

# The elephant in the living room:

how our appliances and gadgets are  
trampling the green dream

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An update to *The rise of the machines*



energy saving trust®



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## Executive summary

Five years ago the Energy Saving Trust published *The rise of the machines*, a report on the impact of home electrical products on energy use and carbon emissions. This report is the follow-up to that publication, and looks at how the regulatory, manufacturing and retail landscapes have changed; how our appliances and gadgets have changed; and how we need to change the way we use them. It re-examines the trends and future scenarios for domestic appliance electricity consumption in the UK that have emerged in the intervening years and sets this within the context of achieving the UK's 2020 emissions reduction target.

The message is clear: there is an elephant sitting in our living rooms. This report shows how, unless we change how we do things in our homes, even with all existing and planned policy measures and timetabled efficiency improvements in place, and working to optimum effect, our household electricity use and bills will keep on rising, just at a time when we most need to reduce them. And we will not meet the UK's 2020 target for cutting domestic appliance electricity carbon emissions. This report outlines how we can target our energy use to make a difference.

Using the Market Transformation Programme's future energy-use reference scenario, and working with two ends of a spectrum of potential electricity carbon factors forecast for 2020, this report estimates the shortfall in greenhouse gas emission savings from domestic appliance electricity use at between 0.7 and 7 million tonnes. This is equivalent to the CO<sub>2</sub> emitted by 1.3 million households annually.

There are pockets of good news. A number of appliance groups are consuming less energy, and several forecasts for 2020 are more favourable than they were just a few years ago. New legislation and initiatives since 2006 – in particular the implementation of the Eco-design of Energy-Using Products (EuP) Directive (now recast as the Energy Related Products (ErP) Directive), and the 1-Watt initiative – are beginning to make a real difference to how appliances are designed.

However, policy interventions and product technology improvements cannot be expected on their own to provide the fast, deep emissions reduction we need to achieve, within the time we need to achieve it. For good reason, policies and legislative frameworks take time to implement, and to bear fruit. As well as working along the whole

domestic electrical supply chain, there needs to be a concerted campaign to change the way we all behave at home, to reduce domestic energy demand dramatically – within this decade.

There are a number of identified approaches that, if implemented rapidly, could well bring the domestic appliance electricity emissions reduction target within reach. They focus on two main areas: influencing consumers' purchasing decisions, and advice and information to help people use their products efficiently in the home.

The Energy Saving Trust is in a unique position to drive this reduction in demand at the consumer level. Initiatives like the Voluntary Retailers' Initiative – in which eight leading television retailers are working together to stock only the most efficient TVs available – can help push the market forward. We advise thousands of people a month on how to save energy, and our Endorsed Advice service trains organisations that give energy-saving advice to deliver the best, most useful advice, helping consumers to feel confident in the information they are receiving. And our Energy Saving Trust Recommended label not only helps consumers to identify the most efficient products in each class; it enables valuable partnership with manufacturers, and acts as a driver towards the design of more efficient products.

In conclusion, this report shows that while good progress has been made in the last five years, there is still some way to go to get on track for meeting our near-term emissions target. The government's Green Deal programme will help to address insulation and other interventions to the fabric of domestic homes; but we also need to look at the elephant that's sitting inside those homes.

## Introduction

We've all heard of white elephants: they're things we don't need and can't use. Pink elephants are things we shouldn't be seeing, because they're not there. This report is about a green elephant: it's sitting in our living rooms, and kitchens, and bedrooms, and we don't know it's there.

The elephant is the unacknowledged fact that, although we are buying more energy-efficient products, we're actually using more energy in our homes. Five years ago the Energy Saving Trust report, *The rise of the machines*, showed the impact of domestic appliances on energy use and carbon emissions. This report updates that original one, and looks at how the landscape, the gadgets, and the way we use them have changed in the intervening years.

The number of appliances, electrical goods and personal electronics we buy is rising. We now own many more electrical items than we used to, as anyone knows who has moved into a new home and lamented the inadequate number of electrical sockets for the things that have to be plugged into them. With this proliferation of gadgets and gizmos, we need to learn new ways of interacting with them. We leave things on when we don't need to, or on standby 24/7, we leave chargers plugged in all the time; we assume that owning energy-efficient appliances means we don't have to use them carefully or even turn them off.

The result of this is that, despite efforts over the five years since our original report, and massive strides in the regulation landscape, carbon emissions have not been going down at the speed they need to. Not since the privatisation of the energy industry in the early 1990s has there been so much change in the energy landscape over a short period of time. But to hit our targets, the change needs to be all-encompassing: changes in how we generate our power, and who generates it and on what scale; changes in what we buy and in its design; and last but not least, changes in how we use the electrical items we have in our homes.

In the UK, 29% of our CO<sub>2</sub> emissions come from the home. Add personal travel to this, and this rises to around 47% of the total<sup>1</sup>. If we are to meet our target of a 34% reduction in emissions by 2020, and the ambitious 80% reduction in 2050, we need to slash domestic emissions dramatically – and quickly.

*The rise of the machines* made a series of recommendations that were designed to help make substantial inroads into reducing carbon emissions in the home. Chapter 1 looks at those recommendations and whether they have been implemented. It charts how the energy landscape has changed in the intervening years, and reaches a new set of conclusions about what is needed for the coming years.

Chapter 2 includes a timeline and commentary showing how the legislative landscape has changed since 2005, creating the framework through which ambitious emissions reductions are to be achieved.

Chapter 3 assesses the past and present consumption for the main domestic appliance areas, and shows what the scenario is likely to look like in 2020.

In Chapter 4 we look at the issues that will feed into the potential range of electricity CO<sub>2</sub>eq emission factors, and analyse our chances of meeting the 34% emissions reduction target for domestic electricity use.

The report concludes with a summary of what needs to be done to get rid of the elephant in all our living rooms, by changing the way we buy and use domestic electrical products.

<sup>1</sup> DECC, 2009 final UK greenhouse gas emissions: data tables:

[http://www.decc.gov.uk/en/content/cms/statistics/climate\\_change/gg\\_emissions/uk\\_emissions/2009\\_final/2009\\_final.aspx](http://www.decc.gov.uk/en/content/cms/statistics/climate_change/gg_emissions/uk_emissions/2009_final/2009_final.aspx)

# 29%

In the UK, 29% of our CO<sub>2</sub> emissions come from the home.



## Chapter 1: Five years on from *The rise of the machines*

In the summer of 2006, we published a report warning of the effect of ever-increasing electrical appliances and gadgets on our domestic electricity consumption and carbon emissions. *The rise of the machines* brought together evidence and data on electrical products in the home, cautioned against the increasing amount of electricity some products consume, and made recommendations for actions to help reverse the rise. This was set against the need to reduce the amount of energy we use, to help meet UK carbon reduction targets.

Five years on, with domestic energy consumption still rising – with new, bigger, do-more appliances, ever more devices, and growing numbers of chargers in every home – Britain's carbon reduction targets have been strengthened, presenting an even firmer challenge to households across the country.

*The rise of the machines* found that:

- The number of electrical appliances, products and gadgets we typically own has trebled since the 1970s
- Although these appliances have been growing, on average, 2% more efficient year on year, electricity consumption from domestic appliances doubled between 1970 and 2002
- Flat-screen TVs bucked the general trend in better energy efficiency levels: in 2005 a typical plasma screen TV used four times the electricity of the (usually smaller) traditional CRT set it was replacing
- Keeping more and more items on stand-by carried a hidden, or not-so-hidden, cost
- Electricity use in the home was likely to increase by another 12% in the five years to 2010

The report made a number of recommendations, including research, policy and social marketing solutions, to help stop these upward consumption trends.

1. a wide-scale **study of consumer behaviour**, focusing on ownership and usage patterns relating to energy-using products. Such a study would provide valuable insight into consumption patterns and how to reduce demand, especially at peak demand times
2. **tighter product standards**, and the gradual removal from the market of the worst-performing products
3. minimum **standards for stand-by** power consumption
4. a **tax on inefficient products** and bans on very inefficient products
5. wider use of **energy efficiency labelling**, like the Energy Saving Trust Recommended label
6. **voluntary agreements** with retailers and manufacturers to improve product lines

### Recommendation: Study of consumer behaviour on products

Commission a large, longitudinal study on the ownership and use of appliances and products in the home, to better inform government and stakeholders in behavioural and usage patterns and to help understand and reduce peak demand.

Many of the assumptions that manufacturers and retailers rely on regarding appliance usage originate in old studies, or in studies with limited longevity or scope. The landscape is now changing so rapidly that new studies are urgently needed.

**Progress:** The Energy Saving Trust, jointly with DECC and Defra, commissioned a study in 2009. The Home Electricity Study ran through 2010-11, took detailed measurements of about 90% of the domestic energy use in 240 monitored households across the demographic spectrum. Of these, 60 were monitored for a year.

The aim of the study was to provide reliable data on all electrical appliances in the home (including kitchen goods, lighting, computers) – especially products, and consumption patterns, that have significant impact on peak electricity demand – to enable more accurate projections of expected future use. The study has also gathered data on consumer attitudes and beliefs about the environment.

A full report will be published later this year.

### **Recommendation: Accelerated and sustained tightening of product standards**

If shops keep stocking the worst-performing products, all the responsibility for green choices lies with the consumer, who often cannot easily tell which products are less efficient than others. Taking the worst performers off the shop shelves – known as choice editing – help consumers make more energy-efficient choices.

**Progress:** This approach is led by the European EuP (now known as ErP) legislation, which addresses energy efficiency in 'end user' products through product design. There is, or will be, an action plan or 'road map' to address each major product group that has sales above a fixed threshold across the EU.

### **Recommendation: Minimum standards for standby power consumption**

The International Energy Agency's 1-Watt initiative, a global scheme introduced in 2006, aims to limit standby energy consumption to one watt or less in most products on the market. The 1-Watt initiative covers all 'plug and play' electrical products as well as electronic household and office equipment<sup>2</sup>.

With standby becoming more and more prevalent in a wider range of products, even in kitchen appliances such as induction hobs and microwaves for example, this issue is still of importance.

**Progress:** Many products are now running on lower standby consumption, and some are well below the 1-watt target. However, the 1-watt initiative, like any other incoming scheme, only applies to new products. As with any other efficiency improvement, existing, ageing products in homes will still have higher standby levels than 1Watt. In some cases this will be much higher: a television bought some years ago, for example, could be consuming around 3W in standby mode, and an early model digital radio could be using up to 5W.

### **Recommendation: Ban of inefficient products from shops**

Banning the most inefficient products from the marketplace could be a significant step towards ensuring a lower-carbon future.

**Progress:** The EU-wide banning of all incandescent lighting by 2012 is a prominent example. To date, 100-watt and 60-watt bulbs have been eliminated from shops, and all others will be phased out by 2012.

