Review of energy efficiency policy options for the residential and commercial building sectors

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PricewaterhouseCoopers

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Executive summary

This report has been commissioned by the Energy Retailers Association of Australia. The purpose of this report is to assess various policy options for increasing energy efficiency in Australia, particularly drawing on overseas experiences, and particularly examining energy efficiency policies that specifically target residential and small to medium size commercial buildings (to the extent that these are covered by the same schemes).

The looming challenges of climate change are driving governments around the world to look for policy options to reduce emissions and encourage adaptation. With the stationary energy sector producing about 40 per cent of Australia's total greenhouse gas emissions, energy efficiency is considered a cost effective way of both reducing emissions and assisting consumers adapt to price increases associated with the introduction of emissions trading.

In a country with an abundance of high quality coal and natural gas, and relatively low energy prices, Australians have arguably had little incentive to improve their energy efficiency. A number of recent studies have identified the potential for a range of energy efficiency improvements in both the residential and commercial buildings sectors - at little or no cost. Capturing these opportunities is not without its challenges, however.

The existence of market failures in the uptake of energy efficiency opportunities is well documented in the economic literature. The most important market failures are:

- Imperfect information: consumers' lack convenient access to information regarding the range and effectiveness of energy efficiency options, resulting in opportunities foregone.
- Misaligned incentives: eventuating when those responsible for selecting or purchasing equipment cannot access the benefits of improved energy efficiency (for example, landlords or agents making energy efficient purchase decisions are not able to readily access the benefits).

International experience

The presence of such market failures have led governments around the world to promote the adoption of energy efficient practices in both the residential and commercial sectors. Recent approaches include:

- Regularly updating energy efficiency standards for new buildings and appliances and extending these to cover building renovations and a wider range of electric and gas appliances.
- Creating government or quasi government organisations dedicated to providing consumers with advice on energy efficiency.
- Reserving a component of energy tariffs to be re-invested in energy efficiency projects.
- Applying energy efficiency targets or obligations on energy retailers.
- Using government 'spending power' to lead by example in energy efficiency best practice and provide a powerful incentive for technology innovation.
- Mandating energy performance certification for buildings and applying incentives for green building development and refurbishments.

Detailed quantitative information on the effect of the various policies is not readily available, highlighting a problem for governments in determining the most appropriate and cost effective policy options. In addition, the analysis of the impact of energy policies is complicated by the

interaction of other factors influencing per capita energy consumption, including the prevailing economic conditions, local climate and energy prices. The findings of this report should be viewed in this context.

Notwithstanding the lack of clear data, anecdotal evidence suggests that deploying a combination of policies and facilitating partnerships between government and the private sector is more effective in achieving gains in energy efficiency than either the government or private sector acting alone to pursue one policy response.

Australian plans

Australia already has some experience in the introduction of a range of energy efficiency measures. The policies can be broadly categorised as:

- Information and education campaigns
- Building and appliance standards
- Financial and other incentives
- Mandatory energy efficiency targets

Recently the focus on climate change and the expectation of rising energy costs as a result of introducing an emissions trading scheme (ETS) in 2010 has led to an increased focus on energy efficiency policy at both the state and Commonwealth level. Policy makers are particularly focusing on the residential and commercial building sectors. This has resulted in a range of apparently uncoordinated policy responses across jurisdictions, with these sometimes overlapping. For example:

- Mandatory building certification – only being applied in ACT.
- Variations in standards regarding building energy efficiency across states and territories.
- Numerous state and territory specific grant and rebate programmes – e.g. NSW Energy Savings Fund, Commonwealth and Victorian solar hot water rebates etc.
- Proposals for three separate energy efficiency obligations for retailers in Victoria, South Australia and New South Wales, all due to start in 2009.

Un-coordinated policy responses can be expected to lead to less efficient outcomes. For example, the energy efficiency target schemes currently being developed by the states are likely to result in higher transaction and compliance costs than a national response.

The recent commitment by the Council of Australian Governments (COAG) to develop a National Strategy for Energy Efficiency may signal a renewed effort to develop innovative approaches and align existing policies and programs more closely so as to remove overlap and inefficiency. This report provides a qualitative assessment of possible policy approaches available to government for driving energy efficiency. It focuses primarily on the residential sector but also considers commercial buildings.

Evaluation framework

Each category of policy option has been assessed through an evaluation framework which considers:

- the appropriateness of the measure;
- the effectiveness at achieving policy objectives;
- the cost effectiveness of delivery; and

- other impacts including the extent to which the policy is likely to complement the Australian emissions trading scheme (ETS), now referred to as the Carbon Pollution Reduction Scheme (CPRS).

This report evaluates the four types of policy options and identifies a number of specific options that appear promising based on publicly available information concerning international experience.

Findings

Our assessment of overseas and Australian experiences highlights the complexity of the problems faced by policy makers. It is apparent that there has been very little formal (quantitative) analysis of the actual impacts of policies and combinations of policies. The findings therefore rely to an extent upon more subjective and anecdotal evidence. In summary, the findings suggest that:

- Given the market failures, energy efficiency policy has a role to play in complementing emissions trading.
- No single policy option addresses all market failures comprehensively; there is no 'silver bullet', and therefore a range of responses are required.
- International research shows that energy efficiency has been effective in flattening growth in energy consumption, not reducing overall demand.
- There is a need to fully consider transaction costs when developing new policy approaches.
- Nationally-consistent frameworks should be pursued wherever possible, as they will tend to minimise costs while still allowing individual state needs to be met and innovation to thrive.
- Collaboration between government and private entities (especially energy retailers) has been more effective where there has been certainty around cost recovery and/or a profit incentive.
- Government can play a 'leadership' role, for example using its procurement volume to create a market for efficient appliances or by working with suppliers to drive innovation.

The following summarises an assessment of the respective merits and challenges associated with the four categories of policy responses considered.

Building and appliance standards

Standards are widely considered to be the most efficient and cost effective of energy efficiency policy options for *new* buildings and appliances. These can be seen as the first tier and most important of policy options for increasing energy efficiency. A number of such measures have already been introduced in Australia and elsewhere.

Enforcement of standards, particularly for appliances, has been of concern in a number of countries. Effective monitoring and enforcement is critical if standards are to be effective. Testing carried out in Australia has historically shown high rates of non-compliance with equipment standards, with many products carrying labelling which give false claims of efficiency ratings.

It is also important to drive energy efficiency improvements in the *existing* building stock. There is less experience in the application of standards to existing buildings compared with new buildings.

Information and education

Given the public good characteristics of energy efficiency improvements, there is an important role for governments to play in the provision of information and education. Informing consumers of their ability to improve energy efficiency will also generate private benefits in the form of cost savings.

Information and education programmes can help reduce the incidence of the rebound effect (cost savings being spent on other energy intensive products or activities).

Internationally, a number of countries and regions (including various states in the United States) have set up government or quasi government organisations dedicated to advising consumers on energy efficiency. Australia could also benefit from such an organisation which could provide a powerful focal point for coordinating a consistent message to the public. It could also attract knowledge and funds from the private sector, as has happened in the United Kingdom under the Energy Savings Trust model.

For the delivery of information, appliance and building certification appear to be effective and lower cost options, as they provide an incentive for manufacturers and building developers to improve the energy performance of their products. Recommendations for the extension of appliance labelling to more products and the national roll-out of building certification have already been made through the National Framework on Energy Efficiency.

Financial and other incentives

Financial incentives (either economic or fiscal) do not target the market failures applicable to energy efficiency directly. Instead, they improve the private benefits of undertaking energy efficiency opportunities. In a strict economic sense, the case for their use on the grounds of cost effectiveness is therefore questionable. Also, the potential for “non-additional” improvements implies an additional cost will be borne by society, which may be inequitable, especially at a time when an ETS is being introduced.

However, there may be specific cases or other objectives for which financial incentives could be appropriate. These include: addressing fuel poverty or protecting low income households from increasing energy prices (on the basis that such consumers cannot afford to undertake energy efficiency improvements); and incentivising research, development and commercialisation of promising technologies.

Non-financial incentives, such as planning concessions for green buildings, have been effective in the US. There would appear to be scope for Australia to incentivise more cost-effective energy-efficient buildings through wider use of building certification as a means of awarding incentives – such as expedited permitting and increased density or height. From this perspective the roll-out of nationally consistent building certification standards to support such incentive schemes is particularly important.

Accelerated “green depreciation” is another measure that has attracted recent attention as a way of incentivising more rapid uptake of energy efficiency improvement opportunities in the commercial buildings sector.

Mandatory energy efficiency targets (white certificate schemes)

While international experience with such schemes is fairly limited to date, early indications are that mandatory energy efficiency targets (i.e. white certificate schemes) can be effective in delivering energy efficiency improvements. However, these schemes are complex to design and do not come without their own challenges.

A key concern with white certificate schemes is their level of cost-effectiveness. If mandatory targets are not easily met by liable parties, consumers could be forced to pay for uneconomic forms of abatement.

'Non-additionality' is also a concern for white certificate schemes, because it can mean that society subsidises viable actions which may have occurred anyway. The risk of incurring 'non-additionality' costs has clearly increased at a time when the CPRS is being introduced – for example, if retailers incur costs in 'seeking out' and implementing energy efficiency gains that may happen anyway due to increases in energy prices.

The magnitude of transaction costs is not well understood. In a study undertaken by the European Commission transaction costs were estimated to be up to 40% of overall costs (this included costs associated with identifying opportunities, providing information to customers, assessing sub-contractors and complying with scheme administrative requirements) (Luis Mundaca 2006).

As for any policies that require compliance by national organisations, there is likely to be additional costs if the energy efficiency target schemes are not uniform across states. Ultimately, these additional costs will be borne by consumers. Consistent with the objectives of the National Framework on Energy Efficiency, to the extent possible these policies should be nationally-coordinated.

As a result of their relationship with end customers, energy retailers can play an important role in assisting governments with the implementation of energy efficiency policies. However, the incentive of retailers to innovate may be reduced in markets where the price of electricity is regulated, because of a constrained ability to recover costs.

Key conclusions for policy makers

1. Energy efficiency policy has a role in complementing policies such as the CPRS to reduce greenhouse gas emissions.

2. Policies aimed at improving energy efficiency should generally be based on a nationally-consistent framework whilst at the same time accommodating the needs of each state and allowing local innovation.

3. Transaction costs associated with energy efficiency polices represent a sizeable proportion of the overall costs of implementing such schemes. Governments must focus on reducing these costs to make energy efficiency more effective.

4. Retailers can play an important role in assisting government deliver energy efficiency outcomes. However, it is important to ensure that adequate incentives are in place for retailers to seek out opportunities and that they are able to recover the costs of doing so.

5. Information provision is a key complement to any policy and is best driven by government, as foreshadowed in the CPRS Green Paper. Information may need to be tailored to meet local needs.

6. Building and appliance standards require appropriate measurement and enforcement. Greater enforcement of standards may be a more cost effective way of increasing energy efficiency than more complex policy options. There is also a need to drive energy efficiency improvements within the *existing* building stock, although there is little experience of applying standards to existing buildings.

7. There may be a role for a nationally-coordinated government organisation dedicated to advising consumers on energy efficiency. Such an organisation could provide a powerful focal point for coordinating a consistent message to the public and in attracting knowledge and funds from the private sector. Collaboration between government and private

stakeholders such as energy retailers and appliance manufacturers appears to have been effective in overseas jurisdictions such as California.

8. There is a strong case for rolling out mandatory building certification nationally. As well as helping to overcome information barriers this could be used as a means of incentivising developers to increase the energy performance of buildings.

1 Introduction

This report has been commissioned by the Energy Retailers Association of Australia (ERAA). The purpose of this report is to assess various policy options for increasing energy efficiency in Australia, particularly drawing on publicly available information regarding overseas experiences, and particularly examining energy efficiency policies that specifically target residential and small to medium size commercial buildings (to the extent that these are covered by the same schemes).

Energy efficiency, in the context of this review, refers to the ratio between energy inputs and outputs. This can be seen from two perspectives:

- the efficiency of converting fuel into electricity or heat on a large scale, for example within a power station (supply side energy efficiency), or
- the ratio between electricity and fuel inputs and useful outputs (such as heating, cooling and lighting) at a consumer level (demand side energy efficiency).

In this report energy efficiency refers to demand side energy efficiency, or the degree to which consumers are efficiently using electricity to gain useful benefits.

This review is concerned with examining energy efficiency policies that specifically target residential and small to medium size commercial buildings (to the extent that these are covered by the same schemes). The range of policy options that this review has addressed include:

- provision of information regarding energy efficient alternatives
- mandatory or minimum building and appliance standards
- financial incentives, and
- market based initiatives or certificate schemes.

A particular aim of this report is to review the operational features of certificate schemes given their increasing popularity internationally in recent years and the attention they are receiving in Australia.[1]

This study outlines advantages and disadvantages of broad policy options against an evaluation framework. It does not aim to recommend a particular option, but rather highlights the merits, disadvantages and challenges of the alternative approaches designed to address the increased uptake of energy efficiency.

In preparing this report we have observed that quantitative evaluations of policy packages are difficult and rare (UNEP 2007, p 55). For this reason this study contains mostly a qualitative evaluation of policy options. Where relevant data is available this has been provided.

[1] For example the Victorian Energy Efficiency Target (VEET), Residential Energy Efficiency Scheme (REES) in South Australia and the recent review by the Senate Standing Committee on Economics of the National Market Driven Energy Efficiency Target Bill 2007 [2008].

Part A
Background

2 The policy context in Australia

2.1 The environment in which this review is undertaken

Given international concern with climate change, governments worldwide are increasingly looking at options to mitigate risk and adapt to the potential impacts. In this context, energy efficiency is often seen as an inexpensive option for reducing emissions and adapting to price increases. However, the case for government intervention to improve energy efficiency is not without some debate, particularly in the context of how energy efficiency measures may integrate with a comprehensive ETS.

Commonly advanced and supported arguments for government intervention include:

- A need to overcome market failures and other 'barriers' to energy efficiency.
- Emissions trading is not designed to *directly* reward actions taken to reduce energy demand (in the same way it directly rewards reductions in emissions production through the value of emission allowances).
- Electricity demand is inelastic and therefore increasing energy prices, do not drive a corresponding increase in the level and uptake of energy efficiency measures.
- A high proportion of the public do not make rational, privately cost effective decisions even when provided with relevant information either because of information overload (bounded rationality) or the fact that energy costs are not large enough to be a concern.
- Energy efficiency is a cost effective means of reducing GHG emissions.

Conversely, some commentators argue against government intervention, on the grounds that:

- Energy efficiency policy amounts to 'picking a winner' – the result being that other lower cost options may be crowded out.
- Energy efficiency policy increases costs due to the likelihood of non-additionality (dead weight losses).
- Unintended outcomes result, for example the rebound effect (savings from more efficient equipment being spent on other energy intensive products or activities) and likely negative impacts on wealth distribution.

Whilst it is reasonable to suggest that ongoing government support for energy efficiency interventions demonstrates that the pro-intervention arguments are in the ascendancy, it is important to acknowledge the counter arguments so that the negative risks associated with government intervention can be minimised.

2.2 An inconsistent national approach toward energy efficiency

The debate about the future of energy efficiency policy in Australia is taking place in an environment in which there is a range of (sometimes inconsistent) national and state energy efficiency policies in place. These principally involve the provision of information to consumers, regulation of minimum standards, consumer awareness and capacity building.

Coordination of energy efficiency policy in Australia is undertaken through the National Framework for Energy Efficiency (NFEE) as developed by the Energy Efficiency Working Group of the Ministerial Council on Energy established by the Council of Australian Governments (COAG). Stage one of the

NFEE, adopted by the Ministerial Council on Energy in 2004, resulted in a set of nine policy packages which extend, or further develop, energy efficiency measures currently being implemented in Australia.[2] In December 2007, the Ministerial Council on Energy also agreed to a further five new energy efficiency measures under NFEE stage two.

The intent behind the NFEE is an increased focus on national coordination. However, to some extent there will remain a need for State Governments to continue to develop energy efficiency policies that are fit for their individual needs. The question is to what extent these overlapping policies are optimal.

The 2005 Productivity Commission report on energy efficiency found that many inquiry participants expressed that coordination of government energy efficiency policies — both within and between jurisdictions — needed to be improved. As noted by the Building Products Innovation Council (as cited in PC 2005):

> *"there are a number of different approaches to energy efficiency in Australia and the eastern states are certainly leading the way. Unfortunately they are each leading their own way and we have a need to understand and implement different energy solutions for the same building requirement, varying based on the state in which it is constructed."*

The Government of Western Australia (as cited in PC 2005) also noted that:

> *"A lack of government coordination has meant that organisations operating across jurisdictions often face different regulations, reporting requirements and formats in relation to energy programs."*

The Productivity Commission has further argued that national uniformity is generally desirable where variations across jurisdictions would reduce cost effectiveness by increasing costs for firms that operate nationally (PC 2008, p 16). The lack of uniformity across states can be seen especially with regard to the list of existing and yet to be established trading schemes. There are currently:

- five Environmental Trading Schemes operating in Australia — one National scheme (MRET) and four State-based schemes (VRET, NSW GGAS, ACT GGAS and 13% Gas Scheme), and
- three trading schemes specifically aimed at energy efficiency are planned to commence on 1 January 2009 —the VEET, REET and NEET schemes in Victoria, South Australia and New South Wales respectively.

Additionally, on the horizon is the Carbon Pollution Reduction Scheme (CPRS), the national emissions trading scheme due to start in 2010; this is expected to replace the NSW and ACT GGAS Schemes and possibly the 13% Gas Scheme.

This multiplicity of trading schemes has been cited as resulting in reduced liquidity, uncertainty of future pricing and significant transaction and compliance costs for scheme participants (Johnson, Winter & Slatery, 2008). Given the increasing public awareness of climate change and attention given to the likely price increases resulting from a national emissions trading scheme there appears to be little prospect of attention to energy efficiency policy reducing in the near term.

As a means to bringing some form of co-ordination around energy and environmental policy in February 2008 the Commonwealth Government commissioned Roger Wilkins to conduct a strategic review of climate change policies with a mandate to develop a set of principles to assist the Governments assessment of whether existing environmental programs are complementary to the CPRS.

