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Learning the hard way: Australia's policies to reduce emissions

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Report Overview

Australia, like other industrialised nations, is seeking to become a low-carbon economy that continues to grow while minimising carbon emissions. Both Australia's main political parties are committed to reducing Australia's emissions to 5% below 2000 levels by 2020. However there is intense political controversy about the best means to achieve this target.

Because Federal and State Governments have tried more than 300 emission reduction policies and programs since 1997, we already have a great deal of information about which programs and approaches work and which do not.

This report analyses four kinds of carbon abatement instruments: market mechanisms; grant tendering schemes; rebates and energy efficiency standards. Based on experience, only an economy-wide carbon price (a type of market mechanism) can achieve the scale and speed of reductions required for Australia to meet its 2020 commitments without excessive cost to the economy or taxpayer.

Of all the measures analysed, market mechanisms, such as a carbon trading scheme, have delivered the greatest emissions reductions and have met targets ahead of time. They work because they minimise the need for government to predict the future. They provide certainty, enabling business to invest with greater confidence. They provide flexibility by devolving decision making to businesses and individuals, allowing them freedom to choose how to reduce emissions, without government involvement. They work best where they include the broadest range of abatement options and stay administratively simple.

By contrast, analysis of a range of grant-tendering programs – involving $7 billion in budget funding – shows that they cannot reduce emissions at the necessary scale or speed. On average, for every million dollars the government commits to such schemes, only $30,000 of operational projects result within five years and only $180,000 within 10 years. Based on experience, government would need to announce an abatement purchasing fund of $100 billion to meet the 2020 emissions reduction target.

Rebate programs – worth $5 billion in budget funding – have also produced relatively little abatement and are simply too costly for taxpayers per unit of abatement acquired. Using rebates to achieve the 2020 emission reduction target would require a budget of more than $300 billion over the next ten years.

Energy efficiency standards can usefully complement a carbon trading scheme. But because they are limited in scope and slow to take effect, they cannot play more than a support role in meeting the 2020 targets.

A carbon trading scheme or tax will not be costless, but it is highly unlikely that government can achieve 2020 emission reduction targets at a lower cost through alternative measures. They will either fall short of the target or cost a lot more.

Governments may also want to support low-carbon technologies to build industry capacity for deeper emission cuts in the long run. Experience suggests that where possible these should be supported through market mechanisms based on objective, clearly defined performance criteria and eligibility requirements.

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1. Purpose and scope

1.1 Purpose

Both Australia's main political parties are committed to reducing Australia's emissions by 5% below 2000 levels by 2020. This report considers the experience of past and existing policies to indicate which policies are most likely to meet this target. In particular it seeks to identify policies that are both reasonable in cost and likely to be able to deliver the scale of emissions reduction required by 2020.

1.2 Scope

This report reviews the record of past policies implemented by Federal and State Governments since 1997, when Australia signed (but did not ratify) the Kyoto Protocol and when an increasing number of policies to address global warming began to emerge. Because Federal and State Governments have tried more than 300 emission reduction policies and programs since 1997, we already have a great deal of information about which programs and approaches work and which do not.

Of these measures, most involved relatively small amounts of money and achieved few emission reductions.[1] This report focuses on the four main mechanisms to reduce emissions:

- **market mechanisms**: government sets a binding target for emissions or electricity from lower emission fuels but leaves it up to private firms as to how best to meet the target;
- **grant tendering schemes**: government funds individual projects, prior to their construction, which it believes are likely to reduce emissions or advance clean energy technology;
- **rebates**: government provides an amount of money to individuals and businesses to purchase specified products that reduce greenhouse gas emission;.
- **energy efficiency standards**: government sets minimum levels of energy efficiency that products such as refrigerators or light globes must meet in order to be sold.

For such policies to be included in our analysis they had to seek emission reductions from the two largest sectoral sources of greenhouse gas emissions:

- electricity generation; or
- combustion of fossil fuels for heating and industrial production.

These sectors – referred to as stationary energy – comprise half of Australia's greenhouse gas emissions and account for 62% of Australia's expected growth in emissions between 2000 and 2020. It appears highly unlikely that Australia can meet its 2020 target without substantial cuts to emissions from stationary energy.

[1] A good example is advertising campaigns such as the 2007 Climate Clever campaign and the 2008-09 Think Climate, Think Change campaign. There is little evidence that these materially reduced carbon emissions

1.3 Assessment criteria

In analysing these policies we looked at the following factors:

- **Cost effectiveness:** the cost to the government budget and the cost and benefit to private individuals and companies in reducing emissions by a tonne of carbon dioxide equivalent (CO_2-e). We viewed a cost of below $20 a tonne as good value, up to $50 as acceptable value, more than $50 as questionable without substantial benefits in enhanced capacity to abate emissions in the future, and more than $100 as too expensive.
- **Size of abatement:** whether the measure can substantially reduce emissions in the years to 2020.
- **Speed and scalability:** whether the measure can reduce emissions quickly and whether it can be expanded to meet more challenging targets over time.
- **Risk and quality:** whether the emissions reductions are secure or could be reversed by an adverse event (such as fire burning down trees)

1.4 Data sources

Development of this report has relied on a wide range of sources of information, most of which are detailed in our references section and are in the public domain. We have also made extensive use of confidential interviews and discussions with:

- Current and former government officials at both junior and senior levels who have been involved in developing and implementing the policies analysed;
- Staff of companies who have sought or been provided with support under the government programs we have analysed;
- Advisors and industry associations who have been closely associated with the government programs analysed.

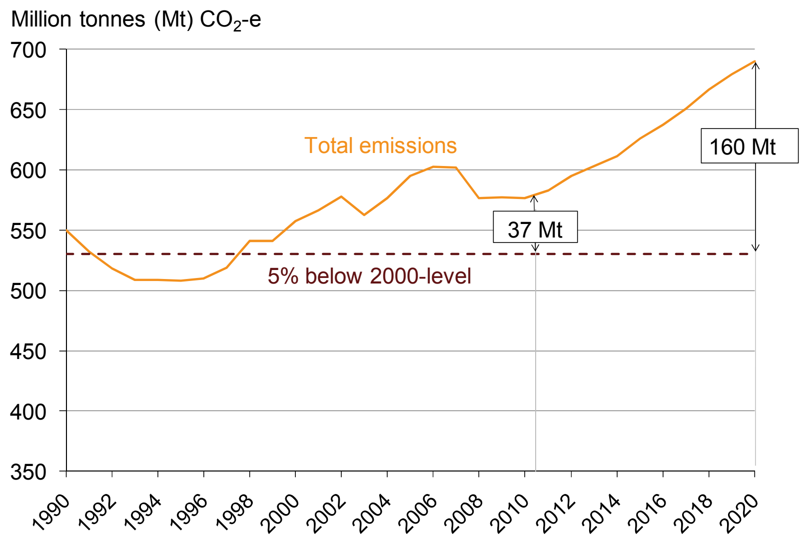
These confidential interviews have enabled us to understand how these programs have unfolded over time and the difficulties they have experienced. This report would not have been possible without this generous assistance.

2. The policy challenge

2.1 The 2020 emissions reduction target

Reducing Australia's emissions to 5% below 2000 levels by 2020 will not be easy or costless. Between now and 2020 a number of sectors in the economy that consume fossil fuels are expected to grow substantially. For Australia to both accommodate this growth and meet a 5% emissions reduction target will require government policies (beyond those already committed to) that by 2020 will reduce emissions by 160 million tonnes of CO_2-e a year.

Figure 1.1 Australia's carbon emissions reduction target



Source: DCCEE (2010a)

Policies must be assessed against this challenge: can they be expanded over the next few years in order to produce an annual reduction in emissions of this size? To give a sense of scale, it requires measures equal to:

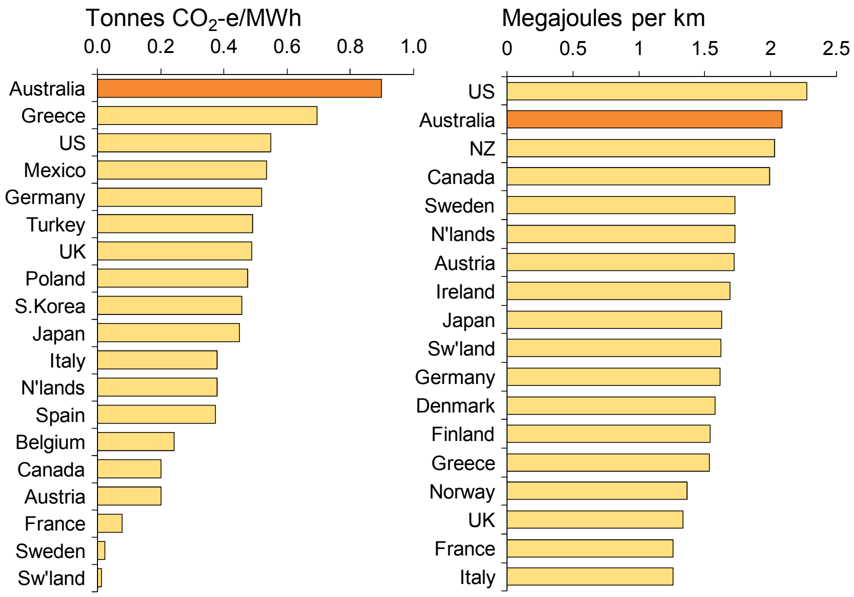
- Eliminating emissions from all of Australia's planes, trains and automobiles, and in addition replacing the current use of gas for heating and industrial production with a zero emission energy source;
- Expanding from 10% to 75% the amount of electricity that is sourced from renewable energy;
- Reforesting an area of land at least half the size of the State of Victoria.

2.2 Australia's particular electricity problem

Electricity produced from coal creates far more carbon emissions than other fuels such as gas, renewables or nuclear power. Because coal has been considerably cheaper in Australia than in many other developed nations, we have for many years not only relied on coal but also used it inefficiently in power stations.[2] As a result, our electricity production is the most carbon-intensive in the developed world.

[2] IEA (2008)

Figure 2.2 Major OECD economies - Carbon emissions from electricity generation production and energy intensity of transport – major OECD economies



Sources: IEA (2008); World Resources Institute (2011)

To reduce Australia's reliance on coal, governments must either:

- place a cost on emitting greenhouse gases that would make coal more expensive; or
- subsidise less emission-intensive alternatives to make them competitive against cheap coal fired power stations

Either alternative will cost money, which must come from electricity users paying higher bills or from taxpayers.

There is also great potential for Australia to become more efficient in consuming energy and in using emissions-intensive materials. Australia's energy use per unit of industrial output, for example, is one of the worst in the OECD.

The amount of energy used, per kilometre, to transport people in Australia is the second highest in the developed world, as shown in Figure 2.2. This is largely because Australians use public transport less and drive vehicles with poorer fuel efficiency than in other developed countries.

All these factors suggest Australia could substantially reduce emissions while still driving cars and keeping the lights on. But we would need to put in place incentives to produce electricity using less carbon-intensive fuels, and become more efficient in our use of fossil fuels - as many other wealthy developed nations already do.

3. Performance of government programs

To meet Australia's 2020 targets, programs must substantially reduce emissions without excessive cost to the economy or taxpayer.

Based on experience, only an economy-wide carbon price (a type of market mechanism) can do so, as shown in figure 3.1.

