not provide the breakdown of energy consumption by commercial buildings and residential buildings. These have been estimated using the share of energy consumption as published earlier by ABARE (2007). On this basis it is estimated that energy consumption in:

- residential buildings increases from 431.4 PJ in 2007-08 to 604.6 PJ in 2029-30 or an average annual growth of 1.5 per cent per annum; and

[1] Reflecting concerns about the uncertainty involved in 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.

- commercial buildings increases from 260.6 PJ in 2007-08 to 443.1 PJ in 2029-30 or an average annual growth of 2.4 per cent per annum.

2.4 Baseline buildings sector greenhouse gas 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 which are largely from actual combustion of fuels within the sector) from residential (non-transport) and commercial services and construction accounted for 29.2 Mt CO_2-e in 2007, while Australia's total emissions amounted to 597.2 Mt CO_2-e (DCC, 2009).

Indirect emissions from the building sector

A 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.

Additionally, in estimating the GHG emissions from consumption of purchased electricity, it is important to consider indirect emissions 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.[2]

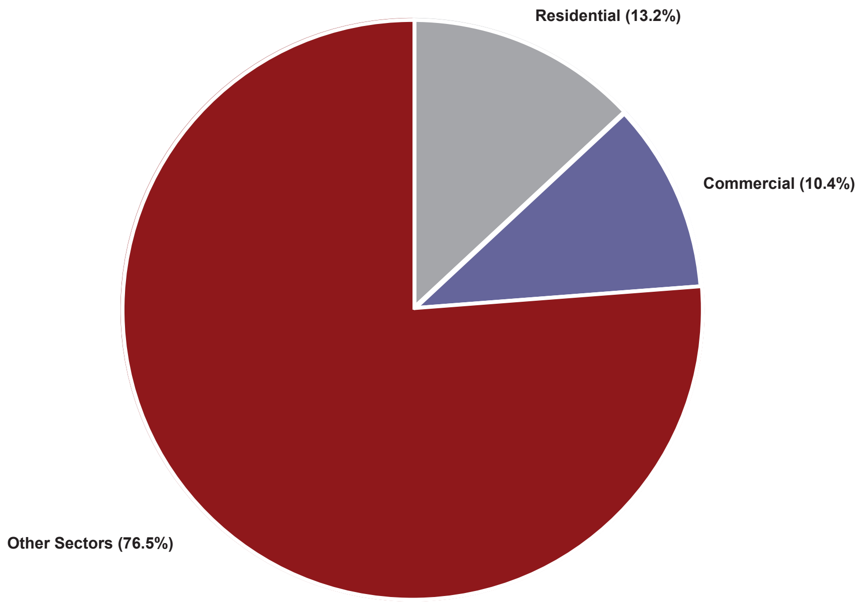
These emissions are a consequence of the buildings sector's demand for energy, and they can be altered. As such, it is reasonable and useful to look at emissions from the perspective of their source of demand rather than their source of supply.

Taking into account energy consumption and scope 2 and scope 3 emission factors for the differing fuels including electricity consumed in the buildings sector, the indirect GHG emissions from the buildings sector are estimated to amount to 137.1 Mt CO_2-e in 2007-08. This represents 24 per cent of Australia's total emissions (see Figure 2.2).

[2] Note that scope 3 emissions in one industry include 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.

Figure 2.2

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



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

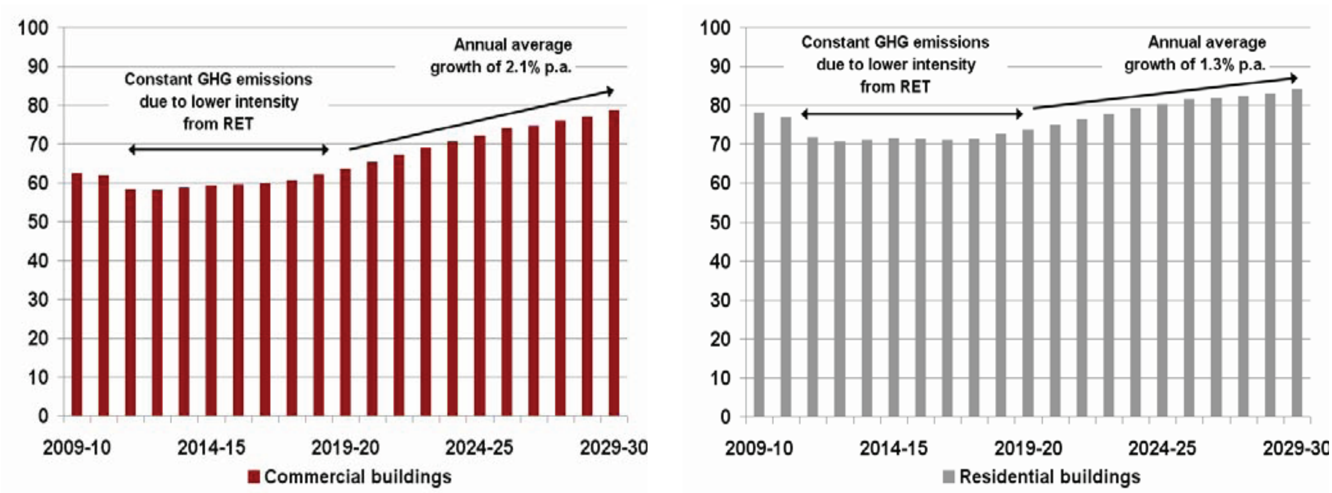
Source: ABARE 2010, Treasury 2008 and Allen Consulting Group 2010. Note: figures may not add to 100 per cent due to rounding. The residential sector contributes 76.8 Mt CO_2-e, and the commercial sector 60.3 Mt CO_2-e. GHG emissions of 137.1 Mt CO_2-e represent 24 per cent of national total.

Baseline GHG emissions growth

Reflecting the ABARE 2010 energy use baseline, GHG emissions due to energy consumption in the buildings sector are expected to grow into the future. This is estimated to rise from 137.1 Mt CO2-e in 2007-08 to 162.7 Mt CO2-e in 2029-30. This is an increase of around 19 per cent over the period.

Figure 2.3

BUILDINGS SECTOR GHG EMISSIONS BY SUB-SECTOR (MT PA)



Source: ACG

Notably, reflecting the workings of the CPRS and the RET in the baseline projection, emissions are essentially contained in the period up to around 2019-20, and then grow thereafter. The rate of growth differs by sub-sector. The growth rate in emissions after 2019-20 is higher for the commercial sector reflecting the influence of growth in economic activity and are relatively lower in the residential sector reflecting trend rates of population growth.

2.5 Potential energy efficiency in the buildings sector

In updating the Second Plank report The Allen Consulting Group has reviewed the evidence tabled by ASBEC and others about the technical potential for energy efficiency in the buildings sector. Details about this potential are provided in Box 2.2.

