Phase 2: Exploring the relationship between environmental regulation and competitiveness

A case study on the Energy Labelling Directive

A research report completed for the Department for Environment, Food and Rural Affairs by SQW Consulting

August 2007

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1 Introduction

1.1 SQW were commissioned by DEFRA in 2006 to conduct a literature review of the available evidence on the relationship between environmental regulation and competitiveness to establish the robustness of the conclusions from the available evidence and their relevance to the UK. This study highlighted the need to conduct further research on the impact of regulatory design & implementation and regulatory form on competitiveness.

1.2 As a result, SQW were commissioned to conduct Phase Two of the research, which sought to 'gather and analyse evidence on the impact of the design of environmental regulation on competitiveness' through the undertaking of a set of case studies. The research examined the following policy issues:

- The impact of business design and implementation of regulation on SMEs as compared to larger businesses
- The forms of regulation most likely to induce innovation
- The importance of context in determining the extent of inducement effects of regulation on innovation.

1.3 Although the study is primarily focused on the UK, the intention was to consider, where available, the impacts of policies elsewhere in Europe and in other parts of the world where they are similar to those implemented in the UK in order to provide comparative evidence.

1.4 This case study discusses 'Energy Labelling (hereafter referred to as EL) on particular household appliances; with a particular focus on the impact of the EU Energy Labelling Directive and the associated Minimum Efficiency Performance Standards (hereafter referred to as MEPS) on specific household appliances in the UK. Comparator evidence is also drawn from Labelling and MEPS schemes used in different countries, with a focus on the US experience'. This case study was selected, as it provides a cross-border comparison of the design and implementation of energy labels and also attempts to assess the competitiveness (and trade) impacts of the labels.

1.5 The material used to produce the case study has been derived from an extensive review of the literature and consultations with individuals covering the areas of policy, industry and academia. More details on the sources of evidence can be found in Annex B.

1.6 The next section of the case study describes the concept, design and implementation of the EL in the UK and other countries in more detail, the environmental problem that it is attempting to address and how this relates to the household appliances sector. Section three outlines any evidence on the effectiveness of the regulation to date in terms of economic and environmental outcomes. In Section four, the discussion focuses on the influence that the regulation has had on innovation, productivity and competitiveness. A summary of the case study and concluding observations are set out in Section five.

2 The Energy Labelling Directive

The environmental problem: nature and extent

2.1 The issue of climate change is currently high on the agenda of both Government and industry where one of the main contributors to this problem is the production of electricity through the combustion of fossil fuels. Although the development of electricity generation from renewable technologies is alleviating a small component of this issue, non-renewable energy sources still constitute a significant majority of total electricity production (95.8% of the total electricity production1, in the UK). This issue is compounded by the considerable increase in the consumption of domestic electricity witnessed across the world over the last twenty years, as a result of a significant increase in the use of household electrical appliances. Therefore, there has been escalating pressure on individual Governments and the EU to influence and educate consumers to reduce their energy consumption.

2.2 The introduction of Energy Labelling and Minimum Energy Performance Standards designed to reduce the energy consumption of household appliances is one of the ways in which this effort has materialised.

The concept of the energy label (EL) and minimum efficiency performance standards (MEPS)

2.3 The EL is an information based instrument which seeks to draw consumer attention to the energy consumption of an appliance, thereby enabling an individual to make a comparative judgement on the efficiency of the different appliances available. These have generally taken two forms: *Comparison labelling*, which enable the consumer to compare the efficiency of all products of a particular type e.g. refrigerators, and are used in Europe and the USA (Energy Guide) and; *Endorsement labelling*, which simply awards a label on the basis of a pass/fail efficiency test e.g. Energy Star in the USA.

2.4 Key examples of the EL have been implemented on both a mandatory and voluntary basis, where the comparison label is usually applied as a mandatory instrument, whereas the endorsement label has been implemented on a voluntary basis.

[1] Department of Trade and Industry (DUKES Table 7.4), October 2006

2.5 MEPS seek to impose a minimum energy efficiency standard or a maximum consumption for all products within a certain category. They have also varied in their development and application, where for example:

- **Europe -** uses a statistical approach where the energy efficiency witnessed in the market at the time of the setting of the regulation was used as the basis for the categorisation. The standard was then developed so as to achieve an improvement of 10-15% in the average efficiency of new appliances.
- **US –** uses a technical-economic approach where the standards were set to achieve an increase in energy efficiency up to a specified level which corresponds to a maximum return on investment of three years for the consumer.
- **China –** standards were developed, with no preliminary research, in consultation with manufacturers.