The voluntary banning of patio heaters by some major retailers was a smaller-scale success story in 2008. After the Energy Saving Trust *Green Barometer*<sup>3</sup> series of reports in 2007 highlighted the wastefulness of the heaters, national retailers including B&Q and Wyevale garden centres removed them from stock.

### **Recommendation: Voluntary agreements with retailers**

Working with retailers to support choice editing is a win-win solution: it supports them to sell more energy-efficient products, gaining consumer trust and also helping to reduce UK carbon emissions. This kind of initiative puts pressure on non-participating retailers by raising the standard across the product category, and drives further development.

**Progress:** In 2010 we launched the Energy Saving Trust Recommended Voluntary Retailers Initiative, partnered by Defra. In this initiative eight leading retailers, representing over half the UK market in televisions, have agreed to remove the worst performing TV models from their ranges by 2011, more than a year before the introduction of mandatory EU minimum efficiency standards. The members are Best Buy UK, Comet, Co-operative Electrical, DSGi, John Lewis Partnership, Home Retail Group (Argos), Marks & Spencer and Sainsbury's. We feel that the VRI is a way forward, highlighting the carrot rather than the stick, and benefiting retailers as well as their customers.

**Recommendation: Expand use of energy efficiency labelling**

Energy labels are going through big changes at the moment, and these changes won't necessarily make it much easier to identify the most efficient products. In our previous report we promised to expand the reach of our Energy Saving Trust Recommended label, so consumers have a clear, simple, index-linked indication that a product is 'best in class'. Our scheme awards the label to products that fall within the top 20% of energy efficiency for their product type, and we constantly monitor this to reflect rising standards for energy efficiency.

Since 2006 we have expanded the scheme to include more products; it now stands at nearly 2,500 lines. The first cookers were approved in 2011, and the scheme is constantly being extended to include more popular product groups.

**Recommendation: More research and development on new, energy-efficient technologies**

**Progress:** The past five years have seen research programmes, pilot studies and commercial launches of novel energy-saving technologies. Smart technologies are now the future, not just futuristic. Trials of dynamic demand appliances, which respond to grid activity and turn on and off accordingly, are now underway. Vacuum-panelled refrigerators are now commercially available, and new, ultra-efficient lighting technology got a huge boost with the injection of nearly £1 million from the Technology Strategy Board<sup>4</sup>. LED technology is now becoming more commonplace in domestic settings such as Christmas tree lights and directional spot lighting, and looks set to become a mainstream, mass market technology within this decade – further improving the energy efficiency gains in the domestic lighting sector.

**Recommendation: Mandatory product standards in new homes**

We recommended a minimum standard of energy efficiency in all appliances that come installed in new homes.

**Progress:** There currently isn't a mandatory minimum standard in place for appliances installed by house builders. Developers can, however, attain higher ratings in the Code for Sustainable Homes scheme by fitting more efficient appliances. Launched in England in 2007, the code goes beyond mandatory building regulations, with a star system from 1-6. Ratings are highest where developers can demonstrate that they have included energy-saving and water-saving measures, including high efficiency products and appliances.

Perhaps the most significant recent development for this recommendation is the redefinition of the zero carbon home standard, which no longer requires any compensation for the energy used by appliances within the home. This development makes the need for minimum efficiency standards even more pressing.

To conclude this review, we can see that much progress has been achieved in the past five years; we will reap benefits in reduced carbon emissions (and energy bills) over the coming years. But is it enough to get us anywhere near the reductions we need to reach to meet our 2020 target? We explore this question in chapter 4.

<sup>2</sup> <http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/488&format=HTML&aged=0&language=EN&guiLanguage=en>

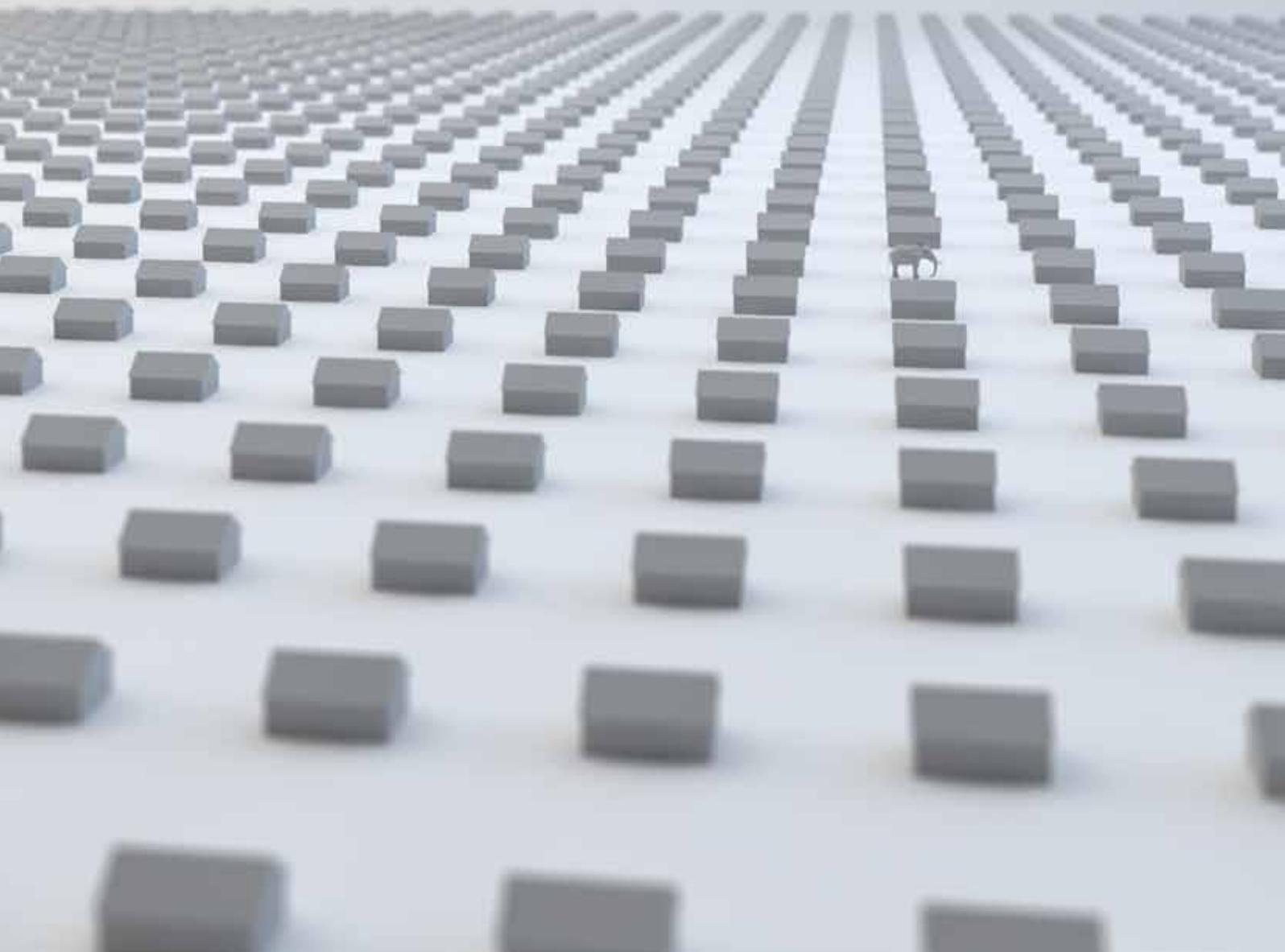
<sup>3</sup> Green Barometer: Patio Heaters July 2007

<http://www.energysavingtrust.org.uk/Publication-Download/?p=4&pid=1095>

<sup>4</sup> Ref: [http://www.innovateuk.org/\\_assets/pdf/press-releases/press%20release%20uel%20phase%202%20awards%203nov10%20final.pdf](http://www.innovateuk.org/_assets/pdf/press-releases/press%20release%20uel%20phase%202%20awards%203nov10%20final.pdf)

# 6.4 million

An estimated 6.4 million households are currently in fuel poverty, around a million more than two years ago.



## Chapter 2: Welcome to the regulation jungle

It is a jungle out there. Despite an unprecedented amount of progressive regulation and legislative activity, which has helped to put energy-efficiency into the mainstream, we can all fall prey to conflicting information, requirements, habits, desires and even evidence, which makes it less straightforward simply to 'save energy'.

The five years since we published *The rise of the machines* have seen many changes to the energy sector both on a national level and Europe-wide. Fuel prices have risen to a historic high, with a peak oil price in 2008 resulting in peak fuel prices in the home, and even more price increases are taking place as we write this update. According to the Met office, we've had three colder than average winters in a row, amid a massive economic crisis that, three years in, still threatens to worsen again before it improves.

In this tumultuous period we have welcomed many new electronic goods into our homes, as the publishing and entertainment industries (as well as others) morph almost weekly into new technological forms. Our hunger for smart phones and tablet computers, games consoles and e-readers, giant fridges and large washing machines, seems to trump even uncertain employment and shrinking disposable incomes.

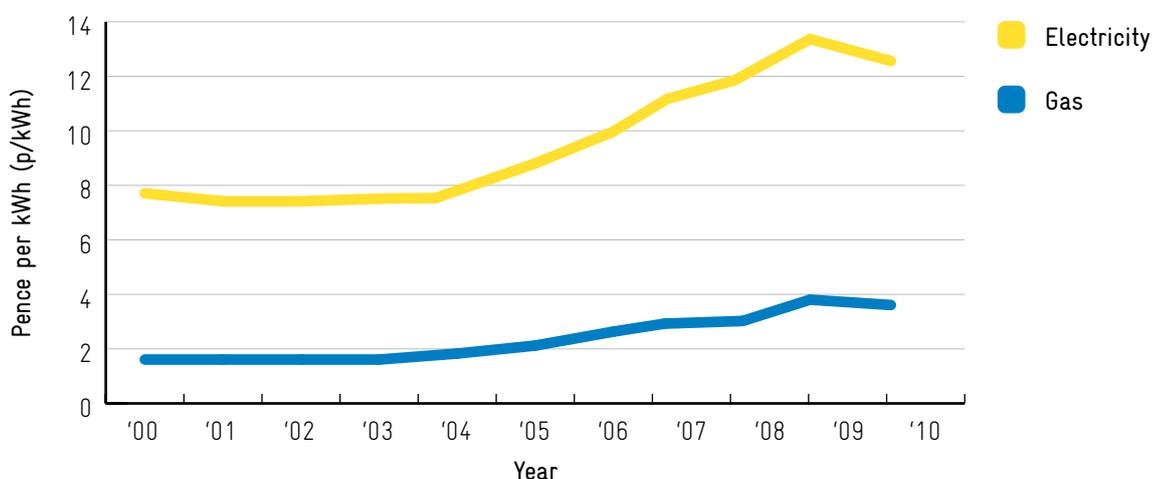
Britain's carbon emissions reduction targets were tightened in the spring of 2011, making us one of the more ambitious countries in Europe. In 2012 the government's Green Deal programme will make it much easier for people to insulate and upgrade the fabric of their homes, and new homes will have to conform to the Zero Carbon Homes standard by 2016. But still our domestic carbon emissions are rising.

