18 INFORMATION AND AGENCY BARRIERS

Key points

There are potentially large and early gains from better utilisation of known technologies, goods and services, including energy efficiency and low-emissions transport options.

Externalities in the provision of information and principal–agent issues inhibit the use of distributed generation and energy-saving opportunities in appliances, buildings and vehicles.

Some combination of information, regulation and restructuring of contractual relationships can address many of the market failures blocking optimal utilisation of proven technologies.

There are significant opportunities for low-cost reductions in emissions across the Australian economy through the deployment of existing technologies and practices. These opportunities include energy efficiency and fuel switching in homes, industry and transport.

This chapter examines these opportunities. The Review's final report will make recommendations on these matters.

The introduction of an emissions trading scheme will increase returns from adopting opportunities to lower emissions. However, market failures will impede adoption of opportunities that may be privately cost-effective. Policies that tackle these market failures would lower the cost of mitigation across the economy.

Tackling these market failures will require changes to entrenched practices and procedures. It will require new skills, supported by significant investment in relevant education. As economies orient themselves towards lower-carbon products and services, demand for these new skills will increase, with potential benefits for individuals, firms and nations that have invested early in education.

Designing effective policies will involve case-by-case analysis and sometimes cycles of testing, evaluation and refinement. Given this complexity and the need for tailored policies in various sectors, this chapter suggests a policy framework rather than detailed policies.

18.1 The impact of information and agency barriers

Two kinds of market failures are especially important in inhibiting the adoption of low-emissions technologies and practices. One relates to externalities in the supply of information and skills. The other involves a principal–agent problem—where the party that makes a decision is not driven by the same considerations as another party who is affected by it.

A substantial proportion of the low-cost low-emissions opportunities in Australia are in sectors that are affected by information and principal–agent market failures. Much of the mitigation potential in these sectors could be achieved relatively early.

18.1.1 Which sectors are affected?

The market is more likely to overcome information and principal–agent barriers in sectors involving large firms. Market failure is most likely to occur where mitigation opportunities are small relative to the transaction costs of securing them, such as:

- energy efficiency, fuel switching and small-scale generation in buildings, industry and transport
- emissions reductions in agriculture, forestry and waste.

18.1.2 How much mitigation potential exists in these sectors?

Various studies attempt to estimate the extent of mitigation opportunities in different sectors. Work by the IPCC (2007: 9, 409) suggests that the majority of global mitigation potential to 2030 at under US$20 per tonne of CO_2-e would occur in sectors affected by information and principal–agent market failures, with around 5 billion tonnes of mitigation potential in the building sector alone out of a total abatement potential of 9–18 billion tonnes in all sectors.

Box 18.1 What is energy efficiency?

Energy efficiency generally refers to reducing the amount of energy required to deliver an amount of a service, such as kilowatts per unit of heat. The International Energy Agency (2006) has estimated that increased energy efficiency could account for 45 to 53 per cent of global emissions reductions in projections to 2050.

Once an emissions trading scheme is in place the cap will prevent emissions from increasing in covered sectors. In this context, appropriate energy efficiency programs can increase individuals' welfare, by delivering more of a service for the same amount of energy.

Energy efficiency does not always correspond to economic efficiency, which involves maximising the efficiency of use of all resources (Sutherland 1994). Where efforts to improve energy efficiency require more input of capital, labour and other resources than is saved in energy, economic efficiency would be reduced.

Nevertheless, the evidence indicates that there are opportunities for increased energy efficiency in Australia that are economically beneficial (Allen Consulting Group 2004), although there are methodological issues in accurately determining the quantum of the opportunity (Productivity Commission 2005). If these opportunities are taken up, the need to expand generation in the next twenty years may be reduced, which could further lower the cost of mitigation, since the cost of renewable and low-emissions energy plants is likely to decline over this period.

Similarly, work by McKinsey & Company (2008) suggests that the majority of technically low-cost mitigation opportunities in Australia occur in sectors affected by information and principal–agent market failures. McKinsey & Company estimates that in 2020 Australia's emissions could be reduced by around 11 per cent below business as usual levels through zero and negative net cost mitigation opportunities, which are predominantly in the transport, buildings and industry sectors.

Many of these studies are overly optimistic as they do not include potentially unavoidable transaction costs from the uptake of more efficient products, such as time spent in information gathering and decision making. They may also use low discount rates, overestimate savings and ignore policy costs (Stavins et al. 2007). On the other hand, many are also conservative in limiting the potential for technology development that could increase the potential for mitigation. Despite the difficulties in estimating the full range of costs and benefits, these studies are useful first steps.

18.1.3 Rationale for additional policies

An effective emissions trading scheme would address the issues of reducing greenhouse gas emissions and urgency of action. The rationale for other policies to support the uptake of low-emissions technologies and practices should be the correction of market failures that increase the cost of mitigation. If these market failures cannot be tackled cost-effectively then there is no case for action, which would increase the cost of mitigation.

Any other justifications for additional policy measures should be rejected.

18.2 Public good information

Individuals can never have perfect information relevant to a decision they are making. However, development of an efficient market in goods and services requires individuals to know:

- the options available
- the rough costs and benefits of the different options
- how to deploy the options (including hiring experts)
- the cost of investigating the options.

Information on the emissions produced or energy used by some technologies can be difficult to determine without extensive testing (Sorrell et al. 2004), which may make information barriers particularly widespread in markets for low-emissions options.

Governments should not be expected to fill the gap in every situation where individuals lack sufficient information to make good decisions. Producing, finding, and processing information has economic costs that need to be considered in decision making. However, where information barriers are caused by market failures, governments may be able to improve the efficiency of the market.

These market failures include the public good nature of some information and bounded rationality. They are discussed below, together with policy options to address them.

18.2.1 Public good information market failures

Some information is a pure public good, as it is not possible to exclude individuals from using it, and one person's use of that information does not prevent others from using it.

Where information has public good characteristics, it is likely to be underprovided by the private sector (Jaffee & Stavins 1994a). The private sector may disseminate information with public good characteristics, such as

consumer magazines. However, as firms are not able to capture all the benefits from public good information, there is insufficient incentive to make information as extensive and widely available as consumers may demand.

Training and education are also important public goods (Brown 2001). Even if individuals have access to information, they may require new skills or a wider body of knowledge to use it (Consumer Affairs Victoria 2006). Given the wide range of technical issues involved in some low-emissions options, gaps in the skill sets of specialists such as engineers or tradespeople could prevent the uptake of low-emissions options across a range of sectors.