Of all the measures analysed, market mechanisms, such as a carbon trading scheme, have delivered the greatest emissions reductions and have met targets ahead of time.

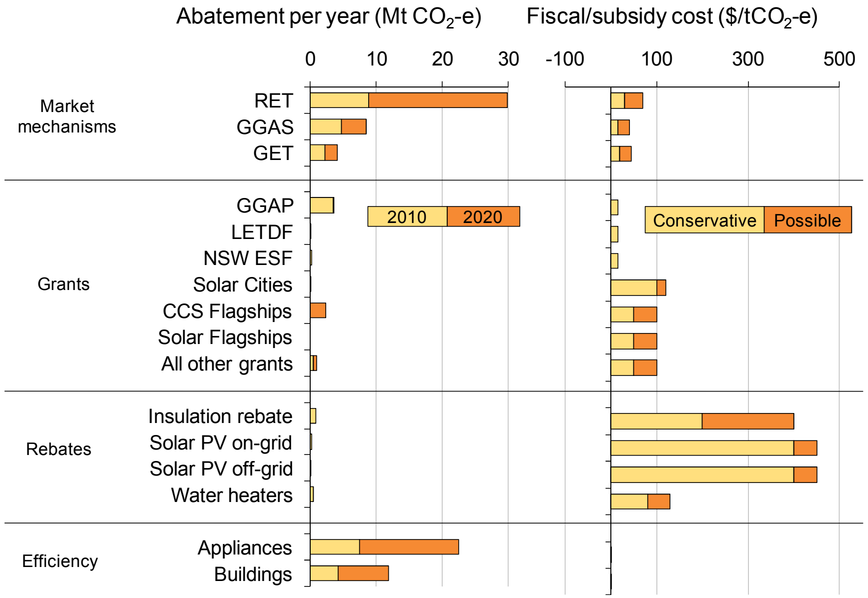
A range of grant-tendering programs has failed to deliver significant reductions in emissions.

Rebate programs have also produced little abatement, at very high costs to taxpayers.

Energy efficiency standards can usefully complement a carbon trading scheme. They can deliver substantial reductions and provide a net benefit to the community at the same time.

The remainder of this report explores how these measures operated in practice, what they delivered, and what we can learn from them about designing future policies.

Figure 3.1 Performance of government programs to reduce carbon emissions



Source: Grattan Institute

4. Market mechanisms

4.1 Overview

Of the policies examined in this report, market mechanisms show by far the greatest promise for achieving substantial emissions reductions by 2020 and the longer term. While energy-efficiency standards can reduce emissions at lower cost, no other measure can match market mechanisms for the speed and scale of emission reductions, while keeping costs moderate.

This is not a theoretical proposition, but is borne out by the experience of the three market mechanisms that Australia has introduced in the past decade: the Renewable Energy Target (RET), the New South Wales and ACT Governments' Greenhouse Gas Abatement Scheme (GGAS) and the Queensland Government's Gas Electricity Target (GET). These three mechanisms set mandatory targets (for emissions reduction, or use of particular energy sources) that electricity retailers must meet through the purchase of tradeable certificates or permits.

Together, these markets have delivered more than 40% of Australia's emissions reductions since 1997 (once the one-off ban on land clearing is excluded) – the greatest amount of reductions among policies introduced by Federal and State governments to cut carbon emissions. The schemes have reached their emissions targets with little difficulty and ahead of time, showing that the cost of reducing carbon emissions is lower than experts forecast.[3]

Under a market mechanism, government legislates a price on pollution, or for avoiding pollution, and then allows businesses to determine how they wish to respond to the price. A trading scheme is the most prominent form of market mechanism. In such a scheme, the government mandates a target level of pollution (reduction), and achievement of the target is managed through the use of tradeable certificates or permits. These represent a unit of the target, such as a megawatt-hour of renewable electricity or tonne of CO_2-e.

Market mechanisms work because they minimise the need for government to predict the future. They provide businesses and individuals with certainty and flexibility. Certainty because once the carbon price and the rules of the market are established, business can invest for the long term with greater confidence. Flexibility because decision making is devolved to firms and individuals, allowing them freedom to choose how to reduce emissions in the most cost-effective way, without government involvement in assessing whether they will work or what the costs will be.

Trading schemes create a price signal that automatically moderates supply and demand for emissions reduction. If, for example, an electricity retailer needs to purchase more certificates in order to meet its obligation under the Renewable Energy Target, it might contract with a wind farm producer to generate more of the tradeable renewable energy certificates that the retailer needs.

[3] Daley and Edis (2010a)

Finally, market mechanisms provide rewards and penalties on the basis of how much energy or emissions are generated, as opposed to grant-tendering schemes that reward promises to produce emissions reductions, many of which never come to fruition (see chapter 5).

However, the market mechanisms that have been designed to date are by no means perfect. Their performance provides valuable lessons for how best to design any large-scale market mechanism to meet Australia's emissions targets. The most important of these are:

- The larger the size of the market, and the broader the scope of emissions reduction measures recognised within it, the better.

- The scheme should avoid or minimise the use of imputed emissions baselines that provide benefits or concessions to firms on the basis of a measure of what they might have done in the absence of an incentive to reduce emissions. Imputed emissions baselines enable firms to plead special circumstances – such as an unusually busy period of production – that they contend make it harder to reduce their emissions from their current amount. These baselines can allow businesses to game the system.

- A trading scheme should be complemented with price floors and ceilings that make demand for abatement responsive to its cost. For example, if the price falls to the floor, it indicates that it is cheaper than expected to reduce pollution. In these circumstances it would be rational to seek to reduce pollution more quickly. The price floor effectively means that pollution will be reduced more than the original target of the scheme.

These lessons suggest that a hybrid of an emissions cap and trade scheme and tax (which acts as a price floor), with very broad coverage of the economy, would be the best model to deliver Australia's 2020 emissions reduction target. Importantly, this scheme could be implemented quickly as the infrastructure to support it is already largely in place with the National Greenhouse and Energy Reporting System.

4.2 What are market mechanisms?

Generally, market mechanisms put a price on carbon emissions or reductions. Under a carbon trading scheme, perhaps the best known market mechanism, government:

1. Sets a clear and measurable target for a maximum level of carbon emissions, or an amount or proportion of electricity that must be sourced from lower emission sources such as renewables or natural gas.

2. Divides this target into permits – a right to emit a single tonne of carbon – or certificates: ownership of a megawatt-hour of renewable electricity.

3. Requires a number of businesses to acquire these permits or certificates up to their level of emissions or their share of the government-mandated target. Failure to do so incurs a penalty for each permit or certificate the business is short of its obligation.

4. Enables the permits or certificates to be freely traded.

The market gives businesses an incentive to acquire permits or certificates whenever their cost is lower than the penalty. It both encourages and enables them to reduce their pollution and/or to invest in low-emission projects. A business that can reduce its emissions for a price lower than the market price can profit by selling its permits to firms that find it harder to reduce their emissions at the low price.

4.3 Australia's experience of market mechanisms

This report analyses Australia's three long-running market mechanisms for reducing carbon pollution and encouraging cleaner energy sources. They are:

- The Federal Government's Renewable Energy Target (RET)
- The NSW and ACT Government's Greenhouse Gas Abatement Scheme (GGAS)
- The Queensland Government's Gas Electricity Target (GET)

A further two energy efficiency trading schemes have been established in Victoria and NSW, but these have not operated for long enough to draw reliable conclusions about their performance.

4.3.1 Emission reductions achieved

Together, market mechanisms have produced more than 40% of Australia's emissions reductions since 1997 (excluding once-off land-clearing gains). While there is still a substantial scale-up challenge to reach 160m tonnes of abatement, the 40m tonnes of abatement these measures are anticipated to deliver, suggests they are capable of delivering the kinds of quantities of abatement that are necessary.

Table 4.1 Australian market mechanisms - abatement and cost

Measure	Annual reduction in 2010	Annual reduction in 2020	Cost per tonne CO_2-e
Renewable Energy Target (RET)	8.8Mt	29.9Mt	$30-$70
Greenhouse Gas Abatement Scheme (GGAS)	4.7Mt	8.4Mt	$15-$40
Gas Electricity Target (GET)	2.2Mt	4.3Mt	$20-$45
TOTAL	15.7Mt	42.6Mt	

Note: Estimates of abatement for GGAS are from DCC (2007), all others from DCCEE (2010a). Figures from 2007 projection have been used because there is insufficient detail provided by the DCCEE(2010) for the downgrade in abatement in 2010 projections.

By contrast, rebates are only estimated to deliver between 1.4 and 1.9 million tonnes of abatement in 2010 and in 2020, and grant-tendering schemes only 4.2 million tonnes of abatement in 2010 and are forecast to produce 7.2 million tonnes in 2020.

4.3.2 Cost effectiveness

The subsidy cost per tonne of abatement delivered by market mechanisms has varied from a low of $15-$40 under GGAS to $30-$70 under the RET. The GGAS, which has the broadest scope of abatement options, has on balance delivered the lowest costs of abatement. With improved targeting it probably could have delivered abatement at even lower cost.[4]

The costs to meet these schemes' targets were generally lower than experts forecast when the schemes were set up.[5]

4.3.3 Ability to scale up

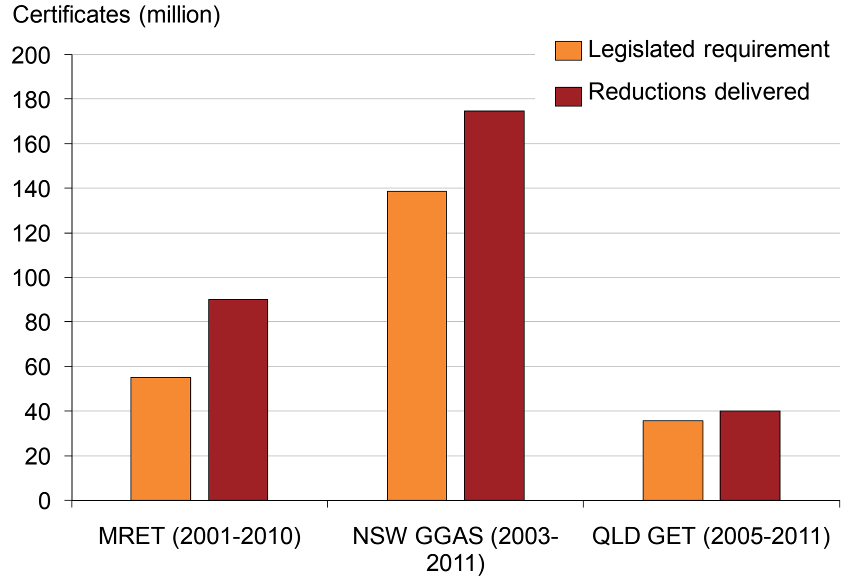
While market mechanisms are estimated to deliver only slightly greater emission reductions than energy efficiency regulatory standards they have demonstrated an ability to expand rapidly while keeping costs at moderate levels. For example, the size of the Renewable Energy Target has been expanded nearly fivefold (from 9.5m to 45m megawatt-hours). Yet the cost to firms of purchasing renewable energy certificates was no higher in 2010 than it was in 2003 to 2005.

Similarly, in 2007 the Queensland Government announced that it would substantially increase the Gas Electricity Target, yet in the year following the announcement prices for certificates fell by a quarter.

In other words, the schemes showed that they could deliver when asked to produce more emissions abatement. Figure 4.1 illustrates that supply of clean energy and abatement in all three market mechanisms has exceeded government targets.