This chapter outlines some of the major regulatory and consumer milestones since *The rise of the machines*, and shows how much of this regulation has addressed the elephant in our living rooms.

### A look at energy bills

Domestic energy bills have increased almost yearly since our first report. They hit a peak of 3.79p/kWh for gas and 13.4p/kWh for electricity in 2009, following 2008's peak in oil prices; as we write, price increases of up to 19% for gas and 16% for electricity are tipping more households into fuel poverty. An estimated 6.4 million households are currently in fuel poverty, around a million more than two years ago. The graph below shows the average movement of domestic energy prices over the last ten years.<sup>5</sup>

Figure 1: Average price: Electricity and Gas



<sup>5</sup> Data taken from DECC annual energy price statistics, table 2.2.3:

<http://www.decc.gov.uk/en/content/cms/statistics/prices/prices.aspx#domestic>

# 2006

The UK's ground breaking **Climate Change and Sustainable Energy Act** is designed.

- Jan: the date by which member states must have implemented 2003's Directive on the Energy Performance of Buildings (EPBD), relating to energy performance certificates and inspection of boilers and air conditioning systems – enacted in the UK in Part 5 of the Housing Act, 2004
- April: the EU 'End-Use Energy Efficiency and Energy Services' Directive requires member states to 'design out' inefficiency in a range of products
- June: the UK Climate Change and Sustainable Energy Bill
- October: the EU 'Action Plan for Energy Efficiency', which runs until 2012, sets target to increase energy efficiency by 20% by 2020
- November: the Stern Review lays out the global economic imperatives for tackling climate change, and the economic ramifications of ignoring it

# 2007

UK government's Energy White Paper sets out four key policy goals: to cut carbon emissions by 80% by 2050.

Following 2005's Eco-design of Energy-Using Products (EuP) Directive, the End-Use Energy Efficiency and Energy Services Directive, and the Action Plan for Energy Efficiency combine to make 2006 a launch-pad year for energy efficiency and products policy in Europe.

The UK's ground breaking **Climate Change and Sustainable Energy Act** is designed, among other things, to boost microgeneration and renewable heating. It requires the government to report to parliament each year on the UK's greenhouse gas emissions and what it is doing to curb them.

In November the **Stern Review** lays out, over 700 pages, the economic reasons why complacency in the face of climate change constitutes a massive market failure. The review warns of the catastrophic risks of 'business as usual'.

# 2008

A new government department (DECC) brings energy and climate change together for the first time in one department.

## 2007

- May: the UK government's Energy White Paper sets out four key policy goals: to cut carbon emissions by 80% by 2050; to maintain reliable energy supplies; to ensure that every home is adequately and affordably heated; and to promote competitive markets
- June: Energy Performance Certificates are launched, providing homebuyers with information on properties' energy efficiency levels
- August: EU Directive transposed into UK law through the EuP regulations 2007

2007 sees measures brought into UK law on both homes and products, with attention paid to the future of market and energy supply – and begins to bring renewable energy into the mainstream.

The **Energy White Paper** changes the focus of the obligation on energy suppliers away from energy savings and towards carbon savings, raises target levels, and expands the range of technologies covered.

The **Energy Performance Certificate**, or EPC – a simple, easy-to-read energy rating – puts energy efficiency up front in the process of buying or selling a home.

### Energy efficiency Rating



The **EuP Directive**<sup>6</sup> puts product design at the forefront of energy efficiency, across the markets. Its framework requires manufacturers of energy-using products (EuP) to reduce products' energy consumption at design stage. In the first phase, it applies to a range of products including lighting, boilers, PCs, televisions, set-top boxes, refrigerators, dishwashers, washing machines, air conditioners, and vacuum cleaners.

## 2008

- January: B&Q bans patio heaters after an Energy Saving Trust campaign calling for them to be removed from sale<sup>7</sup>
- April: the Carbon Emissions Reduction Target (CERT) scheme is launched, and later expanded
- Climate Change Act (2008) establishes a framework for fighting global warming through energy efficiency measures, and sets legally binding targets
- Committee on Climate Change (see 2006) is formed as an independent body to advise government
- August: oil reaches \$150 a barrel
- September: Community Energy Saving Programme (CESP) is announced
- October: new government Department of Energy and Climate Change
- November: The Energy Act 2008 lays out the framework of the new, low-carbon future

2008 brings a strengthening of energy policy and a stiffening of targets. In April the new three-year CERT scheme roughly doubles the carbon savings required by the previous EEC scheme. CERT requires delivery of lifetime carbon emissions savings of 154 million tonnes – equal to 4.2MtCO<sub>2</sub> a year – by 2010<sup>8</sup>. (This target is later increased by 20% to 185 million lifetime tonnes of CO<sub>2</sub>, and the programme is extended by a year<sup>9</sup>.)

Two newly passed acts update the infrastructure for tackling carbon reduction and climate change. The **Energy Act 2008** and the **Climate Change Act** complete much of the framework needed for the UK's transition to a low-carbon, energy-secure economy, covering renewables, the Feed-In Tariff, carbon sequestration, power plant decommissioning and more.

A new **government department (DECC)** brings energy and climate change together for the first time in one department.

<sup>6</sup> The EuP Directive was recast in 2010, and is now referred to as the Energy Related Products (ErP) Directive

<sup>7</sup> Patio Heaters Green Barometer 2007

<http://www.energysavingtrust.org.uk/Publication-Download/?p=4&pid=1095>

<sup>8</sup> Quoted as 42MTC (42\*44/12 = 154MtCO<sub>2</sub>)

<sup>9</sup> <http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/>

Documents1/090715%20CERT%20Amendments%20Supplier%20Guidance%20v5.pdf

## 2009

# 2009

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The government introduces plans for energy suppliers to replace the nation's 47 million gas and electricity meters with smart meters by 2020.

- January: first large-scale 'dynamic demand' appliance trial begins
- Announcement that smart meters for gas and electricity will be installed across the country by 2020
- Renewables target is announced, aiming to increase total renewable energy to 15%, and renewable electricity by 30%
- August: Climate Change Act (Scotland) enshrines in law for the first time targets, duties and mechanisms to tackle the causes of climate change, with carbon emission reduction targets of 42% by 2020 and 80% in 2050
- September: the legal phase-out of 100-watt incandescent light bulbs begins

In January, Npower begins trials (under the CERT scheme, in partnership with the national grid) of a new technology to reduce the need for back-up energy provision. 'Dynamic demand' technology, fitted to appliances with a duty cycle, such as refrigeration products, air-conditioners and water heaters, enables them to detect and respond to high demand on the grid.

# 2010

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The first Pay As You Save (PAYS) pilot is launched in 2010, managed by the Energy Saving Trust.

In May the government introduces plans for energy suppliers to replace the nation's 47 million gas and electricity meters with smart meters by 2020, with the aim of reducing CO<sub>2</sub> emissions by 9.5 million tonnes a year. (This applies to homes, the public sector and small and medium businesses.) Energy Saving Trust research helped mould the design of the meters, to include a visual display with which consumers can easily monitor their energy use. DECC estimates that the move could benefit the UK economy by £7.3 billion over the next 20 years<sup>10</sup>.

# 2011

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The UK government announces that, after a temporary dip which is attributed to the recession, carbon emissions in 2010 rose by 2.8%.

September sees the beginning of the end for incandescent General Lighting Standard (GLS) light bulbs, with bulbs of 100 or more watts, all pearlescent or opal light bulbs, phased out of the supply chain. The UK began a voluntary phase-out of the higher-watt bulbs in 2008. Lower bulbs would be removed in subsequent years until no incandescent bulbs would be left on the market by 2012.

## 2010

- The Pay As You Save (PAYS) pilot launches, administered by the Energy Saving Trust
- March: Retailers sign up to a voluntary initiative phasing out the most inefficient TVs, led by the Energy Saving Trust and Defra
- April: Feed-in Tariff for electricity generating small renewables launched
- May: The change of the UK government
- June: Committee for Climate Change report shows 8.6% decrease in greenhouse gas emissions in the past year
- The government announces its new Green Deal programme, set to go live in 2012

The first **Pay As You Save (PAYS)** pilot is launched in 2010, managed by the Energy Saving Trust. PAYS is a financing solution that will give households a way to invest in energy efficiency and microgeneration technology with no upfront cost, repaid by savings on energy bills. The principle will become the basis of the funding mechanism for the Green Deal programme, which is to be launched in 2012.

The English **Boiler Scrappage scheme** supplied £50 million to replace the oldest, G-rated boilers with A-rated condensing boilers, and save 140,000 tonnes of CO<sub>2</sub> annually. Wales and Scotland soon followed with similar offers.

The **Feed-in Tariff** pays people who generate their own energy for the electricity they produce – even if they use it themselves – and there is a bonus paid for any excess energy they export back to the grid.

The Committee for Climate Change announces an overall 8.6% decrease (c.f. 1.9% in 2008) in GHG emissions in 2009. However, most of this reduction is attributed to the reduction in economic activity and generally recessionary impacts. Less than 2% was attributed to genuine policy induced reductions

## 2011

- March: the UK government announces that, after a temporary dip which is attributed to the recession, carbon emissions in 2010 rose by 2.8%
- March: the definition of 'zero-carbon homes' is amended so that it no longer includes appliances and electrical goods

The **Energy Bill 2011**, which is going through Parliament as we go to press, will change the way domestic energy efficiency measures are paid for and managed on a home-by-home basis. Above all it will announce and set out the terms for the government's Green Deal programme, set to launch in October 2012. The Energy Bill also announces the replacement of the CERT scheme with the Energy Company Obligation, or ECO scheme. The ECO is expected to ensure that poorer households can benefit from the Green Deal, and that homes requiring more expensive measures can also benefit.

The fundamental changing of the **definition of zero-carbon homes** lies at the heart of this report. With no offset required from developers to compensate for carbon emissions from domestic activities, the idea of zero-carbon applies to houses but not homes. With no requirement on builders or developers to install low-energy appliances in new properties, it is more important than ever to understand exactly how we use appliances in our homes, and how we can reduce CO<sub>2</sub> emissions from them.

# 9.2%

Traditional domestic appliances – our washing machines, cookers, fridges – are expected to consume about 9.2% less energy by 2020.



## Chapter 3: Appliances in action – how things have changed

This chapter continues our look at where we were, where we thought we'd be, and where we are now in terms of the energy consumption of typical domestic products. *The rise of the machines* made predictions about how much energy would be consumed by the various appliances we use; this chapter compares the current reality against those earlier predictions and looks ahead to 2020 for where we are likely to be headed.