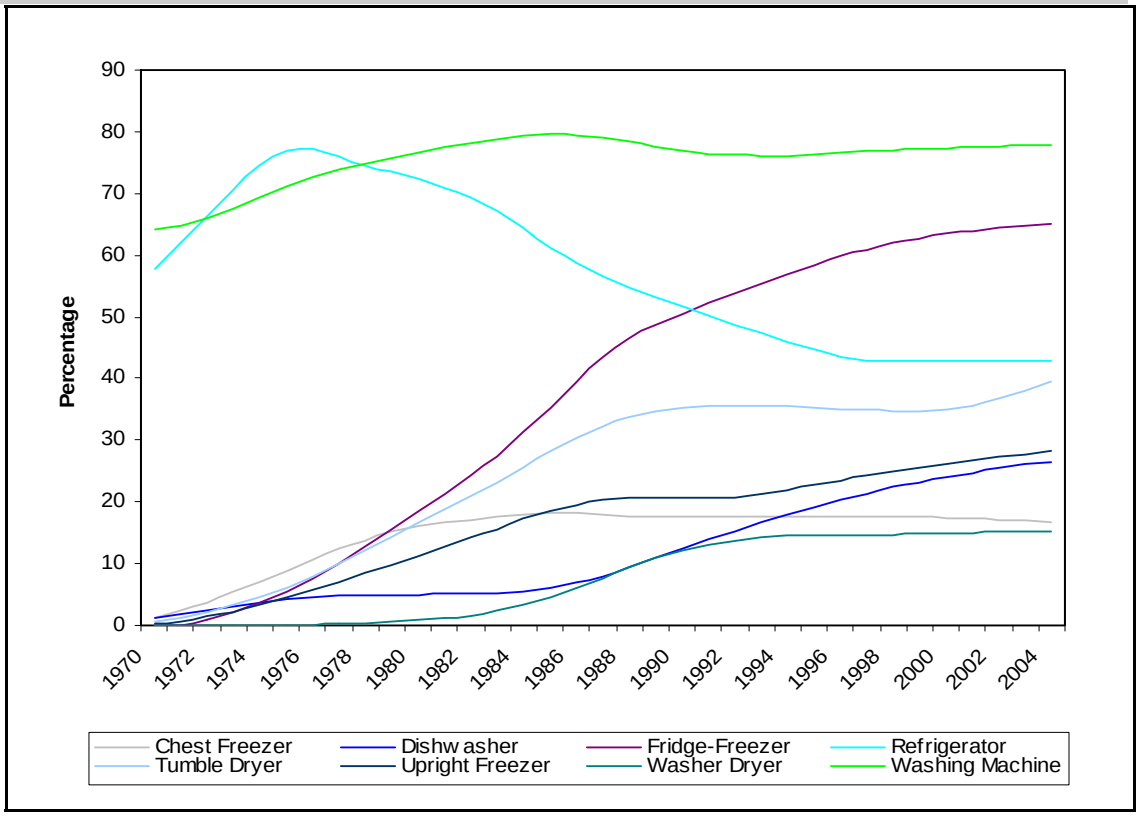
Trends in UK energy consumption

2.6 Since 1970, the UK has witnessed an increase in the number of households (risen from 22.1m in 1990 to 24.6m in 2000) coupled with a decrease in the average number of people per household (fallen from 3.01 in 1970 to 2.36 in 20012). This trend, which has been largely the consequence of later/fewer marriages, higher rates of divorce and couples having fewer children, has led to an increase in the demand for domestic appliances.

2.7 Due to advances in technology since 1970, which have resulted in an increase in the variety of electrical appliances available, and the falling real costs in relation to disposable income; there has been an increase in the number of electrical appliances owned per household. Ownership of some electrical appliances, for example the tumble drier, has grown from close to zero percent of households in 1970 to nearly 40% of all households. The only exception to this trend is the refrigerator, which has witnessed a decrease in ownership, caused by a shift in preference towards the ownership of combined fridge/freezers. Figure 2-1 below shows the trends in ownership of the main 'wet' and 'cold' household appliances since 1970.