[2] Detail is available at the NFEE web site: http://www.nfee.gov.au

In addition, the Australian Government appears to support energy efficiency measures to help mitigate consumer impacts of the CPRS and foreshadowed this in the Green Paper of July 2008. The paper gives a commitment that support for business and household adjustment will be provided through the introduction of energy efficiency measures, consumer information and funding for long payback industrial energy efficiency measures.

In June 2008 the NSW Government announced plans to launch an energy efficiency target effective 1 January 2009. This announcement came just one month prior to the Wilkins report to the Australian Government on complementary policy measures and six months prior to draft legislation on the CPRS and likely impacts being known.

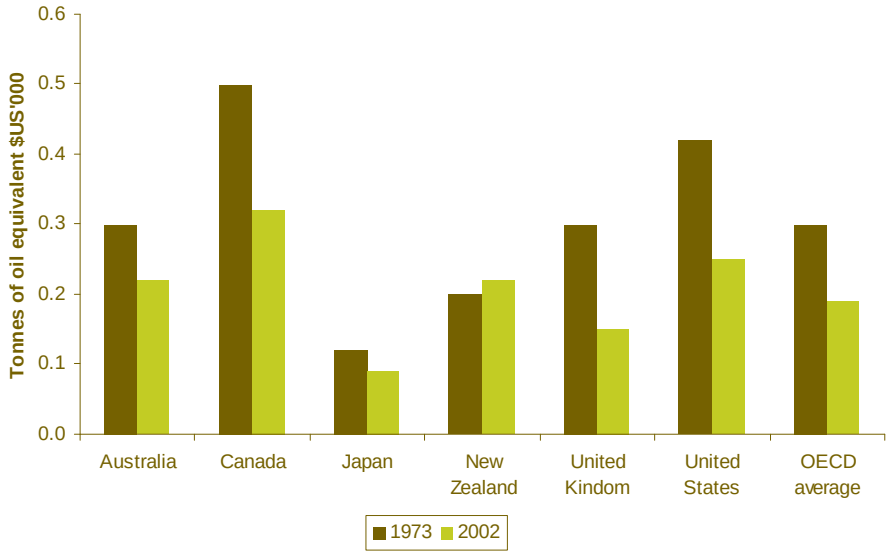
Clearly, this is an environment in which there is a stated desire to adopt a nationally consistent approach to the development and implementation of energy efficiency measures, but where at present there is little commonality of approach amongst States and Territories. Thus, there is value in stepping back to look at the range and effectiveness of options that should be employed to enhance energy efficiency outcomes.

3 The potential for energy efficiency gains in Australia

Energy is an important input into all the goods and services we consume. Most household activities including heating, cooling, cooking, lighting and transport, require energy in some form. Corporations also use energy in activities such as processing and manufacturing materials, transporting goods, heating and cooling premises, providing telecommunication services or powering computers.

Over time, the amount of energy used in Australia, the types of energy used and use by individual sectors have changed. According to the IEA (2004a), Australia's energy intensity in 2002 (measured in terms of primary energy supply per dollar of gross domestic product) is higher than the OECD average (Figure 1). Furthermore, Australia's energy intensity reduction over the period 1973–2002 has been smaller than in most of the OECD countries.

Figure 1: Total primary energy supply per dollar of gross domestic product

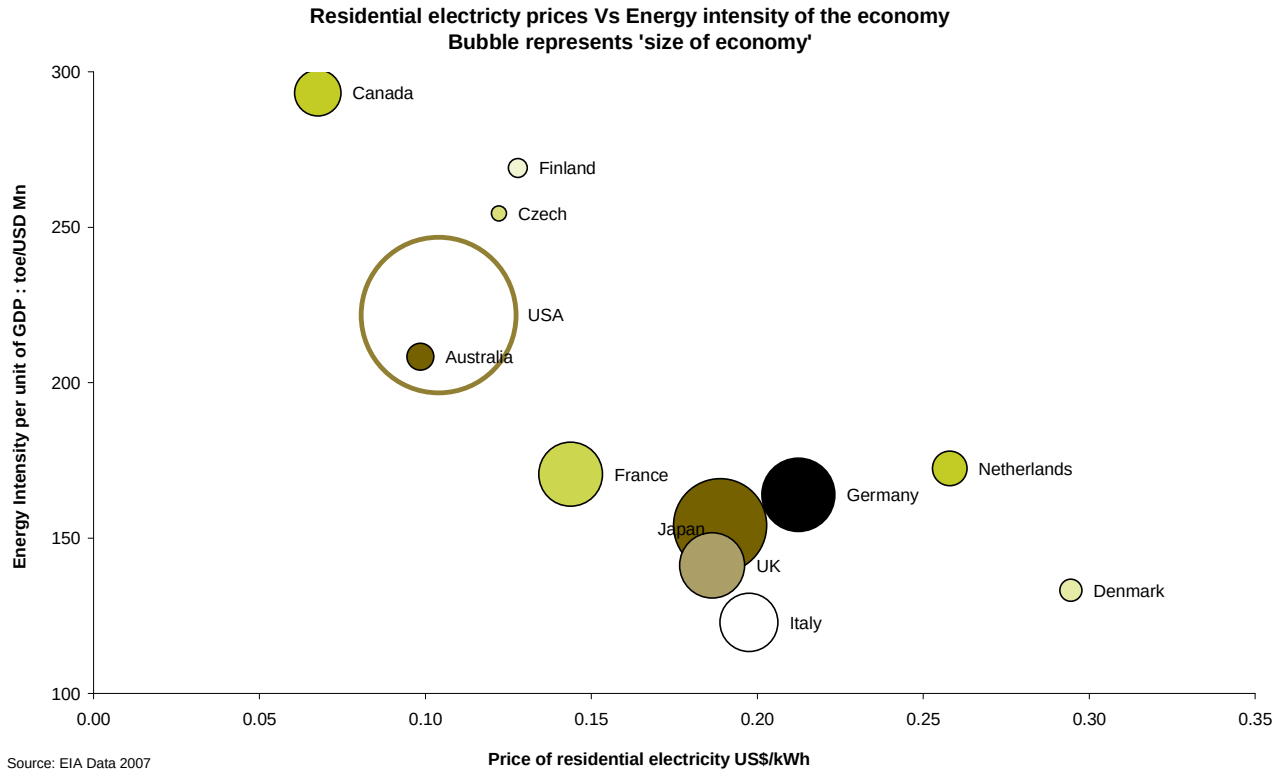


Source: IEA 2004a

Although energy intensity does not necessarily reflect energy efficiency or economic efficiency, the Australian Bureau of Statistics ABS (ABS 2001) argued that Australia's high energy intensity reflects its economic structure, the fact that Australia has relatively more energy-intensive industries than the OECD average (such as the aluminium industry) and that Australian electricity prices are among the lowest in the OECD. Similarly, Australian petrol prices are fourth lowest in the OECD (IEA 2004b). Natural gas prices are also relatively low by OECD standards.

The influence of energy prices, economic structure and other differences (such as climate) on consumption and energy intensity is crucial. Figure 2, although not conclusive, suggests a relationship between energy intensity and energy (in this case electricity) prices.

Figure 2: Total Electricity prices Vs energy intensity of economy



However, such correlations can be somewhat circular – existence of cheap energy will also drive the creation of an economy built on energy use. In the absence of detailed analysis of such considerations, it is therefore not appropriate to draw conclusions about Australia's energy efficiency performance based solely on comparisons of its energy intensity to the rest of the world or by considering energy prices. Ultimately therefore, Australia's energy efficiency performance needs to be assessed in the context of the barriers and failures hindering the operation of Australian markets, rather than through comparisons with the performance of other countries (PC 2005).

Various research sources suggest that there are significant negative cost opportunities to reduce building emissions in Australia through increased energy efficiency (Prime Ministerial Task Group Report on Emissions Trading 2007, pp 133-5; McKinsey & Company 2008). These observations reflect the number of opportunities to improve efficiency and the scale of energy usage in Australia (CIE 2008, p 15).[3] Detailed estimates for the opportunities in NSW are provided in Figure 2.

[3] In Australia energy use in the building sector accounts for 23% of GHG emissions. Of this, residential buildings account for 13% and commercial buildings 10% (CIE 2008, p 15).

Figure 2 Opportunities for Energy Efficiency in NSW

Residential energy efficiency opportunities and associated costs (NSW)

Option	Qnty (Mt CO2e)	Levelised cost ($/tCO2e)
Time switch lights	0.1	-21
Water heater replacement	4.5	-19
Water heater code	0.5	-18
Window shading	1.1	10
Phase out halogen lights	1.4	10
Building star rating	0.3	14
Roof space insulate	3.0	15
Lighting code	0.0	16
Change thermostats	1.1	17
Air conditioning MEPS	5.7	20
Refrigerator MEPS	2.7	20
Consumer electronic MEPS	4.9	21

Commercial energy efficiency opportunities and associated costs (NSW)

Option	Qnty (Mt CO2e)	Levelised cost ($/tCO2e)
Retail air conditioning	0.1	-41
Hospital air conditioning	0.3	-41
Other commercial space air conditioning	0.3	-39
Hospital insulation	0.3	-38
Office building code	2.9	-21
Hospital light	0.1	-19
Other commercial light	0.1	23
Retail refrigeration	0.1	95
Retail light	0.7	108

Industrial energy efficiency opportunities and associated costs (NSW)

Option	Qnty (Mt CO2e)	Levelised cost ($/tCO2e)
Other manufacturing	0.1	-45
Petroleum, coal, chemicals	0.3	-5
Agriculture	0.1	-3
Wood, paper and printing	0.2	0
Non-metallic mineral products	0.3	10
Mining	0.8	16
Metals	2.0	39

Source: Geraldi 2007

However, other sources suggest that the apparent negative costs of energy efficient measures may not be correct when other rational factors, such as time, effort and opportunity costs, are taken into account (CERA 2008, p 1; Garnaut 2008a).

Either way, it is difficult to accurately assess the net benefits of installing energy efficiency measures as this will largely depend on:

- how individuals value their time e.g. the time taken to research and install the equipment, and
- the transaction costs involved by other parties e.g. the costs incurred by retailers in identifying and contacting prospective households (PC 2005, p 17).

Another difficulty in assessing the net benefits concerns the uncertainty surrounding how much energy efficiency may have improved anyway (for example, due to changes in electricity prices, levels of disposable income and general consumer confidence).

Regardless of these inherent difficulties, the evidence available suggests that significant inefficiencies in energy consumption do exist, particularly across the residential sector. The question therefore, is whether this situation can be improved with a net benefit to consumers, appreciating that any policy intervention will involve costs.

4 Why doesn't the market provide the optimal level of energy efficiency?

While the previous section noted the considerable potential for energy efficiency improvements, in practice such opportunities are not being fully exploited.

If all individuals act to maximise their utility, perfectly competitive markets will allocate resources in an economically efficient way, maximising net benefits to society (PC 2005). In reality however, market failures prevent markets from allocating resources in this way. In certain instances therefore, Government intervention is warranted to address market failures such as imperfect competition, imperfect information, public goods, and externalities.

Energy efficiency refers to the most efficient and cost effective way for generating a unit of output (eg. light and heat), for a given unit of input, in this case energy. Evidence suggests that consumers and markets are unable to achieve this pursuit.

There is an extensive amount of literature available which point to the existence of a variety of barriers and impediments to cost effective levels of energy efficiency. It is therefore argued that government intervention is warranted to reduce or remove such barriers as this will benefit both individual energy users and/or society.

Understanding the nature of the barriers (and whether they can be classed as market failure or not) is important in devising policy responses that will improve energy efficiency in a way that maximises economic efficiency. In a report for the NFEE (ACG 2003) three classes of barriers and impediments to energy efficiency were identified:

- asymmetric Information
- externalities, and
- myopia.

The Productivity Commission (PC 2005) identified similar barriers.

For the purpose of this review we have identified and classified the barriers to energy efficiency that can be described as market failure under the following key categories:

- un-priced externalities
- imperfect information, and
- misaligned incentives.

These are discussed in turn.

Un-priced externalities

The un-priced externality of GHG emissions is expected to be principally addressed by the CPRS on the basis that it will assign an additional carbon cost to energy consumed. This is expected to encourage consumers to become more selective and efficient in the way they use and consume energy. It is possible however, that the initial caps set under the CPRS will not equate to a full pricing of this externality. However, the Australian Government has committed to the CPRS as being its primary response to the threat of climate change. On this basis it would not, at this stage, seem appropriate to design another credit based scheme with the aim of addressing this specific barrier, a barrier which the CPRS has been designed to address. For the purpose of this report we will assume that the un-priced externality of GHGs will be resolved through the CPRS.

Even with the full pricing of the environmental impact of GHGs it is possible that this alone will not result in optimum levels of research and development to obtain environmental objectives. Investors may not have the prospect of recovering development costs when competing with existing technologies where these costs have already been recovered. There is a public good associated with funding the development of fundamental technologies that provide the prospect of reduced environmental harm which needs to be valued.

Furthermore, any barriers to fully cost reflective pricing of energy may mean that optimum levels of energy use are not achieved. The presence of retail price caps may act to distort the price signal which would prompt consumers to become more energy efficient. If these price caps lead to non cost-reflective pricing then they can act to significantly distort decisions around energy use.

Imperfect information

Energy bills typically only account for a small percentage of costs for households and many commercial buildings. As such the incentive to be fully informed about energy efficiency is small and the general perception is that energy efficient equipment are more costly than is actually the case (UNEP 2007a). This perhaps is the reason why energy demand is typically inelastic.

There is, however, reason to suspect that if the general public were better informed about the impact their decisions have on energy costs then this may impact both behaviour (eg. not leaving the lights on) and choices around equipment. The question is – can this information be provided at a net benefit? Information around energy efficiency also has 'public good' characteristics. The argument for better provision of information is especially valid at times when energy prices can be expected to increase (as can be expected with the introduction of an ETS) and where the general public are not aware of the likely impact on their energy bills.

In addition to the issues of imperfect information, personal preferences also play a role in dictating levels of energy efficiency. The extent to which there is a role to play for Governments in overriding personal preferences is questionable. This is something that governments may wish to pursue to achieve an environmental objective, but this has less to do with achieving cost-effective energy efficiency (assuming that personal preferences already take into account the value that consumers place on increased consumption).

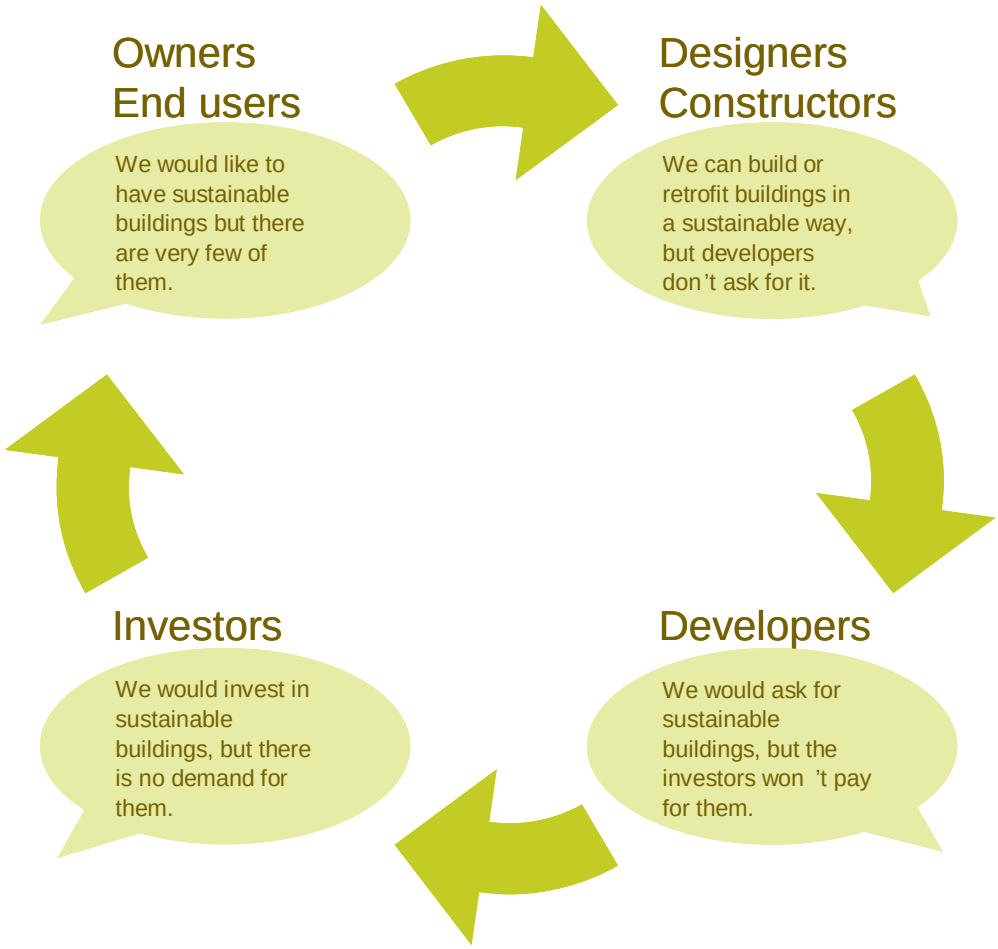
On the other hand communicating the potential benefits of increased energy efficiency and making the options easy to identify and access may well deliver voluntary changes in preferences and behaviour.

Misaligned incentives

Also referred to as split incentives, misaligned incentives refer to the problem where those responsible for selecting and purchasing equipment are not easily able to access the benefits of improved energy efficiency. For example the principal-agent or tenant-owner issue where the performance of embedded equipment is not typically taken into account when comparing rental costs. It is therefore difficult for the owner to accrue benefit for installing more efficient equipment. This poses a particular problem for rented property. In the residential sector 27% of housing in Australia is rented with tenants often having a short tenure (ABS 2008). There is therefore little incentive for tenants to install energy efficient equipment that have more than a very short payback period.