### Product sectors in a nutshell

Electricity demand from lighting is expected to fall by 25% by 2020 if all the policies and legislation in place now are successfully implemented, and the new efficient technologies gain their predicted market share over the coming years.

Traditional domestic appliances – our washing machines, cookers, fridges – are expected to consume about 9.2% less energy by 2020, if all existing and planned policy interventions (mainly through EuP/ErP) are successful.

Consumer electronics – televisions, set-top boxes, radios, DVD and Blu-ray players and other 'infotainment' items – are expected to increase their energy demand by 5% (1.1TWh) by 2020, according to current predictions.

Home computing, or information and communication technology (ICT), is predicted to rise slightly by about 7% (0.5TWh) by 2020, given the policies currently in place. This includes computers, laptops, computer monitors, printers, scanners and home photocopiers.

The chart shows the energy demand profile of each product group in 1990, 2005 & 2009<sup>11</sup>, and the prediction for energy demand in 2020. Forecast figures are taken from the report *Saving energy through better products and appliances*, published by the Market Transformation Programme (MTP) run by Defra<sup>12</sup>. Their 'reference' (or 'business as usual') scenario calculates likely energy use in 2020 on the basis of all EU and UK policy and law known in 2009.

In more detail, how the sectors have changed and are predicted to change through to 2020:

Product group	Energy use in 1990 <sup>13</sup> (TWh)	Energy use in 2005 (TWh)	Energy use in 2009 (TWh)	Projected energy use in 2020 (TWh)
Lighting	16.6	17.5	15.8	11.7
Refrigeration	16.8	15.9	14.5	10.5
Cooking	11.7	13.0	13.3	13.3 <sup>14</sup>
Washing	11.8	13.6	14.2	15.7
Consumer electronics <sup>15</sup>	12.1	19.9	20.8	21.9
Home computing	1.3	5.4	6.5	6.9
<b>Total</b>	<b>70.3</b>	<b>85.3</b>	<b>85.1</b>	<b>80</b>

**Table 1: Electricity use, and projected demand, for domestic products from 1990 to 2020**

11 All electricity data for these years is from DECC's Energy Consumption in the UK (ECUK) Table 3.10, 'Total electricity consumption by household appliances 1970-2009'

12 <http://www.defra.gov.uk/environment/economy/documents/energy-products-1209.pdf> published December 2009, but updated in 2010

13 1990 domestic energy use is included here for reference, as the UK emission reduction targets are calculated against 1990 as the base year

14 MTP predicts that cooking energy demand will stay roughly similar to present levels

15 The electricity consumed by CE products in 2004 was increased in a subsequent revision of MTP figures (17.5 to 19.4 TWh in 2004)

## Lighting

### Then

When we published *The rise of the machines*, lighting was considered the domestic category with the largest demand, at approximately 17.5TWh – making up about 20% of energy use in the home<sup>16</sup>. In our report we predicted that this figure would go up to 21TWh by 2020.

### Now<sup>17</sup>

This prediction was not realised, as these five years have seen the single biggest change in the century-plus of domestic lighting. The 2009 actual estimates put domestic electricity consumption from lighting at approximately 15.8TWh<sup>18</sup> – around 19% of domestic energy used in appliances in 2009.

In addition, the Market Transformation Programme (MTP) now predicts that energy use from lighting will fall by another quarter – down to around 11.7TWh – by 2020.

### What's changed

Basically, the product itself. The two major policy interventions in this sector added up to a massive change in how we will light our homes in future. They are the EU-wide phase-out of old-style incandescent light bulbs, and the incentivising of compact fluorescent (CFL), or energy-saving, bulbs.

Through the energy supplier obligations EEC2 and CERT<sup>19</sup>, energy-saving light bulbs went from an average price of £4 in 2005 to between 50p and a pound in the intervening years – and millions were given away for free by energy companies.

The graph below shows a five-fold increase in CFL bulb sales since 2005 (from 7 million to 40 million) and corresponding drop in sales of incandescent bulbs – which, though still larger, were almost halved in the same time frame<sup>20</sup>.

It has been estimated that, under CERT, around 300 million energy-saving light bulbs were given away or subsidised between 2008 and 2011. The scheme has attracted the criticism in some quarters that sending unsolicited light bulbs to householders meant that many may not have been used. As a result of this, energy suppliers were told to phase out this free distribution by January 2010.

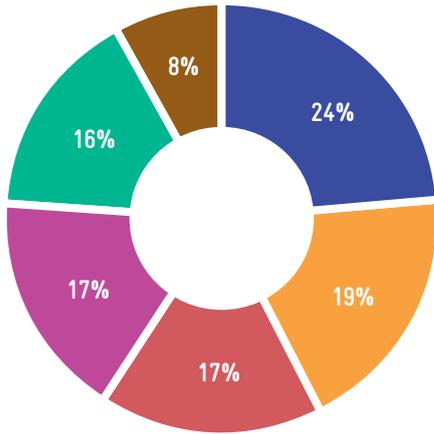


Figure 2: Electricity use in 2009

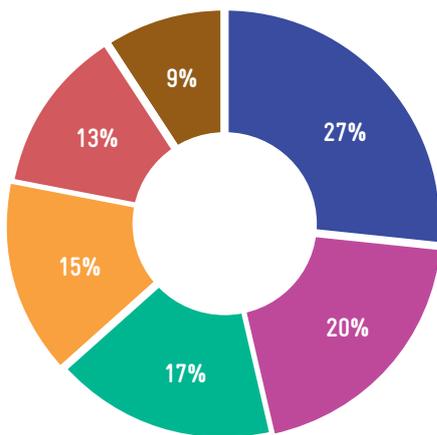
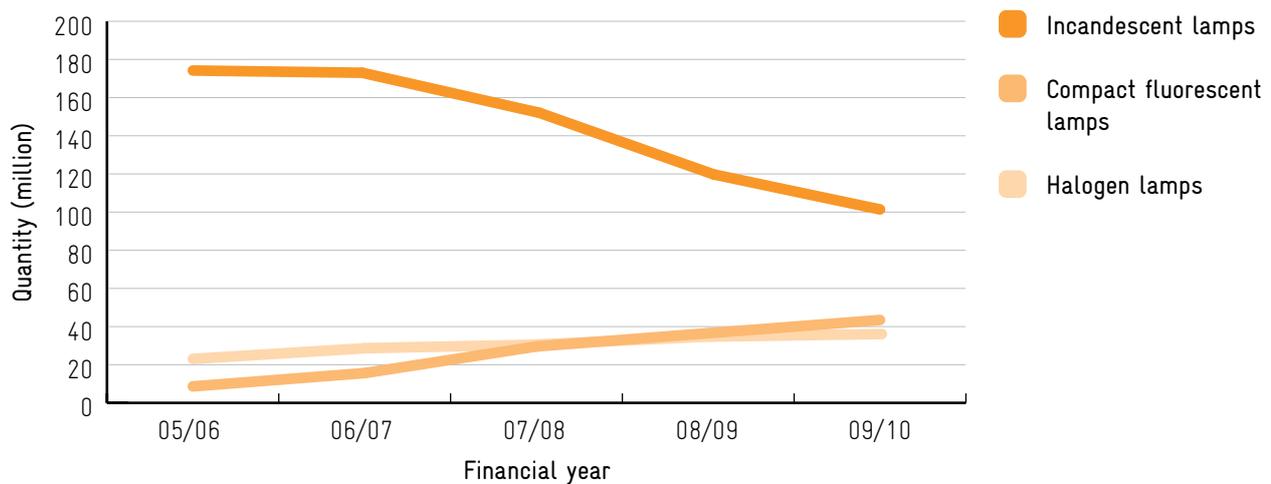


Figure 3: Projected electricity use in 2020



Figure 4: Light bulb sales based on GfK retail panel Source: GfK Retail audit



Although no longer given away free, they continued to be subsidised until March 2011. Even now CFL bulbs can still be bought in major supermarkets and electrical shops for as little as a pound. In terms of payback, energy-efficient bulbs remain one of the most cost-effective measures householders can purchase: replacing just one bulb in the house with a low-energy one can save around £2.50 a year, and a high-use bulb can save more.

### Bye bye incandescents

The EU Commission ruled in 2008 that sales of incandescent (GLS) bulbs will be phased out by 2012. In the UK, a voluntary phase-out of bulbs has taken place around a year earlier than the legislation requires. As we write, standard and frosted 100W, 60W and all frosted bulbs are off the shelves; this has led to earlier energy savings than had been anticipated. The ban is expected to result in 186 million GLS bulbs being removed from the UK market by 2012.

### What's next

CFL light bulbs are already being talked about as 'old technology'; LEDs – that is, light-emitting diodes – are the new kid on the lighting block. Although LEDs are currently used mainly for directional lighting, like work lamps or spotlights, or decorative purposes such as fairy lights, the technology is developing fast, and LED lighting is expected to be the lighting technology of choice within the next five to ten years. LED bulbs are more energy-efficient than CFL bulbs; a standard LED bulb only uses one to two watts.

As well as LED technology, other 'ultra-efficient lighting technologies' (UEL), such as organic light-emitting diodes (OLEDs) and other forms of LED bulbs, are currently under development. This technology should usher in the next generation of domestic lighting, which will reduce the consumption of energy through lighting our homes even further. This is a big turnaround for a product that has historically been one of the highest consumers of domestic energy.

16 A value of 18KWh was used in *The rise of the machines*, but this has subsequently been revised down to about 17.5 TWh in a more recent ECUK Table 3.10, Domestic product electricity usage ,

17 All 'This is now' figures in this chapter are taken from 'Energy Consumption in the UK', Graph 3.10, Total electricity consumption by household domestic appliances 1970 to 2009. Future 2020 figures come from MTP's 'Saving energy through better products and appliances'

18 MTP publication 'Saving energy through better appliances and Products', Dec 2009 Annex 5, page 64. Also: DECC, 'Total electricity consumption by household appliances 1970 - 2009', Table 3.10

19 Energy Efficiency Commitment EEC2 and Carbon Emissions Reduction Scheme CERT

20 GfK Retail Audit 2010

## Refrigeration

---

### Then

Fridges and freezers accounted for approximately 15.9 TWh of household electricity use in 2005. In *The rise of the machines* we predicted that this would fall to 11.4 TWh by 2020.

### Now

According to the most recent figures available, refrigeration products are estimated to have consumed 14.5 TWh in 2009. This is currently expected to fall to 10.5 TWh by 2020<sup>21</sup>.

### What's changed

Historically, refrigeration appliances were one of the highest demand areas in the home as the appliances are always on, but advances in technology are improving efficiency levels.

The good news is that cold appliances have become steadily more efficient: a fridge bought 15 years ago uses on average around 50% more electricity than a comparable model bought today.