[4] This is discussed in this report's companion 'Detailed Analysis' report
[5] Daley and Edis (2010a)

Figure 4.1 Market mechanisms' accumulated requirements and achievements



Source: Grattan Institute (2011) accompanying Detailed analysis. See Figures 1.2, 1.3 and 1.5.

4.3.4 Potential to build industry capacity

Market mechanisms can build industry capacity. The Renewable Energy Target, in particular, has played an important role in expanding capacity to reduce emissions in future. Five years after its introduction, companies capable of developing Australia's high-quality wind resources began to emerge. Australia now has a pipeline of more than 10,000 megawatts of wind projects either under development or operational, and capable of generating more than 10% of Australia's annual electricity demand with zero carbon emissions.[6] While this may not be the most cost-effective option for achieving the 2020 target, these projects are likely to be essential to delivering more ambitious emission reductions after 2020.

The Renewable Energy Target (in conjunction with generous rebates) has also fostered greater capacity within the water heater industry to supply lower emission solar and heat pump water heaters. These now represent around 20% to 25% of water heater sales, compared to just 2% to 5% before the Renewable Energy Target was introduced.[7] The solar photovoltaic retail and installation industry is also starting to show a capacity to supply substantial megawatts of power generation, and has substantially reduced installation costs in the past two years.[8] However, the enhanced capacity for delivery of solar photovoltaics has come at high cost per tonne of CO_2-e.

The Gas Electricity Target also provided a market which helped to stimulate the development of Queensland's coal seam methane resource. It has expanded from nearly negligible levels prior to the scheme, to now being so large that supply will exceed domestic demand levels and be exported in large quantities.

[6] Grattan Institute Power Project Database built up from data sources including state governments' planning department planning applications; Australian Energy Market Operator (AEMO) (2010); Copeland (2010).

[7] Pers. comm. Outhred (2010)

[8] AECOM (2010)

4.4 What explains the success of these market mechanisms?

4.4.1 Markets reward results, not forecasts

The flexibility of market mechanisms enables them to reduce emissions more quickly and at greater scale than other mechanisms. They allow businesses and individuals to determine how and when they will reduce emissions. They reward or penalise firms on the basis of their actual performance in reducing emissions.

By contrast, grant-based schemes provide rewards (in the form of grants) on the basis of non-binding promises embodied within a tender, or forecasts of the technical performance of a product subject to significant variation in the field.

4.4.2 Well-designed markets demand clarity

Achieving substantial emissions reductions at moderate cost requires billion-dollar investments in new and refurbished infrastructure. In order to fund this infrastructure, financiers need to be confident their investment will achieve good returns over a 10 to 20-year time frame. Accordingly, government policy must be clear about the rules governing investment, and investors need to know that these rules will not dramatically change over time.

More than other policy measure, a well-designed market mechanism creates this clarity.

The programs reviewed required government to set up mechanisms for measuring, pricing, and trading a given quantity of abatement or clean energy. Governments had to clearly define eligibility: who could enter the market and on what terms. It created transparency: the registries that governments established to track the activities of firms were made available to all market participants, enabling them to see what reductions were being produced and by whom.[9] It enabled scrutiny of government policy through the visibility of trading levels and the price of certificates/permits. If government substantially changed the rules, the effect was plain to see in the changing price of certificates. Most other policy instruments lack these sources of discipline.

4.4.3 Markets offer flexibility

Under a market mechanism, government sets a clear and measurable target (either a price for emissions or a target volume), and then requires a number (usually small) of businesses to meet the target. The firms can undertake their own emissions reductions, contract with others to reduce emissions on their behalf, or buy emissions reduction certificates in a market. Government limits itself to setting rules of eligibility and measurement, and does not get involved in decisions on how businesses might choose to meet their emissions targets.

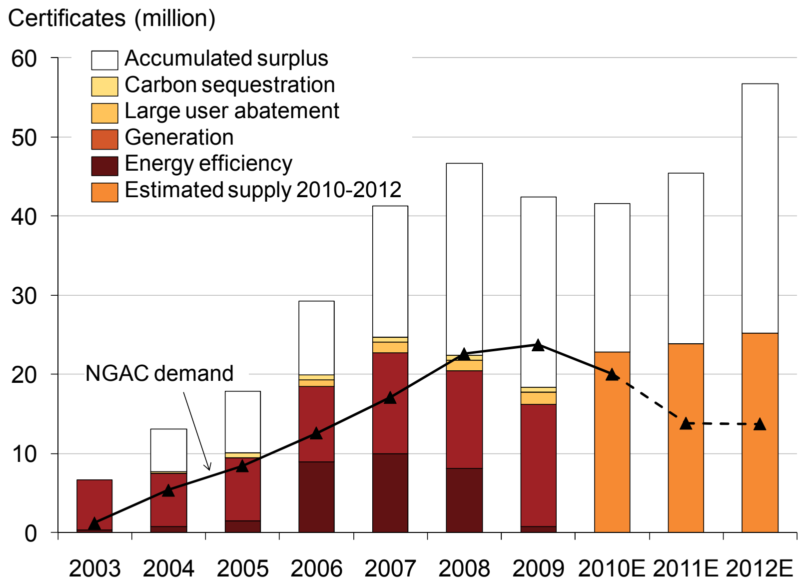
The flexibility of the schemes reviewed has been vital in supporting innovation. They have often thrown up surprising results, in which some options proved to be more effective in reducing emissions than government and experts foresaw.

For instance, use of compact fluorescent light bulbs was essential to achievement of the GGAS target. The development of a huge pipeline of wind projects and an unexpected surge in small-scale solar certificates accounted for a large proportion of certificate supply under the Renewable Energy Target. Sugar cane waste used as fuel, which was forecast to be a huge source of emissions reductions under the Renewable Energy Target, turned out to be irrelevant. Targets under the Gas Energy Target are being achieved using methane derived from coal deposits rather than the conventional natural gas deposits originally envisaged. None of these developments were forecast beforehand.

Largely as a result of such innovations, the schemes have reached their targets at much lower cost than anticipated. Figure 4.2 illustrates the flexibility of the RET, as clean energy sources changed over time.

[9] The transparency of these registries could be further improved however. An important reform would be for NGER to provide data at a facility level, not just company level

Figure 4.2 Supply and demand for Renewable Energy Certificates



Note: RECs data for 2010 is incomplete (registry accessed 22 November 2010) and probably substantially understates RECs from wind, solar water heaters and solar PV: AGL (2010) estimates that solar PV and solar water heaters will create 30 million RECs for 2010

Box 4.1 Why markets work - a US case study

Trading schemes to control pollution were pioneered in the United States to control emissions of sulphur dioxide and nitrogen oxides from coal-fired power stations. Under 1990 legislation, emissions were capped across a number of states. The maximum level of emissions was to reduce each year. Emitters – principally coal-fired power generators – were required to buy certificates proportionate to their emissions.

When the legislation was introduced, its critics said the generators would find reducing sulphur emissions too expensive. But in the scheme's first five years, the price of reducing emissions was about half the price that had been forecast; in its second five years the price fell to a quarter of the forecast. What made the difference was the flexibility provided by a market measure.

Coal-fired power stations had been expected to comply with the scheme by installing scrubbers that remove sulphur from the plant's smoke stacks. However, only half of the anticipated scrubbers were installed. Instead, electricity generators produced nearly 60% of the emission reduction by using a greater proportion of low sulphur coal. The cost of transporting low sulphur coal fell by 50% as the rail industry invested and responded to the commercial opportunity that sulphur regulation produced. Scrubbers also turned out to reduce emissions at lower cost than expected. They cost 40% less to install than the original estimates; and they removed 95% of the sulphur rather than the expected 85%.

By choosing to regulate via a market rather than seeking to select and prescribe the best technology in advance, US regulators allowed for unforeseen innovation that delivered emissions reductions at substantially lower cost.

Source: Burtraw and Szambelan (2009); Harrington et al. (2010); Fraas and Richardson (2010).

There is a great number of options for reducing carbon emissions. While electricity generation and tree planting are prominent examples, there are many other possibilities that in aggregate could deliver large reductions that are rarely thought of. Some obscure examples that scratch the surface include: substituting between different building materials; employing combined heat and power plants; nitrous oxide exhaust controls in chemical plants; reducing electricity losses from our electricity transmission and distribution network; switching steel production from blast furnaces to electric arc furnaces; rearranging and coating pipes to reduce friction; employing variable speed drives in electrical motors; and fundamental restructuring of industry where high emitting plants are shut down.

Providing flexible and devolved decision making, and providing rewards and penalties on the basis of results, are important because of the diversity of options for reducing carbon emissions, and the complexity of decision making required to exploit these options.

Consider a company planning to build a new alumina refinery, which will be a significant source of emissions. Factors the company must assess include expectations of supply and demand for alumina; the price and availability of coal versus gas or other energy sources; the electricity price; potential air quality requirements; the efficiency, costs and maintenance of alternative boiler designs; technological innovation; the availability and cost of finance; and costs of construction materials and labour. Many of these decisions will interact and have an impact on greenhouse gas emissions of the plant as well as other financial factors.

If one plant represents such a complex planning exercise for the most experienced firm, consider how much government and other outsiders would struggle to second-guess how much a refinery should emit, and how much funding it should receive to build a less emissions-intensive refinery. Then imagine the government doing this not just for several alumina refineries but also for power stations, steel mills, LNG plants, chemical plants, and so on.

While economic models can attempt to assess the optimal technology interventions, the computation is so complex, and the information so diffused, that no organisation is likely to succeed. The evidence lies in the poor track record of energy modelling and forecasting to accurately foresee the future, even in broad outline over the last four decades. These modelling exercises have regularly failed to foresee fundamental technological, economic and social changes critical to overall energy outcomes.[10]

Of course, government may be able to identify and implement cost-effective interventions in targeted areas where private individuals and businesses make clearly sub-optimal decisions in areas outside their core expertise. Chapter 7 on energy efficiency regulations provides a number of illustrations. However government is unlikely to improve on devolved and individual decision making where interests and information are well-aligned.

Cap and trade schemes also provide flexibility because the price of certificates (and therefore the effort put into reducing pollution) adjusts to changes in costs and supply. If there is an abundance of low emission projects – usually because they cost less than

[10] See Smil (2003), Chapter 3.

expected – then the price of certificates falls, reducing the incentives to undertake projects. This occurs without active government intervention. By contrast, as discussed in Chapter 6, rebate measures tend to result in unpredictable government intervention if there is greater take-up than expected

4.5 Improving design of market mechanisms

The extensive literature on markets around the world shows that they work best when they are large, broad, and stable for a long period of time. The history of market mechanisms in Australia suggests that these lessons are not always applied, and future markets could be designed better to meet Australia's emissions targets.

4.5.1 Larger markets are more robust

A larger market improves trading efficiency and reduces the potential for market power that reduces productivity and innovation. All Australian market mechanisms have been, at various times, dominated by a small number of buyers and/or sellers of certificates. Under the Renewable Energy Target, for example, just three companies hold the vast majority of the liability.[11] As a result the market is often relatively illiquid, and the companies have substantial market power in the development of new renewable energy projects, reducing the scope for innovative interventions by new entrants and enhanced competition.

The Queensland scheme is particularly problematic and characterised by very thin and irregular trading. Until recently just two companies represented 80% of supply.[12] Such a narrow market can lead to price volatility because a single power project can tip the market from substantial shortfall to substantial over-supply.