Bounded rationality

Even where individuals have access to sufficient information, they may make decisions that appear personally suboptimal for reasons of 'bounded rationality'. Bounded rationality is the concept that individuals and firms may not be able to always make perfect or optimum decisions, as their knowledge and processing abilities are limited. In some cases, socially suboptimal outcomes result.

Firstly, gathering and processing information has costs. A study of energy efficiency investments by Danish companies estimated that transaction costs relating to information gathering and decisions accounted for 3 to 8 per cent of the costs of the investment (Hein & Blok 1995).

Even if individuals have access to information, the personal costs of gathering and processing the information may exceed the personal benefits. Therefore, individuals may choose to remain uninformed even when better information could help them to make decisions that would be more advantageous in the absence of information costs.

For example, Sathaye and Murtishaw (2004) suggested that even if consumers were aware that compact fluorescent lamps could save money, they may need to spend 45 minutes to accurately assess potential savings and locate a shop that sold these lamps. If individuals valued their time at US$20 per hour, this would more than double the 'price' for the first purchase of this type of lamp. However, if individuals could pass this initial cost barrier, over their lifetimes they would probably save significantly on their lighting costs.

Secondly, as the costs of making optimal decisions can be high, some theorists suggest that in many situations people make decisions that are sufficient to meet their needs, rather than optimal (Simon 1955). This type of decision making may be personally optimal for an individual when considering limits to her time, attention and other resources.

One example of this type of behaviour is the use of rules of thumb in decision making. Rules of thumb can include personal habits and cultural norms, such as the widespread use of pay back periods in estimating whether capital investment is worthwhile.

Some rules of thumb deliver broadly accurate results. Kempton and Montgomery (1982) found that the way that individuals estimated savings from investments in insulation were often inaccurate. Even in those cases where households attempted to determine payback periods, they significantly underestimated the cost-effectiveness of investments in insulation.

Finally, in addition to rules of thumb, there are some predictable biases in human decisions that could result in decisions that are both personally and socially suboptimal (Kahneman & Tversky 2000). Some of these biases are relevant for investment in low-emissions options, particularly:

- biases towards the status quo
- high rates of discounting of future costs and benefits compared to immediate costs and benefits.

Finally, individuals also have difficulties in processing, retaining and using information, and may not attempt to weigh up the costs and savings of low-emissions options. Even where savings are known, households may pay them limited attention compared to their perceptions of upfront costs, effort, comfort and social norms (Komor & Wiggins 1988). Bounded rationality presents a challenge to the uptake of some cost-effective low-emissions options.

18.2.2 Policy option: information and education

Government funding for the provision of information and skills can tackle the undersupply of these public goods directly. Information and education programs have strong synergies with an emissions trading scheme, as they can help individuals to identify the carbon price and respond to it. This is particularly important during the scheme's initial phase, when the costs of many goods will change.

However, there is considerable evidence that the effectiveness of basic media campaigns and pamphlets is limited due to bounded rationality (Cone & Hayes 1980). Information programs for households are more effective if they consider social and attitudinal issues and involve alternative communication techniques such as audits, community-based programs and diffusion through social networks (Shipworth 2000). Developing these types of programs generally requires:

- identifying target groups and assessing their knowledge, attitudes and behaviours
- developing communications, possibly using social networks
- testing, evaluating and improving the program before rolling it out.

If governments follow the advice given out by information programs, such as undertaking energy efficiency audits, this can support the credibility of such programs (Bjornstad & Brown 2004).

Where extensive knowledge and skills need to be conveyed, education and training programs will be more effective than information programs. However, education programs have significant ongoing direct and opportunity costs to the provider and the student.

Box 18.2 Tailored information: TravelSmart

Some individuals do not have basic information about the transport options that are available to them and the costs and benefits of those options. Interviews in Perth suggested that information failures may have prevented 24 per cent of all trips being switched from car to other modes of transport. The TravelSmart Household Program in Perth aims to overcome these information failures through tailored information provision, including:

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

Tailoring information and education programs

Information or education programs need to be targeted and tailored to ensure that the right individuals receive suitable knowledge and skills. Target groups for programs should include:

- the general public—for programs that raise awareness of the benefits of energy efficiency, provide basic information on low-emissions practices, and educate consumers on how to identify the costs and benefits of different low-emissions options
- market intermediaries such as retailers and estate agents—for basic education programs
- managers and other non-specialists in business—for programs that raise awareness of practices for energy and carbon management
- specialists—for programs that cover practical skills in the installation and maintenance of low-emissions options for trades such as building and plumbing, and a mixture of theory, knowledge and skills for professions such as engineering (Desha et al. 2007).

Programs also need to be tailored around the information needs and structures of sectors. Where there are already suitable bodies such as outreach programs in the agricultural sector, these may be valuable in diffusing skills and knowledge. In some cases new structures may be required, such as the independent Carbon Trust that was established in the United Kingdom to specialise in delivering knowledge and skills to firms.

Box 18.3 GreenPlumbers

The Australian GreenPlumbers program has trained and accredited more than 3500 plumbers in skills such as installing solar water heaters and leak minimisation since 2001. The program was developed by the Master Plumbers and Mechanical Services Association of Australia with support from private firms, the Commonwealth Government, local councils and the Royal Melbourne Institute of Technology.

In industry, formal education and reskilling courses are generally suitable for addressing the lack of skilled professionals, such as engineers. However, there are also gaps in organisation-wide skills that support energy management, such as energy reporting (Paton 2001). Here companies may need to be engaged directly, as general information provision may be limited in its effectiveness (Energy Consult 2002).

Voluntary industry programs, such as the Australian Government's Energy Efficiency Best-Practice Program, appear to have had success in engaging companies to improve their skills and reduce their emissions (Paton 2001). The final review of this program found that it had been cost effective, and that projects planned under the program could save $74 million by 2010 (Energy Consult 2002).

Investment in learning

While there are likely to be long-term benefits to individuals, firms and nations that invest in education during the transition to a carbon-constrained economy, there are also likely to be significant upfront costs. These upfront costs may present barriers to learning.

