EXECUTIVE SUMMARY

Market failures and policy or policies' successes

Switching to the best technologies available today would save at least 40% of residential electricity consumption in most appliance categories. Moreover, additional savings are possible from the commercialisation of technologies that are now under development.

This potential is made up of many millions of individual opportunities dispersed amongst consumers and end-use equipment. When these are aggregated, the extent of savings is large; however the energy and financial savings on individual residential appliances often appear insignificant to consumers. This is one example of the many different factors which inhibit the uptake of cost-effective energy efficiency within groups of consumers and suppliers. Some of these issues, such as a lack of information and principal-agent problems, constitute market failures; while others, including the prevalence of complex supply chains, lead to diluted market signals and the sub-optimal allocation of resources.

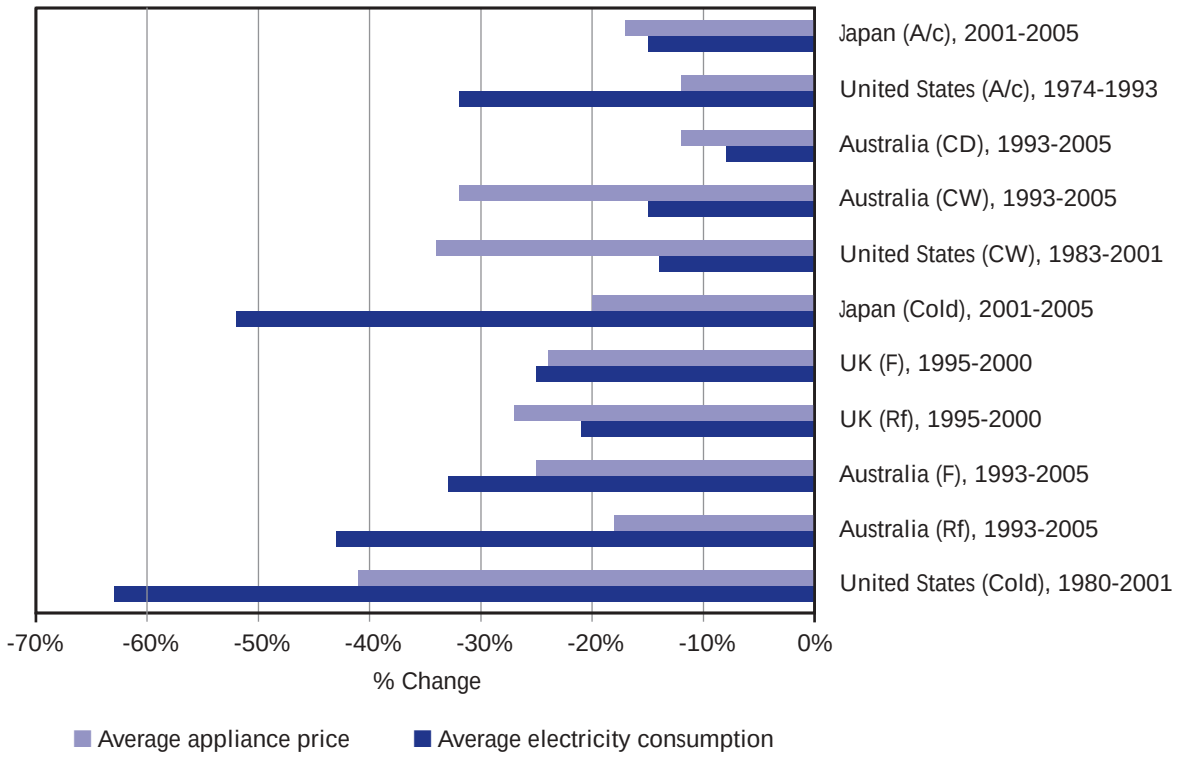
Governments have responded by implementing policies designed to achieve long-term market transformation in the supply and adoption of energy efficient appliances. A wide range of policy measures have been used, generally targeted at different market participants and designed to overcome particular barriers. Minimum energy performance standards and energy performance labels have been the most widely employed measures, frequently supported by government procurement policies, financial incentives such as discounts and rebates, and general awareness raising programmes.