A larger market would cover more activities, and qualify more projects. This leads to more buyers and sellers, reducing the market power of any one player, and increasing the scope for innovative options.

4.5.2 Broader scope means more opportunities

A broader market would also allow a wider range of options for meeting an environmental target, provided they do not undermine environmental outcomes. As discussed above, GGAS, which includes the broadest range of abatement activities, has delivered the lowest costs of abatement.

4.5.3 Long time frames provide greater investment confidence

Longer time frames are important because abatement technologies often involve substantial upfront capital investments with long operational lives of 20 years or more. For these projects to be financed at a reasonable cost it is important that the market mechanism that underpins investments in abatement will be in place for a similar period of time. The Renewable Energy Target was initially a 19 year scheme, and consequently it supported a number of larger power projects.

[11] Pers. comm. Edwards (2007)

[12] Edis and Morton (2007)

4.5.4 Appropriate baselines are needed for genuine and effective emissions reduction

When establishing market mechanisms, governments often have to decide who is entitled to benefit from the scheme or be protected from its costs. Some schemes establish "baselines", which set a firm's level of existing or future emissions, beyond which it must purchase certificates or permits to pollute.

Experience suggests that governments tend to set these baselines too generously, providing businesses with windfall gains for actions that provide little benefit. This is largely because the businesses affected by the baselines almost always have better information about their business than the government does, and can use this advantage to gain an overly generous baseline.

This situation occurred under the Australian schemes we have reviewed in this report, under the now abandoned Carbon Pollution Reduction Scheme,[13] and under the European Emissions Trading Scheme.[14]

In the case of the Renewable Energy Target, owners of hydro electricity schemes in New South Wales and Tasmania lobbied to be included in the scheme on the basis that the extra revenue from the scheme would support capital upgrades that would expand the output of existing facilities. However, the baselines were set based on the generators' historical average output. This failed to take into account that hydro generation is highly variable due to large variation in rainfall. Generators were able to substantially exceed baselines in high water release years without any substantial investments to improve their plant, and without any overall increase in generation when measured over a period of several years.[15]

If government is not cautious, unlimited use of offset credits from baseline and other credit mechanisms can fundamentally undermine a scheme's environmental integrity. For example, more than 50% of credits created to date under the Clean Development Mechanism are thought to represent false abatement.[16]

To minimise these issues, governments should aim to include as many activities as possible within the general carbon pricing scheme so that most businesses have incentives to reduce emissions without a special baseline. Governments should also minimise industry support, such as free permits, that then require governments to set a baseline for the given industry. Industries that are given free permits should receive substantially less than 100% of their total liability so that even if the baseline is set incorrectly, they still have a substantial incentive to reduce emissions.

4.5.5 Targets responsive to low prices

It is not possible to forecast – and put a precise monetary value on – the benefits and costs of reducing emissions. Typically, governments set pollution reduction targets on the basis of a

[13] Daley and Edis (2010b)
[14] Sijm et al. (2006)
[15] Business Council for Sustainable Energy (BCSE) (2003)
[16] CDM Watch and Environmental Investigation Agency (2010);Schneider et al. (2010)

political judgement about the cost they feel businesses and the public are willing to bear. That leads them to focus on what negatively-affected stakeholders tell them is the likely cost of abatement.

The experience of market mechanisms in Australia and overseas suggests that governments worry unduly about the cost of abatement being high and therefore set reduction targets based on what turn out to be pessimistic assumptions. They also have price ceilings built into them so that firms do not have to pay too much to reduce emissions. In practice, however, the cost of achieving reduction targets tends to be much lower than expected.[17] This has often led to crashes in the price of certificates followed by ad hoc government interventions to increase the stringency of the target – in other words, changing the rules of the market after it has been designed.

The fixed nature of the Renewable Energy Target, GGAS and the Gas Energy Target made them unresponsive to low prices and ultimately led to sudden price collapses that have not helped to build investor confidence. These have typically then been accompanied by government interventions to expand these targets or remove some sources of certificate supply. Hard to predict interventions are also not ideal for investor confidence.

A better approach would be to introduce permit/certificate price floors. If the price falls to the floor, that indicates it is cheaper than expected to reduce pollution. Therefore it would be rational to seek to reduce pollution more quickly. The price floor effectively means that pollution will be reduced more than the original target of the scheme.

[17] Daley and Edis (2010a)

5. Grant tendering schemes

5.1 Overview

Grant tendering schemes involve government allocating funding to support projects that reduce emissions or produce low-carbon energy. Experience indicates that these schemes take too long and achieve too little to be relied upon to contribute substantially to emission reduction targets. They have performed poorly in enhancing Australia's technological capacity, and are seriously limited in their ability to be expanded enough to produce significant emissions reductions by 2020.

Over the past decade Federal and State Governments have announced around $7.1 billion dollars to grant tendering schemes aimed at reducing greenhouse gas emissions. Yet only a small fraction of the money has ever been allocated to viable projects. Most projects selected are never built. Every million dollars of announced funding produces on average just $30,000 worth of operational projects within five years and $180,000 within ten.

As a result, the amount of emissions reduction forecasted for the bulk of these programs is just 4.2 million tonnes in 2010 and 7.2 million tonnes in 2020.[18] To put this in perspective, if government were to rely on grant-tendering schemes in order to reduce annual emissions by 160 million tonnes, then based on past experience, government would need to announce an abatement purchasing fund of at least $100 billion to meet the 2020 emissions reduction target.

Considering the past difficulty in actually allocating funds of only a few hundred million dollars, it is very unlikely that a larger scale program would succeed in delivering close to this target.

Grant tendering schemes also tend to be slow to deliver. Nor have they built substantial industry capacity, given how few projects have proceeded to completion.[19]

These schemes are inherently a poor mechanism to reduce emissions or develop low emission technology. The tender process itself usually takes several years to select the projects and finalise funding agreements. Government tends to struggle to identify the best projects. The assessments required are inherently difficult because the projects often involve cutting edge technology or are highly complex. The process favours over-optimistic bids, which then makes completion unlikely. Furthermore over the long periods involved in rolling out grant tendering programs, unforeseen changes unfold that result in winning bidders' projects becoming uncommercial.

At best these programs are a wasteful distraction, since most of the money is never spent. At worst they mislead the general public by creating the impression that the large sums of money announced for projects mean the government is responding to global warming.

[18] DCCEE (2010a)

[19] ANAO (2010b)

5.2 What are grant tendering schemes?

Grant tendering schemes tend to involve a highly complex and ad hoc approach to funding abatement activities, in which:

- Government commits funds to support projects in an area deemed to be a policy priority, such as clean coal or renewable energy.
- Funding occurs through a competitive tendering process, in which government pre-commits to supporting specific projects, usually years in advance of their likely completion.
- Government takes a highly tailored approach to supporting projects. There is typically no consistent relationship between the amount of funding they receive, their cost, and how much abatement or clean energy they produce.
- The basis on which projects are selected and the amount of funding they receive is opaque to those outside the selection process. Guidelines are often open to varying interpretations. Disclosure of the reasons for funding is difficult without revealing commercially sensitive information.

5.3 Australia's experience of grant tendering schemes

Grant tendering programs tend to fall into two broad categories:

- Programs that primarily aim to reduce greenhouse gas emissions at low cost, although there may be other objectives such as reducing peak energy demand and encouraging technology innovation. These include the NSW Greenhouse Gas Abatement Program, the NSW Energy Savings Fund and the Green Building Fund.
- Programs that primarily aim to develop and commercialise immature greenhouse abatement technologies. These include the Solar Cities, Low Emissions Technology Demonstration Program, Solar and CCS flagships, and a range of other programs.

Table 5.1 Australian grant-tendering schemes - abatement and cost

Measure	Annual reduction in 2010	Annual reduction in 2020	Budgetary cost per tonne CO_2-e
Low cost emissions			
Greenhouse Gas Abatement Program	3.4Mt	3.6Mt	<$20
NSW Energy Savings Fund	0.2Mt	0.2Mt	<$20
Green Building Fund	No Estimate	No estimate	Unknown
Develop capacity			
LETDF + State Gov't funding	0.01Mt	No estimate	<$20
Solar Cities	<0.1Mt	<0.1Mt	>$100
CCS Flagships	0 Mt	2.3Mt	$50-$100
Solar Flagships	0 Mt	No estimate	$50-$100
Other programs (>$700m in funding)	0.5Mt	<1Mt	$50-$100
TOTAL	4.2Mt	7.2Mt	

Source: DCCEE (2010a) and NSW DECCW (2010a)

5.3.1 Emission reductions achieved

The emissions reduction forecasted for the bulk of the grant based schemes reviewed is just 4.2 million tonnes in 2010 and 7.2 million tonnes in 2020, as shown in Table 5.1.

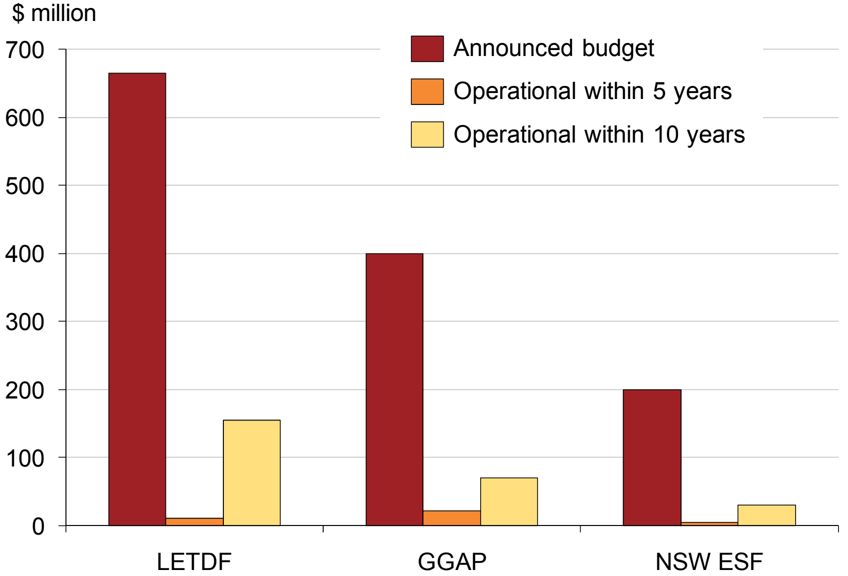
5.3.2 Cost effectiveness

Some grant tendering schemes have reduced emissions at the relatively low costs of under $20, as shown in Table 5.1. Schemes aimed at building industry capacity have been higher cost, reflecting their focus on developing immature technologies.

5.3.3 Ability to scale up

Australia's three largest grant-tendering schemes over the past 12 years have been the Greenhouse Gas Abatement Program, the Low Emissions Technology Demonstration Program and the NSW Energy Savings Fund. A mere 3% of their funding led to actual projects within five years; an estimated 18% of their funds will be spent on actual projects in 10 years, as shown in Figure 5.1 – and this forecast may be optimistic given the past record of grant-funded projects failing to complete.

Figure 5.1 Proportion of grant budgets leading to operational abatement projects within 5 and 10 year period



Source: Grattan Institute, accompanying Detailed analysis. See Table 2.2, Figures 2.2 and 2.3.