Specialists, such as electricians, may face upfront costs but uncertain benefits from learning new technologies. As clients often rely on specialist advice on which technology to install, they may not be in a position to demand more efficient equipment. This may result in the 'lock-in' of some higher-emissions technologies. If this occurs, certification programs could provide an incentive for specialists to learn new information.

Similarly, some companies may not be able to determine the benefits of learning about energy management before the learning takes place. Some programs, such as the Australian Government's Energy Efficiency Opportunities Program, complement voluntary training on energy management with some mandatory components that encourage firms to learn new skills. Some early results of the program are promising, with one plant that had already invested in energy management finding more than a million dollars worth of savings through participation in the program (Department of Resources, Energy and Tourism 2007).

There may be a case for such mandatory requirements early in the transition to the carbon-constrained economy. However, in future these may be unnecessary, as new energy management processes become integrated into standard business practices.

However, education and information programs will not always be effective, as bounded rationality means that individuals may not pay attention to information, may forget information rapidly and, even where they are sufficiently aware and have incentives to make a decision, may not act on the knowledge (McKenzie-Mohr & Smith 1999). In addition, information programs may be less effective when they attempt to convey complex information to individuals, where habits or practices are entrenched, or where other market failures are in operation. In these cases governments should consider other policy options, such as the use of specialists or minimum standards.

Information and education programs are likely to be most effective in cases where bounded rationality is restricted, such as:

- situations where the information is close to the point of decision, such as energy labels on appliances that are examined along with the good
- education programs for specialists, as they are more likely to regularly use and hence retain the knowledge gained. In addition, it is generally cheaper to educate a small number of specialists than a large number of non-specialists.

18.2.3 Policy option: use third parties

Specialists, such as energy service companies, can use economies of scale in gathering and processing information to overcome information gaps and bounded rationality. These companies are paid by firms to make decisions about which technology to buy, thus spreading the cost of gathering information across several parties. As a result, the cost of information to each firm is lowered.

Unfortunately, transaction costs make current forms of energy service contracting less suitable for smaller parties with significant information and bounded rationality problems, such as households and small businesses (Sorrell 2005). Take-up of basic household energy audits, which can be quite cost effective, can be low due to bounded rationality and the inability of households to determine the value of specialists' advice before it has been given.

Various countries have attempted to foster the market for energy service contracting and auditing. For example, energy retailers could offer contracts to households for 'services' such as heating, hot water and appliances, creating an incentive for the retailers to improve households' energy efficiency. Although there has been limited success to date in fostering these markets (Eoin Lees Energy 2006), there is a case to support testing this approach, as it may be an efficient option if successful.

One alternative has been for governments to subsidise third parties to provide advice or directly install low-emission options in houses and businesses. Generally, if the number of audits and subsidised installations is limited and schemes rely heavily on households to make the decision to take up these options, they will tend to favour informed individuals who are already motivated to save energy. Given the distributional impacts, if these programs are limited in scale they should focus on low-income households.

Another alternative is to create obligations or incentives for parties, such as energy retailers, to deliver energy efficiency improvements in households and firms. Market-based schemes have the advantage that they are more flexible and responsive than government schemes, and are used extensively both the United States and Europe. The UK scheme has been particularly successful in encouraging market transformation, with energy-efficient washing machines now dominating the market and becoming cheaper than less efficient machines (Eoin Lees Energy 2006). However, there are challenges in estimating the energy savings from these programs, and there appear to be errors in many estimates of the cost-effectiveness of these types of program. These schemes appear to be worth testing, but the detail of design will be critical and any scheme that is introduced in Australia should be rigorously monitored and evaluated.

18.3 Information asymmetry

18.3.1 Information asymmetry market failures

Information asymmetry occurs when two parties to a transaction do not have equal access to relevant information.

There are potentially significant information asymmetries where appliances, vehicles and houses are not energy rated. It would be extremely difficult for non-experts to determine the ongoing energy use of an appliance, for example, without outside assistance. This allows opportunism, as a product manufacturer could mislead a buyer on the efficiency of a product, which the buyer is unable to verify.

As noted by the Productivity Commission (2005), market participants may attempt to gather or verify information to reduce information asymmetries through such expedients as hiring an energy-efficiency auditor to examine a house before they buy it. However, this can be costly and individuals may choose not to invest in further information gathering, avoid the transaction or place a risk premium on the transaction.

There may be some features of low-emissions options that increase the likelihood of information asymmetries. Goods can be classified as:

- search goods, where quality can be determined before purchase

- experience goods, where quality can be determined after purchase
- credence goods, where quality cannot be easily determined even after purchase.

As noted by Sorrell et al. (2004), market failure is least likely for search goods and most likely for credence goods. For search goods, there is limited information asymmetry. For experience goods, repeat purchasing can overcome the information asymmetry to some degree. However, repeat purchasing is limited for major purchases such as houses, appliances and vehicles. Furthermore, some goods, such as water heaters, may be credence goods with respect to qualities such as energy use, as it is costly to determine their energy use even after purchase. For credence goods, repeat purchasing will not address information asymmetries.

Adverse selection

Information asymmetry can lead to adverse selection, which can occur where sellers are better informed than buyers, resulting in lower-quality goods dominating a market (Akerlof 1970).

In a market where it is difficult for buyers to verify whether a product is of good or bad quality, they may be unwilling to pay a premium for goods that are actually of good quality. Even if manufacturers voluntarily give information on a product's quality, buyers may be wary of this information (Aronson & Stern 1984).

Where this occurs, there would be limited incentives for manufacturers or developers to produce more energy-efficient products (Jaffee & Stavins 1994b). For example, in the markets for appliances and houses there is a strong incentive for producers to lower the upfront costs, which will usually be associated with avoidance of energy-saving features. As a result, most goods for sale on the market will be less energy-efficient, even if buyers would prefer to buy more energy-efficient appliances if they could be sure of their quality.

In some cases the private sector may be able to implement mechanisms to reduce the extent of adverse selection, such as using a third party to verify the quality of the product. However, the private sector may not always be able to coordinate cost-effective responses to adverse selection.

18.3.2 Policy option: mandatory disclosure

Ensuring that both parties in a transaction have access to sufficient information will generally be the most effective way to address information asymmetry. Therefore, it should be the first policy that governments consider when information asymmetry market failures are identified.

Disclosure schemes, such as energy efficiency ratings, complement an emissions trading scheme as they assist individuals to act on the price signal.