The bad news is the danger that some of these energy (and emissions) savings are being eroded by two trends: from the consumer side, in a recent fashion for larger, American-style fridge-freezers; and from the industry side, in adding on new features, which consume more energy.

There is a worrying aspect of these built-in add-on features, such as ice makers and water chillers. The additional features are subject to the use of so-called correction factors – which mean that the extra energy needed to run the additional features is discounted when the appliance is tested for its energy efficiency label<sup>22</sup>. This ‘corrects’ for the benefit of the extra feature; so in essence, the model is given an energy efficiency classification without counting the energy needed to power the extra functionality. Defra evidence suggests that the correction factor can lead to a misleadingly high energy-efficiency rating.

The energy label for refrigeration appliances has also seen a general shift upwards over the past five years, with practically no products below a B rating currently for sale. The A rating dominates, taking 85% of the market share in 2010. More efficient A+ appliances make up 13%, but the most efficient model, the A++, had only half a per cent of the market in 2010<sup>23</sup>.

### What's next

Just as you would insulate your loft or walls to keep heat in, the same principle can be applied to your fridge and freezer to keep cold in. The emerging technology being used – vacuum insulation panels, which consist of a rigid vacuum core of fiber, powder, or foam, enclosed in panels – can achieve very high insulation levels, which will result in less energy needed to chill your food and further efficiency savings in the sector.

Overall, the outlook is generally positive for refrigeration: in 1990, your fridge was one of the highest users of electricity in your home; now, assuming you've bought a new one, it's the third highest; and in 2020 it is expected to be one of the most energy-efficient appliances in your home.

# 50%

A fridge bought 15 years ago uses on average around 50% more electricity than a comparable model bought today.

## Cooking

### Then

In 2005, cooking accounted for approximately 13TWh a year of domestic appliance electricity consumption. At the time, it was projected that the energy used by ovens would decrease, and that by 2020 the figures from hob use would have fallen too – even after taking the rising number of households into account. Kettles, on the other hand, were expected to use 0.5TWh more energy by 2020. Microwaves were also expected to use more energy – 0.6TWh more – in 2020. This was due partly to more people owning them, partly to growth in the number of households, and partly to an increase in stand-by functionality on new models.

### Now

In 2009, cooking accounted for 13.3 TWh of electricity, 15.5% of the household total – not much different from 2005's consumption level.

### What's changed

Not a lot. MTP now forecasts that with existing policy measures cooking-related energy consumption will remain roughly the same between now and 2020. The only major change from previous projections is that a fall in energy use from cookers and ovens is no longer expected; some research suggests people are eating out less and cooking more at home<sup>24</sup>.

Generally, people are tending to prefer electric ovens to gas ovens and hence sales of gas ovens are expected to decline. By 2020 it is predicted that 30% of Britain's ovens will be gas, and 70% electric. This prediction is reversed for hobs, as many people prefer to do stove-top cooking with gas. By 2020 Britain's hobs are expected to be 40% electric and 60% gas.

In 2005, 85% of British homes owned a microwave, and this is expected to remain static into the future. A significant proportion of energy use in microwaves is due to the stand-by function: most models have digital clocks, and according to MTP, consumers prefer models with electronic rather than manual controls. On this basis, even if a microwave is actually in use for only a few minutes a day, it is consuming most of its energy when not actually performing a useful task.

Microwaves are covered under the EuP/ErP legislation and will be considered and addressed under that legislation; but since changes to what can be sold in the future don't affect appliances already in the home, it will not have an immediate impact. Hence, energy consumption by microwaves is expected to stay roughly the same through 2020.

Kettles are small, but most of us use them, and they are estimated to use a third of all cooking-related electricity, at 4.3TWh in 2009. This figure is expected to rise between now and 2020, mainly because of the increasing number of households. Nine million kettles are bought each year, and kettles have a lifetime of about five years<sup>25</sup>. New kettles are coming onto the market with features that can either increase or decrease energy consumption – for example, a 'stay warm' facility can increase consumption, while an 'eco' setting or water-measuring function can reduce it. Time will tell which extras prove more popular with the public, and thus whether they demand more, or less, energy in the coming years.

# 70%

By 2020 it is predicted that 30% of Britain's ovens will be gas, and 70% electric.

21 MTP Saving energy through better products and appliances

22 Correction factors are applied to cold appliances with certain extra built-in features – such as ice-makers; frost-free; built-in units – which means they are allocated a proportion of their energy use which is not counted in determining their energy label classification. This is to 'correct' for the benefit of the extra feature. Defra evidence suggests these correction factors distort the energy label and can lead to an energy rating that is too high. MTP Saving Energy through Better Appliances and Products.

23 Data based on GfK retail panel.

24 Mintel British Lifestyles 2010 report (p68)

25 GfK Retail Audit and MTP, Saving energy through better products and appliances

## Washing



### Then

In 2005, 13.6 TWh of electricity was used by washing machines, tumble dryers, washer-dryers, and dishwashers. The prediction was that, by 2020, energy consumption by washing machines and washer-dryers would shrink by 8%, and by tumble dryers would grow by 18%. Dishwasher consumption was expected to rise by just over 22%. (These figures were later amended to 9%, 17% and 20%<sup>26</sup>.)

### Now

In 2009, energy consumption by washing and drying appliances had risen to 14.2 TWh – an increase of around 4% in five years. Given the trends and existing policies, this figure is now expected to reach 15.7 TWh by 2020<sup>27</sup>.

### What's changed

The vast majority of households – 95% – have access to washing facilities, predominantly washing machines (80%), and a smaller number with washer-dryers (15%). Only 45% of households own tumble dryers<sup>28</sup>.

Tumble dryers are much more energy-hungry than washing machines: new tumble dryers consume 3KWh per use, compared to 0.8KWh for a typical new washing machine<sup>29</sup>. So, in essence, you use nearly four times the energy to dry your clothes that you use to wash them.

Sales of larger washing machines, with load capacity of 7kg and over, are increasing. Using bigger machines for smaller loads means not only running the machine more times, but running a bigger machine more times, and can cancel out some of the efficiencies gained by buying a new, higher-rated appliance. On the other hand, people are washing at lower temperatures, which can use up to 40% less energy<sup>30</sup> than high temperatures. Higher spin speeds may use slightly more energy, though this could be offset if it were shown to reduce demand from tumble drying.

Over a quarter of all households (28.5%) own a dishwasher. The average UK dishwasher runs 4.5 times a week, as against an average 4.1 times across Europe. A dishwasher's average lifespan is assumed (by MTP) to be 13 years.

### What's next

Washing machines can now officially attain the A+ energy rating, although the most efficient machines have been sporting this A+ label for a number of years on an unofficial basis. The old labelling system only used to go up to A, whereas some models surpassed this grading due to energy efficiency improvements, prompting the new A+ rating.

Bigger drum sizes and higher overall energy-efficiency ratings could help to reduce the energy we use washing clothes – if people respond by washing larger loads, less frequently. The danger is that better efficiency could be undermined by machines running with small loads in them just as often as the previous smaller machines.

There is innovation coming through the pipeline. Tumble dryers are being developed that use mechanical steam compression, heat pump technology and variations on solar power; some of these require only half the energy of a conventional dryer. However, they are more expensive, and are currently a niche product.

# 40%

People are washing at lower temperatures, which can use up to 40% less energy<sup>30</sup> than high temperatures.

## Consumer electronics

### Then

Consumer electronics – or entertainment goods – used less energy in 2004 than lighting and cold appliances, at 17.3TWh (16% of the total), but their use rose fast all through the decade. On this basis, five years ago it was predicted that a large rise in energy use to over 30TWh by 2010 was likely.

Since then, predictions have changed as CE technologies have evolved. But what has been shown is that in 2005 consumer electronic products were, in reality, using 19.9 TWh – 23% of the domestic total – so had become the biggest domestic electricity using product sector<sup>31</sup> much earlier than predicted<sup>32</sup>.

### Now

In 2009, electricity consumption from consumer electronics was estimated at around 21TWh, or almost a quarter of our domestic electricity use.

Thankfully, the rather alarming earlier forecast of 30TWh consumption by 2010 now seems to have been an over-estimation, but consumer electronics are still one of the fastest-growing energy consumers in the home. The current forecast is that, given current trends and policies, consumption in this area will grow by another 5% (1.1 TWh) between now and 2020.

### What's changed?

In 2009 the average household owned 11 times more consumer electronics items than they had in 1970, and three and a half times more than in 1990<sup>33</sup>. Between 1970 and 2009, despite improved energy efficiency, when looked at generally, electricity consumption by consumer electronics goods rose by well over 600%, from 3.2TWh to 20.8 TWh.

In the past five years, a number of initiatives have been instigated to reduce this rising consumption. The IEA's 1-Watt initiative, the ErP Directive, and the Energy Saving Trust's Voluntary Retailer's Initiative on TVs have all helped to reduce the much larger rises in energy consumption which were earlier predicted. This shows that concerted action really does work.

# 600%

Between 1970 and 2009, electricity consumption by consumer electronic goods rose by well over 600%, from 3.2TWh to 20.8 TWh.

26 BNDA K001 Domestic Appliances: Government Standards Evidence Base 2009: Key Outputs

27 BNDA K001 Domestic Appliances: Government Standards Evidence Base 2009: Key Outputs

28 BNW01L Key inputs

29 Taken from Saving energy through better products and appliances, p.45

30 EST testing results

31 excluding electric heaters

32 ECUK – 2005 date

33 GfK Market Tracker: Domestic Appliances 2011

## Home computing (ICT)

### Then

In 2005, home computing – or information & communication technologies (ICT) – consumed approximately 5.4TWh of electricity. When we wrote *The rise of the machines*, we expected this figure to be 30% greater, at 7TWh, in 2020.

### Now

The current estimate of energy consumed by home computing in 2009 is 6.5TWh. This is now expected to rise slightly less than we thought five years ago, to 6.9TWh by 2020.

### What's changed

Between 2000 and 2009, electricity use from home computing more than doubled, from 3.1TWh to 6.5TWh. In that time the number of devices in British homes – including desktop and laptop computers, and peripherals like scanners, printers, disk drives – rose from 30,000 to 65,000<sup>34</sup>. In 1985, only 13% of the population owned a computer; in 2009, over three quarters owned at least one<sup>35</sup>. Laptop ownership is expected almost to treble by 2020, overtaking desktop computers. Laptops use much less energy than desktop models, so this is good news for predicted energy consumption levels. New laptops use around 15% of the energy of a new desktop.

Consolidation of functionality is making a difference to the number of devices. Separate printers, copiers and scanners have largely been replaced by 'all-in-ones' or MFDs (multi-functional devices), which include all three functionalities. But where energy consumption from MFDs has almost doubled between 2005 and 2009<sup>36</sup>, consumption by single-function printers has not dropped proportionally, so total energy consumption is still rising. Overall, there is not expected to be much of a change in the energy consumption in this area over the next decade.