The success of these highly targeted programmes is evident: the per unit energy consumption of many major household appliances has fallen dramatically over the past decade in most economies, while at the same time products have increased in size, capacity and power (see Figure 1). Appliance prices have also fallen in real terms, confirming that the correlation between appliance prices and energy performance is generally very low or even negative.

New threats

However, global residential electricity consumption is still growing in all regions as the number and size of the energy-using appliances in the average household increases. While consumption in non-OECD countries has grown at twice the rate compared to OECD countries, the OECD still accounts for 65% of total residential electricity consumption (see Figure 2).

Figure 1 • Recorded fall in average electricity consumption and prices for several major appliance types in selected countries

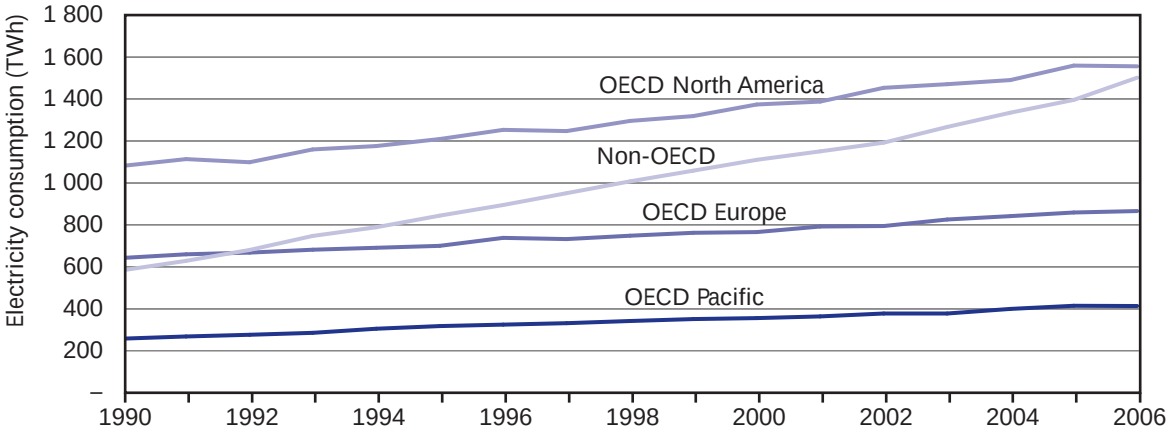


Source: IEA, 2007.

Key:

A/c	Air conditioners	Cold	Refrigerators and freezers	CD	Clothes dryers
F	Freezers	CW	Clothes washers	Rf	Refrigerators

Figure 2 • Residential electricity consumption by region, 1990-2006



Source: IEA statistics.

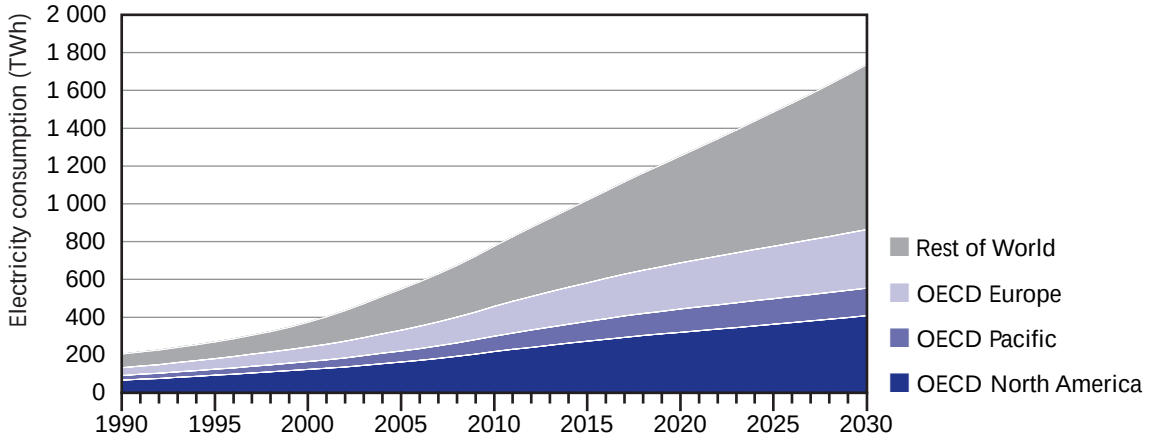
The way in which householders use electricity has also changed. In OECD countries those appliances which previously used the majority of electricity, such as refrigerators, clothes washers and water heaters, are close to saturation levels. As ownership rates have stabilised and the efficiency of these appliances improved (partly due to government policies), their share of residential electricity consumption has fallen. On the other hand, the ownership of air-conditioning and use of lighting equipment has increased in several regions.