Disclosure schemes will be far more effective if they are mandatory, as sellers are only likely to apply voluntary labels to high-performing products, leaving consumers unable to select among average and poorly performing products (Productivity Commission 2005). In addition, the disclosure mechanism, such as an energy efficiency label, needs to be designed with bounded rationality in mind, in order to be as easily understood by individuals as possible.

It is argued that labelling programs for appliances are successful in assisting the uptake of more energy-efficient products in Australia and other countries (George Wilkenfeld and Associates & Energy Efficient Strategies 1999: 49).

There is a strong case for application of mandatory disclosure to goods where it is cost effective. This will be largely determined by the administrative cost of the scheme, its accuracy and the potential savings to consumers.

The potential for accurately and cheaply rating energy use will vary between goods. For refrigerators, it is relatively easy to cheaply assess their energy use—most households' patterns of using a refrigerator will have limited effect on the comparative efficiency of different models. For vehicles, the situation is more complex as a driver's behaviour may influence the efficiency of some cars relative to other cars, but even partially accurate ratings are likely to be valuable.

Mandatory disclosure may not always be able to address information asymmetries, if bounded rationality prevents one or more parties from usefully applying the information, or if one of the parties is not the actual decision maker (see section 18.5). In these situations, minimum standards may be an appropriate policy response (see section 18.6).

18.4 Early adopter spillovers

18.4.1 Information spillover market failures

Some actions by parties can result in benefits to other parties, without those other parties paying for them. Early adopters of some low-emissions options bear additional costs in gathering information, developing skills for adopting the option and testing the reliability of the option (Jaffee et al. 2004). In some cases, the boundary between early adoption and innovation can be blurred. However, early adopters are often unable to capture the knowledge and skill spillover benefits that accrue to other firms, other industries, and the community more broadly. This acts as a disincentive to early adoption of novel technologies and practices.

For example, if a firm installs a relatively new technology in its manufacturing plant it will face higher risks than if it had used a more common technology. The firm may also have to pay consultant engineers higher fees to cover their costs in learning how to install a technology. While much of the benefit will

accrue to the firm, its early adoption will have demonstrated the reliability of the technology to others and provided training to consultant engineers that could benefit future clients.

Most new technologies take time to diffuse. Spillovers and other market failures may extend the time (Jaffee & Stavins 1994a). This delay in diffusion could increase the cost of mitigation.

It may sometimes be possible to overcome the costs faced by early adopters by providing information and training. In other cases, knowledge and skills need to be developed through testing and demonstration—of a relatively new industrial technology, for example—by early adopters.

18.4.2 Policy option: support for early adoption

There is a case for government support for early adoption of new technologies to address spillovers.

This can involve governments, households and the private sector adopting and demonstrating relatively novel technologies. For example, Melbourne City Council's Council House 2 demonstrates a range of technologies that are novel in the Australian building industry. This project also developed skills in the local construction industry.

Support for early adoption needs to be targeted at the type of spillover that is generated. For example, if the primary spillovers arising from early adopters are related to skills, support for early adoption should focus on sharing skills as widely as possible.

Similarly, if programs aim to demonstrate that novel vehicle technologies are reliable, they need to focus on diffusing this information. Supporting a set number of early adopters in conjunction with diffusing information may be more effective than supporting a larger number of adopters without diffusing information. However, as people are more likely to trust known sources (Yates & Aronson 1983), demonstration programs may need to involve regional and community components.

18.5 Principal–agent problems

18.5.1 Principal–agent market failures

Principal–agent problems can occur when one person (the principal) pays an agent for a service, but the parties face different incentives and the principal cannot ensure that the agent acts in her best interest. For example, engineering consultants that are contracted to select a motor for a manufacturing plant do not face the same incentive as the manufacturing company to lower the ongoing energy cost of the motor.

Principals and agents may be able to negotiate to align their incentives more effectively. In the example above, the manufacturing company could stipulate that the engineering consultant use a particularly efficient motor. Principal–agent problems persist when:

- it is hard to monitor a contract due to information asymmetries
- it is difficult to enforce contracts, or
- the costs of negotiating and establishing a better contract exceed the benefits. For example, while residential tenants can attempt to renegotiate leases, offering to pay more rent if landlords improve energy efficiency, the effort is likely to be substantial (Sanstad & Howarth 1994).

Principal–agent problems may entirely insulate some decisions from a carbon price, potentially reducing the adoption of low-emissions options. For example, as residential tenants pay energy bills, landlords may not install energy efficient appliances (IEA 2007a).

Categories of principal–agent problems

The type of principal–agent relationship can influence both the nature of the problem and the appropriate policy response. The International Energy Agency has categorised four types of principal–agent relationships that could affect energy use (see Table 18.1), depending on:

- who chooses the energy-using equipment
- who pays the energy bills.

In all four types the principal uses the equipment.

Table 18.1 Four types of principal–agent problems

	Principal chooses technology	Agent chooses technology
Principal pays the energy bill	**Type 1:** The principals select the energy-using equipment and pay the energy bill. They have an incentive to select efficient equipment and lower their energy use. There is no principal–agent problem.	**Type 2:** The agents select equipment on behalf of the principals, and the principals pay the energy bill. As a result, the agents may not have an incentive to select efficient equipment. This type of relationship occurs between landlords and tenants.
Agent pays the energy bill	**Type 3:** The principals select the equipment, but do not pay for the energy bill. As a result the principals have no incentive to select efficient equipment or lower their energy use. For example, staff select company cars but do not pay ongoing fuel costs.	**Type 4:** The agents select the equipment on behalf of the principals, and pay the energy bill. As a result, the agents have an incentive to select efficient equipment, but the principals do not have an incentive to lower their energy use. This occurs in hotels.

Source: Derived from IEA (2007a).

Principal–agent relationships have repercussions throughout the wider market for goods. For example, the first-hand car market dictates which cars are available in the second-hand car market. Therefore, the principal-agent problem that arises from company car purchases could have significant repercussions on Australia's car fleet.

18.5.2 Policy option: linking principals and agents

Where possible, principal–agent problems should be tackled directly by either:

- improving the ability of principals to monitor and enforce contracts, or
- fostering contracts that better align the interests of principals and agents.

Where information asymmetries prevent principals from monitoring contracts, mandatory disclosure may be an effective way to reduce principal–agent problems.