Box 2.2

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 appliances – such as 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 2008

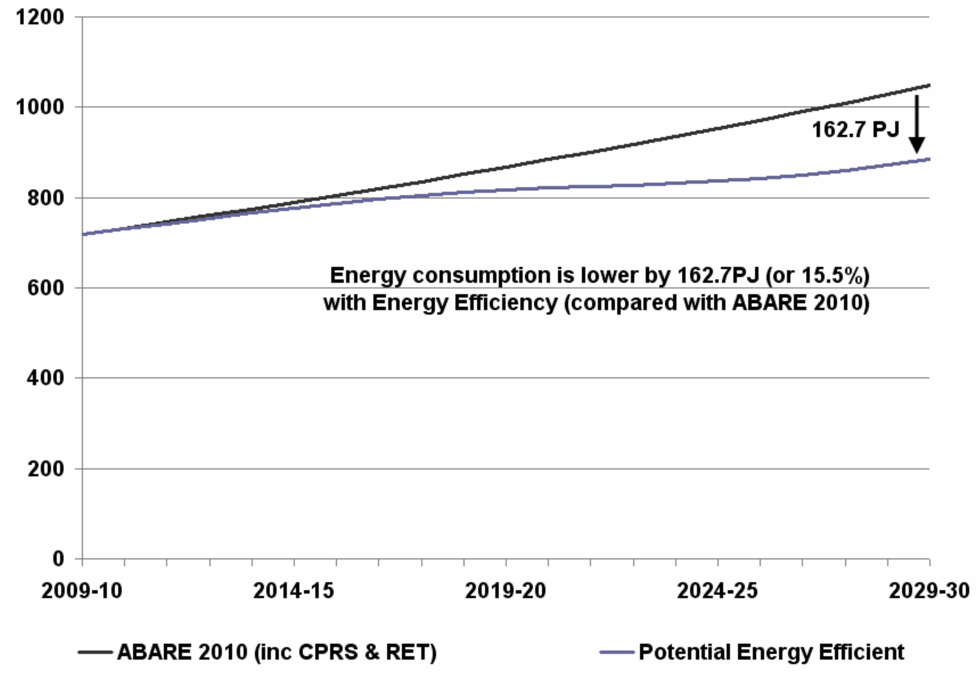
The potential for energy savings from energy efficiency measures considered in this study emerges from like-for-like substitution of existing technologies used in houses and office buildings with more energy efficient alternatives using current known and applied technologies. Buildings are long-lived and many appliances and technologies used in them or technologies fitted some time ago are less efficient than those that are available now after decades of technological change.

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. 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).

In preparing the update of the original Second Plank report it is necessary to account for reductions in energy use that will be driven by policy changes that are taken into account in the baseline scenario. A top down process has been employed. This identifies the expected aggregate change in energy demand reflecting factors such as expected changes in prices. The methodology proceeds by assuming that the change in energy demand will be accommodated by the lowest cost means available to the buildings sector, which is generally the application of energy efficiency approaches. Thus, a slice of the full potential technical efficiency gains that were earlier identified by ASBEC are expected to be absorbed by changes in the baseline projection including the future adoption of the CPRS.

The technical potential for reduced energy consumption in the buildings sector is illustrated in Figure 2.4. The black line and the blue line indicate the energy consumption by the buildings sector under the 'ABARE 2010' and 'Potential Energy Efficient' scenarios respectively. Adopting the identified potential range of energy efficiency measures could potentially lower energy consumption in the buildings sectors from 1048 PJ under the ABARE 2010 scenario to 885 PJ in 2029-30.

Figure 2.4
TOTAL BUILDINGS SECTOR: ENERGY USE (PJ)



Note: ABARE 2010 projections take into account the Renewable Energy Target (RET), other policies to drive a 5 per cent reduction in GHG emissions below 2000 levels by 2020 packaged within the CPRS, as well as existing government initiatives.

Source: Allen Consulting Group 2010, based on ABARE 2010, ABARE 2009, Pears 2007.

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.

2.6 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.

A key change since the publication of the original Second Plank report is the introduction of many policies and policy plans to reduce energy needs in the buildings sector and reduce GHG emissions in general. These have three major effects on energy use in the buildings sector:

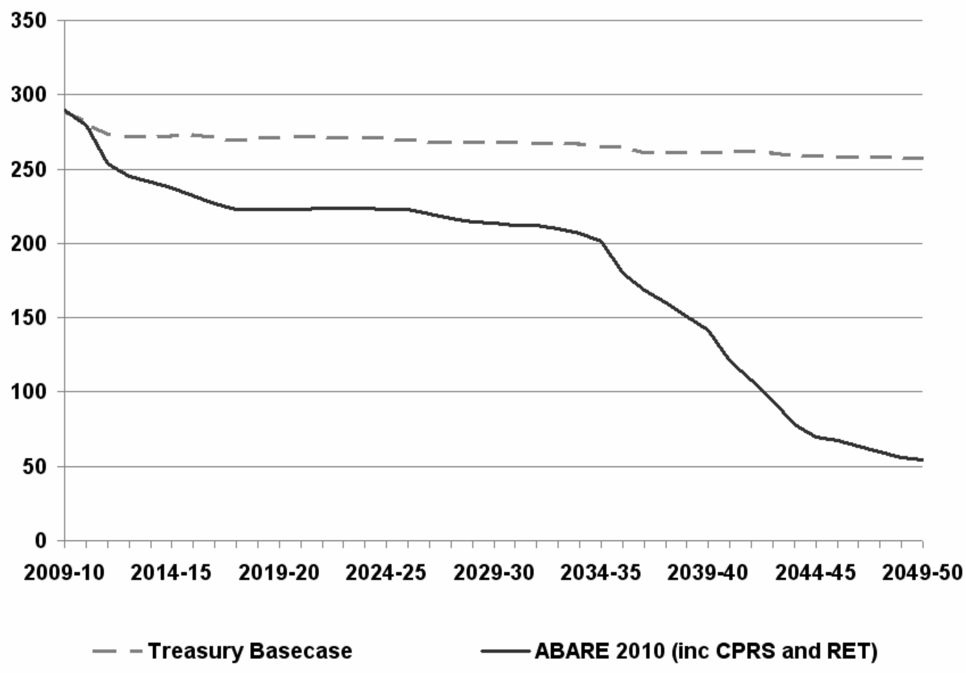
- raising prices for electricity (due to applying prices to GHG emissions under the CPRS and higher prices for renewable electricity generation under the RET) which would reduce demand for electricity.
- introducing specific energy efficiency measures which have the effect of taking up reductions that were previously identified; and
- reducing the greenhouse gas intensity of energy (where alternative technologies produce electricity with less or zero emissions).

The third effect is possibly less well known than the others. The Treasury's 2008 modelling of the CPRS revealed that introducing the CPRS is thought to result 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 (see Figure 2.5).

The projected plunge in the GHG intensity of electricity generation is driven initially by the RET scheme that directly reduces the GHG intensity of electricity supply. This is followed by the projected widespread application of electricity supply technologies such as Carbon Capture and Storage (CCS) throughout Australia. CCS is projected in the Treasury modelling to become a major factor after 2030 and it is portrayed as driving a deep and rapid reduction in emissions intensity in the projections used and reported by the Government.