Other grant-based programs have encountered similar problems in selecting projects that deliver successful outcomes. Both the Solar and CCS Flagship programs are experiencing lengthy and unexpected delays in implementation, and downward revisions in forecast outcomes. Projects are withdrawing as changing circumstances and emerging knowledge of technology and project invalidate tender assumptions.[20] As with other grant-tendering programs, governments are raiding the funds to pay for other initiatives.

These problems are exacerbated by the fact that once a tender is awarded, it often takes several years before a proponent formerly withdraws their project and frees up the allocated funds.

5.3.4 Speed

Grant tendering schemes also tend to be very slow to deliver abatement. In some cases it can take two to three years from the announcement of the program to finalise funding agreements with successful tenderers. Even after government funding has been agreed it can then take several further years before a project has obtained necessary financing, government environmental and planning approvals and constructed the project. Often the projects falter during these subsequent stages. The pattern, particularly from the larger tendering programs aimed at supporting substantial abatement or projects, is that it tends to take five or even ten years to see funded projects through to meaningful outcomes.

5.3.5 Potential to build industry capacity

Grant tendering schemes have done little to build industry and technological capacity. Schemes aimed at low cost emission reductions have delivered so few projects that they have not materially increased industry volumes for technologies close to commercialisation. Schemes aimed at building technology

[20] See, for example, Australian Government (2009); Australian Government (2008); ANAO (2010b); Bligh (2010)

capability have also had limited impact. In addition, many of these programs (such as the Solar Cities initiative) lacked clearly articulated aims about what technology or industry capability they hoped to create.[21]

5.4 Inherent problems with grant tendering programs

5.4.1 Overview

Government grant-tendering is inherently a poor mechanism to reduce emissions, and to develop low emission technology.

Government grant tendering processes will inevitably struggle if:

- government lacks the ability to predict accurately whether bidders can deliver, which is particularly difficult when tenderers propose to use new technologies or have highly complex projects; or

- the criteria for success are not well defined

Grant programs to reduce emissions often face both of these challenges, which create problems for each stage of the tendering and delivery process.

5.4.2 Tender process problems

The tender process itself usually delays projects by several years. Most of the programs reviewed did not award tenders for two to three years because prediction required detailed analysis and criteria were unclear. Once winners were selected, the bespoke projects encouraged by unclear criteria and involving multiple parties, usually then took several years to settle funding agreements. In the programs reviewed, most winning projects did not begin implementation until five years or more after the program was announced.

5.4.3 Tender selection issues

Government tends to struggle to identify the best projects. Programs such as the Greenhouse Gas Abatement Program and the NSW Energy Savings Fund that aim to produce low cost abatement must identify projects in a narrow window. They are looking for projects that require government support to become commercial, but which only require relatively limited government support per tonne of carbon. Governments are generally poorly equipped with commercial expertise to make such fine counter-factual financial judgments.

Many emissions reductions grant schemes require inherently complex assessments. Governments must assess that the technology is viable, the cost is reasonable, and the proponent has the capability to deliver. This is difficult when the technology is cutting edge, and governments do not have internal expertise in any novel technology proposed. Project viability is also difficult to assess when, as with many of the schemes reviewed, the projects are highly complex, involving many parties and requiring many years to develop.

Tenderers cannot prepare effective bids when diverse technologies are eligible, and there are not simple criteria for success. In these circumstances, selection becomes highly

[21] DEH/AGO (2004)

subjective. Many bidders interviewed by Grattan Institute indicated that the lack of clarity around how criteria might be interpreted made it very difficult to develop bids and make informed judgements about future investment decisions.

The process also favours over-optimistic bids, as a number of bidders, both successful and unsuccessful, commented in interviews with Grattan Institute. Over-optimistic bids are by nature likely to produce better forecasts. Unlike standard government tendering (such as for building a road), there are usually no benchmarks to test the viability of the assumptions behind an emissions reduction proposal. Furthermore, because there are inevitably ample reasons to explain the failure of a project, a proponent risks little if the assumptions turn out to be incorrect. This contrasts with standard government tendering where proponents are usually large and experienced industry players, and the government has a credible threat of turning to another builder, and suing for non-delivery. In addition, many companies bidding for emissions reductions projects have limited future if they do not win a grant, so they have little to lose from over-optimistic forecasts.

5.4.4 Project completion issues

Winning tenders for emissions reduction projects are inherently unlikely to be able to complete their project. Most winning tenders reviewed did not proceed to completion or have failed to achieve self-sustaining commercial positions. Reality conflicts with over-optimistic bids. Moreover, projects are highly vulnerable if they are on the edge of known technologies or involve many participants. For example, the $125 million Solar Systems project to build a solar demonstration project failed when a cornerstone investor withdrew. In addition, difficulties with technology often make projects uncommercial. For example, the ZeroGen carbon capture and storage project withdrew from bidding for CCS flagships funding because further study revealed that the site was unsuitable for the proposed technology. Regulatory change can also make projects uncommercial. For example, the HRL lower emissions coal-fired power plant became unviable when the 2008 Carbon Pollution Reduction Scheme White Paper indicated that plants that had not been committed to before mid-2007 would not be eligible for free carbon emission permits.

5.4.5 Industry development issues

The grant-tender process is inherently unlikely to foster the aim of developing industry capability for new energy technologies. Historically, new energy technologies have typically taken decades to develop.[22] Consistent with this experience, most of the emerging energy technologies that were first funded under the 1997 Renewable Energy Commercialisation Program and the Renewable Energy Equity Fund are yet to become commercially viable. Such long development periods are beyond the patience of private capital. Consequently it is very difficult for new energy technology development to succeed without close to full government funding as part of an ongoing, reliable and strategic program.

Private companies are unlikely to be good vehicles for such funding. With commercialisation so remote, the market does not provide discipline, and their only financial incentive is to survive to the next funding round.

[22] Alic et al. (2003); Foxon et al. (2007); Grubb (2004); Stern, N. (2006)

5.5 Policy alternatives to grant tendering

Where technology is already available, a market mechanism that imposes a broad-based, technology-neutral price on carbon is much more effective in delivering large volumes of abatement than a grant-tendering scheme. This is because it avoids the need for government to decide which projects are and aren't worth doing.

Where technology is relatively close to commercial applications, programs that provide rewards on the basis of physically measurable delivered outputs are more effective in building industry capacity. For example, rather than the Solar Flagships grant scheme, solar power could have been promoted through a market mechanism, in which the government announces the volume of electricity it is prepared to purchase from solar PV installations and the maximum amount it is prepared to pay. (A further refinement provides a declining amount that government will pay, depending on the volume of delivered capacity). Developers can then determine without further government intervention whether they wish to proceed with their project. Companies in Europe are building substantial solar PV capacity on this basis. [23]

Where technology is more remote from commercialisation, then direct government funding of government-conducted research and development as part of a strategic development program would avoid the delays and waste inherent in the tender process.

Consequently, the appropriate design of government support for an energy technology depends on how close the technology is to commercial application. A Grattan Institute report in preparation will assess energy technologies against this criterion.

[23] Ernst & Young (2011)

6. Rebate schemes

6.1 Overview

Australian State and Federal Governments have allocated more than $5 billion to rebates subsidising the purchase of products that improve energy efficiency or produce renewable energy.

Experience shows that rebates simply cost too much to contribute significantly to emissions reduction. While rebate programs have lifted sales in some energy-efficient products, they have only reduced emissions a little while expending large amounts of government money. Attempting to deliver the 2020 emission target would cost taxpayers around $300 billion.

Worse, government inability to set rebates at the right levels has led to sudden changes in policy that damaged industry development. Many rebate programs resulted in an unforeseen spike in sales that blew out the government budget. As a result, governments abruptly reduced rebate levels or cancelled the program. The resulting boom-bust cycles disrupted development of industry capacity and undermined investor confidence.

Rebates may also encourage poor-quality vendors to emerge, whose products and services fail to deliver the expected energy savings.

6.2 What are rebates?

Rebates provide subsidies to reduce the purchase price of products that are expected to reduce emissions over their operational life compared to standard products. Lower prices for these products are expected to increase their sales, leading to fewer emissions.

These programs operate in a relatively straightforward manner:

- The rebate level is set at an amount per unit: for example, $1000 per solar hot water system installed;
- Government provides payment on presentation of evidence of sale or installation. (Some programs seek to restrict eligibility for the rebate in order to produce the greatest benefit: for example, only households with existing electric water heaters are eligible for a solar water heater rebate.)
- Products eligible for the rebate must meet certain performance guidelines specified under Australian or International Standards: for example, solar water heaters must contribute at least 60% of the energy used for a household's hot water needs.

Some installation standards may also need to be met. Rebates can be paid to the supplier or purchaser.

Rebates are often favoured by governments because they are relatively easy to implement, easy to explain publicly, and they provide tangible evidence to voters that the government is taking action.

6.3 Australia's experience of rebate programs

The principal rebate programs implemented in Australia over the last 15 years supported a few select products: insulation, solar PV systems, and water heaters. Rebates were also created for household products such as lighting and refrigerators but these have been very small by comparison.

6.3.1 Emissions reductions achieved

Rebates have only reduced emissions by less than 2 million tonnes CO_2-e per year, as shown in Table 6.1. This is less than one eighth of the emissions reductions from market based schemes and one sixth of the emissions reductions from energy efficiency standards. The gap will widen further by 2020.

Table 6.1 Australian rebate schemes – abatement and cost

Measure	Annual reduction in 2010 (million tonnes)	Annual reduction in 2020 (million tonnes)	Budget cost to 2015 ($ million)	Budget/ subsidy ($ / tCO_2-e)	Net cost ($ / tCO_2-e)
Insulation rebate	0.6 – 1.1	0.6-1.1	$2,400	$200-$400	$50-$200
Solar PV on-grid	0.2	0.2	$1,600	>$400	$200-$300
Solar PV off-grid	0.1	<0.1	$328	>$400	Net benefit
Solar & heat pump water heaters	0.5	<0.5	$772	>$80	$30 to net benefit
TOTAL	**1.4 – 1.9**	**<1.4 – 1.9**	**$5,000**		

Sources: Insulation – Grattan Institute analysis derived from NSW DECCW (2010b) & Energy Efficient Strategies (2008); Solar PV on-grid: Macintosh and Wilkinson (2010); and ANAO (2010a). Solar PV off-grid: DCCEE (2010a) and Wyder (2011). Solar and Heat Pump Water Heaters: derived from DCCEE (2011); and Wilkenfeld (2009b)

We estimate that the Home Insulation Program will reduce emissions by between 0.6 and 1.1 million tonnes CO_2-e per year. This estimate is notably lower than Federal Government projections.

In 2011 the government estimated that the insulation program would reduce emissions in 2010 by 2 million tonnes CO_2-e per year,[24] but declining to 0.1 million tonnes CO_2-e per year by 2020.[25] It is unclear why the impact of ceiling insulation was forecast to dissipate so rapidly. This implies that each dwelling receiving insulation saved slightly more than 1.6 tonnes of CO_2-e a year in 2010.[26]

We believe that 0.5-0.9 tonnes of CO_2-e a year per household for each year from 2010 to 2020 is a better estimate based on NSW Government estimates.[27] Other government studies show that the *total* annual heating and cooling-related emissions for an average household amount to 1.6 tonnes of CO_2-e[28] – and that insulation is likely to reduce average heating requirements by just 30%.[29]

6.3.2 Cost effectiveness

Experience shows that rebates simply cost budgets too much to contribute significantly to emissions reduction. Most schemes cost government more than $200 per tonne of CO_2-e (see Table 6.1). The net costs to the community are lower, because for some products consumers benefit through lower energy bills in future. However, the high cost to government budgets of abatement means that it would be politically impossible to use rebates to meaningfully reduce emissions. Rebate schemes have cost Australian taxpayers $5 billion in the last 10 years, as shown in Table 6.1, above). To deliver the 2020 emission target would cost taxpayers around $300 billion.