Where contracts do not align incentives well there is a case for governments to develop new standard contracts that can be used by a range of parties, resulting in benefits from economies of scale. Parties often use standard contracts that may not be optimal due to high costs for individual parties to develop new contracts. An example of a new standard contract, 'Green Leases' for commercial properties, is discussed in section 18.7.3.

New contracts have been mandated in Japan to tackle problems in the vending machine market (IEA 2007a). Previously, Japanese beverage companies typically rented space from building owners for vending machines, but building owners paid the electricity bill, resulting in a Type 3 principal–agent problem. To address this barrier, the Japanese Government stipulated that contracts for vending machines should make beverage companies responsible for both selecting the appliance and paying the energy bill. In combination with standards for vending machines, this policy appears to have driven a 34 per cent increase in energy efficiency in vending machines between 2000 and 2005, in contrast to similar but unregulated display cabinets.

There may be limits to the extent to which improving the links between principals and agents can eliminate principal–agent problems. Examples include:

- bounded rationality reduces the ability of parties to respond to mandatory disclosure
- the transaction costs of enforcing new contracts exceed the benefits, or power imbalances impede principals from enforcing contracts.

Other policies should then be considered. There is a case for minimum standards to provide some level of protection for principals in these situations. As noted by the Productivity Commission (2005: 200): 'The case for mandatory standards appears to be strongest when split incentives typically cause individuals

to use products that are very cost ineffective'. Regulations in such situations should reflect the best interests of the majority of principals, considering the possible loss to principals if regulations dissuade a large number of agents from entering into contracts.

18.6 Minimum performance standards

Minimum standards, such as minimum energy efficiency standards for appliances, can circumvent the need for individuals to identify and avoid appliances that have high ongoing energy costs (Jaffee et al. 2004). Standards can address several of the market failures discussed in this chapter.

There is a case for standards where bounded rationality and principal–agent problems render other policy options ineffective. However, the argument for standards needs to be made on a case-by-case basis. Generally, standards should be considered only after other policy options, as they:

- reduce flexibility
- reduce the opportunity for individuals to make choices
- operate on the presumption that government can make better decisions than market participants, both now and in the future.

Given the likely limits on information available to governments, standards should focus on:

- performance, rather than specifying technology
- features that are unlikely to affect consumers, such as energy efficiency, rather than features that consumers may value, such as the size of appliances
- removing poorly performing products, as it will be generally easier to identify the products that are the least cost-effective for the majority of users, than the products that are the most cost-effective options for all parties in all circumstances.

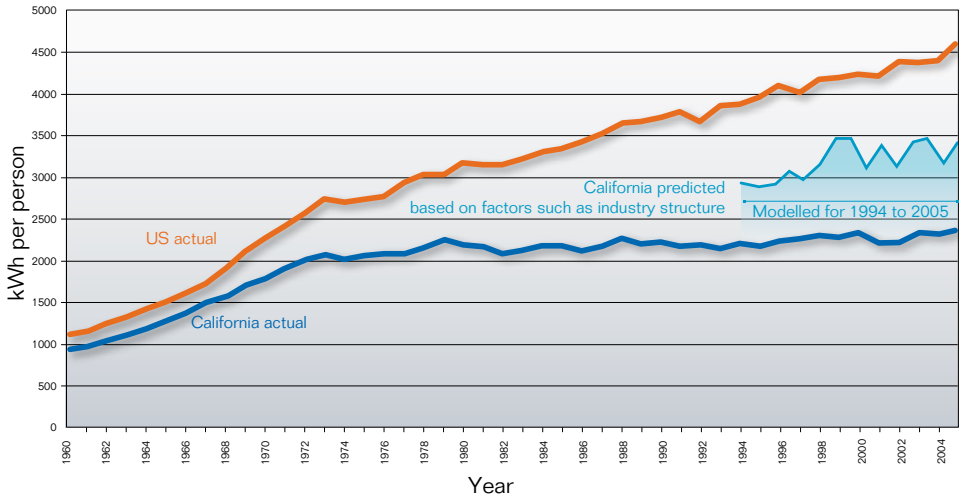
If standards are designed appropriately, with good knowledge of the costs and benefits and sufficient lead time for industry to respond, experience from both Australia and abroad has indicated that they can be cost effective in supporting the uptake of low-emissions options (IEA 2007b).

National Mandatory Efficiency Performance Standards for refrigerators and freezers were introduced in Australia in 1999 and revised in 2005. This set of standards removes appliances from sale that do not meet minimum benchmarks of energy efficiency. Retrospective analysis in 2006 estimated that these policies saved more than 3000 gigawatt-hours of energy by 2005, savings that were 34 per cent higher than was forecast in the original Regulatory Impact Statements (Energy Consult 2006).

California has been held up as a particular success story in improving energy efficiency, with electricity sales per capita remaining steady at the same time as output per person grew strongly. Although this is likely to have been partly driven by California's industry structure and higher electricity prices, recent work indicates that energy policies account for a substantial proportion of the state's higher level of energy efficiency (Kandel et al. unpublished) (see Figure 18.1), with building and appliance standards accounting for around half of these savings (Geller et al. 2006).

Estimates of the costs and benefits of appliance standards have been contested, particularly in the United States (see for example, Meyers et al. 2002; Sutherland 2003; Nadel 2004). However, this debate does not suggest that standards are unsuitable, but merely underlines the importance of using robust methodologies in assessing the benefits of appliance standards and regularly updating standards to ensure that they remain relevant.

Figure 18.1 Residential per capita electricity consumption in the United States, California and as predicted for California



Note: The area between California predicted and California actual (modelled for 1994 to 1995) indicates possible savings from energy efficiency policies.

Source: Kandel et al. (unpublished).

18.7 Applying the market failure framework to buildings

Residential and commercial buildings account for 23 per cent of Australia's emissions from electricity use alone, and their emissions are growing rapidly (Centre for International Economics 2007). Buildings can have a life of more than 50 years. Decisions that are made now will have consequences for future emissions.

While reducing the ongoing energy use of approximately 150 000 dwellings constructed each year will have long-term impacts, the emissions from the greater than seven million existing private dwellings also need to be tackled (ABS 2006b, 2007).

Low-cost technologies and practices that can reduce emissions from buildings in Australia include:

- a more selective use of energy-using appliances
- installing more efficient appliances
- improving insulation.

18.7.1 Market failures in purchasing and using buildings

The market failures already discussed apply to the purchase and use of appliances and buildings in both the residential and commercial sectors. These are explored further below.