In non-OECD countries, while the ownership level for major appliances is already high in urban areas, increased access to electricity in rural areas and growing urbanisation is driving up overall ownership levels and hence electricity consumption.

However, the growth of electricity consumption by small electrical and electronic devices has been the most rapid of all appliance categories over the past five years in both OECD and non-OECD countries. Quickly rising global ownership levels of information and communication technologies (ICT) and consumer electronics (CE) means that these products now account for approximately 15% of global residential electricity consumption. While efficiency improvements have been made, savings have been cancelled out by the demand for equipment which provides more functionality, or is larger or more powerful, and therefore uses more electricity.

Looking ahead, it is likely that ICT and CE equipment will take an even greater share of residential electricity consumption unless policy measures are introduced to increase energy efficiency. Under estimated market conditions, the IEA expects that energy use by these devices will double by 2022 and increase threefold by 2030 (see Figure 3). By the end of this period, global electricity use by household ICT and CE equipment could rise to 1 700 TWh, requiring the addition of approximately 280 GW of generating capacity. This level of consumption is equivalent to the current combined total residential electricity consumption of the United States and Japan, and would cost householders around the world USD 200 billion in electricity bills.

Figure 3 • Estimated electricity consumption by ICT and CE equipment in the residential sector, by region, 1990-2030



Source: IEA estimates.

Considered together with other areas of electricity growth in the sector, this scenario will lead to an increase in overall residential electricity consumption by most countries, posing a serious challenge

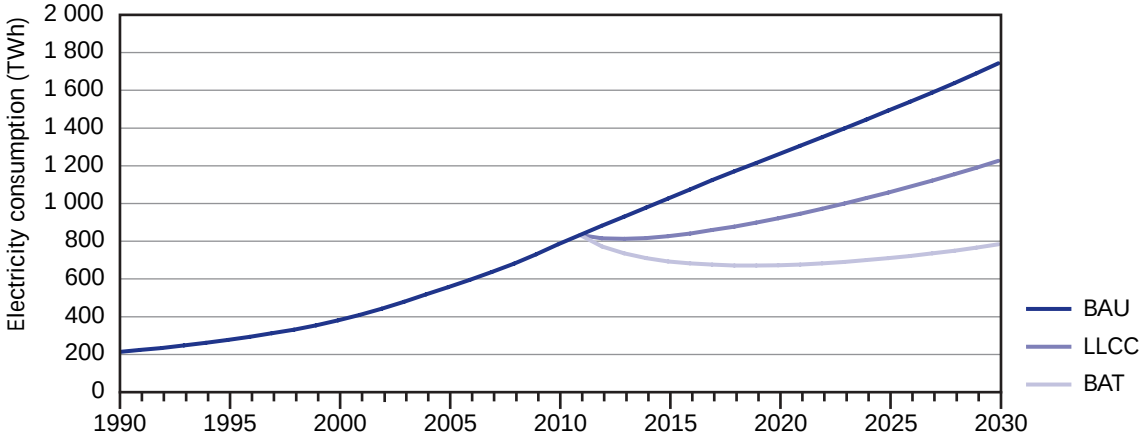
to all governments with policy ambitions to increase energy security and economic development, and to mitigate climate change. It suggests that in order to meet their policy objectives in these fields, governments will have to pay far closer attention to these new areas of electricity consumption or else implement policies to make rapid and deep cuts in other sectors. This situation demonstrates the need for energy efficiency policies to continually evolve and adapt to changes in markets, technological advancements and energy costs; and highlights the need for greater scrutiny of end-use trends so that governments are better able to make informed and timely policy decisions at a time when residential electricity consumption is undergoing rapid structural change.