[2] Energy and Productivity to 2010 – Potential and Key Issues.

Figure 2-1: Percentage of households owning household domestic appliances, 1970 to 2004



Source: Environmental Change Institute

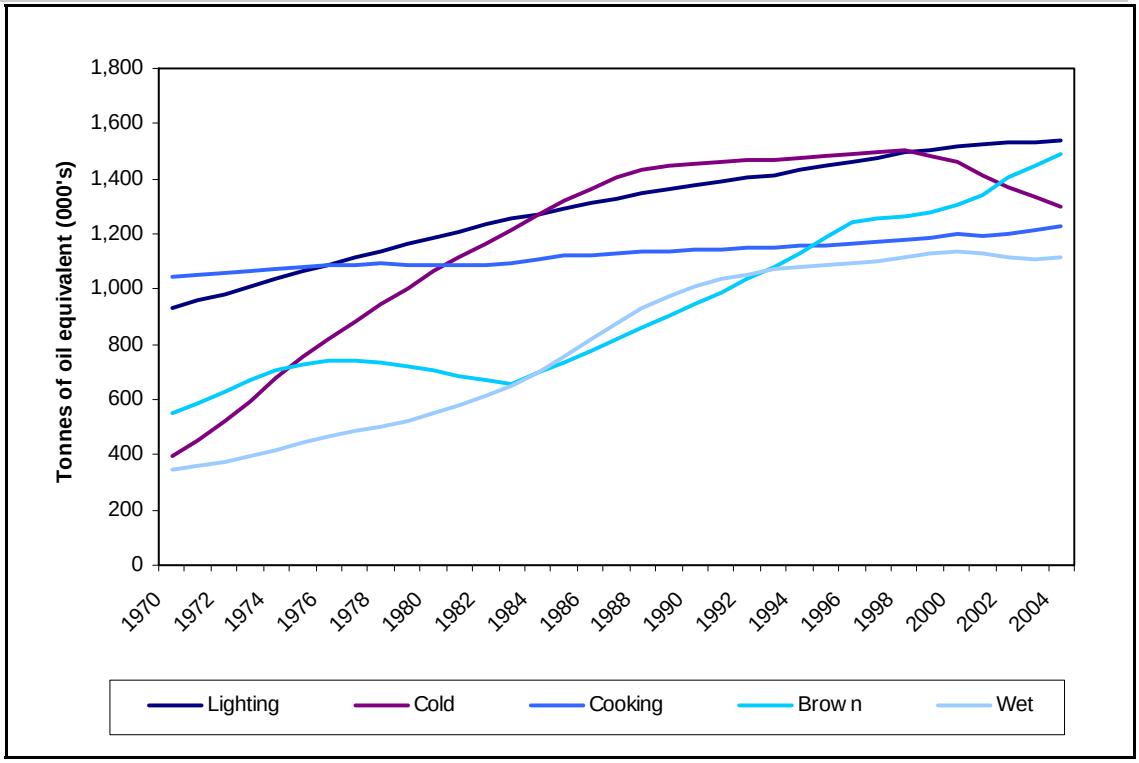
2.8 Similar trends have been witnessed in other developed economies, for example, in 2000, the French economy predicted that domestic electricity consumption would double by 2010 in the absence of energy conservation policies[3]. The rising trend in electricity consumption has also been more recently replicated in newly industrialising economies. Menanteau[4] in 2000 predicted that the growth in electricity consumption may be even higher than has been observed in France; with for example refrigerator sales increasing by 20% per year in China.

2.9 The increase in the number of appliances in operation has resulted in an increase in the total energy consumption per household. Figure 2-2 below shows the increase in the energy consumption of household appliances by appliance group5 since 1970, where energy consumption is measured in tonnes of oil equivalent. The overall picture indicates that energy consumption

[3] Labelling programmes and efficiency standards to control the energy consumption of household appliances: Current situation, main results and recommendations, Philippe Menanteau, ADEME, 2000
[4] Labelling programmes and efficiency standards to control the energy consumption of household appliances: Current situation, main results and recommendations, Philippe Menanteau, ADEME, 2000
[5] Definitions of appliance groups are: Brown goods: Electronic consumer goods -TVs, VCRs, music centres & satellite & cable TV equipment. Cold appliances: Refrigerators, freezers and combined fridge-freezers. Cooking appliances: Electric ovens, electric hobs, kettles & microwaves, & small cooking appliances. Wet appliances: Washing machines, tumble dryers & dishwashers. Miscellaneous appliances: Vacuums, irons, electric showers, central heating pumps, PCs & other office equipment.

has significantly increased over the period from 1970-1990 and has witnessed a slow down in growth for most appliance groups from 1990 onwards.