Information asymmetries

While tenants and appliance users face a strong incentive to lower ongoing energy costs, developers and manufacturers do not face this incentive unless they can command higher prices for more efficient buildings and appliances (Golove & Eto 1996). This requires buyers to be able to confidently assess the energy efficiency of buildings and appliances. Adverse selection may also affect decisions by owner-occupiers. If occupants expect that they will sell a building soon, they may not capture the full benefit of investments in energy efficiency through energy savings (Bjornstad & Brown 2004), unless prospective buyers can assess the building's energy efficiency.

Public good information and bounded rationality

Even where appliances and buildings have energy efficiency labels, individuals will not take up more efficient options if they are unaware of the benefits of energy efficiency, or are unable to calculate ongoing savings. While market intermediaries, such as real estate agents, could provide information, they

often lack skills and training (Dutruge 2006). Imperfect information and bounded rationality also affect how individuals use appliances, which strongly affects the energy used by appliances and buildings.

Commercial tenants are more likely than households to have access to information, and are more likely to be able to process it effectively (Kempton & Montgomery 1982). However, firms may still lack the time and skills to process and evaluate the information effectively (De Canio & Watkins 1998), and internal factors may impede decision making.

Principal–agent problems

In the Australian rental market, landlords are generally responsible for the purchase and maintenance of fixed appliances, such as water heaters. The tenant pays the energy bills and a fixed rent to the landlord, which is agreed when the contract is first signed. Therefore, during the period of the lease there is no incentive for landlords to invest in improving the energy efficiency of their properties, even if energy prices rise (IEA 2007a).

This appears to affect the energy efficiency of the 28 per cent of homes that are rented in Australia (ABS 2006a). A survey in South Australia, for example, found that rented houses contained different types of fixed appliances to other houses. For example, low-flow shower heads were installed in over 42 per cent of owner-occupied households but only 25 per cent of private rental homes (ABS 2004).

In the commercial sector, industry sources suggest that at least 70 per cent of offices are leased rather than owner-occupied. However, commercial tenants are generally more aware of energy costs and are often in a better position to negotiate with landlords.

Spillovers

Early adoption of novel technologies, including new heating, ventilation and cooling systems in commercial buildings, can face higher costs and demonstrate their reliability to other parties.

18.7.2 Market failures involving specialists

There are overlaps in market failures where specialists are involved in the installation of appliances (for example, replacing hot water systems) and construction.

- **Specialists may lack the information or skills** to install low-emissions options (Lovins 1992). This may be a particular problem in building construction, where integrated processes require several parties, such as architects, engineers and construction workers, to be familiar with a technology in order to use it.

- **Clients need to have sufficient information** to demand more efficient appliances and buildings. If specialists are aware of a low-emissions option, they may be able to persuade clients to select that option. However, clients may be wary of specialists' advice, particularly if the low-emissions option has higher upfront costs. This could result in adverse selection for skills, as it would reduce the benefits to specialists of investing in learning about low-emissions options. Design quality may be particularly affected by adverse selection, as clients face difficulties in determining the quality of design. As a result, time and cost pressures may result in contractors using off-the-shelf or familiar designs (Sorrel et al. 2004).
- **There are principal–agent problems** between clients and specialists. In particular, construction is characterised by many parties, including clients, developers, architects, engineers and construction workers, who are linked by contracts and subcontracts. Specialists often lack incentives to lower ongoing energy costs, and asymmetric information limits the ability to monitor and enforce contracts. Contractors may substitute technologies that are specified in the design with cheaper options, particularly if they are unfamiliar with the specified technology.

  Some contracts may create disincentives for agents to specify more efficient equipment (Lovins 1992). Engineering fees are often set as a percentage of the capital cost of building services, which creates an incentive for engineers to select equipment that is larger, and more energy-intensive, than required (Sorrell et al. 2004).
- **There are spillover benefits** from early adoption. Parties developing or adopting novel building designs face higher costs. In doing so, however, they demonstrate the value and reliability of new technologies and provide training to specialists. In the building sector first movers may also develop new processes in the industry. Energy-efficient buildings generally require more integrated design and construction processes than are typically used (Sorrell et al. 2004), requiring the development of new processes and contracts. However, once a construction team has used these improved processes it can implement them again.

18.7.3 Policy responses in the building sector

A variety of policy responses will be required in the building sector to address the multiple and interacting market failures.

Mandatory labelling for equipment and buildings

Australia already has a labelling program in place for appliances. Labelling should be extended to appliances that use sufficient energy for the benefits of labelling schemes to exceed the administrative costs.

The Australian Capital Territory has introduced a mandatory energy efficiency rating scheme for houses at the point of sale. A recent study suggests that there was a statistically significant correlation between house prices and energy efficiency ratings (Department of the Environment, Water, Heritage and the Arts 2007). Modelling results suggest that, for a house worth $365 000, increasing the rating by half a star would, on average, increase its market value by $4489.

There are some concerns with the accuracy of building rating schemes (Williamson 2004). These criticisms correctly raise the issue that efforts need to be made to ensure that rating tools are as accurate, flexible and useful as possible. Overall, there appears to be a case for a national mandatory energy efficiency rating scheme for buildings.

Education, tools and certification for specialists

The building sector is already an area of skills shortage, and responding to carbon constraints is likely to exacerbate this skills gap. Modelling by the Dusseldorp Skills Forum suggests that, under an emissions trading scheme, employment would grow rapidly in the construction sector, accounting for 10 per cent of national employment growth in the period 2005 to 2025 (Hatfield-Dodds et al. 2007). There is a case for governments to assist in training new workers and reskilling existing workers through:

- developing retraining courses and incorporating energy-efficiency components into vocational and university courses. Desha et al. (2007) suggest that engineering courses in Australia currently vary considerably in their coverage of energy efficiency
- providing tools such as design guides and advisory services
- fostering on-site training through demonstration programs (see next page)
- introducing accreditation to provide an incentive for specialists to learn.

Behaviour change and third-party programs

Increased awareness and skills among consumers is essential to enable the adoption of privately cost-effective low-emissions options, even in situations where specialists are involved.