Meanwhile, along with televisions, computer monitors have moved away from cathode ray tube (CRT) technology to the much more efficient flat screen LCD model, and LED screens are coming in as we write. This has helped to lower energy demand.

### What's next

Both the technology of home computing and how we use it are changing and developing at a dizzying pace, and looks set to keep doing so. The trend of convergence means more and more items – games consoles, tablet computers, mobile phones, the above-mentioned printers, and even televisions – perform overlapping computing functions. A new 'Infotainment' sector is developing. New functionality within existing devices may mean they will need to consume more processing power per unit, and divergence in the form of netbooks, notebooks, tablets, smartphones, e-readers may mean more energy used by chargers. Equally, where we now use electronic devices to do new things (read, do homework, buy our groceries), it is also likely that much of the work we previously did on big, inefficient desktop computers will come to be done on small, more efficient devices.

At the moment the pace of change makes it hard to predict future energy consumption for this area; we will be publishing a report next year taking a much more in-depth look at current trends and likely future developments.

34 ECUK 2011

35 Source: Office of National Statistics General Lifestyle Survey, Table 4.19 Consumer durables, central heating and cars 2009 edition

36 ECUK 2011

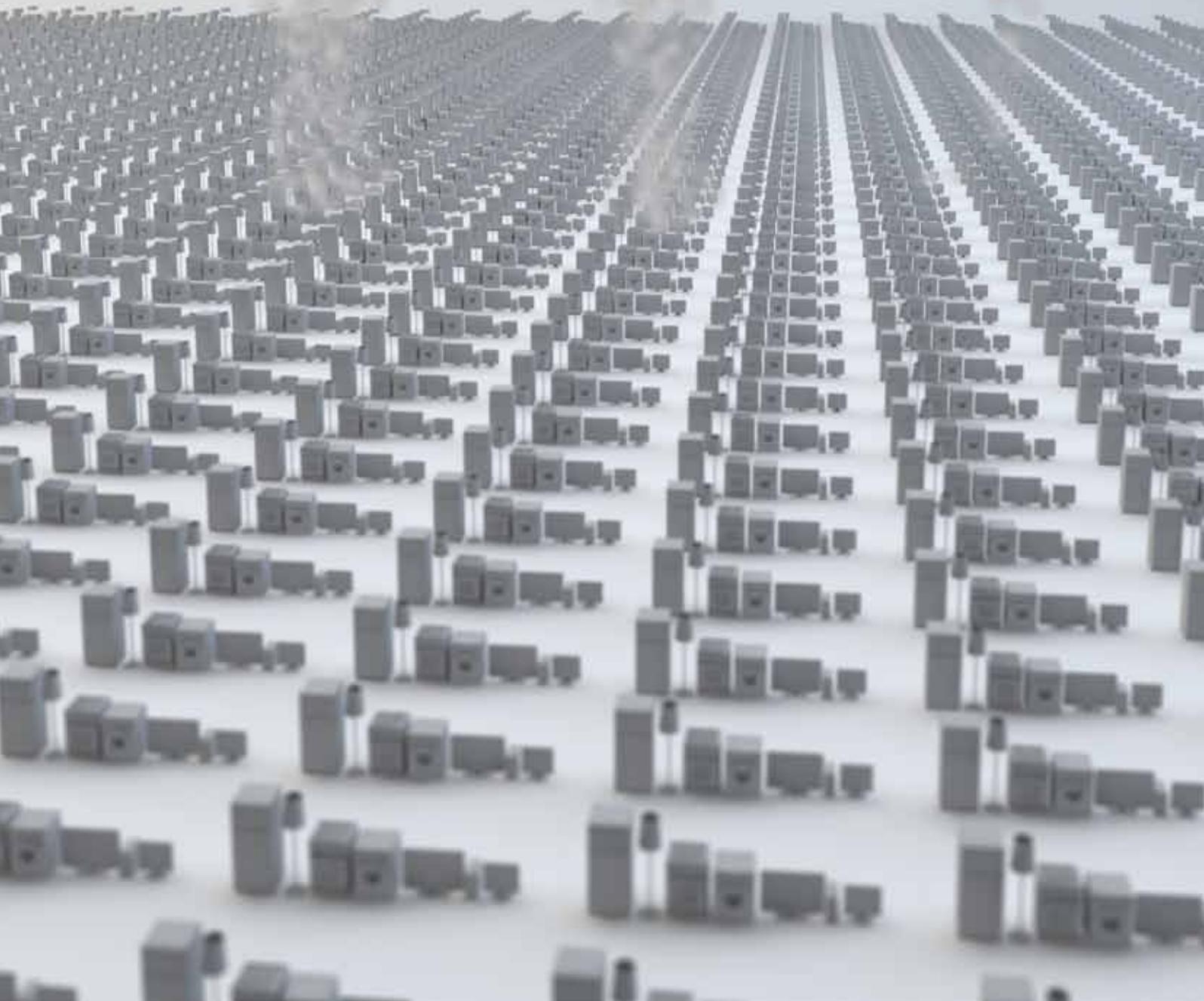
# 65,000

the number of devices in British homes – including desktop and laptop computers, and peripherals like scanners, printers, disk drives – rose from 30,000 to 65,000.<sup>34</sup>



# 36 million

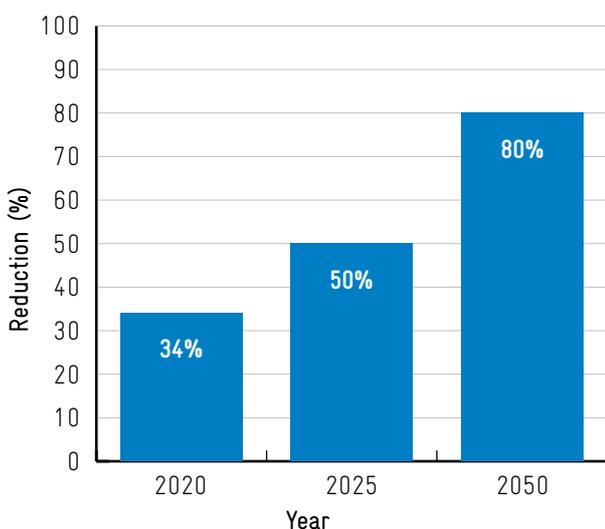
We need to make sure that in 2020 our emissions from domestic appliances stand at no more than 36 million tonnes.



## Chapter 4: Carbon reduction targets: will we hit them?

The UK's carbon reduction targets lay out an ambitious vision of a low-carbon future for Britain. But can we achieve it? The government has pledged – and enshrined in law – its intention to reach the following stepped reductions in greenhouse gas (CO<sub>2</sub>eq) emissions, based on 1990 levels:

**Figure 5: Projected reductions in greenhouse gas (CO<sub>2</sub>eq) emissions**



When we say 'greenhouse gases', we are referring to carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). The abbreviation CO<sub>2</sub>eq reflects the global warming potential of all the greenhouse gases combined, at an equivalent to the potential of CO<sub>2</sub>.

In 1990, the year on which the reduction targets are based, domestic appliances in the UK consumed around 70TWh and emitted 55m tonnes of CO<sub>2</sub>eq<sup>37</sup>. To reduce emissions by 34% from this baseline, we need to make sure that in 2020 our emissions from domestic appliances stand at no more than 36 million tonnes.

Because these targets relate to CO<sub>2</sub>eq emissions, rather than to actual energy consumed, different fuel sources have different implications for meeting the targets. For example, electricity from the grid currently emits around 2.5 times more greenhouse gases per kWh, at 0.54kg

(540g) of CO<sub>2</sub>eq,<sup>38</sup> than gas does. This means that saving a kilowatt unit of electricity will cut emissions by more than twice as much as saving a kilowatt unit of gas.

The UK's plan to reduce carbon emissions depends in part on the plan to decarbonise the national grid over the next forty years. There are specific targets that relate to this. In theory, as more and more of the UK's energy is generated from low-carbon sources (including nuclear), this 0.54kg (540g) of CO<sub>2</sub>eq per kWh of electricity should reduce to a smaller amount.

Because the decarbonisation of the grid is both a challenging and critical part of the strategy to reduce emissions, it's difficult to model those potential future emissions without considering different possible scenarios for the carbon factor of electricity. One scenario, using figures from Defra's forecast of future carbon intensity, is that, in 2020, CO<sub>2</sub>eq emissions from electricity will be lower than current levels, because overall more of our electricity will be generated by renewable sources. Our analysis also considers what will happen if CO<sub>2</sub>eq emissions from electricity remain roughly at today's levels. To estimate what the energy consumption for domestic products will be in 2020, we use the MTP's predicted electricity demand from domestic appliances under the reference scenario in 2020<sup>39</sup>. These scenarios produce a range of possible CO<sub>2</sub>eq emission levels from domestic energy use in 2020.

<sup>37</sup> Electricity use by products in 1990 was 70.3 TWh, and the average delivered electricity CO<sub>2</sub>eq factor was 0.77651 kgCO<sub>2</sub>eq/kWh. Thus, total emissions due to product use is calculated at 54.6Mt CO<sub>2</sub>eq.

<sup>38</sup> CO<sub>2</sub>eq emission factor for end-user domestic electricity, from 2008, DECC guidelines for CO<sub>2</sub>eq reporting, is 0.54284 kg/CO<sub>2</sub>eq kWh.

<sup>39</sup> From Saving energy through better products and services, DECC publication 2010

The two scenarios are:

#### CO<sub>2</sub>eq emissions from domestic electricity use

##### Scenario 1: 2008 emissions level

CO<sub>2</sub>eq emission levels from domestic electricity use in 2020 remain at approximate current level<sup>40</sup>: 0.54kg (540g) of CO<sub>2</sub>eq per kWh

#### CO<sub>2</sub>eq emissions from domestic electricity use

##### Scenario 2: grid decarbonisation<sup>41</sup>

CO<sub>2</sub>eq emission levels from domestic electricity use in 2020 are less, as forecast by Government: 0.458kg of CO<sub>2</sub>eq per kWh

#### How does the domestic sector shape up?

We can see that, for households to play their part in meeting the 2020 emissions reduction target of at least 34% on 1990 levels, we will all have to use less energy in our homes. How much less we will have to use will depend on how carbon-intensive the grid is, as this will determine the level of CO<sub>2</sub>eq emissions per kWh.