Figure 2.5

ESTIMATES OF SCOPE 2 AND 3 EMISSION INTENSITY FACTOR FOR ELECTRICITY GENERATION (KG CO_2-e/GJ)



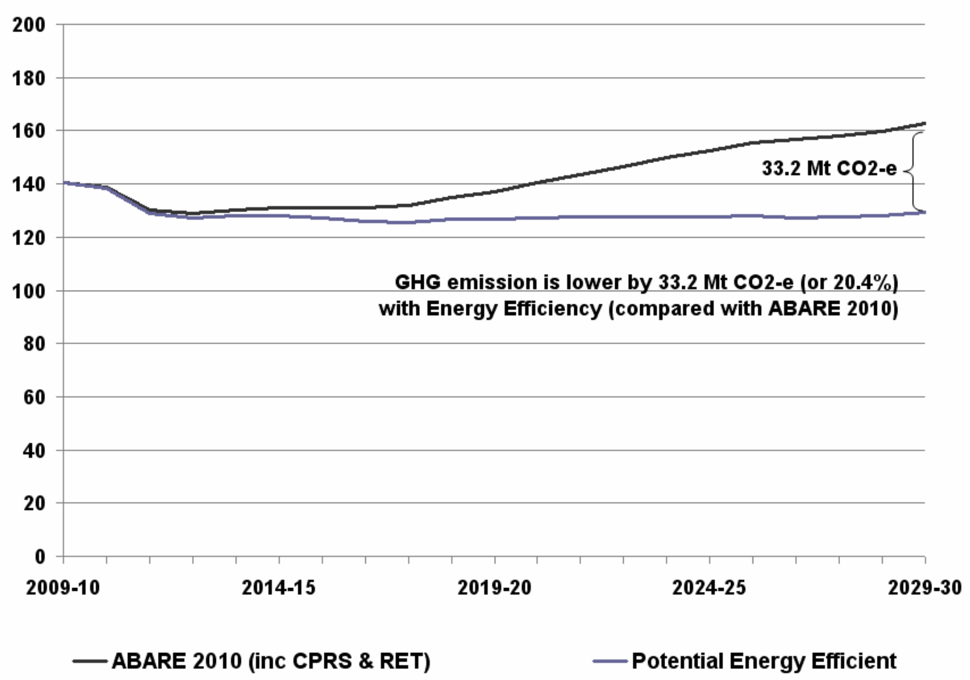
Note: Treasury Basecase scenario refers to the reference case in Treasury 2008 where there is no CPRS and RET. ABARE 2010 scenario refers to the CPRS -5 as modelling in Treasury 2008, which includes the RET and a 5 per cent carbon emissions reduction below 2000 levels by 2020.

Source: Allen Consulting Group 2010, based on ABARE 2010, Treasury 2008, MMA 2008, DCC 2009.

Adopting the full potential range of energy efficiency measures identified by ASBEC could result in a substantial reduction in GHG emissions in the buildings sector compared to the ABARE 2010 scenario. Emissions in the buildings sector are projected to be 33.2 Mt CO_2-e (or around 20.4 per cent) less than the ABARE 2010 scenario by 2030.

Figure 2.6

PROJECTED BUILDINGS SECTOR EMISSIONS (Mt CO_2-e)



Note: ABARE 2010 projections take into account the Renewable Energy Target (RET) and a 5 per cent carbon emissions reduction below 2000 levels by 2020 have been incorporated in the projections, as well as other existing government initiatives.

Source: Allen Consulting Group 2010, based on ABARE 2010, ABARE 2009, Pears 2007.

It is important to note that the technical potential for energy efficiency considered in this report is an assessment of the possible changes utilising existing technologies and does not take into account behavioural changes or future technological development that may change outcomes.

The reduction in projected GHG emissions in the buildings sector by 2030 is lower than the estimate made in the original Second Plank report. The original report indicated that energy efficiency in the building sector could drive reductions of between 57Mt to 66Mt per annum by 2030. The current estimate is about half of those potential savings. The difference is driven by the changes in the baseline projection which includes raised prices for electricity due to the CPRS, energy efficiency policies already in place since the previous study and a reduction in the projected GHG intensity of electricity.[3]

[3] Given the substantial challenges being faced by those seeking to develop commercial CCS systems, the size of public subsidies that are requested to support the introduction and operation of CCS technologies, the Treasury modelling assumptions relating to an expected and dramatic reduction in the GHG intensity of electricity due to CCS technologies seem somewhat heroic and may also be subject to revision in time.

2.7 Other impacts

In addition, it is important to acknowledge that energy efficiency in the building sector introduces other benefits that are worthy in their own 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 ratios 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:

- assist with adaptation by making buildings cope better in more extreme conditions;
- bring health benefits for occupants from reduced heat stress;
- raise productivity; and
- involve improved resilience – buildings operate better if and when energy supplies are interrupted if they are built to rely on less energy inputs.

2.8 Barriers to change

Given the advantages of increased energy efficiency in the building sector what is stopping 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 person affected by it.

Some of these issues are addressed by the mix of policies included in the CPRS, the RET and other recent policy measures. Others have not been addressed, or are not fully addressed.

One point is to note that, while the CPRS provides some incentive for parties in the buildings sector to improve their energy efficiency, it does not fully realise the energy efficiency potential of the buildings sector. Essentially, for the buildings sector, the CPRS imposes a tax on consumption of electricity (and GHG intensive energy sources in general). Once the parties in the buildings sector have adjusted to higher prices due to the introduction of a CPRS they have no incentive to make further reductions, even though these are available and may have a lower cost to the economy than the price of the tax. This is because under the CPRS it is not possible for parties in the buildings sector to 'outperform' (that is, to make greater efficiency gains than those stimulated by an increase in the cost of electricity and other GHG intensive energy sources) and trade emissions reductions.

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

2.9 Savings potential revisited

Overall, it seems that revisions to energy use forecasts and other factors have not changed the picture greatly. After factoring RET and CPRS, there still appears to be great potential to reduce greenhouse gas emissions through energy efficiency in the buildings sector. The identified technical potential for reductions in GHG emissions in the buildings sector in addition to those stimulated by the CPRS and RET policies amounts to 33 Mt by 2030.

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

First and second planks reconsidered

What is the role of energy efficiency in the buildings sectors if policy approaches such as the CPRS are postponed indefinitely?

3.10 Uncertainty surrounding the CPRS

Due to a lack of bipartisan support for the Carbon Pollution Reduction Scheme (CPRS), combined with slow progress on reaching a global agreement to limit carbon emissions, the introduction of the CPRS has been delayed. This section of the report examines the impacts of energy efficiency in the buildings sector if the CPRS was postponed indefinitely and no alternative price signal were introduced.

3.11 The outlook without the CPRS

The baseline projection in the previous chapter was founded on official projections of the energy outlook for the buildings sector including the CPRS and the RET. Naturally, this baseline would change substantially if the full CPRS package was not implemented. The key areas of change are in terms of changes in electricity prices and the emissions intensity of electricity.