Even on a larger scale the transaction costs associated with communicating and negotiating a share of the benefits often suppress the actual benefits. It is also difficult for the consumer to know for sure what the actual benefits will be, hence an element of risk that consumers often discount for. The problem of misaligned incentives in the building sector can result in what has been called the 'circle of blame', illustrated in Figure 3.

Figure 3: Circle of Blame



Source: www.rics.org.

It is clear that barriers to optimal levels of energy efficiency do exist. The question then is whether it is appropriate for governments to intervene, and if so how. The following section considers this question further, and in particular assesses some of the available policy options used by governments to address the applicable barriers.

Part B
Evaluation of energy efficiency policy options

5 The evaluation framework

Core components for justifying government intervention are generally cited as being because:

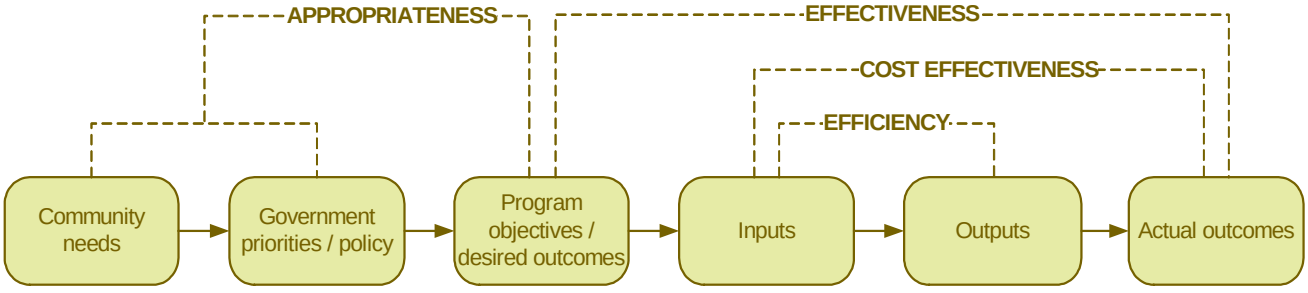
- market failure exists
- benefits associated with overcoming the market failure justify the costs, and
- intervention can be justified as the lowest cost solution from an economy-wide perspective.

Taking a more expansive approach, in evaluating policy options a common approach is to focus on three interrelated facets of performance:

- Appropriateness – the extent to which objectives/desired outcomes align with government priorities/policies and community/client needs (which can be seen in the context of addressing identified market failures).
- Effectiveness – the extent to which outcomes are achieving objectives.
- Cost effectiveness – the relationship between inputs and outcomes (expressed in dollar terms).

The manner in which these facets are interrelated is explained in Figure 4.

Figure 4: Framework for assessment of policy options



• Affordable energy • Minimised impact from climate change and policies to mitigate • Intergenerational equity	• Reduce GHGs • Counteract increasing energy costs • Encourage innovation to address climate change	• Increase energy efficiency • No negative distribution impacts • Maintain effective competition	• Regulation • Admin and compliance $$$'s	• Energy efficient measures • Increased consumer awareness	• Reduce GHGs • Reduced energy costs

With this framework in mind, the following criteria have been applied to assess the policy options within the scope of this study.

- **Appropriateness** — The extent to which the program objectives are optimal for achieving community needs. To determine this, the objectives of the proposed policy must be clear (PC 2005, p xx). Our assessment looks at how, and in what respects, the 'market' fails to provide adequate incentives to achieve the stated objectives and why government intervention is expected to improve matters (intervention has costs which need to be recognised and compared to the expected benefits of intervention).

In this study we have assumed that the key objective is to achieve cost-effective levels of energy efficiency. The premise being that optimum levels do not currently exist.

- **Effectiveness** — The degree to which the policy concerned overcomes any identified failure, and whether this is optimal. Our assessment also considers risks to stakeholders, in particular risks that the targeted level of energy efficiency will not be achieved.
- **Cost effectiveness** — The degree to which the benefits justify the costs, and whether the policy concerned is likely to be the least cost solution. We have also considered how much the policy in question provides flexibility for innovation that may help to deliver lower costs.
- **Other factors separately identified** — Here we deal with the wider impacts of the policy in question, particularly impacts in relation to wealth distribution and any impacts on effective competition in energy supply which may have a negative impact on energy prices. We also consider to what extent the policy will encourage investment in energy efficient technologies.

  A key requirement for any policy aimed at encouraging energy efficiency will be that it complements other policies with related objectives. Of particular relevance is compatibility with the CPRS.

We have assumed that the priority for energy efficiency policy in Australia is to overcome non-price barriers to optimal levels of energy efficiency. There appears to be general consensus that the market does fail to deliver optimal, privately cost-effective levels of energy efficiency (although to what degree current levels are sub-optimal is difficult to determine and estimates vary considerably). Arguments against intervention are based on the premise that the policy in question does not address the key barriers, will not deliver a net benefit or is not the lowest cost solution.

In the following section we have evaluated various policy options against the evaluation criteria listed earlier, including the important question of cost. Section 7 then compares the options side by side, drawing on some of the available research that contains comparative data.

6 Options for addressing energy efficiency

The principle approaches applied by governments to encourage or mandate the uptake of energy efficiency are shown in Figure 5.

Figure 5: General policy approaches used to enhance energy efficiency

Information & Education	Building and appliance standards	Financial and other incentives	Obligations / 'White Certificate Schemes'
Advertising campaigns Information centres and hotlines Metering devices and associated information Energy audits Appliance labelling Building certification	Building Standards Appliance Standards	Economic Incentives Fiscal Incentives Building concessions[4]	Mandatory or Voluntary Linked to ETS or not

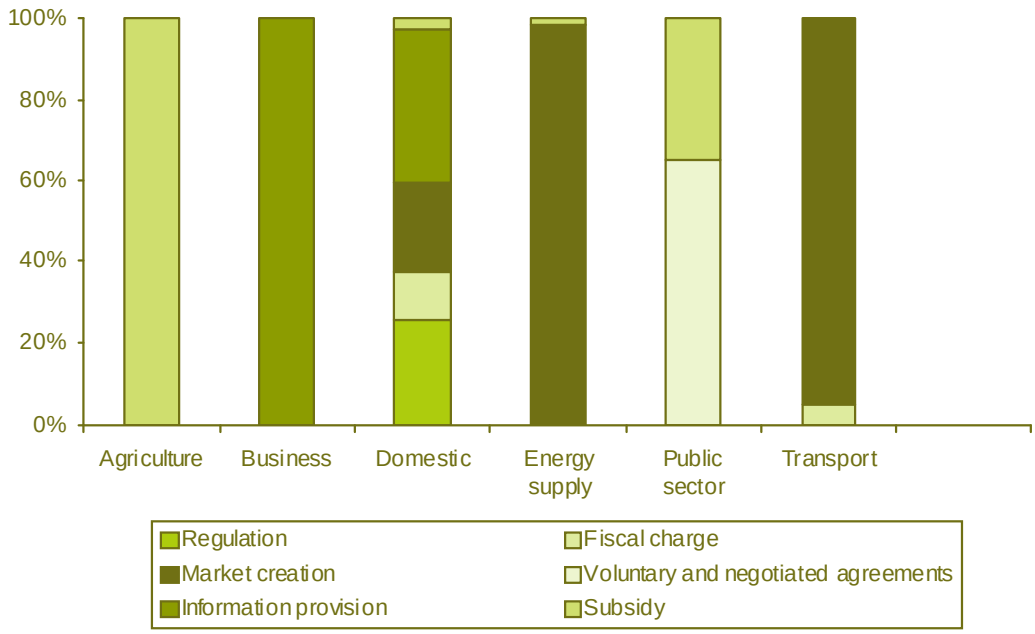
Another notable example of an approach to encouraging energy efficiency being applied in the United States is one of decoupling regulated utilities profits from increased energy sales[5]. However this approach is easier to use where energy utilities are regulated, as in the United States. This is not the case in Australia where, for the most part, retailers operate under a regime of full contestability.

[4] A number of states in the US create an incentive for building developers to improve the environmental performance of buildings through offering expedited permitting or additional density and/or height for green/energy efficient buildings. Expedited permitting applies in more than 10 US cities, see for example the Chicago Department of Construction and Permits *Green Permit Programme.* In Arlington, near Washington DC, efficient buildings (generally Local Energy Efficient Demonstration projects) can apply to be considered for additional density/height.

[5] A growing number of states have redesigned their revenue calculations for regulated utilities to reduce the link between sales and profits. Historically utility revenue has been calculated largely on the basis of energy supplied. By decoupling utility revenue from energy sales an incentive to increase the uptake of energy efficiency is provided.

Governments in OECD countries have a clear preference to adopt a range of policy options for tackling energy efficiency.[6] For example, the range of policy options utilised in the UK is illustrated in Figure 6.

Figure 6: Mix of policies used in the UK to combat climate change



Source: Defra

Typically, different policy options are used by governments to address different objectives. Figure 7 lists some of the objectives typically targeted and demonstrates the importance of clear objectives for informing policy choice.

Figure 7: Objectives of key policy responses

Policy response options	Objective
Information and education	• Influence behaviour through awareness of individual and societal benefits • Influence technology choices through informing on benefits
Financial incentives	• Overcome commercial barriers • Reduce unit production costs for promising technologies
Building and appliance standards	• Remove least efficient equipment from the market
Obligations / 'white certificate schemes'	• Hand responsibility to those best able to identify and deliver the optimum balance between information and financial incentives at lowest cost

[6] See information analysing the combination of policies applied at http://www.odyssee-indicators.org. A specific example is New York Mayor Bloomberg's Sustainability Action Plan which includes strengthening energy codes, creating an Energy Efficiency Authority, introducing targeted incentives, expanding peak load management, fostering a green energy market, including property tax abatement for solar installations, and launching an energy awareness and training campaign. (www.nyc.gov/html/planyc2030/html/plan/energy.shtml).

International energy efficiency performance

As noted earlier, there is a general shortage of robust analysis on the effectiveness of energy efficiency policy to-date. However, the following limited analysis attempts to illustrate where jurisdictions have managed to flatten the rate of per capita energy growth through the implementation of (well regarded) energy efficiency policies while maintaining healthy levels of GDP growth.[7]

Figure 8: Electricity Consumption per Capita 1990 - 2005

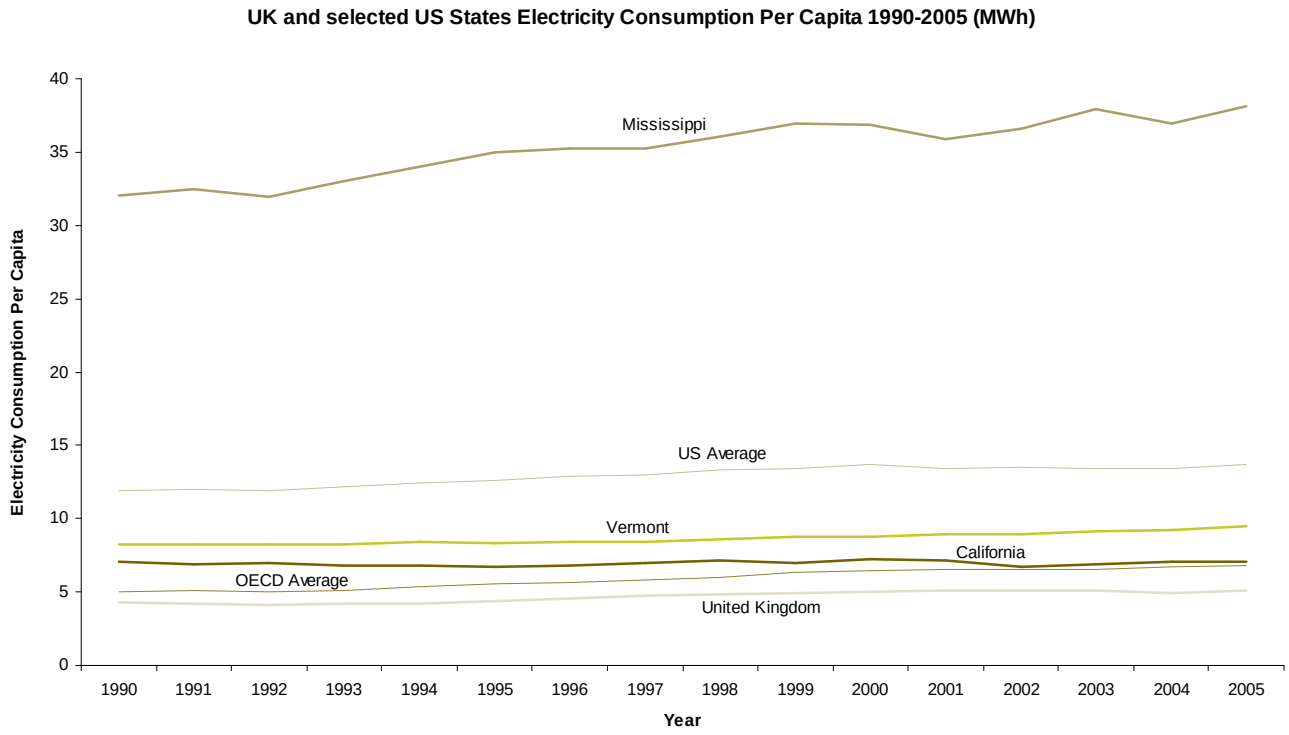


Figure 9 Energy efficiency performance of various regions

Country / State	Policy assessment[8]	Real GDP/GSP growth ('98 to '05)	Per capita energy use (MWh, 2005)	Per capita energy use growth ('98 to '05)	Likely success factors
United Kingdom	Well regarded	2.39%	5.77	0.66%	- Clear secure funding for retailers

[7] The analysis is limited in that it does not take account of wider economic factors during the period, any economic structural adjustments or energy prices.

[8] This is a relatively subjective measure which reflects the US Council for an Energy Efficient Economy's report, 'The State Energy Efficiency Report Scorecard, June 2007' and the research undertaken in developing this report.

Country / State	Policy assessment[8]	Real GDP/GSP growth ('98 to '05)	Per capita energy use (MWh, 2005)	Per capita energy use growth ('98 to '05)	Likely success factors
California (US)	Very well regarded	2.83%	7.06	-0.2%	- De-coupling the revenue of regulated utilities from profits - Secure funding for regulated utilities obtained through a levy - Wide-ranging, stringent and well enforced appliance and building standards - Collaboration and government leadership
Vermont (US)	Very well regarded	3.07%	9.49	1.5%	- High per capita funding - Dedicated independent energy efficiency body with clear targets and funding
Mississippi (US)	Poorly regarded	0.59%	38.07	0.79%	n/a
US average	-	1.74%	13.73	0.44%	n/a

The UK, California and Vermont have implemented some well regarded energy efficiency policies and have managed the per capita energy use (and at lower absolute levels) while maintaining healthy gross domestic/state product growth. California's absolute per capita energy use is almost 50% of the US average.

It should be noted though that, whist these regions can be seen as some of the leaders in energy efficiency policy, these policies have so far only succeeded at flattening, rather than significantly reducing, energy consumption.

A particular example of how a range of policy options for increasing energy efficiency have been applied with good effect can be seen in California. California is the world's fifth largest economy and, through a mix of energy efficiency policies and actions, has seen some of the most impressive results observed in recent years (see Figure 10).

Figure 10: California – an example where energy efficiency policy has worked

Over the past 30 years California has held per capita electricity use at an almost constant rate, while the rest of the US has seen its per capita electricity use increase by nearly 50%. During the same period the state has also increased its inflation-adjusted economic output per unit of electricity consumed by over 40% compared to a national average of 8%. The energy efficiency programs of the state are said to have saved 12,000 MW of peak demand (1.2% of current installed capacity) and about 40,000 GWh (14% of generation) of electricity per annum in 2006.[9]

California has been able to achieve significant gains in energy efficiency by implementing dynamic pricing, demand response programs, cost effective building and appliance standards and public education campaigns on energy efficiency (IEA 2008, p 107).

The current Energy Action plan, released in 2005 identifies *'cost effective energy efficiency as the states preferred means of meeting energy needs'.*

The California Energy Commission (CEC) and California Public Utilities Commission (CPUC) consider that the following policy measures have been most successful in achieving success with energy efficiency:

1 **Building and appliance standards**: California has implemented building standards since 1970. These have been upgraded every four to five years. The building and appliance standards have been instrumental in ensuring that buildings and appliances are designed to optimize energy use and have delivered the largest contribution to energy efficiency (IEA 2008, pp 102-103).

2 **Utility sponsored initiatives funded through regulatory pass throughs**: In 1996, California launched the four year *system–benefit charge* to mobilize funds for energy efficiency and demand side management (DSM) initiatives through a non-bypass able wires charge. A similar DSM surcharge was introduced in 1999 for gas utilities. The total revenue collected for energy efficiency activities through the fund amounted to US$1.8 billion between 1998 and 2005 (Energy Efficiency Policy Centre 2006). The funds are managed by individual utilities that have flexibility to design and modify energy efficiency incentive schemes in the form of loans, grants and rebates to suit customer requirements. The utility sponsored programs have helped customers overcome the initial investment barriers for energy efficiency.

3 **Other funding for utility sponsored incentives**: In 2006 the CPUC also introduced a further $2 billion in government funding for utility sponsored efficiency improvement programs to be implemented between 2006 and 2008.

4 **Low interest loans**: The energy efficiency financing program in place before 2006 offered 4.4% interest loans to public buildings and counties. Feasible projects are given loans up to US$3 million from a US$40 million endowment fund set up for this purpose.

5 **Decoupling of utility revenues from units sold**: Viewed as a particularly important policy measure going forward. Under this approach tariffs are not linked exclusively to the amount of units sold but adjusted to ensure financial viability of the utilities. This signals a strong commitment from the government towards optimizing energy usage.

According to the California Energy Commission, the energy efficiency initiatives have resulted in a net benefit of US$5.3 billion over the last decade (IEA 2008, p 107).

The following sections further discuss and evaluate the range of policy options described above.