There is a case for using third parties to provide tailored advice to households and small businesses. These programs can be effective in changing household energy use (Nadel & Geller 1996). For example, the Home Energy Advice Team program in the Australian Capital Territory partly subsidises audits for homes. These programs provide private information (Productivity Commission 2005) and so have some distributional consequences, but if they can be developed to be cost effective they could lead to changes in both household behaviour and building efficiency that benefit households and the economy more widely.

As noted earlier, some programs go further to provide incentives or obligations for third parties to identify and implement energy efficiency improvements in homes and businesses, such as the Victorian Energy Efficiency Target. These programs may be more effective at improving energy efficiency, but there may be significant methodological problems and it is not yet clear how cost effective these programs can be. As discussed in section 18.2.3, there is a case for testing these types of programs, but they should be rigorously assessed and focused on low-income households.

Improved contracting

The Commonwealth Government has developed 'Green Leases' that set out obligations for landlords and tenants to cooperate in reducing energy and water use (Christensen & Duncan 2007). The Commonwealth Government demonstrates and promotes the viability of these leases by using them when it leases commercial property or leases out its property to commercial tenants. Given the extensive principal–agent problems in buildings, there is a case to promote improved contracting in leasing, construction, engineering and services.

Research and demonstration programs

There are significant overlaps between the various stages of research, development and diffusion in buildings. Innovation occurs in the development of new products, installation of components, configuration of components and integration of components to change the overall performance of a building (Gann et al. 1998).

As noted by the International Energy Agency (2006), only 3 per cent of energy research and development expenditure in the countries that are members of the agency was directed to buildings from 2001 to 2005, even though this sector is projected to account for 18 per cent of global emission reductions by 2050. There is a case for expanding the role of the Cooperative Research Centre for Construction Innovation.

Skill spillovers and on-site training are also critical in the building sector. Programs that focus on integrating training into demonstration, such as Lochiel Park in South Australia, could have significant benefits.

Building and appliance standards

There is a case for appropriate appliance and building standards. Standards for new buildings and renovations need to be proportionate, simple and sufficiently flexible to allow owners to have features that they value and to allow innovation in the sector.

Ideally, standards should be national rather than state-based in order to lower the cost of building standards on the industry, with variations in standards

based on climatic zones. Building standards should also be accompanied by an indicative pathway for the standards that may be introduced in the future, to assist the sector to adapt its practices. Such a pathway, which is updated as new information becomes available, could be a powerful tool to diffuse information on possible future trends in energy prices to developers and building owners, who may not otherwise consider such issues.

There is also a case for minimum standards for rental housing at the point of lease (Scott 1997). Such regulation would need to consider the equity impacts of standards and regulations on rental housing costs.

18.8 Conclusions

The Review will consider the various policy interventions that might reduce the costs of market failures related to information externalities and principal–agent problems and provide clear recommendations in the final report.

References

ABS (Australian Bureau of Statistics) 2004, *Domestic Use of Water and Energy, South Australia*, cat. no. 4618.4, ABS, Canberra.

ABS 2006a, *2006 Census of Population and Housing Australia*, cat. no. 2001.6, ABS, Canberra.

ABS 2006b, *2006 Census of Population and Housing Australia: Expanded community profiles*, cat. no. 2005.0, ABS, Canberra.

ABS 2007, *Building Activity, Australia*, cat. no. 8752.0, ABS, Canberra.

Akerlof, G. 1970, 'The arket for lemons: quality uncertainty and the market mechanism', *Quarterly Journal of Economics* 89:488–500.

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

Aronson, E. & Stern, P.C. 1984, *Energy Use: The human dimension*, Freeman, New York.

Bjornstad, D.J. & Brown, M.A. 2004, *A Market Failures Framework for Defining the Government's Role in Energy Efficiency*, Joint Institute for Energy and Environment, Knoxville, Tennessee.

Brown, M.A. 2001, 'Market failures and barriers as a basis for clean energy policies', *Energy Policy* 29: 1197–207.

Centre for International Economics 2007, *Capitalising on the Building Sector's Potential to Lessen the Costs of a Broad Based GHG Emission Cut*, Centre for International Economics, Canberra.

Christensen, S. & Duncan, W.D. 2007, 'Green leases: a new era in landlord and tenant cooperation', *Australian Property Law Journal* 15(54): 1–10.

Cone, J.D. & Hayes, S.C. 1980, *Environmental Problems/Behavioral Solutions*, Brooks/Cole Publishing Company, Monterey, California.

Consumer Affairs Victoria 2006, *Information Provision and Education Strategies*, Research Paper No. 3, Consumer Affairs Victoria, Melbourne.

DeCanio, S.J. & Watkins, W.E. 1998, 'Information processing and organisational structure', *Journal of Economic Behaviour and Organisation* 36: 275–94.

Department of the Environment, Water, Heritage and the Arts 2007, *Modelling the Relationship of Energy Efficiency Attributes to House Price: The case of detached houses sold in the Australian Capital Territory in 2005 and 2006*, a statistical consultancy report, Australian Bureau of Statistics, Canberra.

Department of Resources, Energy and Tourism 2007, *Energy Efficiency Opportunities Industry Case Study: Orica Limited*, Commonwealth of Australia, Canberra.

Desha, C., Hargroves, K., Smith, M., Stasinopoulos, P., Stephens, R. & Hargroves, S. 2007, *State of Education for Energy Efficiency in Australian Engineering Education—Summary of questionnaire results*, The Natural Edge Project, Adelaide, <www.naturaledgeproject.net/Documents/Energy_Efficiency_Survey_-_Summary.doc>.

Dutruge, J.P. 2006, 'Eco-innovations, eco-investissements, quells outils financiers au service des régions et des PME/PMI?' presentation at the Enviropea European Conference, Lyon, France, 20 April, <www.cd2e.com/CD2EStatic/contenu/energie/Synthese_Enviropea_Lyon.pdf>.

Energy Consult Pty Ltd 2002, *Full Term Review of the Energy Efficiency Best Practice Program*, Department of Industry, Tourism and Resources, Canberra.

Energy Consult Pty Ltd 2006, *Retrospective Analysis of the Impacts of Energy Labelling and MEPS: Refrigerators and freezers*. prepared for the Australian Greenhouse Office, Energy Consult Pty Ltd, Jindivik.

Eoin Lees Energy 2006, *Evaluation of the Energy Efficiency Commitment 2002–05*, Department for Environment, Food and Rural Affairs, London.

Gann, D.M, Wang, Y. & Hawkins, R. 1998, 'Do regulations encourage innovation? The case of energy efficiency in housing', *Building Research and Information* 26(4): 280–96.