Electricity prices

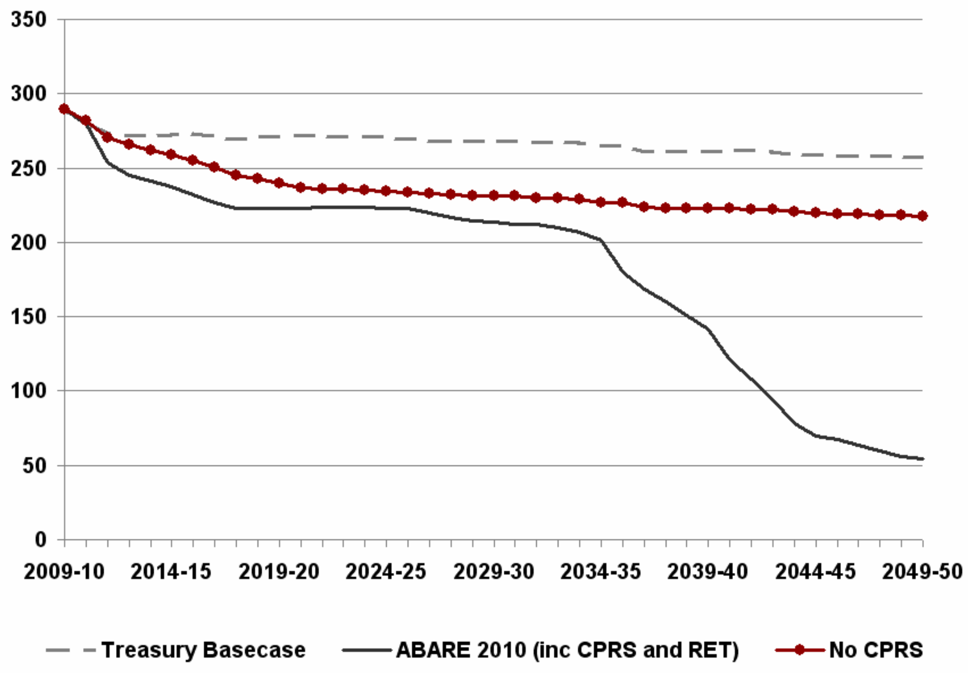
A major role of the CPRS is to place a price on GHG emissions and so with the absence of the CPRS, prices for GHG emissions and GHG intensive energy such as electricity would be lower. According to Treasury modelling, the CPRS -5 scenario (which bundled the ETS and other CPRS including the RET policies) would raise the price of electricity by around 30 per cent by 2030. In contrast, according to McLennan Magasanik Associates (consultants advising the Treasury) the RET policy alone would cause electricity prices to be higher by around 4 per cent (MMA 2008). The difference made by the CPRS alone is therefore roughly the difference between these values (that is, electricity prices would be around 26 per cent lower without the CPRS).

Emission intensity of electricity

Without the Emissions Trading Scheme (ETS) and higher prices on GHG emissions at the heart of the CPRS, the predicted transformation in electricity generation would probably proceed at a lower pace. In this case the change in GHG intensity of electricity would be shaped by the impact of the RET alone. By mandating that 20 per cent of electricity generation comes from essentially zero GHG emissions technologies the RET drives a step down in the GHG intensity of electricity. While this step down is significant, probably peaking after 2020, it does not have the same depth as the changes that arise from the introduction of CCS technologies that is projected to occur after 2030. Figure 3.7 shows that the 'No CPRS' scenario would achieve a still significant reduction in emission intensity although lower than that projected by the scheme that included an ETS and the RET.

Figure 3.7

ESTIMATES OF EMISSION INTENSITY FACTOR FOR ELECTRICITY GENERATION ($KG\ CO_2$-e/GJ)



Note: Treasury Basecase scenario refers to the reference case in Treasury 2008 where there is no CPRS and RET. 'ABARE 2010' scenario refers to the CPRS -5 as modelling in Treasury 2008, which includes RET and CPRS. 'No CPRS' scenario includes the RET policy but not the CPRS policy.

Source: Allen Consulting Group 2010, based on ABARE 2010, Treasury 2008, MMA 2008, DCC 2009.

Projected energy use with the 'no CPRS' scenario

Taking into account the above factors changes the view about what to expect in energy consumption in the buildings sector. It is estimated that the buildings sector would consume around 1094.8 PJ in 2029-30 if the CPRS is delayed indefinitely. For reference, this compares with 1048 PJ projected under the current baseline (with CPRS) in the ABARE 2010 scenario.

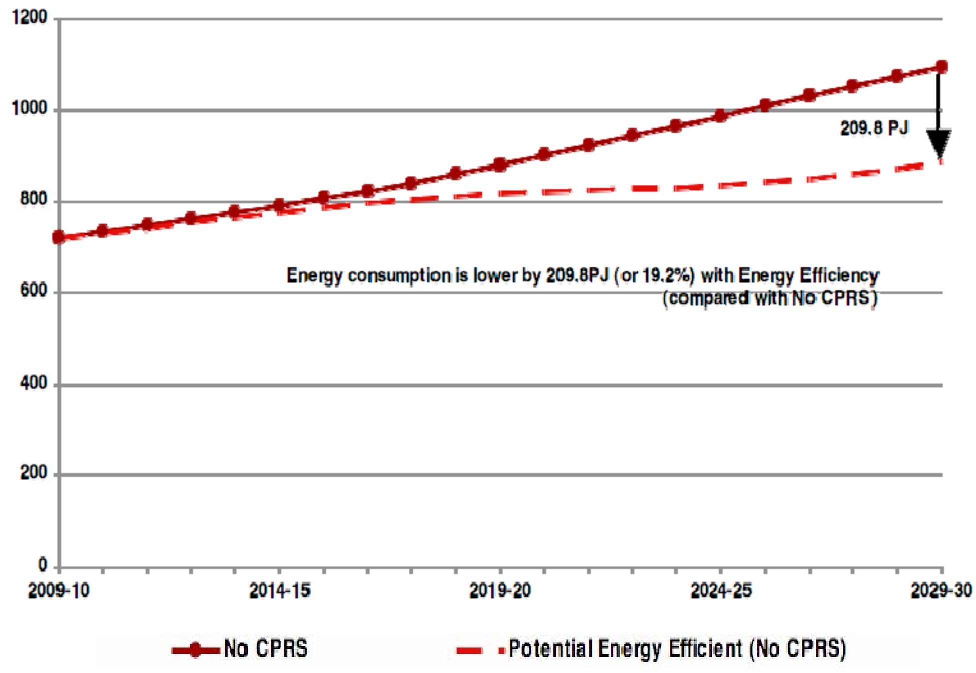
3.12 Energy efficiency in the buildings sector without CPRS

Uncertainty surrounding the implementation of the CPRS means that energy efficiency may play a role that is larger than previously expected in Australia's mitigation effort.

Without the CPRS there are less factors driving reductions in the demand for energy. Prices for electricity will rise in this scenario and encourage people in the buildings sector to use less electricity, but this effect will not be as strong as in the situation when there is also a CPRS. A wide range of energy efficiency actions are likely to remain open for pursuit by decision makers in the buildings sector. If all of the cost effective technical energy efficiency measures identified by ASBEC in the original Second Plank report were adopted not just those that are likely to be adopted because of higher electricity prices, the building sector could drive a further reduction in energy consumption in the buildings sectors by 209.8 PJ in 2029-30 beyond that stimulated by the RET (see Figure 3.8).[4] This compares with potential savings of 162.7 PJ when there is the RET and the CPRS in the ABARE 2010 baseline.