An alternative future

Governments should take heart from the fact that alternative technologies exist now which could greatly reduce the impact of electronic equipment. As with many other categories of appliances, there is a large efficiency spread amongst products of similar price which perform equivalent tasks. In the few instances where clear market drivers for energy efficiency exist, such as with mobile devices where size, weight and extended battery life are valued features, the industry has demonstrated an ability to deliver large savings in energy consumption.

Figure 4 shows the potential impact on the business as usual (BaU) projection of switching to more efficient technologies which represent the least life-cycle cost (LLCC), and therefore impose no additional costs on consumers. The global adoption of LLCC technology would cut electricity consumption by an estimated 30% in 2030, compared to the business as usual scenario. Even more dramatically, by using the best currently available technologies (BAT),[1] electricity use could be cut by more than half, saving USD 130 billion in consumer electricity bills and avoiding the need for 260 GW of new generation capacity - more than the current generation capacity of Japan.

Figure 4 • Estimated electricity savings from adoption of least life-cycle cost (LLCC) and best available technologies (BAT)



Source: IEA estimates.

1. *BAT technologies and processes are not only currently available, but in many cases already have some penetration in commercial markets.*

Understanding the problem and creating solutions

Governments have a range of policy tools available to help stimulate a sustainable market for more energy efficient technologies, many of which have already proven to be effective when fully implemented. New policies which internalise a carbon price will generally help to make energy efficiency more cost-effective, however they will not overcome the majority of specific barriers facing ICT and CE equipment. For example, motivated consumers still need to differentiate between the performance of products; and consumers that take equipment as part of a rental or service agreement will still have no say in the product's efficiency.

For governments to adequately respond to the new challenges posed by increasing residential electricity consumption, and particularly in the ICT and CE fields, they will need to build on the established infrastructure of existing programmes to deliver targeted policy measures. However, the current capacity of these schemes is already severely stretched.

Many programmes are already missing the opportunity to deliver 20% to 50% more savings due to poor attention to implementation. Designing good appliance policy initiatives and implementing them successfully requires on-going resources for (amongst other functions) data collection and analysis, for the protocols and infrastructure to test and publicise the performance of appliances, and for maintaining consumer confidence in the programme. Market surveillance needs to be undertaken as part of a comprehensive compliance regime, and programme requirements should be reviewed periodically to check that they keep pace with technological advances.

These detailed implementation issues demand constant vigilance because failure to address them can halve the level of savings achieved by policy measures. Even though appliance programmes have delivered significant quantities of energy and greenhouse gas savings at a lower cost compared to many other types of government programmes, there is evidence that they could achieve far more. Yet many national appliance programmes rely on low numbers of staff and small, fluctuating budgets which continue to impede their effectiveness.

For governments to expect energy efficiency programmes to extend to the delivery of new policies for ICT and CE equipment, while maintaining existing coverage, is unrealistic without a commensurate increase in the allocation of resources. Such expenditure would be fully justified because many of the same techniques which will save energy in ICT and CE equipment will also have application in other residential appliances, and other sectors of the economy.

Smarter electronics which match the energy used by appliances to the services demanded by the user can lead to large improvements in energy efficiency, particularly in the growing number of appliances connected in digital networks. Already many portable devices manage their energy consumption effectively and, with the implementation of some key policies, these same techniques would become more generally applied.