[9] http://energyalmanac.ca.gov- Electricity Statistics

6.1 Information and education

Key findings

- Information and education around energy efficiency is particularly important in influencing behaviour and in support of other policy initiatives in order to reduce the rebound effect.
- Government can play a key role in information dissemination.
- Australia may benefit from a dedicated body (perhaps cooperation between state government departments responsible for energy efficiency) set up to manage the provision of information to consumers nationally. Such an organisation could provide a powerful focal point for coordinating a consistent message to the public and in attracting knowledge and funds from the private sector to assist in raising general awareness around energy efficiency (for example through public-private partnerships).

Policy options

Provision of information can be centrally provided, mandated by governments or freely provided by equipment manufacturers and not for profit organisations. Information can also be either active (targeted at specific consumers) or passive (reliant on approaches from customers who may want to become more efficient but are not sure how).

Channels for the dissemination of information typically include:

- information and education campaigns
- information centres and hotlines
- metering devices and related data (for example real time data or information on energy bills)
- energy audits
- appliance labelling
- building certification.

A number of sources recommend that more information and education is necessary if other policy options aimed at increasing energy efficiency are to be effective.[10] Information is seen as having a key role to play in supporting other measures (such as financial incentives and white certificate schemes).

The importance of information is illustrated by studies showing that individuals usually estimate the power consumption of their appliances on the basis of their function and size, rather than the actual power rating (UNEP 2007b). They think, often wrongly, that large appliances take more power than smaller ones. They also tend to overestimate the power consumed by lighting and other visible applications, while underestimating the energy needed for heating water and other less visible applications. Research suggests that some of the most promising approaches to the provision of information being used internationally but not yet adopted in Australia are:

- wider application of appliance labelling
- building certification schemes, and

[10] See for example at http://www.ewc.polimi.it/documents/EWC_brochure.pdf *White Certificates: concept and market experiences*, pg 4.

- coordination of information through an organisation dedicated to providing energy efficiency advice [11]

Labelling for a wider range of appliances and building materials

Requiring energy efficiency labelling and certification is particularly relevant in the case of long life assets where consumers cannot trial performance through frequent repeat purchasing.

The following appliances are currently subject to labelling in Australia:

- refrigerators and freezers
- clothes washers
- clothes dryers
- dishwashers
- air conditioners - non ducted single phase.

Under stage two of NFEE further items such as water heaters, home entertainment and computer equipment are proposed to be included. The Commonwealth Government has also committed to revise and update the existing labelling system, including introducing a new 10-star appliance rating scheme (Ministry for Environment, 2008).

Building certification schemes

Implementation of the Energy Performance of Buildings Directive (EPBD) in the EU in 2006 has required obligatory energy certification of new and existing buildings as well as prominent display of this certification in public buildings.

In the US building certification is voluntary. However the Leadership in Energy and Environmental Design (LEED) green building rating system has become established as a third party certification programme and the nationally accepted benchmark for the design construction and operation of high performance green buildings. Although a voluntary rating system, state and local governments across the US are adopting LEED for public-owned and public-funded buildings. There are LEED initiatives in federal agencies, including the Departments of Defense, Agriculture, Energy, and State.

In Australia the ACT is the only state currently to have a mandatory building certification scheme. Since 1995 it has been an ACT Government requirement that all designs for new dwellings achieve an energy efficiency rating of at least four stars. Since 1999, there has also been mandatory disclosure of actual energy performance for all residential properties offered for sale.

A study of international directions for building certification schemes commissioned by the Australian Greenhouse Office in 2005 concluded that the introduction of such schemes is no small matter (FaberMaunsell 2005). However, at that time (2005) little practical experience was available regarding these schemes that were in their infancy internationally. Since then the NFEE has recommended national mandatory building certification, however this is yet to be implemented across all states.

[11] The IEA in its energy efficiency policy recommendations to the leaders of G8 countries cited that “Mandatory energy performance requirements and labels have proved to be a highly cost effective policy tool for encouraging the reduction of average energy consumption in equipment” and “One policy option that promises to be particularly effective is the mandatory provision of energy efficiency ratings of buildings to prospective purchasers and tenants”

Dedicated body for the coordination of information around energy efficiency

In terms of increasing awareness on energy efficiency the UK relies on the Energy Savings Trust as a key body for dissemination of information. The Energy Savings Trust has been credited with orchestrating the provision of private funds amounting to three times that of public funding in support of information awareness.

There is no equivalent to the Energy Savings Trust at either a national or state level in Australia. Instead, consumer advice from governments appears mostly limited to government websites containing consumer/technical guidance materials and tools to assist with energy efficiency calculations. Australian government funding for information and education campaigns regarding energy efficiency also appears to be limited.

Figure 11: The Energy Savings Trust[12]

The Energy Savings Trust is considered to be a cornerstone of the UK government's commitment to improve energy efficiency. It is a quasi governmental non-profit organisation funded by the UK government and the private sector.

Established in 1992, the EST is dedicated to helping citizens cut their carbon dioxide emission by promoting the sustainable and efficient use of energy in the home and in transport. It was established to stimulate energy efficiency in the UK domestic sector in order to reduce CO2 emissions and address various social issues such as fuel poverty.

The EST's strategy includes: disseminating information, developing energy efficiency marketing strategies, commissioning research, bringing together stakeholders and giving grants and loans for a variety of projects, accrediting green electricity suppliers, working to create a market for clean fuelled vehicles and promoting combined heat and power.

Examples of the EST's activities include:

- providing comprehensive advice on energy efficiency through the 'Act on CO2' advice line and 21 regional advice centres
- working with local delivery partners and the supply chain to ensure that the low carbon products and services (including green financial packages) citizens need are effective and ready to meet demand
- accrediting products under the 'Energy Saving Recommended' label, which signposts consumers to products that save the most energy
- facilitating the 'Energy Efficiency Partnership for Homes', a network of over 395 organisations from the public, private and voluntary sectors. The Partnership aims to work together to reduce the energy consumed by UK households and tackle fuel poverty, and
- managing the 'Housing Energy Efficiency Best Practice' programme, which is the key source of advice and training for house builders, designers and architects on achieving energy efficient new build homes and refurbishments.

In 2008-2009 the EST received £35 million in funding form the Department of the Environment (DEFRA) with other government bodies (such as the Department for Transport) adding additional funds.[13] In 2001-2002 funding of £25 million leveraged a further £82 million from other sources (Banks 2002).

Through its network of Advice Centres and 500 staff the EST has provided energy efficiency advice to over 7 million people over the last 10 years contributing an estimated 12 millions tonnes of CO2 savings.

Evaluation

Appropriateness

Intuitively, the provision or mandating of more information by governments is critical to overcoming the failure of the market to adequately provide information with regard to how behaviour can influence energy costs. Given the public good characteristics of general information around energy efficiency there is a need for governments to take a lead where this information is otherwise being underprovided.

[12] http://www.energysavingtrust.org.uk

[13] http://www.iea.org/textbase/pm/?mode=pm&id=2197&action=detail

On the other hand, the case for governments to provide information on the benefits of specific equipment is weak to the extent that private manufacturers are incentivised to provide this wherever a benefit is present (especially in light of rising energy costs as expected under an ETS scheme).

The provision of information plays an important role in encouraging positive changes in culture and mindset. As such any gains can result in long term benefits through changes in behaviour that may become ingrained. For this reason dissemination of information is viewed as particularly important for locking in any benefits gained from other policy options.

With imperfect information being identified as a key market failure there is a clear case for addressing this to the extent that this can be done with a net benefit.

Effectiveness

Evaluations of energy efficiency policies in various OECD countries have found that the success of regulatory and voluntary measures often relied on the concurrent implementation of information programmes which increased their clarity (IEA 2008). In particular, information on energy efficiency is important to prevent the financial savings attributable to more efficient equipment being spent on more energy intensive activities or products – the rebound effect.

The effectiveness of information provision is however inherently difficult to assess. Any number of other factors may impact behaviour (for example changes in climate, levels of disposable income and general perceptions of economic health). It is particularly difficult to baseline what would have happened anyway, in the absence of more information, even more so than for policies that directly incentivise the uptake of energy efficient equipment. Evaluation of the effectiveness of information programmes is usually carried out through consumer surveys which test the impact that programmes have had on a sample of the population.

The effectiveness of information provision is likely to depend upon:

- The type of information: aimed at influencing behaviour change or switch in equipment.
- How it is communicated: for example, as a ‘star rating’ or more transparently in terms of dollar benefits for individuals.
- Who it is provided to: small consumers who typically do not take time to analyse costs and benefits will typically have the most to gain.
- Who it is provided by: information that is perceived to derive from biased sources may be ignored.
- Whether it is centrally or locally provided: achieving the right balance between the economies of scale associated with national campaigns and targeting the needs of specific consumers at a more local level.

Due to the different needs of individuals information may need to be tailored in order to be most effective. As the Productivity Commission submission to the Garnaut climate change review noted “some measures, such as the provision of general information on energy efficiency, do not necessarily benefit from being nationally coordinated. Indeed, there can be benefits through jurisdictions pursuing different approaches and learning from one another’s successes and failures (PC, 2008).”

Cost-effectiveness

Ex-post evaluations are rare

It is rare for governments to undertake ex-post assessments of the cost effectiveness of information. However this is necessary in order to determine whether the provision of information is justified, whether it has resulted in net benefits and to provide valuable learning for future programs.

Mandatory labelling programs are considered most cost-effective

Labelling programs are generally considered one of the most effective and cost-effective policy tools aimed at achieving market transformation (UNEP 2007a). Experience with the transaction costs associated with labelling in the Netherlands for example has assessed these as being as low as 0.12 Euros per product on average (IEA 2006).

Mandatory labelling in Australia has been reported as having reduced energy consumption from appliances by approximately 4% annually from 1993 to 2005 at a negative cost of $30/tCO2 (IEA 2008). GHG emission reduction due to tighter labelling standards is expected to reach a total of 81 MtCO2e between 2005 and 2012, with costs between -$135/tCO2 and -$23 /tCO2, depending on the discount rate applied (IEA 2008).

Building certification is more costly but still promising

Building certification is more expensive than appliance labelling since calculations have to be performed for every house individually. Investigation of the costs associated with certification of 4,000 residential buildings in Germany showed that more than 30% of buildings faced costs in excess of €300(IEA 2008). Nevertheless these higher costs may well be acceptable on account of the long lives of buildings and negative impacts of inefficient energy performance. The IEA consider that building certification promises to have a substantial impact on consumer choices over long life assets (IEA 2008). However the IEA also point out that it is too early to assess the overall impact of certification as these schemes are still relatively new.

Nonetheless building certification can be expected to lead to a number of advantages. For example, independent verification helps financiers place value on the reduced operating costs and likelihood of increased revenue streams from higher rents.

A study conducted in 2008 by CoStar Group has found that sustainable "green" buildings in the US outperform their peer non-green assets in key areas such as occupancy, sale price and rental rates, sometimes by wide margins.[14] According to the study, LEED buildings command rent premiums of $11.24 per square foot over their non-LEED peers and have 3.8 percent higher occupancy. LEED certified buildings were also assessed as selling for an average of $171 per square foot more than their peers.

Central coordination of information provision would appear to have benefits

As described earlier in Figure 11 the Energy Savings Trust in the UK appears to have been particularly successful in leveraging significant funding from the private sector towards the promotion of energy efficiency advice in the community. Historically there has not been much focus on the coordination of this advice from Australian governments, perhaps because energy prices in Australia have been some of the lowest in the world. However, with energy prices in Australia expected to increase (for example due to the introduction of a carbon price) this can be expected to strengthen the case for providing energy efficiency advice.

In its business plan for 2001 – 2004 the EST stated that “Through its expertise in developing partnerships, in promoting and marketing energy efficiency and alternative vehicle fuels and through its relationship with suppliers and industry, the Trust offers a unique means of moving towards the governments’ energy efficiency and carbon saving goals in the domestic and small business sectors”

[14] See: http://www.costar.com/partners/costar-green-study.pdf

In the US a number of the best performing states on energy efficiency have set up publicly funded bodies dedicated to optimising energy efficiency performance for consumers and small businesses (ACEEE 2007). These organisations are typically funded through a fixed component added to all energy bills. Web sites for most of these organisations cite some element of partnering with utilities in order to help target the provision of information and advice.

Figure 12: Examples of coordinated approaches to the delivery of energy advice

The Energy Trust of Oregon began operation in March 2002, charged with encouraging energy market transformation in Oregon, and amongst other things:

- Bringing energy-saving and renewable energy opportunities to consumers who historically have been underserved
- Helping businesses that promote energy efficiency and renewable energy to succeed and thrive
- Encouraging the public to integrate energy efficiency and renewable energy into their daily lives[15]

Efficiency Vermont provides technical assistance and financial incentives to Vermont households and businesses, to help them reduce their energy costs with energy-efficient equipment and lighting and with energy-efficient approaches to construction and renovation.

New York City (NYC) has also announced plans to create a new authority responsible for the implementation of NYC energy conservation and efficiency programs. To improve energy efficiency planning the City has teamed with Con Edison, National Grid, and the Natural Resources Defense Council to propose a New York City Energy Efficiency Partnership plan. The aim of this partnership is to facilitate communication among all major energy efficiency providers and better harmonize their programs.[16]

These positive examples of a coordinated approach to the provision of information and education would suggest that there is scope for Australia to gain benefits from a similar approach - a national body or perhaps joint forum of state based organisations that could effectively work with the major retailers to identify consumers particularly in need of advice.

Other factors

The voluntary nature of the corresponding response means that the provision of information and education is likely to have little impact on wealth distribution. Positive responses to the information provided are also likely to help consumers adapt to the impact of an ETS on electricity prices.

As with other policy options the key factor is whether it delivers net benefits and at lowest cost. Typically Governments do not undertake detailed analysis on the resulting energy reductions – and as such it is difficult to assess the cost benefit ratio of most information programmes that have been introduced by Governments. However, lack of information is likely to be a significant contributor to sub-optimal decisions on energy use. The challenge is to identify the most cost effective means of educating consumers on energy efficiency. The most effective way to do this is likely to be with governments working with organisations such as retailers to inform decisions on where to best target the information.

Figure 13: Evaluation summary – information and education

Evaluation criteria	Summary of evaluation	
Appropriateness	Critical to overcoming the failure of the market to provide adequate information. Required to effect behavioural change.	✓✓
Effectiveness	Risk of limited impact if not well designed and targeted.	✓
Cost effectiveness	Potential to be low cost but high impact – particularly for labelling and building certification.	✓✓

[15] See: http://www.energytrust.org/who/index.html

[16] See: http://www.nyc.gov/html/planyc2030/downloads/pdf/progress_2008_energy.pdf

Other factors	May encourage new ways to meet the performance benchmark (eg for 5 star appliance labelling). No negative impact on ETS and may help ETS liable participants achieve their obligation at lower cost. No significant distributional impacts.	✓✓

Key

✓✓	Generally positive
✓	May be positive depending on design
✖	Generally negative

6.2 Building and appliance standards

Key findings

- Standards are widely found to be the most effective and cost effective of energy efficiency policy options.
- Effective measurement and enforcement of standards, particularly for appliances is a critical success factor for these schemes.
- To the extent that compliance issues exist, seeking to address these through, for example, more border checks, is likely to be a more cost-effective means of ensuring energy efficiency than implementing more complex policy options.
- For a more comprehensive impact, building standards should address existing as well as new buildings.

Policy options

Building and appliance standards for energy efficiency set minimum requirements or guidelines for levels of energy efficiency to be achieved. Standards can be introduced as legislative instruments (i.e. by establishing regulation which sets a minimum standard) or can be voluntary. Regulation is usually introduced when it is recognised that market failures would not allow economic instruments alone to reach the objective of the energy or environmental policy or where bounded rationality is an issue.

Both building and appliance standards are widely used internationally to promote energy efficiency.

Building standards

Most developed countries have set up mandatory energy efficiency standards for new dwellings and service sector buildings. In Europe the EU Directive on the Energy Performance of Buildings (EPBD) aims to promote the convergence of building standards. In the United States, the *Energy Independence and Security Act 2007* provides for improved energy efficiency in buildings through directing The Department of Energy to establish energy efficiency standards for all new housing.

A recent trend has been to extend regulations to cover building renovations and to combine standards with information provision in the form of energy efficiency certificates so that purchasers and tenants can easily compare the energy efficiency of buildings.[17] Revisions of building codes are also becoming increasingly regular to ensure that standards continue to improve as technologies develop. The EPBD provides for a mandatory revision every five years.

In Australia energy efficiency requirements for the thermal performance of the shell of the building are incorporated in the Building Code of Australia, though there is some inconsistency in the way that jurisdictions have adopted these. A number of jurisdictions also have state specific requirements, such as the use of greenhouse efficient water heaters and, in Queensland, energy-efficient lighting. NSW uses an integrated development approval sustainability tool called BASIX that incorporates building shell and fixed appliance energy efficiency.

[17] Such a certificate was introduced in 1999 and extended recently to all EU countries with the Directive on Buildings (generally in 2006 or 2007). These certificates enable to buyer to obtain information about the energy consumption of the dwelling they are going to buy or rent. These certificates have some similarities with the labelling of electrical appliances, but are more complex. In the UK new homes will have a mandatory rating from 2008. New homes, and others sold or leased, will require an Energy Performance Certificate with key information on the energy/carbon performance in the sale pack.

One of the stated ambitions of the NFEE is to achieve nationally consistent minimum energy efficiency design standards for new homes, units and apartments across Australia as well as minimum energy efficiency design standards for major renovations.