Returning to the consumption levels given in the reference scenario line provided by MTP, we see the following projections for electricity demand, per product sector, to 2020:

Product	Electricity use in 1990 (TWh)	Electricity use in 2009 (TWh)	Reference scenario 2020 (TWh)
Lighting	16.6	15.8	11.7
Refrigeration	16.8	14.5	10.5
Cooking	11.7	13.3	13.3 <sup>42</sup>
Washing	11.8	14.2	15.7
Consumer electronics	12.1	20.8	21.9
Home computing	1.3	6.5	6.9
<b>Total demand (TWh)</b>	<b>70.3</b>	<b>85.1</b>	<b>80</b>

**Table 2: Electricity demand in 1990, 2009 and the reference scenario forecast demand in 2020**

From the table we can see that the volume of domestic electricity demand in 2020 is forecast at 80TWh, a reduction in real terms of about 6% from 2009 levels, but 14% higher than 1990.

According to Scenario 1, where the end-user emissions factor remains similar to the current level, this would mean domestic electricity emissions in 2020 of around 43.6 million tonnes of CO<sub>2</sub>eq<sup>43</sup>. This is about 7 million tonnes over the target limit of 36 million tonnes. At this rate, we would have achieved around a 20% reduction in emissions on 1990 levels; but the target is 34%.

To achieve the 34% emissions reduction target with 80TWh of electricity demand, the emissions factor in 2020 would need to reduce to 0.39837kgCO<sub>2</sub>eq/kWh.

In Scenario 2 the outlook is more positive: 2020 CO<sub>2</sub>eq emissions from domestic products are 36.7 Mt CO<sub>2</sub>eq. This means missing the target by a much lower 0.7 MT CO<sub>2</sub>eq.

In all probability, domestic electricity emission factor levels in 2020 will fall somewhere between these two scenarios; so, although the news may not be that bad, it does confirm that we will probably miss our target by between 0.7 and 7 million tonnes of CO<sub>2</sub>eq on current projections.

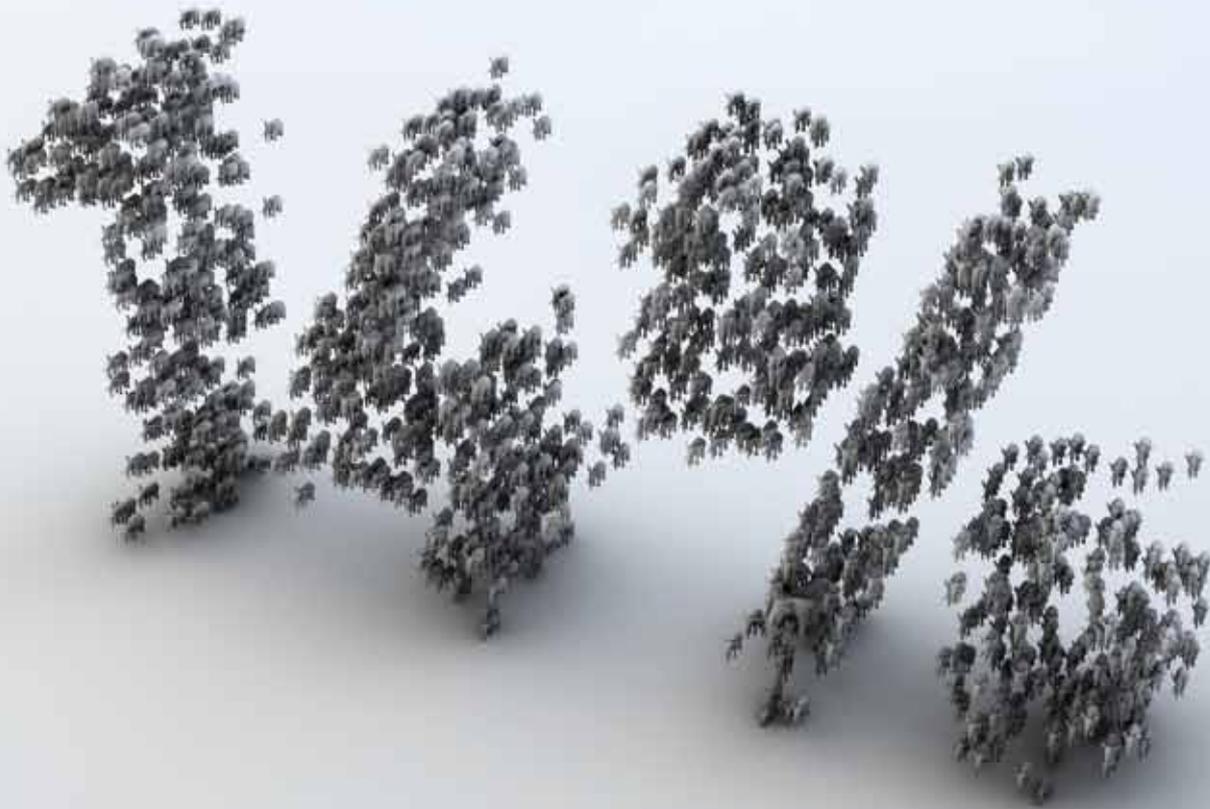
40 Actual emissions in 2008

41 Domestic end user CO<sub>2</sub> emission factor in 2020 is projected to be = 0.372kg, this is uplifted by 8% to account for Transmission & Distribution losses, and multiplied by 14% to convert CO<sub>2</sub> into CO<sub>2</sub>eq = 0.458 kgCO<sub>2</sub>eq/KWh. CO<sub>2</sub> factor taken from Defra/DECC GHG reporting guidelines 2010.

42 MTP literature gives no actual numbers for cooking: the prediction is for energy use to stay more or less the same, so the 2009 figure is used in the 2020 MTP reference scenario.

43 80.24 TWh x 0.54284 kg/CO<sub>2</sub>eq/KWh = 43.6 Mt CO<sub>2</sub>eq

Domestic electricity demand in 2020 is forecast at 80TWh, a reduction in real terms of about 6% from 2009 levels, but 14% higher than 1990.



# 91%

91% of people say they are in the habit of turning off lights when not in the room, but only two thirds are doing it all the time<sup>48</sup>.



## Chapter 5: What manufacturers, retailers and consumers can do

This report has focused so far on how technologies and governments, both national and EU, have advanced the quest for a low-carbon future. As previous chapters outline, work is being done on several fronts to reduce both the amount of electricity we use in our homes, and the emissions intensity of that electricity. But the current forecast for appliance electricity use in 2020 predicts that we will fall short of our emission reduction target by between 0.7 and 7 MtCO<sub>2</sub>eq; it is clear that we need to reduce domestic energy consumption more quickly than the existing legislation and other initiatives alone will achieve, especially given the ongoing challenge of decarbonising the grid quickly and economically. Even with the best industry and government efforts, our ability to meet the domestic carbon emission reduction targets will rely also on the willingness and ability of consumers to change their energy consumption behaviours.

There are two main areas where changes in everyday habits can make a real difference: through the appliances and other electric items people choose to own, and how they use those products. Some behaviours in the home have changed – more people than ever routinely recycle, and turn off lights. Others may be more likely to change as smart technologies catch on: as a customer triallist for the energy company EDF said: ‘When you see a bill it’s just historical, you have to pay it. But when you see the real time usage you can act to reduce it’<sup>44</sup>.

### What people buy

Industry, both manufacturers and retailers, can help consumers to make more energy-efficient choices. Simply making and stocking more efficient appliances – choice-editing – means that it becomes no longer possible for consumers to buy energy-inefficient electrical products.

Research has shown that consumers want to make a green choice: they feel better when buying a more eco-friendly product, as long as it has the features they want and the price is right. More than half of respondents to our recent attitude and behaviour tracker<sup>45</sup> are satisfied with their current level of environmental activity. Their main drivers for taking action are to save money (84%) and not to waste energy (76%).

Our Voluntary Retailers’ Initiative (joint-funded by DECC) has brought together eight retailers who make up over half the television retail market, to create a platform for stocking only the more efficient television models, ahead of European directives on energy use. By levelling the playing

field this way, the initiative also acts as a spur to retailers who aren’t already members of the system.

But choice editing is unlikely to affect how many electrical products people buy, unless retailers choose to stop stocking items like digital picture frames, fibre-optic Christmas trees and other novelty ornamental items. On this basis, while choice-editing is an important element in changing consumer behaviour, there is a need to encourage people to stop and think about whether they really need to buy another item that plugs in.

Another thing retailers can and should be doing is providing clear, informative advice. A well-informed, helpful staff member can make a big difference, guiding a purchaser through the product range to choose the most appropriate and efficient product for their needs. Even aside from the bewildering choices we are often faced with, the idea that ‘bigger is better’ has grown in popularity in recent years: TVs, fridge-freezers, and even washing machines are all increasing in size. But bigger is not always the most appropriate choice, and a more efficient machine that’s bigger than the old one it is replacing may not use any less energy at all, if it isn’t used effectively. Availability of energy-efficiency advice is the crucial link in the chain. (The Energy Saving Trust’s Endorsed Advice service helps retailers and other advice providers to provide high-quality energy-saving advice.)

### Looking for the label

A level below choice-editing is the labelling of products with ratings for energy efficiency, to encourage consumers to buy the most energy-efficient models. As well as the feel-good factor of making a pro-environmental choice, there is a clear benefit to householders in buying appliances that will cost less to run for years to come. After all, we routinely think this way when buying cars, where it is routine to state a vehicle’s likely miles per gallon. With energy bills going up all the time, it makes simple good sense to buy more efficient appliances for our homes.

<sup>44</sup> Future Foundation, *Ethics and inhibitions: the evolved pause-before-purchase vibe*, 2010

<sup>45</sup> Energy Saving Trust *Attitudes and Behaviours Tracker 2011*

The A-G energy rating on household appliances is the best-known scheme of this kind, although the scheme is currently going through significant changes to the ratings consumers will have to take on board, understand and use over the coming years. For example, with products becoming more energy-efficient – necessitating higher grades on certain product ranges such as fridges and washing machines – it is sometimes confusing for consumers to tell whether the B-rated, or A, A+ or A++ rated appliance is the one they should be buying for the best savings, this is where well informed retail staff are vital to the customer buying experience.

The 'Energy Saving Trust Recommended' labelling scheme simplifies the process of buying the most efficient product in its class. To achieve Recommended status, products have to meet strict criteria, representing the most efficient 20% of products in each category. With markets constantly evolving, each product's performance is monitored annually against current standards to ensure that it is still in the top of its class.

An Energy Saving Trust Recommended fridge-freezer could use £104 less in electricity over its lifetime than a less-efficient model, and save half a tonne of carbon dioxide. Multiply this over a whole house full of appliances that come under the scheme, and it's clear that even buying habits alone can begin to make a significant difference to household bills and carbon savings.

Energy Saving Trust Recommended provides basic tools for the certified companies and licenced retailers to train their staff, so that the label is complemented with person-to-person advice for consumers at point of sale. The scheme now involves nearly 3,000 product lines and nearly 250 certified companies or licenced retailers, including most major manufacturers and retailers in the UK.