Figure 3.8

BUILDINGS SECTOR ESTIMATED ENERGY USE (PJ)



Note: 'No CPRS' scenario includes the RET policy but not the CPRS policy.

Source: Allen Consulting Group 2010, based on ABARE 2010, ABARE 2009, Pears 2007.

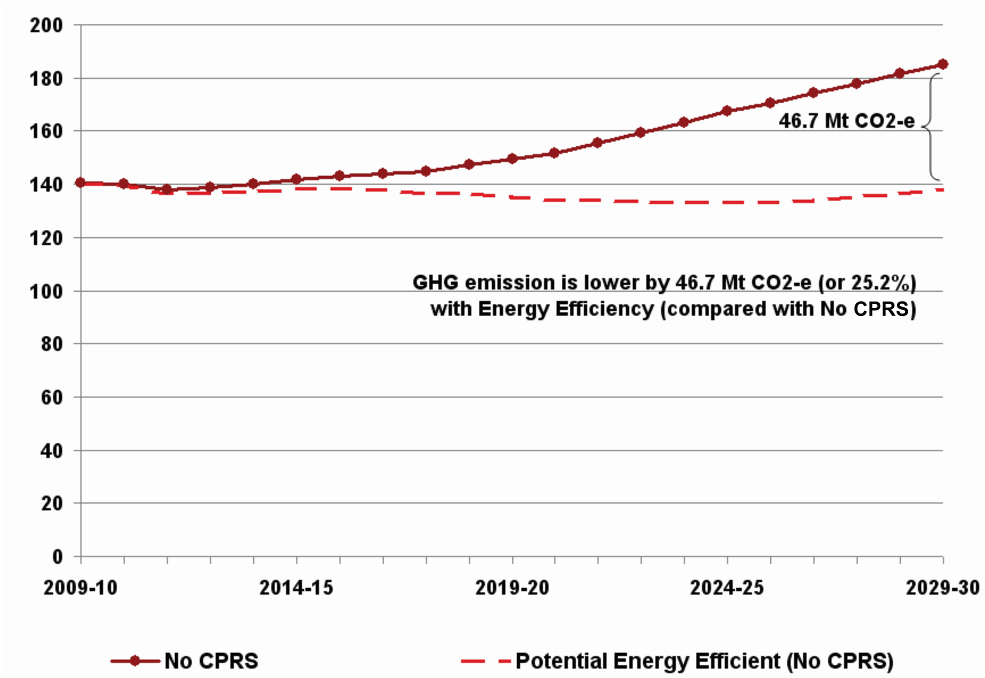
A more important factor is the projected reduction in the emissions intensity of electricity. Without the CPRS, the emissions intensity of electricity would be higher. In these circumstances the same level of energy saving would derive a larger reduction in GHG emissions.

[4] This takes into account the reduction in available energy efficiency measures likely to be available to the building sector because of changes in the baseline. For example, it makes allowance for the expected use of energy efficiency as a means of adjusting to the price increases that will arise from the RET.

The projected emissions from the buildings sector under the 'No CPRS' and the 'Potential Energy Efficient (No CPRS)' scenarios are illustrated in Figure 3.9. It is estimated that without CPRS (the 'No CPRS' Scenario) GHG emissions from the buildings sector grow from 140.5 Mt CO_2-e in 2009-10 to 185.2 Mt CO_2-e in 2029-30. Adopting the fuller range of energy efficiency measures (the 'Potential Energy Efficient (no CPRS)' scenario) would see GHG emission lower at 138.5 Mt CO_2-e in 2029-30. Thus, when there is no CPRS, energy efficient measures could be expected to reduce GHG emissions by 46.7 Mt CO_2-e in 2029-30. This is larger than the reduction of 33.2 Mt CO_2-e available from the buildings sector when there is the CPRS.

Figure 3.9

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



Note: 'No CPRS' scenario includes the RET policy but not the CPRS policy. Technical potential energy efficiency includes policies that are currently in place, such as the phase-out of inefficient incandescent light bulbs and the home insulation program.

Source: Allen Consulting Group analysis 2010 based on ABARE 2010, Treasury 2008 and MMA 2008

3.13 Key points

Uncertainty surrounding the implementation of the CPRS means that the 'first plank' in Australia's mitigation effort may not eventuate. This implies that there is a bigger potential role for energy efficiency measures in the building sectors.

Indeed, analysis shows that without CPRS, there will be some key changes in the Government's outlook. This includes the following.

- The price of electricity is projected to be lower than had been assumed previously.

- Electricity consumption is projected to be higher than ABARE's 2010 estimates.
- Electricity generation is projected to be more GHG intensive.
- In these circumstances energy efficiency in the buildings sector can reduce buildings sector emissions by 46.7 Mt CO_2-e in 2030.

Chapter 4

The buildings sector and GHG 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.

4.14 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 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 possibly 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 supply sector. Renewable energy supplies are relatively expensive and some forms (for example, wind turbines) 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 savings could be a form of insurance policy against the delayed arrival of new technologies that may bring in less emissions intensive electricity generation. Indeed, some energy efficient measures could be lower cost than renewable energy or low emissions coal fired generation.

4.15 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 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 (including via tax deductions for losses).

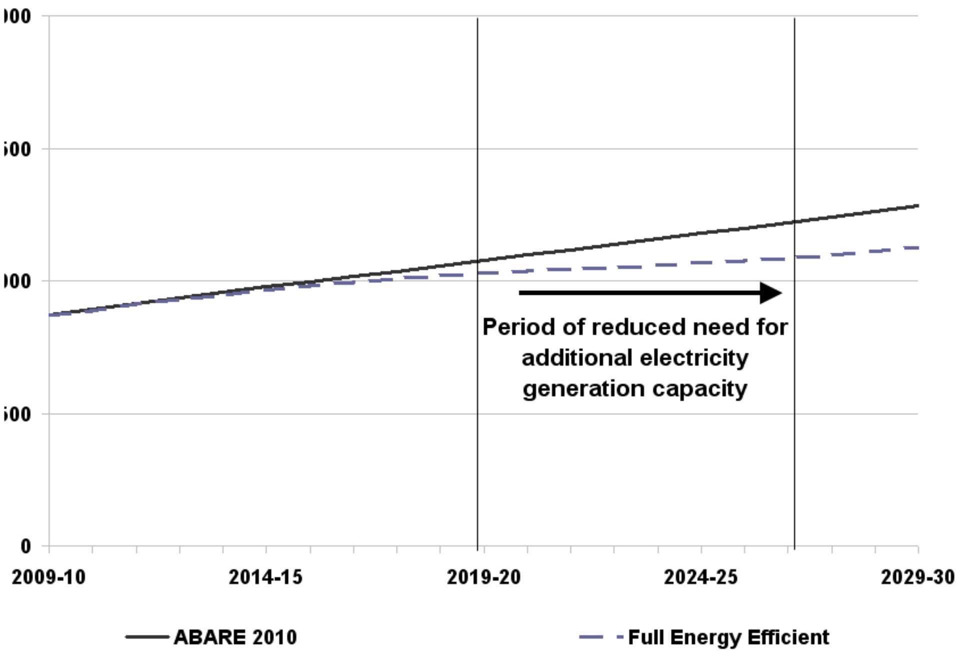
Given significant policy and technological uncertainty, it is not a good time to commit to any particular generating technology. For instance, development of the mainstream technology, coal fired power stations, would probably commit to greenhouse gas intensive electricity for some time to come, or could 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.[5] Electricity consumption projections with and without energy efficiency measures in the building sector are illustrated in Figure 4.10.