6.3.3 Ability to scale up

Rebates have little ability to scale up. Australia's rebate programs have focussed almost entirely on a handful of residential products responsible for less than 10% of stationary energy emissions.

Substantial expansion of rebate schemes beyond these products would be impractical, even if it were financially feasible. Almost 50% of Australia's emissions are produced by mining and manufacturing sectors, which generally use highly differentiated processing equipment and systems. Setting rebates for such bespoke equipment is not practical. There is such diversity of other consumer products that setting rebates for low emissions products would also be impractical.

6.3.4 Building industry capacity

Rebate schemes have generally not built substantial industry capacity. Indeed, as discussed below, they promote a boom-bust cycle that inhibits industry development. Government inability to set rebates at the right levels has led to sudden changes in policy that damaged industry development. Many rebate programs resulted in an unforeseen spike in sales that blew out the government budget. As a result, governments abruptly reduced rebate levels or cancelled the program. The resulting boom-bust cycles disrupted development of industry capacity and undermined investor confidence.

[24] DCCEE (2011a)
[25] DCCEE (2011)
[26] DCCEE (2011)
[27] NSW DECCW (2008); NSW DECCW (2010a)
[28] DCC (2009); Energy Efficient Strategies (2008)
[29] For example see www.yourhome.gov.au; CSR Bradford Insulation (year unspecified)

6.4 Inherent problems with rebates

6.4.1 High costs to government budget

Rebates must be very generous because they are offered to householders, who tend to place great weight on the upfront costs of an energy product and little weight on future energy savings.[30] As a result, the cost to taxpayers of reducing emissions through rebates tends to be at least $50 per tonne of CO_2-e and can be as high as $400.

Rebates can also waste public money by rewarding householders for purchases they might have made anyway. According to the Audit Office, half of respondents in a 2003 survey said they would have installed a solar photovoltaic system, albeit often a smaller one, even if there were no rebate.[31]

Rebates can incur further waste if they support actions that already have other regulatory support such as the multiple and overlapping State and Commonwealth policies encouraging installation of solar hot water heaters.

6.4.2 Inability to set a sustainable price

Setting the rate of a rebate is difficult. Too low, and the scheme is ineffective. Too high, and consumers will rush the scheme, blowing out its budget. In particular, if production costs are lower than predicted, the product can become virtually free to consumers, and a rush of installation inevitable.

Consequently, setting an appropriate rebate price requires a good understanding of consumer behaviour, and an accurate assessment of current *and future* producer costs.

Historically, governments have not got this balancing act right very often. Either the rebate is too small, producing no real change, or it is hit by unforeseen surges in demand, leading to substantial budget over-runs, abrupt changes or even cancellation of the program.

6.4.3 Sudden policy changes undermining industry capacity

Governments often change rebate policy significantly with little warning. The Federal government changed the level or eligibility for the solar rebate seven times in 10 years. It changed the level or eligibility for the hot water appliance rebates four times in three years. When production costs are lower than expected, and demand is higher than expected, then government budgets blow out unexpectedly. It is almost inevitable that in these circumstances, governments respond with sudden policy changes restricting the rebate. These changes leave investors reluctant to invest in building a sustainable industry.

[30] Gillingham et al. (2009), p.7, 16-17; Attaria, S. Z. et al. (2010); Train (1985); Howarth and Sanstad (1995); Hausman (1979); Geller and Attali (2005); Kempton and Montgomery (1982); Meier and Whittier (1983); Levine et al. (1994); Gately (1980)

[31] ANAO (2004)

For example, take up of the Home Insulation Program was "extraordinary and unexpected", according to the Hawke Review of the program. At its peak, demand was running at almost two and half times the anticipated level.[32]

Many existing businesses dramatically expanded their operations in anticipation of ongoing robust demand. But in February 2010 the government suddenly put the program on hold pending an investigation into a range of problems. In April, contrary to the assurances it made to industry representatives in February, it closed the program. About 1.2 million of a projected 2.7 million homes had been insulated.[33]

The abrupt and unexpected end to the program left a number of businesses and employees in severe financial distress. The National Audit Office found that, "The fallout from the program has caused reputational damage to the insulation industry, and financial difficulties for many Australian manufacturers and installers."[34] A Senate inquiry reported similar findings.[35]

Similarly, Government repeatedly underestimated demand under the Photovoltaic Rebate Program, later rebranded as Solar Homes and Communities. This produced budget over-runs, repeated changes in rebate levels and ultimately an abrupt cancellation of the program in June 2009.

[32] Hawke (2010)
[33] Commonwealth Senate Standing Committee on Environment Communications and the Arts (2010)
[34] ANAO (2010b)
[35] Commonwealth Senate Standing Committee on Environment Communications and the Arts (2010)

Constant changes and short-term policy horizons have dogged the solar PV rebate programs and undermined investment confidence. As the Senate Standing Committee on Environment, Communications and the Arts stated in a 2008 report:

> *" repeated changes to the rebate scheme over a number of years have made it difficult for solar businesses to plan for growth. The rebate scheme has been intended to encourage householders to adopt renewable energy and to provide a platform from which the solar industry may grow and mature. The committee considers that, in the long term, a rebate of this size is not likely to provide a sustainable footing for growth."*[36]

The same pattern emerged with solar and heat pump water heaters. In 2007 the Howard Government introduced a rebate for households installing solar hot water or heat-pump systems[37]. The level of the rebate and the eligibility criteria for receiving it were changed 4 times in the next 3 years.

6.4.4 Poor installation reducing effectiveness

Rebates can tend to encourage poor quality products or installation that do not reduce emissions as forecast. If the rebate allows an operator to offer free or nearly free installation, then operators may be tempted to offer low quality low cost products and installation. Householders have relatively little incentive to verify for themselves that the installation is good quality. And governments will struggle to verify installation of relatively low

[36] Commonwealth Senate Standing Committee on Environment Communications and the Arts (2008)
[37] Edis and Morton (2007)

value products across a large number of households. The problems are exacerbated if the program is implemented quickly.

For example, the Home Insulation Program ultimately conducted inspections, and around 29% identified some level of deficiency. Foil insulation was removed from 36% of houses inspected, and 4,000 potential cases of fraud were identified.[38]

6.5 Policy alternatives to rebates

The primary policy justification for rebates is that they help to overcome consumer inertia. Energy efficiency regulatory standards have played a similar role in many areas, at much lower cost to the taxpayer. For example, electric hot water heaters, whose replacement was originally encouraged by a rebate, are being phased out by regulation.

Rebates might be most useful where:

- Price is a weak mechanism to change sub-optimal consumer behaviour; *and*
- products and options are too diverse to regulate through energy efficiency regulations.

For example, retrofit of the existing building stock has wide variation in efficiency improvement potential due to such things as orientation. In these cases, the rebate should be designed to overcome consumer inertia, but only if this creates a net benefit to consumers.

Rebates might also be useful to capture externalities. For example, a rebate might be justified if it delayed or prevented expensive augmentations of the electricity transmission and distribution network. However, such rebates would ideally be linked to the actual demand avoided so that incentives are aligned as closely as possible.

If using rebates in these circumstances, it will usually be better for government to use instruments developed at arm's-length from politicians. These incentive mechanisms should determine the level of subsidy and the products which receive them based on standardised and transparent formulas or methodologies tightly linked to estimated savings in greenhouse gas emissions and electricity infrastructure costs.

Alternatively, government could try to create an energy efficiency market such as the Carbon Reduction Commitment in place in the UK. As a variant, the regulatory regime governing electricity network monopolies might allow third parties to compete to provide "nega-watts" that would avoid the costs involved in augmenting electricity networks, somewhat like the regulatory model in California. The exact design and scope of such a mechanism is beyond the scope of this report, but considering the $43b capital expenditure being incurred in augmenting and maintaining networks over just the next five years,[39] there is a pressing need to find a better model to encourage energy efficiency. The costs of augmenting networks might also be

[38] ANAO (2010a)

[39] esaa (2010)

reduced if electricity was more expensive at peak periods, more accurately reflecting costs to the system.[40]

[40] Nelson et al. (2011)

7. Energy efficiency regulatory standards

7.1 Overview

Energy efficiency standards set minimum levels of energy efficiency that products and buildings must meet to be legally sold in Australia. They have reduced emissions substantially, and have also saved consumers and the economy money. They do so because they produce better decisions than consumers are likely to make individually.

However, energy efficiency standards can only play a support role in meeting the 2020 targets. They are slow to take effect, do not restrain usage, and do not extend to substantial industry consumption. They should complement rather than replace a well-designed carbon price. However, better enforcement of existing energy efficiency regulations would reduce emissions further.

7.2 What are energy efficiency standards?

Energy efficiency standards involve government insisting that goods or construction of buildings meet a minimum level of energy efficiency. This usually involves a detailed technical exercise:

- Product standards are developed or adopted to define a set of products, such as lighting or office buildings, to which energy efficiency regulations will apply.
- Technical standards are developed or adopted to define and measure the energy efficiency of each relevant product type. For lighting, the standard defines the energy consumed to produce a given amount of light; for office buildings it defines the energy consumed in lighting, heating, cooling and lift operation per square metre of office space.
- Testing facilities and regimes are established to assess whether products meet the energy efficiency standard.

While these regulations are typically quite prescriptive in defining particular standards for many narrow product classes, they usually do not specify the technology to meet the energy efficiency standard. This often leaves manufacturers with real flexibility. For example, one refrigerator manufacturer may roll out an especially efficient compressor, while another manufacturer introduces a super-insulating door.

7.3 Australia's experience of energy efficiency standards

7.3.1 Emission reductions achieved

Energy efficiency standards have been set for many products sold in Australia. They have reduced emissions almost as much as market mechanisms. They are anticipated to reduce emissions further by 2020, as shown in Table 7.1.

Table 7.1 Energy efficiency measures emission reductions and costs

Measure	Annual reduction in 2010 (m tonnes)	Annual reduction in 2020	Cost per tonne CO_2-e
Appliance and equipment minimum regulatory standards	7.4	22.5	Net benefit
Building standards	4.2	11.8	Net benefit
TOTAL	11.6	34.4	

Sources: Appliance standards – Wilkenfeld (2009a), Department of Climate Change and Energy Efficiency (2010a)

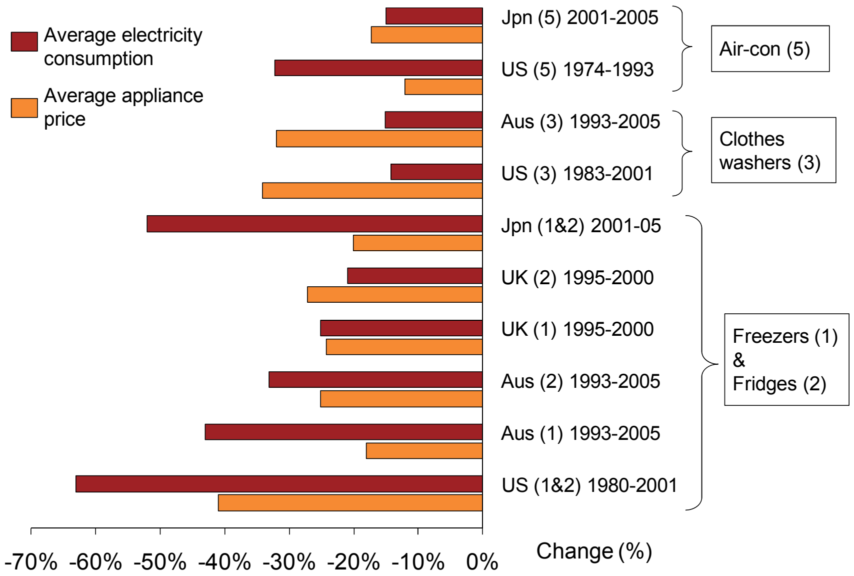
7.3.2 Cost effectiveness

Energy efficiency standards have achieved these results with a net economic benefit to consumers. Implementation and management have cost State and Federal governments very little - less than $15m per annum.