### How people use appliances

Once an appliance is installed in the home, usually the most substantial part of its energy and carbon footprint will be determined by how it is used. According to MTP<sup>46</sup>, people are buying larger washing machines and then washing the same number and size of loads as with their previous smaller machines. A larger, albeit more efficient, washing machine used to wash frequent small loads is likely to use as much energy than a smaller machine used in the same way – even though it is more efficient for its size than the older model was. To realise the energy and monetary savings from this new purchase, the family has to change its habits and switch to fewer and larger wash loads.

In addition to this, the simple act of washing at 30 degrees instead of higher temperatures for normal washes can save around £10 a year.

A large, American-style fridge will make it tempting to buy more food at once, as there is the extra room to store it. However, this storage space may well be contributing to food waste, as items get lost in the back, or simply can't be eaten before their use-by date. WRAP, the UK's waste advisory body, estimates that households waste an average £480 per year on the food and drink they throw away<sup>47</sup>.

Even turning lights off when not needed can save £6 a year, and a low-energy bulb can save around £45 over its lifetime – and up to £70 if it has replaced a high-wattage incandescent bulb, or is used for more than a few hours a day. 91% of people say they are in the habit of turning off lights when not in the room, but only two thirds are doing it all the time<sup>48</sup>.

Despite better efficiency and the lower standby losses arising from the 1-Watt initiative, energy use from televisions is still rising. Buying an energy-efficient Energy Saving Trust Recommended TV over the least efficient on the market can save £70 in running costs over the lifetime of the product. Turning it off instead of leaving it on standby is a small behaviour change that will add up, across all UK households.

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46 MTP: Saving energy through better products and appliances

47 [http://www.wrap.org.uk/downloads/Household\\_food\\_and\\_drink\\_waste\\_in\\_the\\_UK\\_-\\_report.9828bfd6.8048.pdf](http://www.wrap.org.uk/downloads/Household_food_and_drink_waste_in_the_UK_-_report.9828bfd6.8048.pdf) page 6

48 Energy Saving Trust Attitudes and Behaviours Tracker 2011

Table 3: Energy Saving Trust Recommended products, then and now

2006

**Lighting**

CFLs  
Halogens

**Home appliances**

Fridges, freezers, fridge-freezers  
Washing machines  
Dishwashers  
Tumble dryers

**Home electronics**

TVs  
Energy saving mains controllers

**Heating**

Gas, oil & LPG boilers  
Heating controls  
Hot water cylinders

**Glazing**

Windows

**Insulation**

Cavity  
Loft  
External wall  
Internal wall

2011

**Lighting**

CFLs  
Halogens  
LEDs

**Home appliances**

Fridges, freezers, fridge-freezers  
Washing machines  
Dishwashers  
Tumble dryers  
Kettles  
Ovens & hobs  
Irons  
Vacuum cleaners

**Home electronics**

TVs  
Energy saving mains controllers  
Set top boxes  
TV recorders  
DAB radios  
Telephones  
Home energy monitors and plugs

**Heating**

Gas, oil & LPG boilers  
Heating controls  
Hot water cylinders  
Passive flue gas heat recovery devices

**Glazing**

Windows

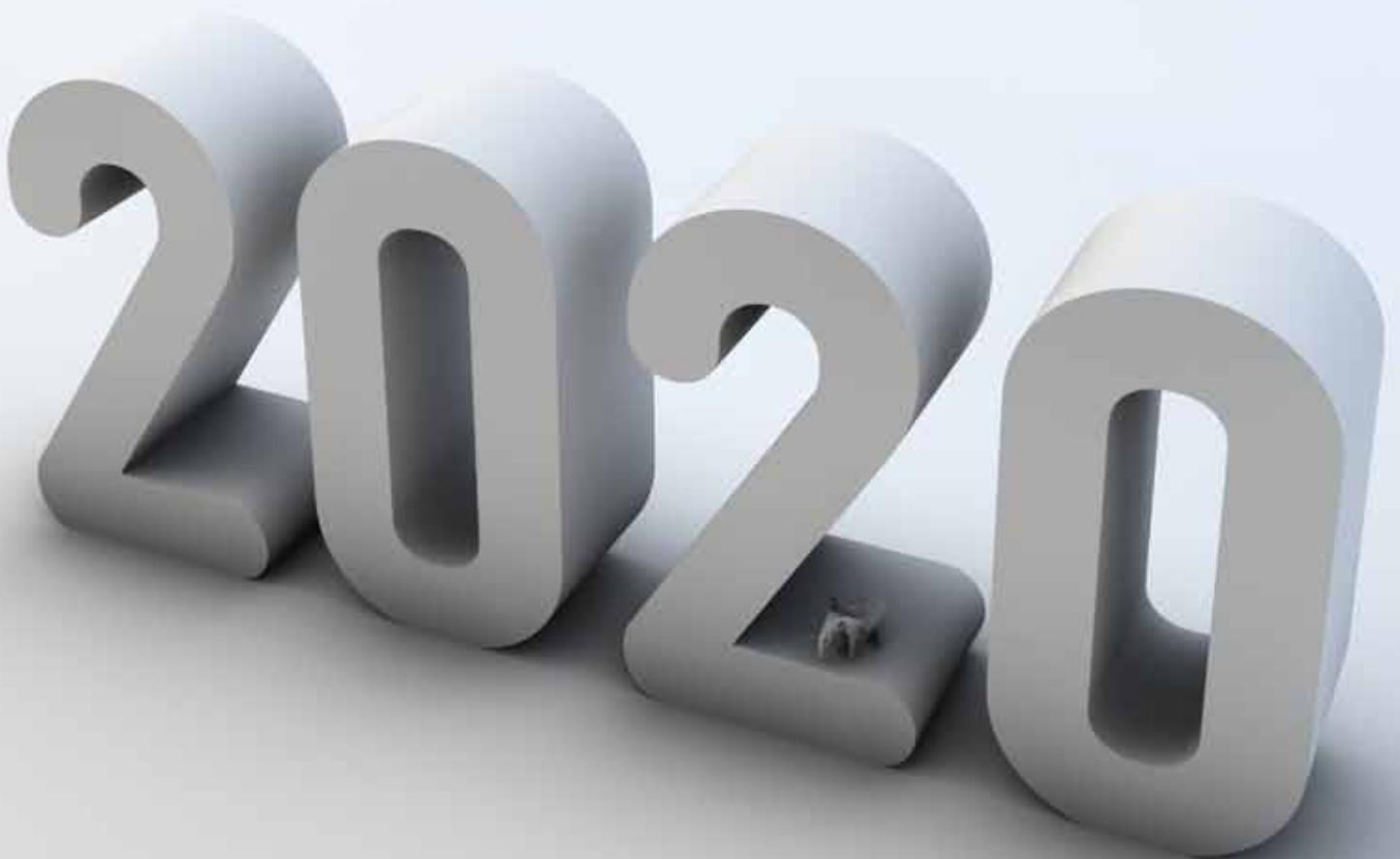
**Insulation**

Cavity  
Loft  
External wall  
Internal wall Pipe

**Computing**

Laptops  
Desktops  
Printers  
Monitors

This report shows how, with all existing and planned policy measures and timetabled efficiency improvements in place, and working to optimum effect, we are still likely not to meet the UK's 2020 target for cutting our domestic appliance electricity carbon emissions.



## Conclusions

There is much to celebrate in terms of technical and legislative improvements in the domestic energy sector over the last five years, but there is no cause for complacency yet. We have made progress, across the EU, over the years since *The rise of the machines* was published, and the various policies that have been implemented recently are beginning to bear fruit. Energy use in several historically high-consuming product areas (like lighting and refrigeration) is beginning to show a marked downward trend, and predictions of how things could have looked in 2020 are less pessimistic than they were a few years ago. In particular, the 1-Watt initiative and the EuP (now ErP) Directive are making their influence felt. Saving energy is more mainstream than ever before.

However, the focus on energy saving is predominantly concerned more with the fabric of the home than what goes into it. Indeed, The Green Deal will do much to address insulation and interventions to the fabric of domestic buildings, but not necessarily how we typically live inside them. This report shows how, with all existing and planned policy measures and timetabled efficiency improvements in place, and working to optimum effect, we are still likely not to meet the UK's 2020 target for cutting our domestic appliance electricity carbon emissions.

In short, it is time for us to get rid of the elephant that's sitting inside our living rooms.

We conclude that:

- Policy interventions and product technology improvements cannot be expected on their own to provide the fast, deep emissions reductions we need to achieve within the next ten years. For good reason, policies and legislative frameworks can take time to implement, and their benefits years to bear fruit. Alongside work across the whole domestic electrical supply chain, there needs to be a concerted campaign to change the way people behave at home, to reduce domestic energy demand dramatically – within this decade.
- There needs to be consistent, easy-to-understand and transparent labelling, so consumers can tell which products really do use the least energy in typical, everyday use, and hence will save the most money on their energy bills.
- There is a requirement for simple advice at point of sale to ensure that people are able to buy the most efficient product for their needs. A voluntary initiative that

supports retailers in engaging customers, not only with their initial purchasing needs but with helping to minimise their on-going energy bills by addressing the costs of running appliances, would encourage the purchase of more efficient models.

- With the smart meter rollout imminent, a comprehensive advice campaign should roll out alongside it, in the same vein as the digital switchover campaign, to ensure householders are fully aware of the benefits of energy efficiency and household energy management, and its link to lower energy bills.
- To help curb appliance and energy consumption in new properties, stronger guidelines should be required for new homes. This could fit into a widening of scope to take into account both the fabric of the building and the energy-consuming products that reside within it.
- Energy efficiency advice should be regularly vetted and endorsed under a national scheme to ensure that the information is correct, reliable and consistent. This is going to become particularly important as the new Green Deal is rolled out. Trust is an important aspect for any advisor, and accreditation by an independent, respected body would add weight and credence to the advice offering.

With more and more electronic products in the home, it is more important than ever to ensure that people have access to relevant and timely information, to help them make the right purchases – and to trusted advice on using their appliances and gadgets most energy-efficiently. Energy bills are taking a larger chunk out of household expenditure with each passing year. It is now time for householders to take back control of their bills, and stop feeding the elephant in the living room.

# About Energy Saving Trust

The Energy Saving Trust is the first port of call for independent and impartial advice on saving energy and money.

Times are changing, and so are we. We are to become a social enterprise, and we seek charitable status. This means that we will establish a new charitable parent company, under which will be a non-profit company delivering substantial government-funded programmes and a wholly owned trading subsidiary. This move is driven by opportunities presented by the Green Deal.

Our mission is to find the best ways to change people's behaviour and to introduce energy-saving measures into homes. We do this by providing expert insight and knowledge about energy saving, supporting people to take action, working with business, government, local authorities and others to drive improvements in the energy-saving market, and by providing quality assurance for goods, services and installers.

We are at present a not-for-profit company limited by guarantee.

The Energy Saving Trust was formed in 1992.



**energy saving trust**<sup>®</sup>

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