[5] 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 4.10

ELECTRICITY CONSUMPTION, AUSTRALIA WIDE (PJ)



Source: The Allen Consulting Group analysis, 2010.

In Figure 4.10 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 the identified energy efficiency measures using known and tested technologies as well as pressure from 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 (and higher standards are being considered at present) 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.

4.16 Accelerated emissions abatement

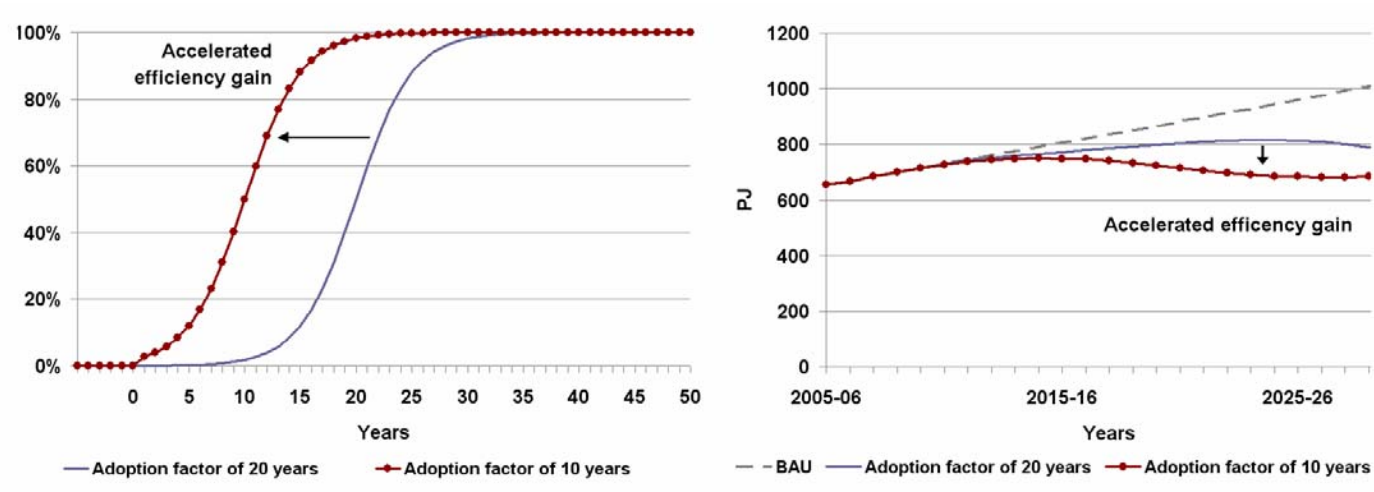
The CPRS and the potential emissions abatement from the buildings sector have been analysed on the basis of long term policy changes. The CPRS scenarios examined are modelled around the CPRS-5 scenario, which starts off with a relatively modest abatement target while Australia awaits coordinated international 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's energy efficiencies project a pace of change in line with projections based on 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 assistance costs and higher carbon prices. 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 economic 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 4.11

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.

4.17 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.[6]

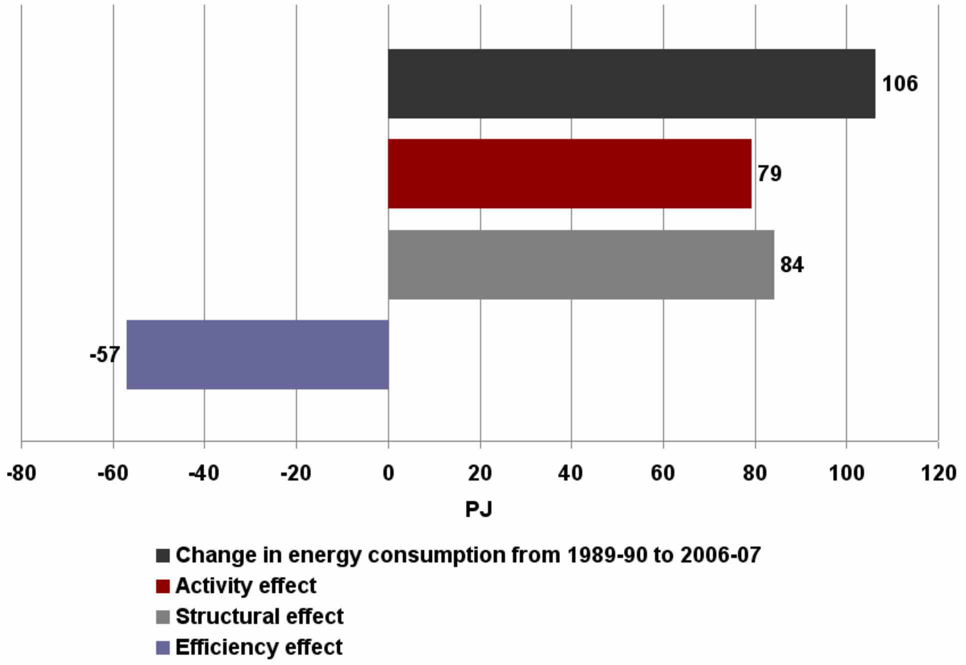
In practical terms, the rebound effect would be experienced where savings in electricity bills due to better insulation allow households to buy and use bigger flat screen televisions using more electricity and being a source of demand for more greenhouse gas emissions. There are grounds to expect that many decisions made by households and businesses do not take into account energy consumption factors. Surveys show that in office-based businesses, 77 per cent of energy related decisions involved no consideration of the energy consequences (Weber 2000). 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.

[6] 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.

More recent research by ABARE illustrates how changes in spending can erode the gains obtained from energy efficiency (ABARE 2009b). This analysis uses a factorisation technique, which is a method that decomposes a change in energy use over time into an activity effect, a structural effect and an efficiency effect. Using this approach, ABARE has shown that energy efficiency in the residential part of the buildings sector saw a reduction in energy use of 0.9 per cent a year over the period 1989-90 to 2006-07, leading to a saving of 57 PJ. However, the structural effect including increases in house sizes and appliance ownership and a reduction in household occupancy, led to energy consumption being 84 PJ higher than it otherwise would have been. In addition, an activity effect reflecting increased incomes and growth in the economy energy consumption also increased energy consumption by 79 PJ over the period. The net impact was an increase in energy consumption in the residential sector of 106 PJ. It is concerning that increased spending power (reflected in higher income, greater availability to credit as well as savings from more efficient electricity use) as well as factors such increases in population and the numbers of people living in each dwelling can combine in this way and in the absence of a concerted policy structure, offset the impact of previous energy efficiencies.