Key policy approaches

Long-term policy objectives

Governments should define long-term policy objectives for technology in the electronics field, setting performance targets for individual appliances categories and work with industry and other

stakeholders to agree on implementation plans. This approach defines the desired outcome and therefore provides industry with the long-term view on which to base their business models. It allows all stakeholders the opportunity to agree on a range of activities which will be most effective in reaching government objectives.

Action by governments

Policy makers need to select combinations of measures which are best suited to achieve their policy objectives and overcome market barriers. For ICT and CE equipment, all layers of government can play a key role in establishing markets for high efficiency products by adopting strong procurement policies. Where principal-agent issues prevent investment in energy efficiency, governments can also include energy efficiency obligations within licensing agreements for third parties, such as TV service providers. These are some examples of the very direct actions that governments can take to stimulate a switch to a more energy efficient economy.

Horizontal policy approaches

One of the major challenges in establishing policies for ICT and CE equipment is the difficulty in closely defining individual devices as they vary functionality and new product categories enter the market. However, as further convergence occurs, products are increasingly defined by the functions that they perform, rather than by their product description. Policy measures should therefore attempt to be horizontal in nature and based on functionality, thereby spanning a cross-section of devices.

In practical terms, both mandatory and voluntary policy measures can incorporate this approach by establishing targets horizontally for common functions provided by any device. While the IEA has previously recommended this approach for standby power policies, it has application for all energy consuming activities, including times when devices are performing their primary function.

Power management

For ICT and CE equipment, the largest proportion of savings result from ensuring that products are able to modulate their power requirements according to the services they provide to users. All portable devices have very advanced power management processes which co-ordinate appropriate features within their hardware and software, demonstrating the technical feasibility of these systems.

Power management requirements, to ensure that electricity is not being consumed by functions not being used, are an example of policies that should be introduced horizontally for all new electronic appliances. Policies should specify that power management functions are fully automated so that input from consumers is not required for the device to work efficiently, and loaded as the default option within all products supplied. While consumers should be able to change power management settings, governments and industry might consider appropriate disincentives for disabling power management completely.

Efficiency scaled to size

In the past, energy performance targets, thresholds or limits have included a scaling factor such that the energy which is allowed to be used by products is related to their capacity, size or volume. However, when this information is used as the basis for consumer information, consumers may infer that products with the same label rating, or which carry an endorsement label, consume similar quantities of electricity; which can be far from the truth. Policy measures would better reflect national policy objectives for energy and greenhouse gas reduction through re-structuring these thresholds so that larger or more powerful appliances are required to have higher, but attainable, efficiency levels.

International co-operation

Electronic devices are the most globally traded of all household appliances. Therefore international co-operation in the development of energy efficiency policies has many benefits that include the promotion of access to the best performing products, reduced compliance costs for product suppliers and the transfer of best practice in policy design and implementation.

Considerable progress has been made in recent years on the alignment of policies on ICT and CE equipment as a result of on-going dialogue between energy efficiency programme managers on test methodologies and future policy intentions. Further alignment is possible but will require governments to ensure that their strong support for harmonisation is reflected throughout the processes involved in standardisation and energy policy development.

Many further detailed policy options are outlined in this book that, if fully implemented will assist governments and industry to meet the challenges posed by mounting electricity consumption.[2] Many of the solutions lie in stimulating the potential within electronic appliances to be cleverer about the energy they, and all appliances, consume. To make this happen will require a scaling-up of government investment in the processes of policy development and implementation.

2. *Recommendations made in this publication are generally aimed at governments, their agents, energy efficiency programme managers and relevant industry stakeholders and cover policies for programme organisation and administration, as well as for particular appliance categories. As a result of new research undertaken for this publication it has been possible to extend the scope of recommendations beyond those previously made by the IEA. In particular, new recommendations have been added to the 25 provided to G8 leaders in 2008 (OECD/IEA, 2008b). The relevant sections of this publication reference both those included in the original 25 and additional recommendations supported by the latest analysis.*