Geller, H., Harrington, P., Rosenfeld, A.H., Tanishima, S. & Unander, F. 2006, 'Policies for increasing energy efficiency: thirty years of experience in OECD countries', *Energy Policy* 34: 556–73.

George Wilkenfeld and Associates & Energy Efficient Strategies 1999, *Regulatory Impact Statement—Energy labelling and minimum energy performance standards for household electrical appliances in Australia*, report prepared for the NSW Department of Energy and the Australian Greenhouse Office, George Wilkenfeld and Associates, Killara, <www.energyrating.gov.au/library/detailsris-modelregs.html>.

Golove, W.H. & Eto, J.H. 1996, *Market Barriers to Energy Efficiency: A critical reappraisal of the rationale for public policies to promote energy efficiency*, Lawrence Berkeley National Laboratory, Berkeley, California, <http://eetd.lbl.gov/EA/EMS/ee-pubs.html>.

Hatfield-Dodds, S., Jackson, E.K., Adams, P.D. & Gerardi, W. 2007, *Leader, Follower or Free Rider? The economic impacts of different Australian emission targets*, The Climate Institute, Sydney.

Hein, L.G. & Blok, K. 1995, 'Transaction costs of energy efficiency improvements', in *Proceedings of the 1995 Summer Study: Sustainability and the reinvention of the government—a challenge for energy efficiency (NWS–95056)*, A. Persson (ed.), The European Council for an Energy Efficient Economy, Stockholm.

IEA (International Energy Agency) 2006, *Energy Technology Perspectives 2006—Scenarios and strategies to 2050*, IEA, Paris.

IEA 2007a, *Mind the Gap: Quantifying principal–agent problems in energy efficiency*, IEA, Paris.

IEA 2007b, *Experience with Energy Efficiency Regulations for Electrical Equipment: IEA Information Paper in support of the G8 Plan of Action*, IEA, Paris.

IPCC 2007, *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, B. Metz, O.R. Davidson, P.R. Bosch, R. Dave and L.A. Meyer (eds), Cambridge University Press, Cambridge and New York.

Jaffee, A.B. & Stavins R.N. 1994a, 'The energy paradox and the diffusion of conservation technology', *Resource and Energy Economics* 16: 91–122.

Jaffee, A.B. & Stavins R.N. 1994b, 'The energy-efficiency gap: what does it mean?', *Energy Policy* 22(10): 804–10.

Jaffee, A.B., Newell, R.G. & Stavins, R.N. 2004, *A Tale of Two Market Failures: Technology and environment policy*, Resources for the Future, Washington DC.

Kahneman, D. & Tversky, A. 2000, *Choices, Values, and Frames*, Cambridge University Press, Cambridge.

Kandel, A., Sheridan, M. & McAuliffe, P. unpublished, 'A Comparison of Per Capita Electricity Consumption in the United States and California', paper submitted to the American Council for an Energy Efficient Economy Annual Conference 2008.

Kempton, W. & Montgomery, L. 1982, 'Folk quantification of energy', *Energy* 7(10): 817–27.

Komor, P.S. & Wiggins, L.L. 1988, 'Predicting conservation choice: beyond the cost-minimisation assumption', *Energy* 13(8): 633–45.

Lovins, A. 1992, *Energy-efficient Buildings: Institutional barriers and opportunities*, E Source Inc., Boulder, Colorado.

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

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

Meyers, S., McMahon, J.E., McNeil, M. & Liu, X. 2002, 'Impacts of US federal energy efficiency standards for residential appliances', *Energy* 28: 755–67.

Nadel, S. 2004, 'Critique of the CATO Institute study "The high costs of federal energy-efficiency standards for residential appliances" by Ronald Sutherland', American Council for an Energy Efficiency Economy, Washington DC, <http://aceee.org/buildings/policy_legis/stnds_info/cato.pdf>.

Nadel, S. & Geller, H. 1996 'Utility DSM: What have we learned? Where are we going?' *Energy Policy* 24(4): 289–302.

Paton, B. 2001, 'Efficiency gains within firms under voluntary environmental initiatives', *Journal of Cleaner Production* 9: 167–78.

Productivity Commission 2005, *The Private Cost Effectiveness of Improving Energy Efficiency*, Productivity Commission, Canberra.

Sanstad, A. & Howarth, R. 1994, 'Normal markets, market imperfections and energy efficiency', *Energy Policy* 22: 811–18.

Sathaye, J. & Murtishaw S. 2004, *Market Failures, Consumer Preferences and Transaction Costs in Energy Efficiency Purchase Decisions*, California Energy Commission, Berkeley.

Scott, S. 1997, 'Household energy efficiency in Ireland: a replication study of ownership of energy

saving items', *Energy Economics* 19: 187–208.

Shipworth, M. 2000, *Motivating Home Energy Action: A handbook of what works. Prepared for the Australian Greenhouse Office*, Australian Greenhouse Office, Canberra.

Simon, H.A. 1955, 'A behavioural model of rational choice', *Quarterly Journal of Economics*, 69: 99–118.

Sorrell, S. 2005, *The Economics of Energy Service Contracts: Tyndall Centre working paper No. 81*, Tyndall Centre for Climate Change Research, Norwich, UK.

Sorrell, S., O'Malley, E., Schleich J. & Scott, S. 2004, *The Economics of Energy Efficiency*, Edward Elgar Publishing Ltd, Cheltenham, UK.

Stavins, R.N., Jaffee, J. & Schatzki, T. 2007, *Too Good to Be True: An examination of three economic assessments of California climate change policy*, Resources for the Future, Washington DC.

Sutherland, R.J. 1994, 'Energy efficiency or the efficient use of energy resources?' *Energy Sources* 16: 257–68.

Sutherland, R.J. 2003, 'The high costs of federal energy-efficiency standards for residential appliances', *Cato Institute Policy Analysis* 504: 1–15.

Williamson, T. 2004, *Energy-Efficiency Standards in Residential Buildings: A Plea for evidence-based policy making*, submission to Productivity Commission Public Enquiry into Energy Efficiency, <www.pc.gov.au/inquiry/energy/docs/submissions>.

Yates, S.M. & Aronson, E. 1983, 'A social psychological perspective on energy conservation in residential buildings', *American Psychologist* 38(4): 435–44.