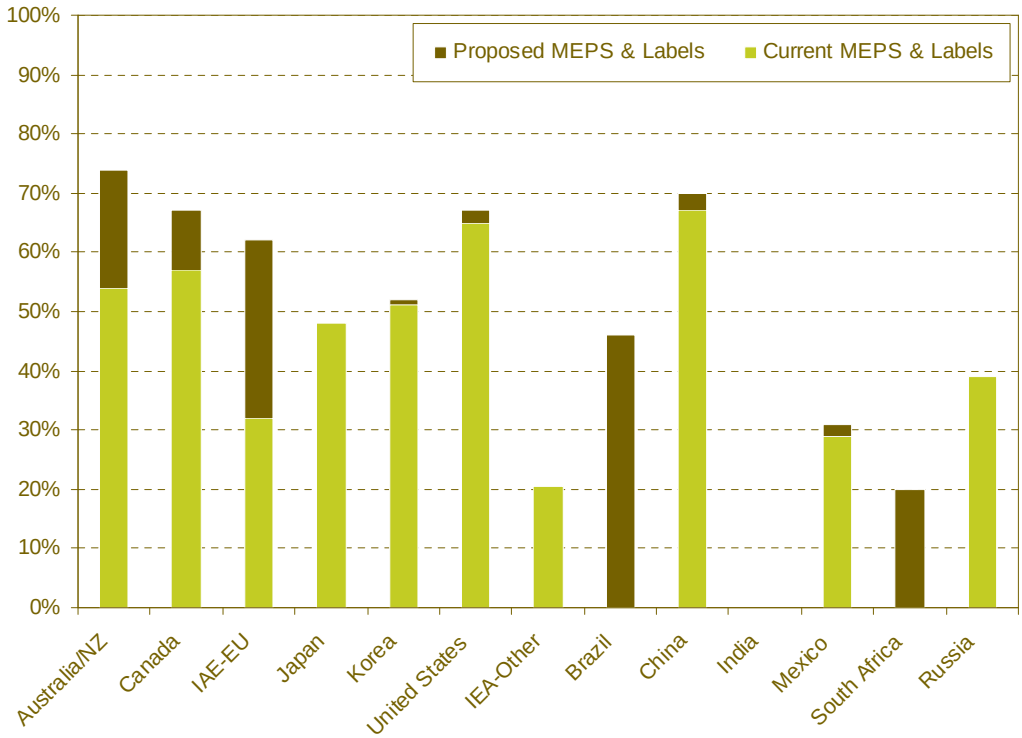
Appliance standards

Minimum Energy Performance Standards (MEPS) have been introduced in a wide range of countries, primarily to reduce energy consumption within the residential sector. Generally countries have initially introduced such standards for appliances responsible for the largest proportion of energy consumption (for example refrigerators and air conditioners) and subsequently expanded the standards to cover a wide range of equipment including lighting, washing machines, dryers, dishwashers and water heaters.

In Australia MEPS have been established for refrigerators and freezers, electric water heaters and refrigerative air conditioners. These are used in combination with mandatory energy labels. Over the next three years, MEPS are planned for an expanding range of products, including gas water heaters, lighting, standby power use, home entertainment equipment and external power supplies.

Australia compares favourably with other developed countries with MEPS covering appliances that account for over 50% of electricity consumption and the expanded range of products expected to take this to over 70% (IEA 2007).

Figure 14: Percentage of electricity consumption covered by mandatory policies, by country



Source: IEA 2007

Evaluation

Appropriateness

Minimum standards are important in overcoming market failures where the selection criteria of consumers generally exclude energy efficiency (television sets for example), or the economic impact for selecting a building or appliance with poor energy efficiency is difficult for consumers to assess.

Standards are an important policy option where provision of information alone cannot be expected to bring about optimal decisions (due to information overload and bounded rationality). In particular they can be seen as important at a time when consumers may not be able to foresee the price impacts of an ETS.

Building and appliance standards have also been found to be effective at addressing misaligned incentives (at least for new buildings and appliances) (PC 2005, p xxxvi). Standards are particularly relevant when equipment is replaced infrequently (for example domestic water heaters) and for high cost purchases such as buildings where consumers cannot easily change after experiencing the running costs of those investments.

Effectiveness

Mandatory minimum standards remove the worst performing buildings, appliances and design practices from the market. As such they can be expected to be effective in raising the overall level of energy efficiency for buildings and appliances. However, they need to be aimed at existing as well as new buildings if they are to have a wider and more immediate impact.

Standards are widely found to be the most effective policy option

Building and appliance standards are often at the core of energy efficiency policy. Worldwide experience with building and appliance standards suggests that these have been responsible for achieving some of the largest gains in energy efficiency and emissions reductions.

In the UK building standards introduced in 2002, and updated in 2006, for the domestic sector have been evaluated as delivering significant contributions in terms of emissions savings when compared with all other policies (DEFRA 2006, p 13).

In the EU, the combined introduction of MEPS and labelling led to a rapid increase in the market share of the most energy efficient appliances (WEC 2008). In anticipation of standards, manufacturers withdrew less efficient models and introduced new more efficient designs to meet demand and differentiate themselves from their competitors.[18]

In the US, minimum performance standards for appliances have also had a significant impact. For instance, the average consumption of cold appliances has decreased from 1,726 kWh/year in 1972 to just 490 kWh today (WEC 2008).

Performance standards are most effective when used in combination with labelling or certification

A limitation of minimum standards is that they do not drive innovation as there is no incentive to go beyond the minimum. This can be overcome where the standard is combined with labelling or certification. Labelling and certification act as incentives for manufacturers and building developers to

[18] www.odyssee-indicators.org.

differentiate themselves from their competitors and stimulates the introduction of new, more efficient equipment and buildings.

A review of energy efficiency policies by the World Energy Council in 2008 found that:

> *"Labelling programmes and performance standards are effective instruments, which enable authorities to benefit from low-cost energy savings, consumers to spend less on electricity, and manufacturers to improve their products and become more competitive against imported, less efficient products." (WEC 2008)*

Governments can help to 'raise the bar' through their procurement power

Anecdotal evidence from the US, for example relating to procurement of desktop PCs, suggests that Government can play a role in assisting manufacturers work towards new standards by using its significant purchasing power to create an initial market for more efficient products.

Governments can also drive innovation itself. In 1987, the US Natural Resources Defense Council, having had insufficient supplier response to a lighting tender, engaged experts to innovate to meet new stringent requirements and later invited suppliers to inspect the results (David B Goldstein, 2007, pg 42).

Enforcement of standards is a key success factor

In Australia concerns have been raised recently about poorly performing appliances that fail minimum energy performance standards and have misleading labelling.[19] The problem identified is one of cheap imported appliances entering the country and being sold at low prices in small outlets. Cases have been found where these cheap 'no name brand' equipment have been carrying star ratings that are not accurate reflections of performance.[20] Funds for testing equipment are limited and regulators are often forced to rely on the manufacturers in-house tests.[21]

A review of enforcement activities undertaken by nine European Union Member States in relation to the EU Energy Labelling Directive found that five of the States did not follow up on compliance issues despite evidence that only 60-80% of products displayed labels (ANEC 2007).

Similarly relatively few countries have carried out evaluations of their building codes. According to the few studies available, it seems that the actual energy performance of new buildings is below that which could be expected from the building regulations. This can be explained in part by non-compliance with the building regulation (WEC 2008).

The IEA have noted that although there is now substantial experience in the design and implementation of enforcement mechanisms, it is evident that all countries could improve this aspect of their programmes (CELMA 2007).

In Australia the Ministerial Council on Energy has set up the Equipment Energy Efficiency Programme (E_3) to assess compliance with equipment standards in Australia. E_3 coordinates sample testing of equipment with an annual budget for testing of about $300,000.[22] E_3 has reported that the average failure rate of equipment tested since the programme commenced in 1991 is 35% (EEEP 2006). This high rate of failure is partly a result of selecting products considered to be at the highest risk of failure.

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[19] Harnessing the power of the stars, article in the Sydney Morning Herald, 14 November 2007

[20] See program transcript from a Four Corners television programme on 25th June 2007 available at http://www.abc.net.au/4corners/content/2007/s1961538.htm

[21] ibid

[22] See information at http://www.energyrating.gov.au

Nonetheless, this would suggest that there is a significant amount of electrical equipment being sold in Australia that does not conform to the energy efficiency standard.

The Ministerial Council on Energy considers the Equipment Energy Efficiency Programme to be an extremely cost effective measure. The programme has been estimated to deliver economic benefits to Australia - with a total estimated value of $4.8 billion by 2020 with greenhouse gas emissions savings being achieved at a net present value of minus $23/tonne of CO2e (EEEP 2006).

The historically high failure rate yet high cost effectiveness of this programme would suggest that a significant increase in gains may be possible with more effort applied to effective measurement and enforcement, including more meaningful consequences for non-compliance.[23]

Cost effectiveness

Standards are generally shown to be cost effective

A difficulty in assessing the cost-effectiveness of standards is the difficulty of knowing how much cheaper less efficient equipment and buildings would have been if they were still allowed to enter the market. However it could be expected that the widespread use of building and appliance standards, especially when applied across other countries at a similar level, will effectively act to reduce the unit production costs through significant increases in demand.

Studies examining the cost effectiveness of building regulations and appliance standards have found these to be the most cost effective means of increasing levels of energy efficiency, usually assessing these policies to deliver substantial lifetime cost savings. A recent review of data from a number of sources regarding the cost effectiveness of various energy efficiency policies showed standards to consistently be the most effective.[24]

Assessments of additional costs associated with most building standards suggest that these are limited to a few percentage points, if anything at all (WEC 2008). With regard to appliance standards, studies have shown that the increased uptake of more efficient appliances generally leads to cost reductions in these equipment (WEC 2008).

A major argument for the use of building and appliance standards is that they remove the transaction costs that would otherwise be associated with installing more efficient equipment. Studies estimate that transaction costs can amount to as much as 40% of the cost of installing energy efficient measures.[25] High transaction costs are especially likely when dealing with a large number of diverse installations, as with the residential sector.

A key driver of cost effectiveness of standards is the level at which the requirements are set. Typically Governments look to review and tighten standards every few years in line with improvements in technology. Standards are typically set at levels that are already commercially available, and from this perspective a good estimate of the costs associated with mandating this level can be made. This reduces the risk of mandating equipment that would not prove beneficial for the majority of the population. To the degree that standards are widely applied they can also be expected to reduce the unit cost of production for efficient materials and equipment.

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[23] Perhaps through a vehicle such a s consumer protection law, for example

[24] See for example UNEP and CEU, *Assessment of policy instruments for reducing greenhouse gas emissions from buildings*, 2007; and also report prepared for Euroace – Building Energy Efficiency Alliance, *Assessment of Potential for the saving of carbon dioxide emissions in European building Stock*, May 1998

[25] See http://www.ewc.polimi.it/dl.php?file=Final%20report%20on%20transaction%20costs.pdf. Report to Intelligent Energy Executive Agency by IIIEE at Lund University, *Transaction costs of energy efficiency projects: a review of quantitative estimations*, 7 February 2006

Variations across states and territories can increase costs

One area where the costs associated with building standards may increase is where they are not uniform across the country. This is likely to impose additional administrative costs for developers who operate nationally as they seek to comply with a number of varying requirements.

The Productivity Commission found that "The current State and Territory-based variations in energy efficiency standards for new houses increase costs for the building and building products industries. The case for such variations appears to be weak" and recommended that "Australian, State and Territory Governments and the Australian Building Codes Board should examine ways to prevent local governments creating variations in minimum energy efficiency standards for buildings." (PC 2005)

Other factors

The main concern levied at building and appliance standards is that they do not distinguish between those that have different financing costs. Any uplift in prices associated with introducing the standard are likely to be felt most by the less wealthy. However experience to date would suggest this is a relatively minor impact with building and appliance standards being assessed as bringing about significant net benefits to consumers.

In terms of encouraging investment in new technology performance standards that are updated regularly can be expected to stimulate innovation and the introduction of new more efficient products, especially when combined with appliance labelling and building certification.

Figure 15: Evaluation summary – building and appliance standards

Evaluation criteria	Summary of evaluation	
Appropriateness	Important for overcoming market failures when the provision of information alone cannot be expected to address the problem. However does remove some choice for consumers.	✓
Effectiveness	Effective in removing the worst performing technologies and practices. Increased effectiveness when used in combination with labelling or certification to drive innovation. Major concern is one of ensuring compliance.	✓✓
Cost effectiveness	Widely assessed as being the most cost-effective policy option for the residential and small commercial sectors due to removing transaction costs. Generally expected to provide significant net benefits for consumers. Widely applied nature is likely to have reduced the unit production costs of more efficient equipment.	✓✓
Other factors	Can be effective in encouraging innovation where a timeline for future increases in standards is provided and the standards are used in combination with performance labels or certificates. Little impact on ETS as standards are usually set well in advance and can be accounted for in setting the ETS cap.	✓✓

Key

✓✓	Generally positive
✓	May be positive depending on design
×	Generally negative

6.3 Financial and other incentives

Key findings

- Financial incentives do not target the market failures applicable to energy efficiency therefore the case for their use on the grounds of cost effectiveness is questionable. The potential for non-additionality also implies an additional cost for society, especially at a time when an ETS is being introduced.
- Other objectives such as addressing fuel poverty or protecting low income households from increasing energy prices and incentivising research, development and commercialisation of promising technologies mean that financial incentives may be appropriate.
- Non-financial incentives, such as planning concessions for green buildings, have been effective in the US. There would appear to be a strong case for Australia to incentivise more cost-effective energy-efficient buildings through wider use of building certification as a means of awarding incentives – such as expedited permitting and other planning concessions. Incentives may also assist the acceptance of mandatory building certification where this is about to be rolled out.

Policy options

Economic Incentives

Economic incentives include investment subsidies and low interest loans. Subsidies can be provided to consumers as a fixed amount, a percentage of the investment (up to a capped amount) or as a sum proportional to the amount of energy saved. They can also be provided to manufacturers in order to encourage the development / marketing of more efficient equipment. Investment subsidies are popular in developed countries, with two thirds of OECD countries employing them. In Europe households benefit from about 50% of all investment subsidies provided (WEC 2008).

Investment subsidies are typically targeted at priority groups (for example low income households and tenants) and restricted to equipment with long payback times but high efficiency gains or innovative technologies. The approach used in Thailand is novel, with grants applying to investments that have a high internal rate of return. Other variations include loans for installation of energy conservation improvements. These often work on the premise that borrowers will use the cost savings generated by the improvements as the primary source of revenue for repaying the loans.

Various states across Australia use economic incentives to promote energy efficiency in buildings. For example rebates are given to install solar and heat pump hot water systems that replace electric hot water systems in existing privately owned homes. Another example of this is the Green Building Fund. The Commonwealth government has committed $90m to the Green Building Fund as part of its Clean Business Australia initiative (a $240 million partnership between Government and industry to deliver energy-and-water efficient projects with a focus on productivity and innovation). This scheme will offer assistance of up to 50% of costs for energy efficient retro-fitting of existing commercial office buildings and will provide support for training initiatives for building operators.

Fiscal Incentives

Fiscal incentives involve a reduction in tax and can be applied in various ways, for example:

- Accelerated depreciation, which is targeted at industry / the commercial sector.

- Tax credits and deductions provided to households who have certain energy saving measures installed professionally.
- A reduction on tax or import duties paid on energy efficient equipment / investments and installation and maintenance services.
- Tax concessions for companies that meet commitments to energy efficiency gains or carbon dioxide reductions.

Tax credits exist in almost 40% of OECD countries (WEC 2008). For example, in a number of states across the US tax credits are awarded for buildings that comply with certain green building standards, such as under the LEED rating system. The amount of tax credit awarded generally depends on the size of the building and its environmental or energy performance rating.

There have recently been calls from Australian industry for the introduction of accelerated depreciation for energy efficient assets in order to promote retrofitting of existing buildings. For example, the Property Council of Australia supports accelerated depreciation for 'green refurbishments' which meet a certain standard so organizations can benefit by reducing taxable income in the initial years of investment.

Companies in countries where accelerated depreciation regimes are already in place (for example in the Middle East and Asia) claim that such schemes have resulted in increased competitiveness.

Other types of incentives

A recent approach in the US is to encourage energy efficient buildings through offering non-financial incentives such as expedited permitting and increased floor space. The American Institute of Architects has identified density / floor area ratio bonuses as being a particularly attractive incentive for builders.

Figure 16: Green-building incentives

A number of states in the US have started to apply building concessions to incentive energy efficient buildings. These include (American Institute of Architects 2008):

Height / density bonuses – where the developer is eligible for height or density bonuses (or other incentives such as reductions in landscaping requirements) in return for achieving a specified level of green building rating. For example Arlington and Virginia award commercial and private developments additional height of up to three stories depending on the level of certification.

Expedited permitting – streamlining the permitting process with green buildings taking priority over less efficient buildings when applying for planning consent.

These programs can be particularly attractive to developers and owners in cities that have capacity shortfalls with the added advantage of reduced financial impact for the taxpayer.

In order to qualify for these incentives buildings are usually required to obtain certification. The Leadership in Energy and Environmental Design (**LEED**) is a nationally approved green building rating system created by the United States Green Building Council (USGBC). Under this rating system all buildings are certified by independent third parties.

As of November 2007 around 8000 projects covering 1.5 billion square feet of built-up space have been registered under the green building program with 1100 being certified (NAIOP 2007).

A study to evaluate the costs and benefits of green buildings in California found that an average 2% increase in construction costs resulted in average life cycle savings equivalent to 20% of construction costs (Sustainable Building Taskforce, California 2003). These benefits are expected to significantly outweigh any scheme administration costs. Californian standards are generally considered to be the widest ranging and best enforced in the United States

Evaluation

Appropriateness

Financial incentives are typically provided for technologies that are not obviously viable for the majority of the population but yet offer the prospect of reducing energy consumption or becoming more cost effective following production economies of scale. Accordingly financial incentives are less about cost effectively optimising energy efficiency and more about encouraging new technology for long term environmental benefits. This is a very different objective to overcoming market failure to promote energy efficiency.

Financial incentives do not directly address the market failures applicable to energy efficiency and therefore the case for their use on the grounds of cost effectiveness is questionable. In particular they do not address behavioural issues. However, there may be a case for financial incentives being applied when the objective is something different, for example in overcoming the initial financial barrier to the uptake of energy efficient equipment experienced by low income households.

Effectiveness

In terms of encouraging specific technologies, financial incentives have the advantage of being easily directed to the outcome being sought (MMA 2008). However it is very difficult for Governments to know what level of uptake will be driven by a particular level of subsidy.

Financial incentives also tend to be limited in duration and run until a set budget has been exhausted. This may act to limit their total effectiveness in terms of long term impacts on energy efficiency. An evaluation of fiscal policies operated in the UK noted that these have had an unknown impact since they tend to modify behaviour temporarily (IEA 2008, p 247).