Figure 4.12

DECOMPOSITION OF CHANGE IN ENERGY CONSUMPTION IN THE RESIDENTIAL SECTOR



Source: ABARE 2009b

The dangers of the rebound effect are not confined to energy efficiency measures alone. The government has promised to ensure that most households would not be disadvantaged from the introduction of the proposed 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.[7]

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. The Government may point to the advantages of the CPRS, particularly those attributes which place a price on carbon, as being a robust and comprehensive approach. It may also be helpful to look at other pragmatic approaches.

One approach is to make adjustments in engineering predictions regarding the impact of energy efficiency to account for rebounds.

It may be feasible to alter other policies to contain rebound effects. If first home owners concessions were structured to phase down as houses get bigger, and to phase up as dwellings become more efficient it would send useful price signals. While energy star building rating systems focus on energy efficiency per unit of floor area, other mechanisms such as BASIX apply a target based on the average occupancy. This makes the target much tougher for big houses. Energy labelling systems for appliances are typically linked to performance per unit of capacity rather than performance of a product. Thus a star rating for a large fridge or air conditioner can be the same as a smaller one, allowing it to consume more energy.

It is notable that 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.

4.18 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.

[7] 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 from 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?

5.19 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 in a shorter timeframe, it is necessary to also 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 high consumers and households in non-gas areas, in areas where there are network constraints, or 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.

Energy use in the commercial segment of the buildings sector is expected to grow faster 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 in the commercial segment.

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. This should include measures that actually target energy efficiency and greenhouse gas emission savings in commercial 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.

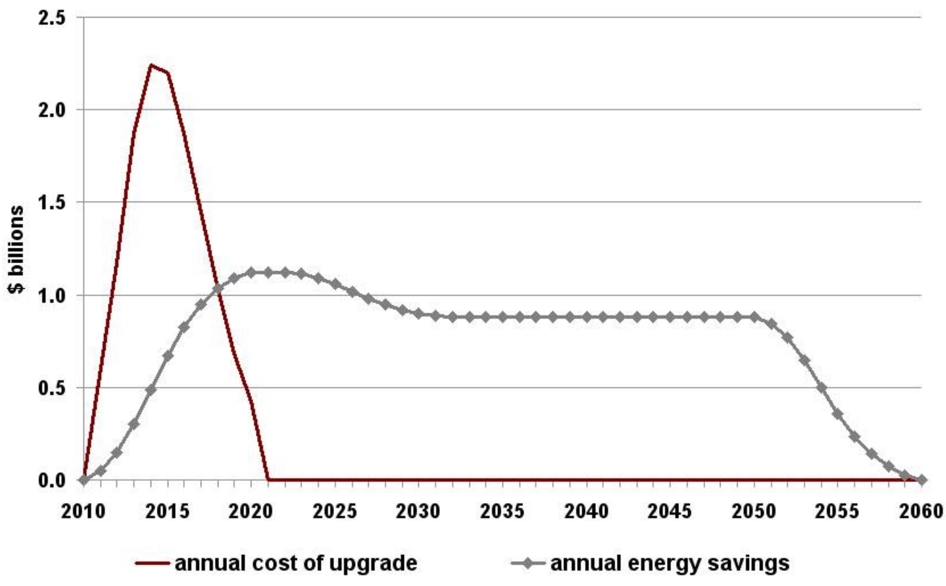
5.20 Closing the funding timing gap

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.

A typical example of the energy efficiency timing gap is portrayed in chart 5.1. This looks at the changes in finances of a building sector sub component as a whole drawing upon expected technical costs of energy efficiency options and the expected technical savings (especially in avoided electricity costs spread out over many years).

Figure 5.13

TYPICAL CAPITAL EXPEDITURE AND PAYBACK PROFILE FROM ENERGY EFFICIENCY MEASURES APPLIED ON A LARGE SCALE



Source: Allen Consulting Group

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 buildings sector would purchase an asset that provides returns over time reflected in lower energy expenditure.

Clearly when looking at a sector as a whole there would be a significant imbalance between when costs are incurred and when the benefits are obtained. 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.

Ultimately, 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. It would be beneficial for public policy settings to focus on closing the funding timing gap. This will be essential as public policy measures move from approaches that focus on correcting information problems (such as disclosure of energy efficiency performance) towards encouraging substantial investment across large numbers of building owners and operators.

5.21 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 of the sort identified in this report.

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.

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

- Private sector incentives
- Funded incentives
- Regulated performance
- Research generation
- Knowledge dissemination

Amongst many other policy suggestions raised by ASBEC members were the use of smart metering, energy retailer financed improvements, rates and charges relief, increase in minimum energy efficiency and thermal performance, benchmarking and emissions capping of new residential buildings, red tape reviews, sector wide procurement of green buildings and education and awareness campaigns. The capacity for governments to lead by example through their role as property owner, landlord and tenant should not be overlooked.

It is not clear that the policy ideas outlined 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

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.

A.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 A.1).

Table A.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.[8]

8 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 studied in detail elsewhere.

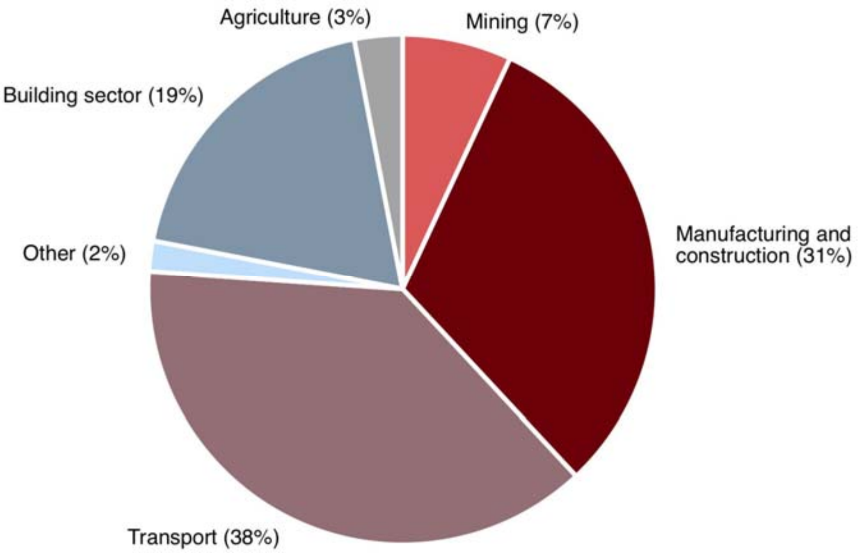
The buildings sector additionally excludes many activities that may also involve buildings or structures. These excluded activities span activities such as agriculture (farm buildings), manufacturing (factories) transport (train stations, bus terminal and airports etc) and construction. Excluded activities 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.[9]

A.2 Energy use

The buildings sector is a major source of demand for energy. Indeed, according to the most recent ABARE 2010 data, the buildings sector (that is, the operation of buildings and the equipment within them) consumed 692.0 PJ in 2007-08. This is equivalent to approximately 19 per cent of total energy consumption (or energy end use) in Australia.

Figure A.1

ENERGY CONSUMPTION SHARE BY SECTOR 2007-08 (%)



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

Source: ABARE, 2007.

As illustrated in Figure A.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).

[9] It would be a useful task for a study to extract better building related energy use data in some other sectors.