While these abatement and cost estimates are based largely on projections, they are supported by post-implementation evaluations. These suggest that the energy efficiency of regulated appliances has improved substantially beyond likely business as usual trends. Post-implementation reviews also show that the actual costs to implement energy efficiency standards were less than estimated in projections undertaken for regulatory impact statements.[41] Appliance prices have continued to decline despite substantial tightening of efficiency requirements, as shown in Figure 7.1.

[41] Ellis (2007); Energy Efficient Strategies (2010a, b); Energy Consult (2010); Energy Consult (2006); McMahon et al. (2000)

Figure 7.1 Change in electricity consumption and prices for major appliance types



Source: IEA (2009)

7.4 Why energy efficiency standards work

Energy efficiency standards work because they embody better optimised decisions than consumers are likely to make individually.

It may seem surprising that energy efficiency standards can reduce emissions at no net cost. But a long-standing body of research literature shows that consumers and businesses systemically make poor decisions about energy efficiency and miss opportunities to save money.[42]

In part, they miss these opportunities because they lack information. People often do not know how much energy they consume or how they might consume less.[43] The efficiency of products may not be easy to see. Information on energy use is often received a long time after it was consumed, with no breakdown of the impact of individual actions. Utility bills have been compared to a supermarket that does not put price tags on its goods and only sends a monthly bill for the total expenditure, a month in arrears.

However, even when they have better information, consumers still make decisions that cost them money.[44] The major obstacle is insufficient capacity to process the massive quantity of information in modern life. One needs to keep in mind that electricity and gas bills typically represent less than 3% of household and business expenditure. Individuals and businesses lack the time, resources and capacity to take into account all relevant and available information for every decision.[45] Instead they prioritise and typically spend little time analysing energy efficiency investments, which might offer high returns on investment, but the absolute gains are often small.

[42] Train (1985); Howarth and Sanstad (1995); Hausman (1979); Geller and Attali (2005);Meier and Whittier (1983); Levine et al. (1994); Gately (1980)
[43] Kempton and Montgomery (1982; Attaria, S. et al. (2010); Shipworth (2000)
[44] Stern, P. (2008); Bartiaux (2008)
[45] Simon (1978)

Instead, purchasers typically apply simplified decision rules that tend to underweight or ignore energy operating costs. These simplified decision rules save time and effort but in some circumstances lead to significant errors, even when training and information should help people to avoid these errors.[46]

Suboptimal decisions can also result if the capital purchaser does not pay the operating bill. For example, landlords pay for heaters and insulation, but tenants pay the energy bill. In business, managers who decide on capital expenditures are often not responsible for energy costs.

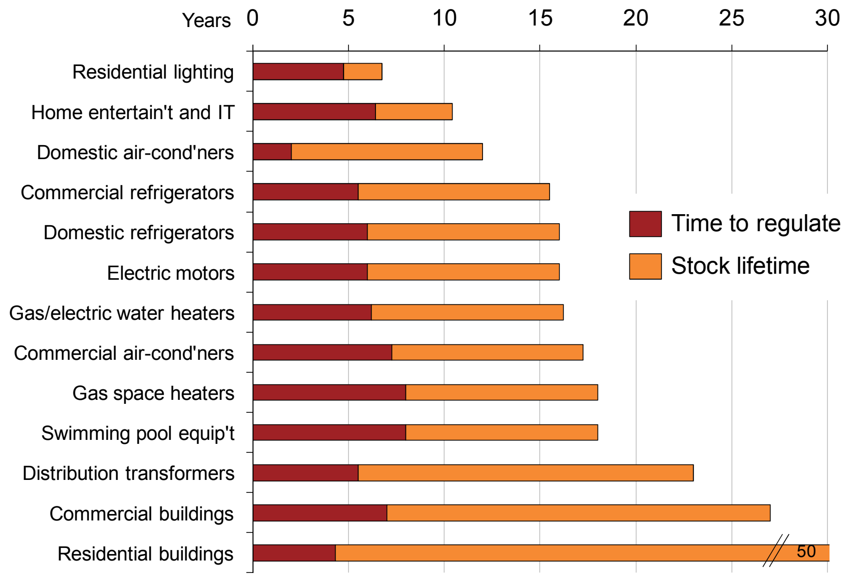
In these circumstances where individuals make systemically sub-optimal decisions, government can efficiently gather information to make better trade offs, and regulate so that consumers can benefit from these. The gain depends on the quality of the government's information and its analysis of the costs and benefits of regulatory standards.

7.5 Limitations of energy efficiency regulations

7.5.1 Slow impact

Implementing new standards takes a long time. Typically it takes about six years to introduce new efficiency standards, and then a further 5-10 years for new purchases to replace the existing stock, as shown in Figure 7.2.

Figure 7.2 Time to implement Australian energy efficiency standards



Sources: Australian Building Codes Board) (www.abcb.gov.au); related regulatory impact statements available from: www.energyrating.gov.au

Creating a new standard requires time and substantial consultation with affected stakeholders to achieve quality results.[47] It requires engineering analysis of existing products and potential improvements, consumer analysis of the impacts of changes, supplier analysis such as the impacts on competition, and development of technical standards.

[46] Kahneman (2003); Sunstein and Thaler (2003)

[47] Wiel and McMahon (2003)

Even once a standard is established, programs typically provide a notice period of up to three years to enable suppliers to adjust their operations and products to meet the standards. The next round of standards is only initiated after a break of a few years so that suppliers can recoup investments required to meet the prior standard.[48]

It then takes several years for the existing stock of products in use to turn over and be replaced by products that meet the new standards. This usually takes at least five years, and sometimes decades, as shown in Figure 7.2.

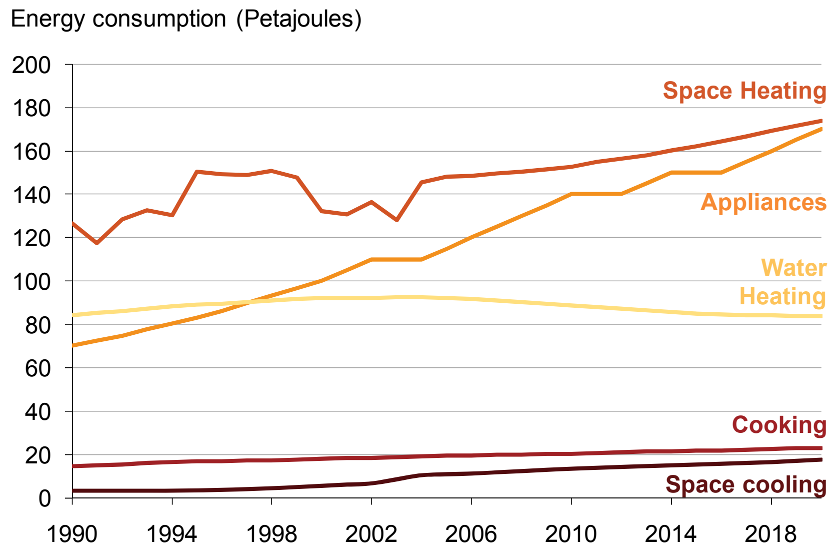
Some industry experts believe that standards could be implemented faster.[49] Delays may also produce new costs, such as the proliferation of highly inefficient low voltage halogen lighting. Nevertheless, significant acceleration would be difficult without sacrificing quality and thoroughness.

7.5.2 Efficiency savings have struggled to keep pace with more and larger energy consuming equipment

Despite improvements in the efficiency of individual products, overall Australian energy consumption continues to increase.

Absolute carbon emissions produced by the products that consume most household energy – refrigerators, water heating and lighting – are declining or are expected to stabilise shortly. However, these gains are being offset by larger homes, the proliferation of home entertainment equipment, increased penetration of air conditioners, and smaller household sizes, as shown in Figure 7.3.

Figure 7.3 Trends in total Australian household energy consumption by major end use



Source: Energy Efficient Strategies (2008)

Energy efficiency regulations can reduce energy consumption for a given device while it is turned on. However, efficiency regulations cannot restrain usage. Energy consumption is affected by the size of equipment, how many devices people own

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[48] Holt et al. (2000)

[49] Based on Grattan Institute interviews with energy efficiency experts and the experience of one of the authors, who has been a staff member of a government program implementing energy efficiency standards

and use, how many hours they stay on, and how well they are maintained.

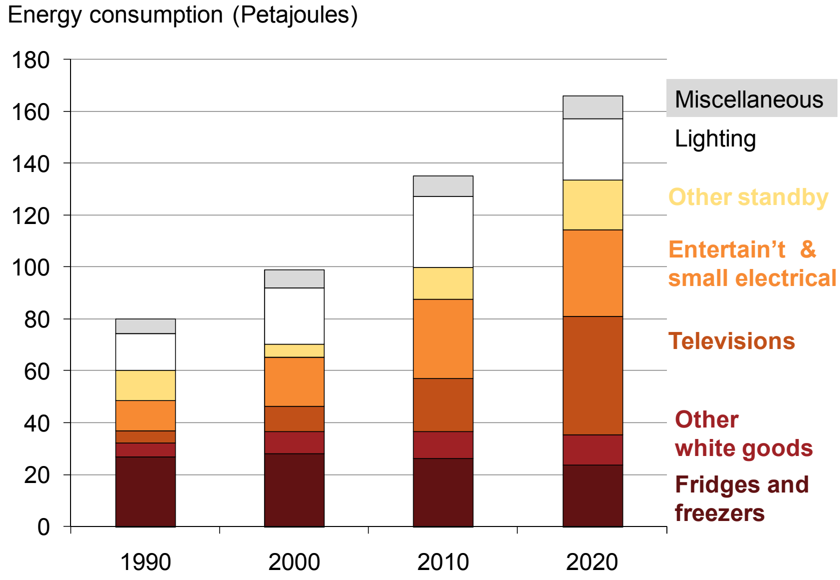
The average size of new Australian homes increased by 40% between 1985 and 2009. Australia's new homes are now the largest in the world – well above those in the US, and almost double those of the UK.[50] And larger dwellings require more heating, cooling and lighting.

Energy usage is increasing substantially because people own more, larger televisions, used for more hours. In additional small electrical entertainment and computer equipment has proliferated, collectively consuming substantial amounts of electricity, even when switched off in stand-by mode,[51] as shown in Figure 7.4.

This does not suggest that energy efficiency standards are not worthwhile, but that they are insufficient in isolation.