Although there is limited evidence on the effectiveness of financial incentives successes have been claimed. For example, the green building tax credit scheme in New York has been credited with accelerating the adoption of sustainable design practices with approximately 10 percent of all public and private projects applying for tax credits since program inception in September 1999. The New York scheme has subsequently been rolled out in a number of other states across the US.

Cost effectiveness

Financial incentives effectively equate to a subsidy for the technology in question. They have an opportunity cost through diverting Government spending which may have been spent on other services, and have an administrative cost associated with running the scheme. Indeed, for the green building tax credit scheme in New York, whilst take up has been high, staff associated with the scheme have noted that ‘offering incentives and ensuring that they are well spent is a significant administrative burden.’

A key problem for financial incentives aimed at increasing energy efficiency at the domestic level is that there are generally no additionality criteria. This provides the risk that the cost to society as a whole will be driven up due to ‘free-riders’, those who would have acted even without the financial incentive. This problem is particularly relevant at a time when the cost of carbon is about to be internalised through the introduction of an ETS. Introducing, or leaving existing financial incentives in place, increases the risk of non-additionality costs being passed through to consumers. This risk can be reduced by applying the incentive only to low income households.

A further challenge for financial incentives is in determining the level of incentive that will achieve the desired effect (in this case increased uptake of energy efficient equipment).

Non-financial incentives, such as expedited permitting for efficient buildings, reduce the burden on the public budget, and hence can be expected to be more cost effective than other forms of incentive. In

particular non-financial building incentives have been found to receive popular support in the US. Such incentives may be useful as a means of encouraging the acceptance of building certification where this has not yet been widely rolled out, such as in Australia.

Other factors

The key questions for financial incentives are whether they are appropriate given the objective concerned. Another consideration is whether they are compatible with an ETS. Since financial incentives are usually aimed at specific equipment or buildings they are unlikely to be effective at achieving the lowest cost abatement. Therefore where they are designed to achieve an environmental benefit they are likely to increase the cost of doing this.

Figure 17: Evaluation summary – financial and other incentives

Evaluation criteria	Summary of evaluation	
Appropriateness	Financial incentives do not directly address the market failures applicable to energy efficiency. More appropriate to encouraging the uptake and unit cost reduction of pre-commercial equipment.	×
Effectiveness	Results appear to be mixed. Tax credits and concessions for green buildings appear to have had some success.	✓
Cost	Very difficult to assess what level of subsidy will achieve the desired uptake of energy efficient equipment. Non-financial incentives likely to be more cost effective.	×
Other factors	Encourages 'free-riders' and may increase cost overall due to risk of non-additionality, especially at a time of introducing an ETS.	×

Key

✓✓	Generally positive
✓	May be positive depending on design
×	Generally negative

6.4 Market based/certificate schemes

Key findings

- Early indications are that white certificate schemes have proved effective in delivering energy efficiency measures. However these schemes are complex and do not come without challenges.
- A mandatory target can be expected to increase the cost of achieving carbon reductions by 'crowding out' other lower cost forms of abatement.
- Non-additionality, and the associated cost to society, is a concern. This is particularly the case given the likely magnitude of transaction costs. Risk of non-additionality costs are increased at a time when an ETS is being introduced.
- Equity can be a concern. Even if net benefits can be expected those who are not targeted with the role out of energy efficiency measures are likely only to see an increase to their bill (as costs are likely to be spread across the population). Those who do benefit from having energy efficiency measures installed however are likely to benefit significantly.
- White certificates should not be seen as a fix all solution as this policy option does not generally address behavioural factors. If this type of scheme is to be implemented it is important that it is supplemented with information aimed at encouraging efficient behaviour and reducing 'the rebound effect'.
- State based schemes are likely to be more costly than a scheme with national coverage. Individual state based schemes are likely to drive up the administration costs for liable parties and increase procurement costs due to low liquidity caused by variations in scheme rules.

Policy options

Market or certificate based schemes have started to gain support, particularly in Europe, as a means of driving energy efficiency. These schemes are commonly referred to as 'white certificate schemes'.

The first design question for such a scheme is whether the scheme should be based on a 'Baseline-and-credit' or 'cap-and-trade' arrangement.

To-date only baseline and credit schemes have been used with regard to energy efficiency and these have not been included as part of a wider ETS. An exception to this is the NSW Greenhouse Gas Abatement Scheme (GGAS), which is an emissions trading scheme that incorporates energy efficiency as a component. However, the GGAS scheme is a baseline and credit scheme and hence fundamentally different from the proposed Australian ETS which will be cap-and-trade.

In one exception, a new UK scheme called the Carbon Reduction Commitment will come into effect in 2010. This is a proposed mandatory 'cap and trade' scheme which will be applied to large energy users which are not covered by the EU ETS. Organisations spending more than £0.5m per annum on electricity are expected to be included and it will likely cover sectors such as education, hospitality, retail, banking, central government, large local authorities, construction, water and waste, storage and communications. A cost-benefit analysis gave a positive result and included the health benefits of air pollution reduction, reduced energy bills and the climate impacts of reducing carbon dioxide. [26] However, it is unclear whether 'hidden costs' such as for management time were included.

[26] http://www.defra.gov.uk/environment/climatechange/trading/uk/pdf/ukets1-4yr-appraisal.pdf

Baseline-and-credit or cap-and-trade

With regard to energy efficiency baseline-and-credit and cap-and-trade schemes take different approaches to achieving the goal of reducing energy consumption.

In a **cap-and-trade** model the total amount of energy consumption is capped. Each liable party is then required to hold allowances or permits. Allowances must be held for every unit of energy consumed. Energy consumption is driven down through the creation of a volume of allowances that is less than the expected total energy consumption. Cap and trade schemes have generally not been used to apply downstream or demand side caps on energy consumption or emissions (as opposed to the upstream or supply side caps applied in most ETS). There are a variety of reasons for this including:

- high administrative costs and difficulty involved in assigning a cap to millions of individuals or households[27]
- difficulty in applying caps to retailers due to customer churn in the retail energy markets
- potential for perverse incentives, for example with retailers only looking to contract energy efficient customers.

Nonetheless, the UK Government is currently considering placing an absolute cap on the amount of energy that retailers can sell (Climate Change Capital 2007). This would equate to a demand side cap (as opposed to the supply side cap being proposed in the Australian CPRS). If such a policy was to be implemented this would place an increasing importance on the provision of 'energy services' (in other words retailers would be incentivised to find cost-effective ways to reduce customer consumption without affecting utility).

The major advantage of a cap and trade scheme is that it is technology neutral. This means that liable parties can meet their obligation in any variety of ways and are not limited to a set of approved measures.

Under a **baseline and credit scheme**, credits are granted for *estimated* reductions in energy consumption. Typically the scheme regulator approves a set of measures (such as energy efficient equipment, building insulation or small scale renewable energy equipment) that are 'deemed' or estimated to provide energy savings over a business as usual or 'baseline' scenario.

Baseline and credit schemes also offer options in terms of who the liable participant should be. In the UK and French schemes the obligation has been placed on energy retailers to deliver a number of 'deemed' or estimated energy savings. On the other hand, Italy has applied the obligation to distribution companies. The decision on where to place the point of liability generally comes down to an assessment of who is best placed to deliver the savings at least cost.

One option for this type of scheme is to let the market decide who is best placed to deliver savings at least cost. For example, Governments could choose to allow specialist energy service companies (ESCO's) to bid directly to achieve the required savings. This could be facilitated through the Government applying a levy to consumers and then holding an auction or other tender process to select parties to role out the energy efficient measures (NERA 2007).

Notwithstanding the UK's analysis forecasting a positive net benefit for its Carbon Reduction Commitment scheme, there is a risk that the administrative complexity involved in a demand side cap

[27] The U.K.'s Department for Environment, Food, and Rural Affairs (DEFRA) published a study of personal carbon trading earlier this year. After concluding that such a system would be "ahead of its time" and too costly, the department abandoned its work on the subject. The estimated cost of implementing the system is between £700 million and £2 billion (US$1.4-3.9 billion), and it would cost between £1 and £2 billion ($2.0-3.9 billion) to run the program each year, the department said.

and trade scheme can be more than any benefits of using this approach. For this reason our analysis of white certificate schemes below focuses on baseline and credit schemes.

International experience with white certificate schemes

Over the last decade there has been a trend towards governments looking to place an obligation on energy retailers (distribution businesses in Italy) to achieve increased uptake of energy efficient measures. These schemes are typically designed to allow for trading of energy efficiency certificates with the premise that traded markets in these certificates will increase price transparency and promote compliance at least cost. The market based schemes applied in the UK, Italy and France, are commonly referred to as 'white certificate schemes'.

The UK was the first country to implement a white certificate scheme in 2002. The Italian and French schemes started in 2005 and 2006 respectively and other countries in Europe have started to move in this direction. In Australia the States of Victoria, South Australia and New South Wales have committed to starting white certificate schemes in 2009. All these schemes are premised on a baseline-and-credit design, albeit with some key differences. Further details and key differences between the schemes are attached at appendices C and D.

Perhaps the most relevant case studies to consider for Australia are the UK scheme (formerly the Energy Efficiency Commitment, EEC, and now termed the Carbon Emissions Reduction Target, CERT) and the NSW Greenhouse Gas Abatement Scheme (GGAS). Although not purely an energy efficiency scheme per se (it targets emissions through supply side measures also) the NSW scheme includes energy efficiency measures as an approved means of reducing emissions against a business as usual scenario.

Of the white certificate schemes in existence the UK scheme has run the longest and hence offers the most practical experience. Key design elements of the UK scheme are:

- Retailers are permitted to trade obligations and credits, but the scheme does not allow for trading outside of this. Generally retailers procure credits through subcontracting energy service companies to deliver energy efficiency measures to homes.
- A proportion of the target has to be met through energy efficiency measures applied to priority groups (typically low income households or the elderly).
- Retailers are required to apply to the regulator for approval of projects prior to being granted credits.
- Obligations only apply to retailers with more than 50,000 customers
- The scheme allows retailers to meet a small proportion of their obligation through market transformation measures (such as micro-generation) and demonstration projects (such as measures aimed at influencing consumer behaviour).

The table below summarises the three phases of the UK scheme and how the targets have developed over time. The fundamental difference between the newly termed CERT scheme and the preceding phases is that the targets are now specified in terms of emissions rather than energy reductions.

Figure 18: Expected emissions savings from the UK's energy efficiency targets

Phase	Scheme name	Dates	Target	Expected emissions savings (annual MtC by 2010)
1	EEC1	Apr 2002 – Mar 2005	62 TWh	0.3
2	EEC2	Apr 2005 – Mar 2008	130 TWh	0.5

Phase	Scheme name	Dates	Target	Expected emissions savings (annual MtC by 2010)
3	CERT	Apr 2008 – Mar 2011	154 MTCO2 (lifetime savings)	1.1

Source: IEA

The NSW GGAS has operated since 2003 and places an obligation on liable parties (energy retailers and large energy users) to achieve emission reductions against a business as usual scenario. Liable parties can do this through activities that are deemed to reduce emissions against a baseline. A number of energy efficiency measures are pre-accredited by the scheme regulator as achieving pre-determined emissions savings (as opposed to energy savings). As such the GGAS scheme is, in its ambition, very similar to the UK CERT scheme (both aim to reduce emissions), albeit the GGAS scheme also includes supply side measures (such as fuel switching by electricity generators) which in the UK are covered under the European ETS.

To date, there has been little in way of ex-post quantitative assessment of the performance of white certificate schemes. For this reason much of the following analysis is based upon qualitative analysis and observations made by a number of commentators.

Evaluation

Appropriateness

White certificate schemes go some way to addressing the key market failures of imperfect information and, in particular, misaligned incentives. However, such schemes also involve risks and administrative complexity that need to be carefully considered before implementation.

With a mandatory scheme there is an incentive on liable parties to achieve energy efficiency improvements in the most cost effective manner. For example, to the extent that it lowers their costs, a retailer can be expected to encourage customers to purchase energy efficient equipment by providing information on the benefits, rather than heavily discounting the price of equipment. However, there is generally no incentive for retailers to encourage customers to change behaviour. From this perspective a white certificate scheme cannot be relied upon to reduce any rebound effect.

A key benefit of baseline and credit schemes is that they create a tangible commodity (white certificates) that is separate to the energy savings produced by installing energy efficient measures and that investors can gain benefit from. From this viewpoint white certificate schemes have the potential for overcoming misaligned incentives. For instance, a building developer or owner who installs approved energy efficient measures may be able to claim credits that they can sell to liable parties. Alternatively an equipment manufacturer or retailer will be able to gain access to these certificates and may subsequently discount the price charged for energy efficient equipment.

The IEA notes that white certificate schemes also seek to overcome financial barriers (IEA 2008, p 233). Therefore such obligations can be seen as not solely looking to address market failures but also have an element of subsidy involved (to the extent that they increase costs for energy retailers).

Effectiveness

Initial data suggests that white certificate schemes are effective

Initial data from existing white certificate schemes suggests that they have proved effective in achieving reductions in energy consumption and emissions.

A recent report by the European Environment Agency stated that households and offices were the main contributors to the decreasing trend in emissions between 2005 and 2006 in the European Union (European Environment Agency 2007). France, Italy and the UK were cited as showing the most significant emission cuts. Coincidentally Italy and the UK were the only European countries to have white certificate programs in place at this time. This, prima facie, may indicate that the white certificate programs have been successful in bringing about reductions in energy consumption.

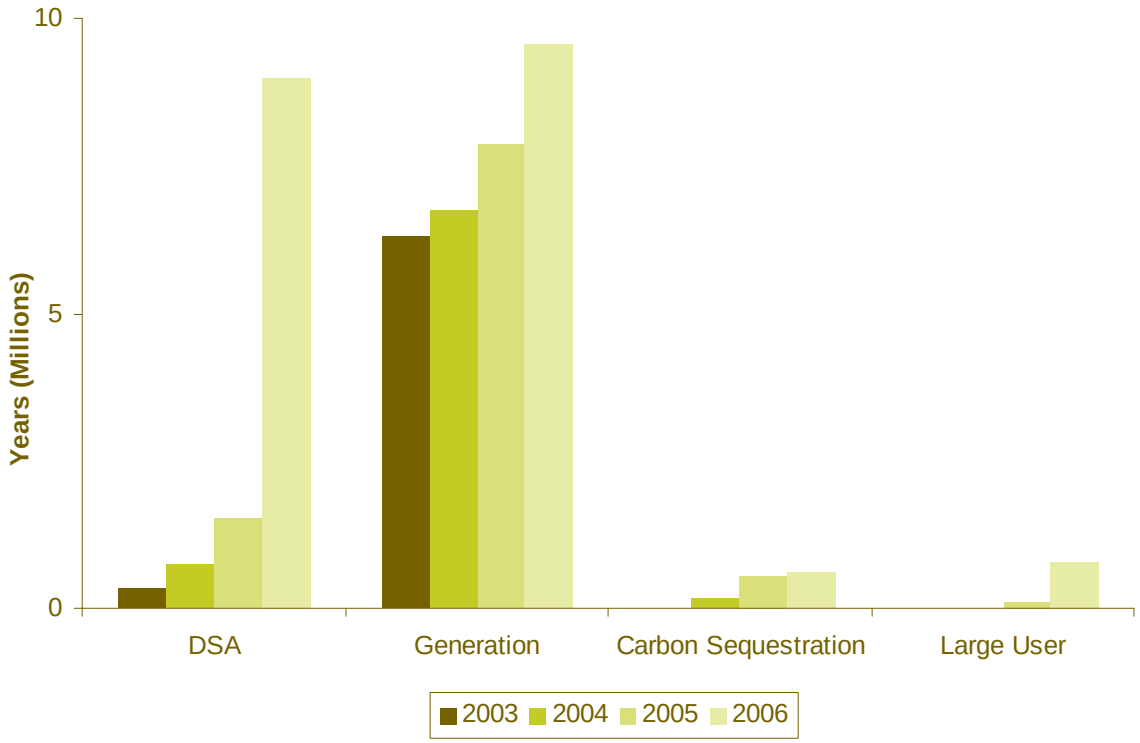
The UK scheme has also been successful in terms of surpassing the target. Phase 1 of the UK scheme saw 86.8 TWh of savings, 40% higher than the 62 TWh target (IEA Energy Policies 2006, p 72). This is likely to be attributable to confidence around the extension of the scheme, ability to bank credits from energy efficiency projects for future obligation periods and a race between retailers to seek out the lowest cost opportunities.

The latest phase of the UK scheme, CERT, is cited as being a central plank of the UK's commitment to reduce greenhouse gases. The UK government anticipates that this scheme will result in annual net savings of 4.2MtCO2 by 2010, equivalent to the emissions from 700,000 homes each year, and stimulate GBP 2.8 billion of investment by energy retailers.[28]

The NSW GGAS provides an interesting comparison of the effectiveness of a baseline and credit scheme to drive energy efficiency improvements where these are competing against other forms of carbon abatement options. Initially, the vast majority of certificates surrendered were associated with emission abatement from generation, with very little from demand side abatement (DSA) activities. However, in 2006 demand side policies accounted for 45% of all certificates created indicating that, despite the increased transaction costs arising from these typically small scale projects, energy efficiency measures proved to be cost competitive with other forms of carbon abatement.

[28] See http://www.opsi.gov.uk/si/si2008/em/uksiem_20080188_en.pdf). DEFRA, *Impact Assessment of CARBON EMISSIONS REDUCTION TARGET 2008-2011*.

Figure 19: NSW GGAS scheme - sources of greenhouse gas abatement certificates



Source: IPART, Compliance and Operation of the NSW Greenhouse Gas Abatement Scheme During 2006

Non-additionality is a major challenge

The number of credits produced under baseline and credit schemes is only part of the story however. A key concern with baseline and credit schemes is one of non-additionality. This refers to the risk that credits (which are 'deemed' or estimated) are granted to those who would have installed energy efficiency measures anyway or too many credits are generated due to inaccurate forecasting of the baseline or business as usual scenario (which typically extends out for some years).