A.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 29.2 Mt CO_2-e in 2007, while Australia's total emissions amounted to 597.2 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.

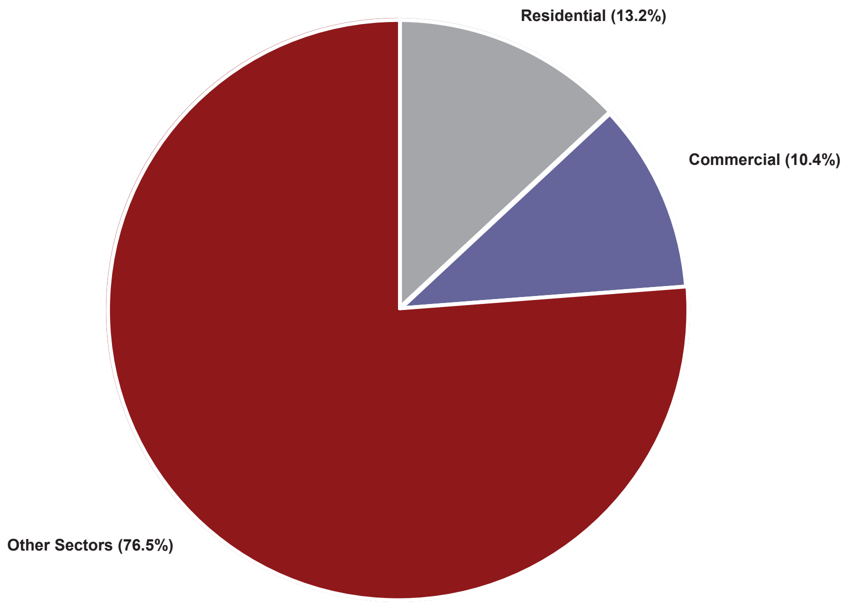
Additionally, in estimating the GHG emission from consumption of purchased electricity, it is important to consider indirect emission that occur during the extraction, production and transportation of fuel burned at generation as well as the indirect emission attributed to the loss in electricity in 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.[10]

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 137.1 Mt CO_2-e in 2007-08. This represents 24 per cent of Australia's total emissions (see Figure A.2).

[10] Note that scope 3 emissions in one industry include 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.

Figure A.2

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



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

Source: ABARE 2010, Treasury 2008 and Allen Consulting Group 2010. Note: figures may not add to 100 per cent due to rounding. The residential sector contributes 76.8 Mt CO_2-e, and the commercial sector 60.3 Mt CO_2-e. GHG emissions of 137.1 Mt CO_2-e represent 24 per cent of national total.

Appendix B

Government energy policies and programs

The Australian Government has announced a number of policies and programs to combat GHG emissions. Theses policies and programs are designed:

- to internalise the costs of climate change (such as the CPRS);
- to implement a fundamental shift in electricity generation sector (such as introducing the RET); and
- to encourage households and businesses to adopt energy efficient consumption behaviour (such as Solar Hot Water rebate scheme and funds for retro-fitting residential and non-residential buildings to increase energy efficiency.)

B.4 The Carbon Pollution Reduction Scheme (CPRS)

The Government's Carbon Pollution Reduction Scheme (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 in 2008. The CPRS itself has evolved in recent months and the Bills may still be subject of amendments when debated once again in Parliament. Significant impacts of the CPRS are highlighted in *Box B.1*

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

Box B.1

IMPACTS OF THE CPRS SCHEME

This box highlights the significant impacts of the CPRS scheme, based on the Treasury 2008 report and details that were announced since the report.

Scheme target — the draft CPRS legislation endorses a global target of GHG stabilisation at 450ppm CO2-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).

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. However, due to a lack of bipartisan support on the CPRS, combined with slow progress on reaching a credible global agreement to limit carbon emissions, the Government has delayed the introduction of the CPRS.

Carbon price — the Green Paper assumed an indicative carbon price of $20 per tonne of CO2-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 CO2-e by 2030, and $115 per tonne of CO2-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 CO2-e by 2030, and almost $200 per tonne of CO2-e by 2050.

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.

Source: Treasury 2008, Department of Climate Change and Energy Efficiency <http://www.climatechange.gov.au/government/reduce.aspx>.

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.[11]

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.

[11] 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.

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 Chapter 5.

B.5 Renewable energy target

The Renewable Energy Target (RET), 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.

B.6 Additional complementary policies

Box B.2 highlights the additional complementary policies that have been announced and implemented from 2008 to May 2010.

It is important to note that many policies are implemented before 2008 (such as the Energy Australian ENERGY STAR program, Energy Labelling program, Renewable Remote Power Generation Program, Energy Efficiency Opportunities legislation). The impacts of these policies are incorporated in the energy consumption forecasts for all scenarios 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[12].

[12] 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.

Box B.2

GOVERNMENT POLICIES IMPLEMENTED COMBAT GHG EMISSIONS

This box highlights the recent government energy policies that were announced and implemented. The Australian Government believes the CPRS is the cheapest and most effective way of tackling climate change and is committed to the bipartisan emissions reductions targets. However, due to a lack of bipartisan support on the CPRS, combined with slow progress on reaching a credible global agreement to limit carbon emissions, the Government has delayed the introduction of the CPRS. Nonetheless, there are a number of policies and programs that are announced and implemented from 2008 to May 2010 to combat GHG emissions.

In May 2009 the Australian 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 is investing $4.5 billion through the **Clean Energy Initiative** to help Australia use the abundance of natural resources to create a cleaner energy supply and to reduce our carbon pollution emissions. The Initiative will create more jobs in clean industries by giving investors the confidence to back low emissions technologies such as solar power, energy from 'hot rocks' in the earth's crust, and carbon capture and storage.

The Commonwealth Government also established the $2.75 billion **Climate Change Action Fund** to provide transitional assistance to the commercial, residential and voluntary sectors to help them as Australia moves to a low-carbon economy. The fund will help businesses and community organisations identify and adopt energy efficiency opportunities, to reduce both energy bills and their emissions. 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.

The Commonwealth Government's **Energy Efficient Homes Package** subsidises the installation of ceiling insulation and solar hot water systems in the residential sector. The **Home Insulation Program** provided ceiling insulation in 1.1 million homes in Australia. Most recently, the **Renewable Energy Bonus Scheme** (REBS) offers eligible Australian households a $1,000 rebate for a solar hot water system or a $600 rebate for a heat pump system. To date, more than 120,000 applications for solar hot water system rebate were received. 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. (Both of these programs have been modified and curtailed in recent months).

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 **National Strategy on Energy Efficiency** (NSEE) announced in July 2009 will also help Australians choose energy efficient appliances, homes and buildings, and make residential and commercial buildings more energy efficient. The measures in the Strategy are framed around the following four key themes:

1. Assisting households and businesses to transition to a low-carbon future;
2. Reducing impediments to the uptake of energy efficiency;
3. Making buildings more energy efficient; and
4. Government working in partnership and leading the way.

For instance, 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 Strategy also aimed to increase the energy efficiency standards for both the residential and commercial buildings sectors. This includes introducing and implementing new standards in the Building Code of Australia starting in 2010.

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

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