Claims that gains in energy efficiency are largely eroded by a rebound effect (whereby consumers will use a product more intensively because it costs less to run) are not supported by the bulk of evidence. According to a number of reviews of the research on this topic, where a rebound effect is detected it usually falls well short of overwhelming reductions in energy consumption from improved energy efficiency. [52]

Figure 7.4 Trends in Household Electrical Appliance Energy by Type



Source: Energy Efficient Strategies (2008)

The dominant driver of increased usage is affluence: with productivity growth and lower prices, people can afford to own more and larger stuff.[53] Improved energy efficiency may accumulate over a decade to save households perhaps a few hundred dollars per year; this is small relative to real household annual income growth of thousands of dollars over a similar period.

[50] Commsec (2009)
[51] Energy Efficient Strategies (2008)
[52] Geller and Attali (2005); Sorrell et al. (2009); Sorrell (2007)

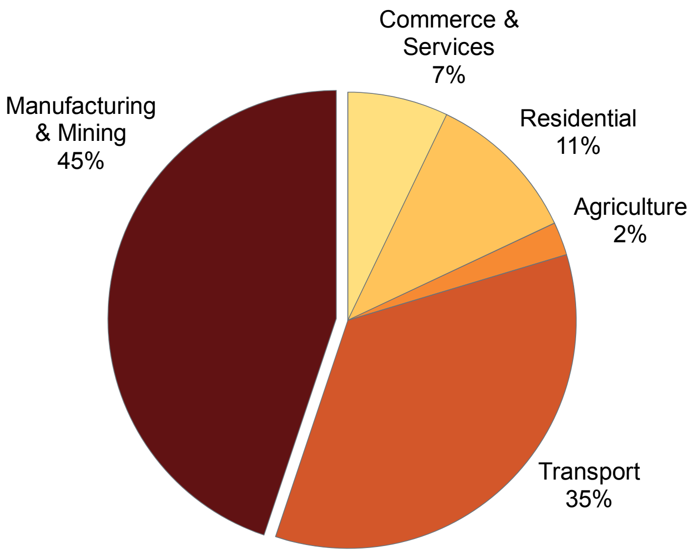
[53] Nadel (2011)

To achieve significant reductions in emissions it is not enough to improve the efficiency of equipment. Australia must also reduce the carbon intensity of the energy this equipment uses.

7.5.3 Energy efficiency schemes do not cover major industrial consumers

It is difficult to apply energy efficiency standards to the mining and industrial processes that are responsible for nearly half of Australia's total energy consumption.

Figure 7.5 Australian energy consumption by sector



Source: ABARE (2010)

Energy efficiency standards work well when many consumers use similar devices in similar circumstances. However, mining and industrial processes tend to use highly specialised and customised equipment and processing systems. Setting standards for these products and processes in many cases is not practical. Also energy-intensive businesses can typically afford to dedicate greater attention to energy consumption and efficiency than households and commercial sector businesses because it is a more significant cost factor.

7.6 Improving energy efficiency regulation

Better enforcement of existing energy efficiency regulations could reduce emissions further. Many products sold do not meet current standards, and only very limited resources are expended on compliance. Some estimate that about 20% of products sold are not compliant.[54] Greater resourcing for enforcement would increase compliance, and reduce emissions.

At present the budget for compliance and testing of Australian appliances and equipment is extremely modest: a mere $500,000 in 2008-09 and $1.5 million in 2009-10.[55] Only 0.6% of the registered products that are regulated were tested in 2008-2009;[56] this is budgeted to double in 2009- 2010,[57] but will remain small.

In addition there is a need to dedicate greater resourcing to improve the level of data collected on equipment and appliance

[54] Ellis et al. (2009), based on sales-weighted average
[55] George Wilkenfeld & Associates and Marsden Jacob Associates (2010) p.91
[56] Department of Climate Change and Energy Efficiency (2010b) p.27
[57] E3 Committee (2009)

sales and usage patterns across residential, commercial and industrial sectors across a range of locations.[58] This would enable energy efficiency standards and energy policy more generally to be better targeted and designed.

[58] Cited in DCCEE (2010b)

8. Choosing the right policy: Case study on Green Carbon

Reducing carbon emissions can raise abstract issues. Public debate can often jump to more tangible discussions about which abatement technology is the best. This leads to calls to ban coal fired power stations, fund solar panels, construct public transport, research clean coal, or plant lots of trees.

"Green carbon", and its large potential as a carbon sink, has received recent attention. Based on Australia's experience of the last 14 years, what policy is best in responding to these opportunities?

8.1 Green carbon – great potential

Green carbon includes planting trees and cultivating soils to store greenhouse gases.

Australia has a large area of land capable of storing carbon either through establishing and retaining trees or through changing agricultural practices so that soils retain more carbon rather than releasing greenhouse gases from decaying plant matter back into the atmosphere.

Estimates of the theoretical/technical potential for greater retention and storage of carbon within soils and trees in Australia are detailed in Table 8.1. The potential is very large – in the realm of several hundred million tonnes of CO_2-e reductions per annum.

Table 8.1 Estimates of maximum technical annual abatement from options for reducing emissions in natural/biological systems

Option	Garnaut (2008)	CSIRO (2009)
AGRICULTURE	>300Mt	164Mt
Examples: Rehabilitate over-grazed rangelands and mulga lands, savanna burning, build soil carbon and reduce nitrous oxide emissions, reduce livestock methane		
FORESTRY	>300Mt	853Mt
Examples: convert land to forestry for dedicated commercial carbon sequestration; convert land to forests for biodiversity; growth of commercial forestry for timber; reduced land clearing; management of forestry regrowth		
BIOENERGY	44Mt	9Mt
Biofuels and electricity from biomass such as wheat straw; creation of biochar for power and soil sequestration		

Source: Garnaut (2011)

Not only might green carbon practices store greenhouse gases, they might also improve soil fertility, improve agricultural output, reduce soil salinity and even provide habitat to support native wildlife.

Farmers may be willing to undertake such actions for low cost considering all the other benefits that green carbon also provides.

8.2 Uncertain outcomes

However, there are many uncertainties. The estimates in Table 8.1 do not take into account the potential cost of realising this abatement, and are subject to very high levels of uncertainty.

The CSIRO in describing their own estimates stated that,

> *"It must be recognised that these estimates contain a combination of biological, technical and implementation uncertainty."*

In relation to the main soil carbon options they observed,

> *"The most difficult to implement are the options that apply to complex eco-systems and where there is a high level of uncertainty about carbon storage, for example, regeneration of rangelands and mulga.*

In a subsequent 2010 report the CSIRO further flagged uncertainties around estimates measuring the potential for soils to capture carbon:

> *"There is a strong theoretical basis partially supported by a limited number of field studies for significant soil organic carbon sequestration potential in several Australian agricultural sectors. However, a general lack of research in this area is currently preventing a more quantitative assessment of the carbon sequestration potential of agricultural soils."*[59]

Furthermore, these soil carbon measures would need to be implemented at vast scale to reduce emissions significantly. According to CSIRO's 2010 study, improved management of cropland or changes in management of pasture is likely to store around 1 tonne CO_2-e per hectare per annum.[60] Therefore to deliver just half of Australia's 2020 emissions reduction target through soil carbon would require changes to at least 10% of Australia's land mass, and possibly more.

It is also unclear how soil carbon sequestration could be measured regularly over large areas at a reasonable cost in order to verify the claimed emission reductions.

Considering the many uncertainties about volume and cost, is is a big call to rely on this option without also supporting alternatives.

8.3 Policy choices

A carbon pricing scheme will deliver the lowest cost abatement whether or not green carbon works out.

[59] Sanderman et al. (2010)
[60] Sanderman et al. (2010)

The beauty of a broad-based carbon pricing scheme is that if abatement from green carbon turns out to be plentiful at low cost and can be reliably measured, then the scheme will result in a lot of green carbon initiatives. After all, why would businesses pay more than they must in order to comply with government obligations? If green carbon works at a large scale then it will lead to a lower carbon price which will reduce the impact on electricity prices.

But if green carbon turns out not to be cheap and plentiful, or its abatement can't be reliably measured, then the market mechanism will lead Australia to reduce emissions in other ways, and will not waste money on green carbon.

Governments could instead make grants to green carbon projects, or provide rebates for green carbon activities. The history of other programs to reduce emissions suggests that these could be ineffective or expensive.

A scheme that provided grants to farmers proposing to adopt green carbon practices would encounter many of the problems experienced by the Greenhouse Gas Abatement Program and the NSW Energy Savings Fund. The scheme would need to identify in advance land improvement projects within a narrow range of commercial outcomes. On the one hand, it would want to avoid projects that are commercially viable anyway. On the other hand, it would want to avoid projects that are ultimately high cost per tonne of abatement. Based on the history of previous programs, government will struggle to make this assessment.

Although a comparison might be drawn with water markets, this is not a good analogy. Australia now allows water rights to be traded. When the government wanted to increase environmental flows, it bought water permits from irrigators at the market price. However, it would be misleading to draw an analogy with government buying promises from farmers to change their practices and increase soil carbon. There is no “execution risk” with water: by simply doing nothing and taking no water, the farmer effectively increases environmental flows. It is easy for government to verify how much water the farmer has (or has not) taken from the river. By contrast, in order to actually reduce greenhouse gases, the farmer must actively change practices, the technology needs to work, and government must verify how much CO_2 has been captured in the soil. A lot can go wrong, and it is difficult for government to be confident in advance that the recipient of public money will ultimately reduce emissions as promised. In the meantime, significant government funds will remain locked up in the scheme, unavailable to others.

Alternatively, government could provide a dollar amount to any farmer who has adopted a particular practice. This would encounter many of the issues experienced by solar rebate programs. If the price is set too low, then farmers will ignore the scheme. If the price is set too high, then the scheme may be rushed by farmers sensing commercial opportunity, blowing out the scheme's budget, and creating a boom bust cycle. Either way, if the government pays for adopting a practice, rather than for measured emissions reductions, then the practice may have less impact than forecast, and government may be paying a relatively high price per tonne of CO_2-e. The best mechanism would be for government or private sector to pay for emissions reductions actually delivered – a market mechanism.

Box 8.2 Examples of green carbon projects supported by past government programs

While not its specific focus, the programs reviewed in this report pursued a number of projects where green-carbon fell substantially short of expectations, suggesting that policy should seek abatement from a wide range of sectors and avoid substantial reliance on green-carbon.

In 2006 under the Greenhouse Gas Abatement Program, the National Association of Forest Industries was awarded a $10m grant to sequester carbon in multi-purpose plantations. The project never delivered any abatement.

Prior to 2003, under the Renewable Energy Commercialisation Program, Biomass Energy Services and Technology was provided with an $850,000 grant to develop a biochar and energy power project. This company, now called Pacific Pyrolysis, is still fine-tuning its technology almost 10 years later and is still at pilot/demonstration stage.

In 2000, prior to the commencement of the Renewable Energy Target, government-commissioned experts forecast that sugar cane biomass would supply around 50% of renewable energy under the scheme. Instead it only delivered 10%.

Under the NSW Government's carbon trading scheme (the Greenhouse Gas Abatement Scheme) tree planting and forestry is eligible to earn abatement certificates for the carbon they sequester. Yet since 2003 biocarbon has only reduced emissions by half a million tonnes per annum, and only accounts for 2.7% of the abatement certificates created under the scheme

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