Baselines can only be estimated and cannot be known with total accuracy. For example, if energy prices and other factors (such as general economic health of the nation) outturn to be substantially different from what was predicted then this could result in over estimation of the impact of the scheme. The concern over non-additionality is increased where there is increased uncertainty over energy prices (as is the case with introduction of the CPRS).

As noted recently by the Commonwealth Government "Offset schemes are administratively complex and require considerable judgement to determine baselines" and "determining these baselines is inherently subjective, increasing the risk that schemes do not promote genuine abatement" (DCC 2008).

Due to the small size of domestic energy efficiency projects it is not practical to assess each project for additionality prior to granting credits. This opens up the possibility of 'deadweight losses', energy efficiency savings being counted even though these would have happened without the scheme.

In the UK scheme this problem is dealt with by adding an estimation of the deadweight losses to the scheme target. The total non-additionality within the first phase of the UK scheme has been assessed to be as high as 21% (Eoin Lees 2007, pg 98). Any non-additionality implies additional costs for consumers, essentially consumers are paying to subsidise actions that would have happened anyway.

Because of the inherent uncertainty around baselines set in advance it is particularly important for ex-post assessments of the accuracy of baseline setting to be carried out if the impact of the scheme is to be more accurately assessed. However, evaluation by the International Energy Agency suggests that there has not been a good track record of this happening in Europe (IEA 2006).

A major criticism levied at the GGAS scheme is one of low levels of additionality. The Centre for Energy and Environmental Markets at the University of NSW (CEEM) have undertaken a number of reviews of this scheme which point to concerns over the additionality of projects.

The problem of estimating additionality has been demonstrated in the amount of certificates created through giveaways of compact fluorescent light bulbs (CFLs). Initially the scheme administrator (The Independent Pricing and Regulatory Tribunal, IPART) assumed that 80% of all CFLs sold were actually installed. CEEM have observed that this assumption was reduced to 40% after a number of organisations started giving away CFLs for free and claims for credits increased substantially raising concerns that the 80% assumption was too high. CEEM argue that it is quite likely that a significant number of those CFLs given away were not actually installed, and yet credits were awarded (Centre for Energy and Environmental Markets 2007).

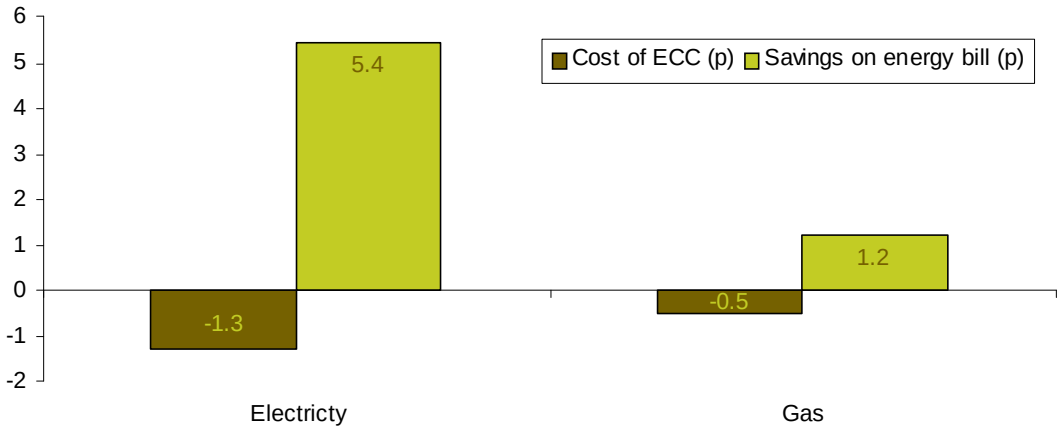
CEEM make the point that failure to carry out independent ex-post evaluations of the true extent of additional savings created by the scheme are likely to cause concerns over credibility.

Cost effectiveness

Initial results suggest that the cost effectiveness of schemes has been good

Notwithstanding the concerns over non-additionality evaluation of phase 1 of the UK white certificate scheme (EEC1) would suggest that it has delivered a significant net benefit to consumers (see figure below).

Figure 20: Cost effectiveness of saving one unit of electricity (kWh



Source: Evaluation off Energy Efficiency Commitment 2002-05 Eon Lees Energy.

For the first phase of the UK white certificate scheme the financial benefits for customers have been estimated to range from 0.6 to 6.0p/kWh for insulation and lighting savings respectively. When avoided external costs due to emissions savings are included, estimated economic benefits range from 3 to 8p/kWh (Luis Mundaca 2006). The UK Government has evaluated that the net present value of the measures necessary to meet the EEC1 target after including all costs and benefits was 3 billion GBP

over the lifetime of the measures, using a discount rate of 3.5%. The total cost was estimated to be 0.6 billion GBP (Eoin Lees 2007).

Data regarding the performance of the French and Italian schemes appears to be limited, although the expected cost of the first phase of the Italian scheme is estimated to be low with the amount allowed in the distribution price formula being at least a factor of six less than the price of electricity and gas to residential customers (Eoin Lees 2007). There appears to have been no ex-post evaluation of the costs and benefits associated with the NSW GGAS scheme.

Despite the promising early results from the UK there are a number of reasons why white certificates may prove to have higher costs than other policy options. In particular these include:

- Monitoring and verification costs
- Transaction costs
- Increased procurement costs due to low trading liquidity

These issues are discussed below.

Significant monitoring and verification costs may be required in order to ensure credibility

A particular challenge with a white certificate scheme is the amount of monitoring and verification required. White certificate schemes will involve perhaps many thousands of installations of equipment. Credibility of the scheme will require confidence in the validity of the installations for which credits are being awarded and robustness in accounting for those credits. There is a trade off to make between confidence in the credibility of the scheme and the monitoring and verification costs involved.

A major issue cited for energy efficiency projects within the early stages of the GGAS scheme were the costs associated with audits, with applicants being required to pay for audits with an average cost of $10,500. This effectively precluded smaller scale efficiency projects from being implemented. The situation in the UK is quite different with no requirement on scheme participants to carry out audits and only two random sample audits having been required by the regulator in 2003 and 2005 (IEA 2006).

The IEA perceives that monitoring and verification remains a challenging element to better ensure the theoretical efficiency of white certificate schemes (IEA 2006).

Transaction costs for liable parties can be significant

White certificate schemes involve significant administrative effort for retailers. Activities such as identifying opportunities, providing information to customers, assessing sub-contractors and negotiating contracts may involve significant transaction costs. The UK Government has assessed transaction costs associated with CERT as accounting for 14.5% of the total costs of the scheme.[29] However a review of transaction cost estimates carried out by the European Commission found that these ranged from 9% to as much as 40% (Luis Mundaca 2006). This review also noted that these costs can be expected to vary depending upon the type of measure applied. For example the scale of transaction costs during the first phase of the UK scheme has been estimated to be around 10% and 30% for lighting and insulation respectively. Transaction costs can also be expected to increase the longer the scheme runs as the available pool of opportunities becomes more difficult to identify.

The Centre for Resource Solutions cites a number of reasons why transaction costs might be particularly high in a white certificate scheme (Hamrin, Vine & Sharick, 2007). Not least are the multiple interactions

[29] See http://www.opsi.gov.uk/si/si2008/em/uksiem_20080188_en.pdf). DEFRA, *Impact Assessment of CARBON EMISSIONS REDUCTION TARGET 2008-2011*,

that are required between retailers and domestic consumers. Administration costs will also be driven up if national retailers are forced to comply with a number of state based schemes. A combination of significant non-additionality and high transaction costs could be expected to significantly reduce the cost-effectiveness of the scheme. The IEA points out that a deeper insight into transaction costs is needed in order to confirm the theoretical benefits of implementing white certificate schemes involving trading (IEA 2006).

Market size and liquidity will impact on costs

Another factor influencing compliance costs will be the extent of coverage and degree of liquidity available within the scheme. Trading schemes such as the EU ETS and CPRS are designed to have a broad coverage on the premise that this will increase the potential for trading and reduce costs. The IEA point out that trading is an essential feature for reducing compliance costs (IEA 2006, p 163). Schemes with smaller coverage will intuitively be less liquid. From this perspective, the three State based white certificate schemes that have recently been announced in Australia are unlikely to be as efficient as a national approach.

Liquidity can be increased by including not just domestic but also commercial buildings. Data provided in section 3 highlighted that many of the most cost effective energy efficiency improvements are likely to be found within commercial buildings. However, increasing the scope of coverage to include commercial buildings may pose an increased risk to additionality to the extent that market failures are not such an issue for commercial building tenants.

Other factors

Likely positive Impact for technology investors

Along with building standards a mandatory white certificate scheme can be expected to have the most positive impact on technology investors since it is likely to increase the uptake of energy efficiency further than with relying on an ETS alone. However, investor confidence will be impacted by the duration to which the Government commits to a scheme, and any long term targets that are set.

The UK Government has attempted to strike a balance between design flexibility and regulatory certainty through reviewing the design of the EEC/CERT scheme every three years whilst committing to have a scheme in place to at least 2020.

The impacts on retail competition are uncertain

Another important factor to consider is the overall impact on energy prices. A white certificate scheme with an obligation on retailers has potential for a negative impact on retail competition. In particular small retail businesses may struggle to cope with the administrative demands of a white certificate scheme (let alone a combination of state based schemes with different rules), particularly when this adds to other legislation aimed at addressing climate change (in particular the Mandatory Renewable Energy Target and the CPRS). The European schemes have attempted to address this issue by setting a threshold level of customers below which the obligation does not apply.

There is also the question of increased risk for retailers in being able to pass through costs to customers. This is particularly relevant where there is a residential retail price cap in place, as is the current situation for all states in the National Electricity Market. The presence of a retail price cap increases risk for retailers as they must rely on the regulator to assess the cost of energy, including the cost of complying with a number of regulatory obligations. The costs associated with rolling out energy efficient measures

are uncertain and may vary across retailers and jurisdictions. This can be expected to increase the perception of risk and possibly discourage smaller players and new entrants.[30]

Equity may be an issue

A mandatory scheme has important consequences for wealth distribution and equity. Not everyone will benefit from improvements in energy efficiency. An obligation placed on retail businesses makes it difficult to control who experiences the benefits and costs associated with a mandatory obligation. One way to address the costs would be for a transparent levy to be applied to customers (for example related to energy consumption or income).[31]

A particular criticism of mandatory white certificate schemes is that whereas a relatively small percentage of the population are likely to benefit from the reduced energy costs associated with energy efficiency measures, the costs are likely to be spread across the entire population. In particular this stands to disadvantage the poor, but also those that were more efficient to begin with. The UK has attempted to reduce the impact on the poor by mandating that 50% of all energy efficiency measures should be rolled out within a priority sector (typically low income households and the 'fuel poor'). However, it can be expected that there will remain a significant number of lower income households who will not gain access to more energy efficient equipment yet will see an increase in their tariff in order to pay for the scheme.

Although white certificate schemes have been evaluated as having the potential to deliver net benefits there may be a significant number who only experience higher energy bills. This may be justifiable if the energy efficiency projects are the lowest cost carbon abatement solution – but less defensible if they are not. The difficulty with having a white certificate scheme separate to the ETS is that there is no way of accurately knowing whether the emissions reductions will be achieved at a lower or higher cost than achieved through the ETS. A white certificate scheme that sits separate to the ETS is therefore effectively 'backing a winner' to the extent that it is aimed at reducing emissions.

Figure 21: Evaluation summary – white certificates (obligation on retail businesses)

Evaluation criteria	Summary of evaluation	
Appropriateness	Expected to be effective at addressing misaligned incentives and may encourage the provision of information regarding the benefits of energy efficient measures. However, also includes an element of subsidy.	✓✓
Effectiveness	Effectiveness tested in Europe. Early assessments appear promising.	✓✓
Cost	Can be expected to provide net benefits when first introduced. However costs associated with monitoring & verification and transaction costs may reduce cost effectiveness. Extent of additionality can also be a concern.	✓
Other factors	Increases regulatory burden and risks for retailers. May increase cost of meeting environmental objective due to 'crowding out' lower cost abatement options. Distributional impacts may be a concern	×

Key
✓✓ Generally positive

[30] Retailers have recently warned that the combination of retail price caps and an uncertain carbon price created by the ETS increases the possibility of a California style power crisis happening within the national electricity market. See article in the Australian Financial Review, 23 July 2008, p 1.

[31] For instance in Italy the regulator makes an allowance in the distribution price formula to cover the cost of the white certificate program. In the US nearly half the States have or are developing "Public Benefit Funds" which support energy efficiency and/or renewables. Funds come either from a small charge on all bills or through specified utility contributions, for details see www.pewclimate.org/node/1311.

✓	May be positive depending on design
×	Generally negative

7 Comparison of options

In this section we have drawn together the preceding analysis to provide an overview of the evaluation, placing the broad policy options side by side. We have also provided data from other sources which may prove useful from a policy evaluation viewpoint. Appendix A and B provide an overview of our evaluation against the evaluation criteria discussed in section 5.

7.1 Appropriateness

In terms of ability to overcome the key barriers to the uptake of cost-effective energy efficiency all of the policy options evaluated, apart from financial incentives, address these barriers to some degree.

Provision of information from governments (and perhaps in partnership with the private sector) provides the clearest case for use in terms of overcoming lack of information, especially around the impact of consumer behaviour on costs. This is particularly the case at a time when energy prices may be expected to rise. Appliance labelling and building certification are likely to become more important as a means of assisting consumers make more informed decisions as energy prices rise to incorporate the cost of carbon.

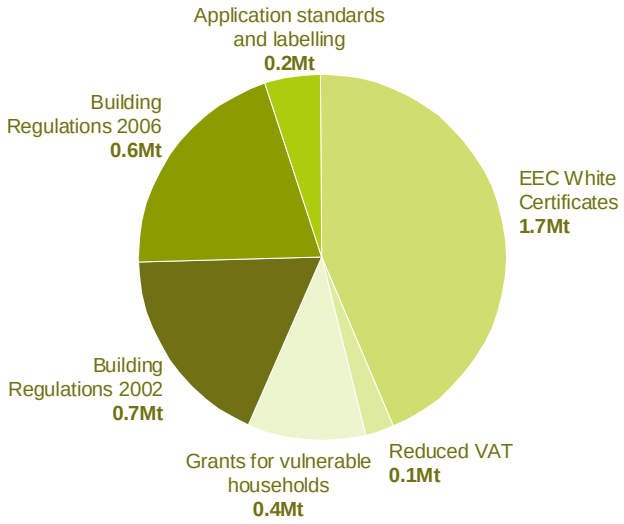
Even with more information, bounded rationality can still lead to poor results. For this reason minimum standards for appliances and buildings, in tandem with information that distinguishes products that perform better than the minimum, can be argued as warranted, particularly given the fact that these policies are often considered to be the most cost effective.

The argument for financial incentives revolves more around encouraging society wide benefits through encouraging research, development and demonstration of energy efficiency technologies that may not be incentivised through market prices alone. To the extent that energy efficiency projects are not the lowest cost GHG abatement options a white certificate scheme also serves the same objective.

7.2 Effectiveness

Perhaps not surprisingly regulated measures such as building and appliance standards and energy efficiency targets have proven most effective. This is reflected in the following figure which shows less than a quarter of estimated emissions savings being derived from voluntary measures in the UK. However, if the cost effectiveness of energy efficiency options is accurate then using these as a voluntary means of reducing emissions within a cap and trade emissions trading scheme could prove effective to the extent that savings could be verified as additional.

Figure 22: UK policies – Emissions savings in 2010 (MtCe)



Source: DEFRA Synthesis of Climate Change Policy Evaluations 2006.

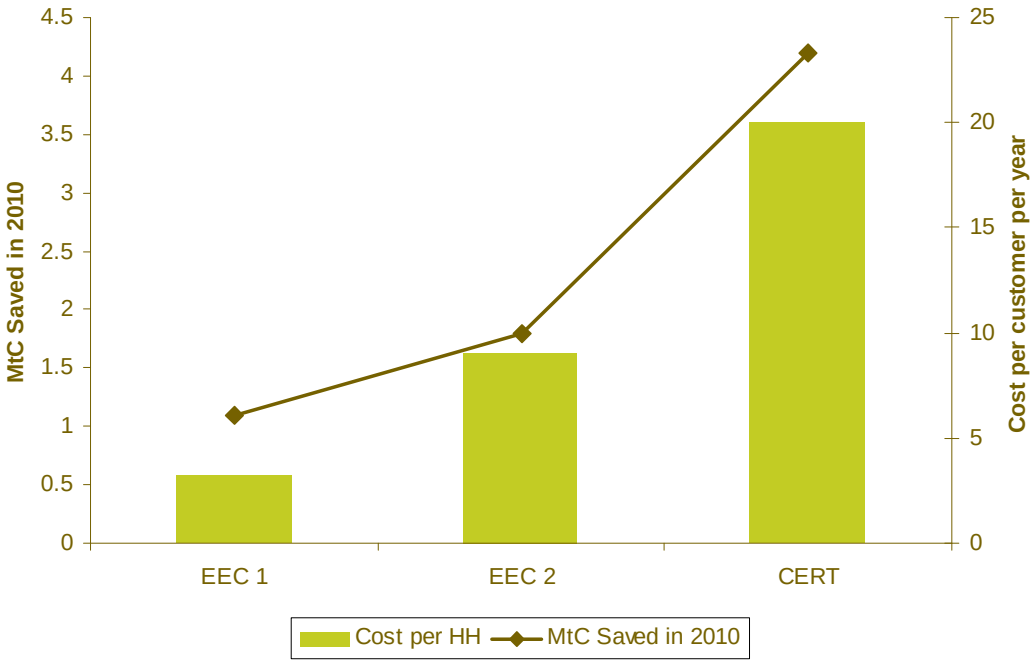
Concern over the rebound effect would indicate the importance of information in encouraging consumers to make informed decisions with regard to energy consumption after initial savings have accrued from regulatory measures. However, it is naturally difficult to isolate the impact of information provision on behaviour and perhaps for this reason the role of information tends not to gain the same degree of attention as other policy options.

7.3 Cost Effectiveness

Cost effectiveness is meaningless without knowing the level of energy or emissions that has been reduced. The cost of improving energy efficiency is likely to increase the higher the target (as the 'low hanging fruit' are removed). This makes it particularly difficult to compare how existing energy efficiency schemes compare on a cost effectiveness basis as schemes will vary in the level of energy reduction achieved. Cost effectiveness will also be a function of the starting point – in other words how much potential there is for improving efficiency in the first instance, with diminishing returns the more overall efficiency improves. This means that a policy that has resulted in low costs in one country may not achieve the same results in another.

The following figure illustrates how the targets and estimated costs have increased across the three phases of the UK's white certificate programme. Costs have been estimated to increase from £3.20 per customer per year in phase 1 to £20 in phase 3 as the targets have increased.

Figure 23: Relationship between energy efficiency targets and costs

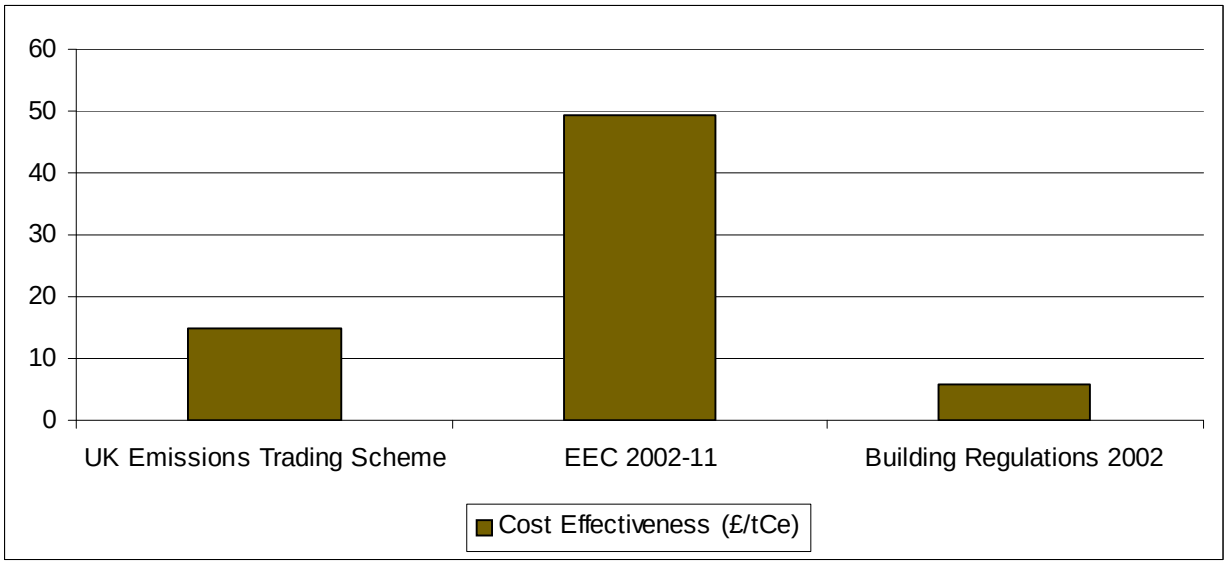


Source: Defra Explanatory Memorandum to CERT 2008 and background information on illustrative mix EEC 2005-08.

One problem with mandatory energy efficiency targets is that it is particularly difficult to assess at what level these will fail to achieve a net benefit. That is, at what point the incremental cost of achieving an efficiency gain will outweigh the benefits. The UK has looked to reduce the risk of mandating targets that do not deliver net benefits through starting with a low target and only increasing this once there is a clearer understanding of the costs involved.

The following figure summarises estimates produced by the UK Government regarding the cost effectiveness of the EU ETS, the UK's white certificate scheme (EEC) and building regulations in terms of cost of delivering emissions reductions. This data suggests that building regulations are the lowest cost solution, whereas the white certificate scheme, albeit evaluated as having net benefits (when reductions in energy bills are included) was evaluated to be a more expensive means of achieving emissions reductions. We note that the UK Government expects the EEC to deliver more than double the emissions savings of the 2002 building regulations.

Figure 24: Cost effectiveness of emission reduction policies – UK[#]



Source: Defra, synthesis of climate change Policy evaluations.

([#] Estimated public spending implications (£m) for FY06/07 to FY 10/11 divided by the average estimated CO2 emissions savings in the UK (MtCe) for 2004-2010)

A recent study by the United Nations Environment Programme (UNEP) contains a listing of international energy efficiency schemes and their estimated cost-effectiveness as reported by a number of sources (UNEP and CEU 2007). Notwithstanding the difficulties in comparing data across schemes and regions, some cursory observations from this compilation of data are:

- In the UK, information programs conducted by the Energy Savings Trust have been estimated as having a net cost of $8/tCO2
- Mandatory labelling and certification programmes in Australia have been evaluated as having negative costs of $30/t CO2 abated (although to what extent these account for problems associated with non-compliance with standards is not clear).
- Appliance standards have been assessed as delivering negative costs in Australia, the US and in Europe
- Economic and fiscal incentives have had mixed results in terms of costs (being evaluated as having experienced a wide range of both negative and positive costs depending upon the scheme and region)
- The UK white certificate program has resulted in negative costs, and the French scheme has been assessed as almost cost neutral.

In particular the UNEP study cited the ability of building and appliance standards to reduce transaction costs as a key success factor stating that:

> *"Regulatory and control instruments such as building codes were revealed as the most cost-effective category of instruments in this study if enforcement can be secured. A number of regulatory instruments achieved savings in the triple negative digit range of costs."(UNEP and CEU, 2007)*

7.4 Other factors

Impact on technology investors

Legislative schemes can be expected to have the most positive impact on investment in energy efficiency technology. In particular, financial incentives, mandatory white certificates and building and equipment standards are likely to provide incentives for investment. To what degree however will depend upon regulatory certainty, duration and the level of targets that are mandated (or in the case of financial incentives the size of funding that is allocated).

Competition issues

Of the options considered only a mandatory white certificate scheme appears to have the potential for any impact on competition in energy supply. The degree to which such a scheme might reduce competition is difficult to assess, although we note that this is likely to increase where the regulatory burden on retailers (particularly small retailers) is already significant. The potential for a mandatory white certificate scheme to become a negative impact on competition is increased where retail price caps exist as these increase the risk that retailers will not be able to recoup costs.

Distributional impacts

Mandatory white certificate schemes pose the biggest challenge for wealth distribution due to the costs typically being spread across the population, whereas only a limited proportion will have energy efficiency measures installed. White certificate schemes can be expected to have an element of subsidy involved, with liable parties needing to offer financial incentives to secure compliance with the target. The cost of funding these incentives will typically be spread across all customers through an uplift in electricity bills. Obligations placed on retailers therefore mean that governments cannot control who pays the cost.

Compatibility with an ETS

Financial incentives and mandatory white certificate schemes prove the most challenging options in terms of compatibility with an ETS. In particular these schemes can act to ‘crowd out’ other low cost abatement options. There will also be concerns over additionality as it is not practical to test projects for additionality, especially at the residential level, prior to awarding credit. White certificate schemes can be expected to have an element of subsidy involved. To the extent that it is a policy objective to support the commercialisation of new technology these risks may be acceptable.

To the extent that energy efficiency projects are not always the lowest cost GHG abatement solutions these schemes can be expected to increase the societal cost of achieving emissions targets.

8 Conclusions

The tables on the following pages summarise our evaluation of the policy options against the evaluation criteria discussed in Chapter 5.

Of the policy options assessed no single policy option comprehensively addresses all barriers. Rather, it is likely that a range of responses will be required to address barriers to the uptake of cost-effective levels of energy efficiency.

Our analysis suggests that building and appliance standards have the clearest case for being adopted by governments on the grounds that they:

- address (to some degree) misaligned incentives
- have the potential to be cost effective, and
- are complementary to the forthcoming ETS.

Enforcement of these is the key success factor.

There is also a strong case for provision of information from governments. The NFEE is endorsing more in this regard through better and extended labelling on appliances and through building certification. There also appears to be merit in governments seeking to leverage private funding for awareness raising through public-private partnerships and a body that acts as a focal point for energy efficiency advice to the general public.

Mandatory white certificate schemes, while likely to be effective initially, also appear to have significant challenges and risks for governments, particularly if planning to be introduced at the same time as an ETS.

Financial incentives have the weakest case for being applied where the objective is to achieve cost effective levels of energy efficiency. However there may be other valid reasons for their use, including the promotion of promising technology and in mitigating the impacts of energy price rises to low income households.

Part C
Appendices

Appendix A Existing Australian residential energy efficiency schemes

Category	Scheme	Description
Direct Financial Incentives	Rebates on solar hot water systems – Australia Wide	Rebates of $1,000 to install solar and heat pump hot water systems that replace residential electric hot water systems. Installing a system also creates 20 RECs valued at around $800.
Regulations and Appliance Standards	Residential building regulations – Australia wide[32]	Vary from state to state and according to climate but generally new homes are required to have: • 5 Star energy rating for the building design and fabric i.e. walls, floors, ceilings, windows, air leakage points, glazing etc. • Water efficient shower heads and tap wear. • Rainwater tank for toilet flushing, or a solar hot water heater (in Victoria). • Gas water heaters (not all states).
	Energy ratings on products – Australia wide	Mandatory ratings for: Refrigerators and freezers, washing machines, dryers, dishwashers and air conditioners. MEPS standards for: Refrigerators, freezers, some air conditioners.
	House energy performance rating – ACT[33]	Since 1995 it has been an ACT Government requirement that all designs for new dwellings achieve an Energy Efficiency Rating (EER) of at least four stars. Since 1999 the ACT Government has required anyone selling or leasing a house to obtain an energy-performance rating that must be disclosed in advertisements and in the contract of sale
Certificate Scheme	NSW Greenhouse Gas Abatement Scheme	A mandatory emissions trading scheme established in 2003 which sets annual state-wide greenhouse gas reduction targets and requires individual electricity retailers and certain other parties who buy or sell electricity in NSW to meet mandatory benchmarks based on the size of their share in the electricity market. If they fail to meet their targets, they must offset the excess emissions through surrender of certificates or payment of a penalty

[32] See http://www.5starhouse.vic.gov.au/5_star_house_making_the_most.htm#implementation.
[33] PC 2005.

Appendix B Proposed Australian residential energy efficiency schemes

Category	Scheme	Description
Regulations and Appliance Standards	Residential Building Regulations – Australia Wide[34]	This year the BCA will be extended to cover home alterations and relocations.
	Lighting standards – Australia wide	An import ban on incandescent lamps / light bulbs by November 2008 and a total retail ban 12 months later.
	Television and other electrical appliance labelling – Australia Wide	A 10-star appliance rating scheme to help consumers identify "super efficient appliances" – like clothes dryers, washing machines and dishwashers A new voluntary television labelling scheme will enable consumers to identify the most energy efficient sets at point of sale, with a proposal to later introduce a mandatory scheme
Certificate Scheme	National Market Driven Energy Efficiency Target – Australia Wide	Tradable certificates awarded for energy use avoided/saved from innovation in energy efficiency, in addition to efficiency activities that would have happened otherwise. Suppliers are obliged to "earn" certificates.
	Victorian Energy Efficiency Target (VEET) - Victoria[35]	VEET, which is due to commence in 2009, sets a target for energy retailers to make energy savings, initially in the residential sector. Energy saving activity will be accredited via a certificate system, with certificates being surrendered to the scheme administrator to achieve compliance. Energy retailers may on-sell certificates in excess of their targets to others retailers who may not have reached their individual targets. Includes an element of partial subsidies on appliances which will have many of the 'effectiveness' characteristics of 'incentive' policy measures.

[34] http://www.5starhouse.vic.gov.au/5_star_house_making_the_most.htm#implementation.
[35] See Department of Sustainability and Environment, Department of Primary Industries, Issues Paper, *Victorian Energy Efficiency Target Scheme*, March 2007.

Category	Scheme	Description
	Residential Energy Efficiency Scheme (REES) – South Australia[36]	Energy retailers in South Australia must achieve targets for: • Energy audits to low income households; and • Energy efficiency improvements in households, of which a proportion of these must be delivered to low income households.
Direct Financial Incentive	Climate Change Fund - NSW[37]	• Part of the $310 million Climate Change Fund will pay rebates to households and businesses to fund energy and water efficiency projects.
Planning, Education and Outreach	Your Home Renovator's Guide	A new guide to help householders and in particular renovators identify ways to incorporate energy efficient saving measures into their homes.
	Web portal	A one-stop web portal to provide consumers with a single window to all federal, state and local government environmental programs for sustainability at home

[36] http://www.dtei.sa.gov.au/energy/government_programs/REES.html.
[37] http://www.environment.nsw.gov.au/grants/ccfund.htm.

Appendix C Key differences of international white certificate schemes

White certificate schemes are operational in the UK, France and Italy and have been proposed in Victoria and South Australia. These schemes are fundamentally premised on the same baseline-and-credit design, albeit with some key differences as outlined in the table below:

Design Feature	Description
Targets	The French scheme is expressed in terms of energy savings, rather than emissions savings, but has been criticised for lack of clarity in terms of their environmental benefits. The UK scheme has subsequently altered this and now sets a target in terms of expected lifetime reductions in CO^2. The Italian scheme expresses the target in millions of tonnes of oil equivalent, the reason being that Italy has an additional objective of encouraging a reduction in fuel imports. Targets are set proportional to the market share of liable parties.
Liable parties	The UK and France have imposed obligations on energy retailers. Italy has imposed the obligation on distribution companies, a key difference here being that costs are passed through to customers within the distribution tariff. Small retailers are generally exempted from the obligation, although the threshold level varies between countries.
Approved measures	Most white certificate schemes incorporate a list of approved energy efficient measures, however in the UK obligated parties are required to seek pre-approval of plans to reduce energy efficiency. This is designed to allow some flexibility for innovation. The Victorian scheme plans to include a list of pre-approved measures but will also assess applications for other measures. Credit for energy efficiency measures are generally granted for average expected lifetime energy reductions. The calculated credit assigned to each measure attempts to take into account the rebound effect and any non-additionality. More expensive and longer life measures such as insulation tend not to benefit as much as credit is usually only given for the first few years of the products life.
Trading	Full trading of white certificates is generally allowed on the basis that this can be expected to reduce the cost of compliance. The proposed South Australian scheme is an exception with trading being prohibited. In the UK white certificates can only be traded by retailers.
Penalties	Most schemes apply a penalty for non-compliance. This effectively caps the cost of compliance and limits the risk of the scheme exceeding a maximum cost.
Scheme duration	Scheme durations tend to vary between three and five years. Early commitment to extending the duration of the scheme is viewed as important in ensuring that early activity does not diminish. Countries that have committed to ramping up obligations and that have allowed banking of certificates have witnessed annual targets for the generation of white certificates being exceeded. This has effectively speeded up the role out of energy efficient measures.
Other elements	The UK scheme seeks to address fuel poverty by mandating a percentage of the target to be directed to priority groups (typically low income households or pensioners). The Victorian scheme plans to incorporate something similar. However the UK has been criticised because of the conflict between the environmental and social objectives. The UK scheme applies 50% bonus credits for activities that have involved an energy audit. This is intended to ensure energy efficient measures are applied where they will deliver the most benefit. The Victorian scheme plans to mandate a certain number of energy audits (to be conducted on low income households) but does not grant any bonus.

Appendix D Operational features of international white certificate schemes

Country	Certificate Schemes	Start Date	Obligated Company	Scheme Target	Trading	Cost of Scheme	Penalty
AUS - Victoria	Victorian Energy Efficiency target	1 Jan 2009	Electricity & Gas retailers	Reduce 2.7 MtC each year between 2009-2011	Yes	Unknown	Not yet announced
AUS - SA	South Australian Residential Energy Efficiency Scheme	1 Jan 2009	Electricity & Gas retailers	Reduce 645 000 Tonnes of carbon emission over 3 years	No	Unknown	Not yet announced
UK EEC1 - 2002-05*	Energy Efficiency Commitment 1	1 April 2002	Electricity & Gas retailers	Energy saving 62 fuel standardized lifetime discounted TWh	Yes between obligated suppliers all trading subject to OFGEM approval	An average price increase of £3.20 per customer per year per fuel. 601.9 Mn Euros	Related to size of miss
UK EEC 2 – 2005-08*	Energy Efficiency Commitment 2	1 April 2005	Electricity & Gas retailers with more than 15000 customers	Energy saving 130 fuel standardized lifetime discounted TWh	Yes between obligated suppliers all trading subject to OFGEM approval	An average price increase of £9 per customer per year	Fine up to 10% of supplier's turnover
UK CERT 2008-11*	Carbon Emissions reduction target	1 April 2008	Electricity & Gas retailers having more than 50000 customers	Lifetime carbon saving of 154 MtC	Yes between obligated suppliers all trading subject to OFGEM approval	2.8 Bn** investment by energy suppliers. £ 20 per household increase in energy bills	Unknown

Country	Certificate Schemes	Start Date	Obligated Company	Scheme Target	Trading	Cost of Scheme	Penalty
ITALY	National Energy Efficiency Action Plan	2005	Electricity & Gas retailers having a customer base of 100000 and above in 2001	2.9 Mtoe from 2005 to 2009	Yes	Unknown	Fee that is proportional and greater than investments needed to comply
FRANCE	Energy Saving White Certificate	1 July 2006	Suppliers of gas electricity, cooling, domestic fuels	54 TWh of cumulative discounted energy savings over 3 years	Yes	137 Mn Euros for 2007 for all energy saving schemes	2 cents/KWh
BELGIUM*	ENERGY Efficiency Scheme	2003	Electricity distributors	0.58 TWh lifetime primary energy per annum	No	£M 25.8 /Yr	10£/MWh missed and fine that cannot be passed through in tariff
IRELAND*	National Energy Efficiency Action Plan	2007	Electricity distributors	0.24 TWh of lifetime delivered energy per annum	No	£M 4 /Yr	Reduction in subsequent CER allowance
DENMARK*			Electricity gas and heat distributors	0.12 TWh of lifetime delivered energy per annum	No	£M 20 /Yr	No

* Data from Defra UK, Evaluation of the Energy Efficiency Commitment 2002-05.
** Defra explanatory note on CERT.

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