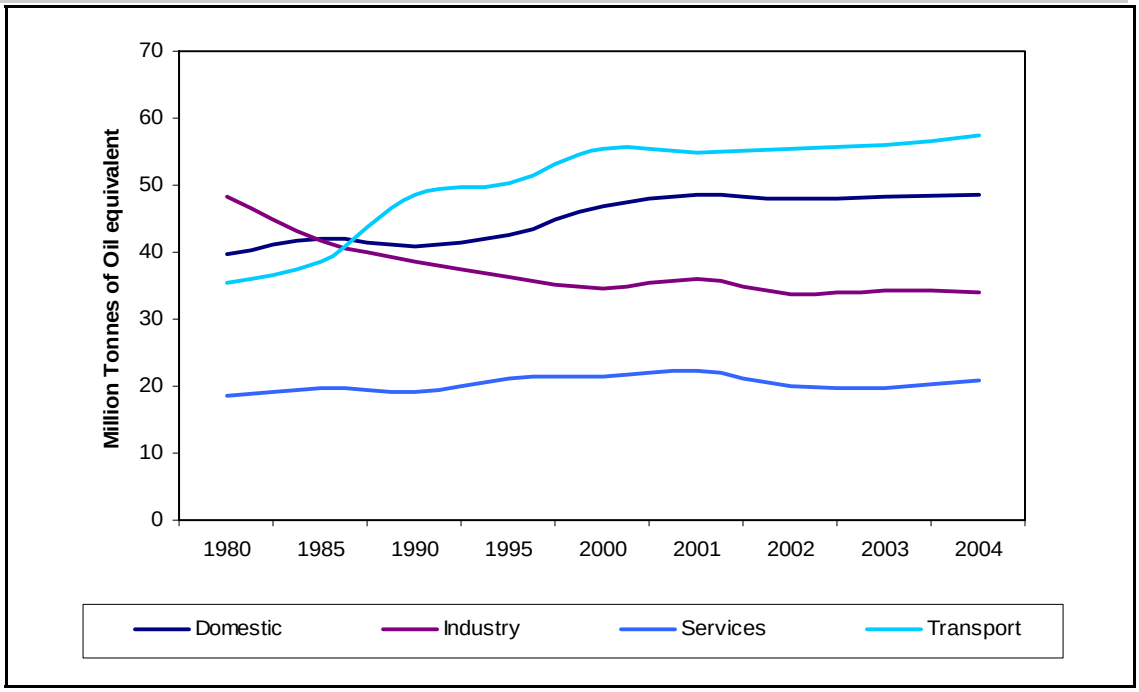
Figure 2-2: Total electricity consumption by household domestic appliances, 1970 to 2004



Source: Environmental Change Institute

2.10 Taking a step back to look at the trends in final energy consumption of the broad sectors in the UK (Figure 2-3), it can be seen that during the period 1980 – 2005, the domestic sector, which includes household appliances and is now the second highest use category of electricity, has seen a moderate increase in energy consumption (22% of the 1980 level in 2004, an increase of 8.9 million tonnes of oil equivalent) in comparison to other uses. Energy used by services has risen by only a small amount (2.1 million tonnes oil equivalent) whilst the transport sector has risen from being the second lowest of the four use categories to the highest user of energy (an increase of 62%). Industry however, has considerably reduced its total use of energy by 14.2 million tonnes oil equivalent over the period.

Figure 2-3: UK Final energy consumption 1980 – 2005



Source: e-Digest of Environmental Statistics, September 2005, Defra.

2.11 The UK introduced the EL following the implementation of the European Commission Energy Labelling Directive as a means of decreasing the growing levels of domestic energy consumption.

The Energy Labelling Directive

Policy objectives

2.12 The energy-labelling framework Directive was issued by the European Commission on the 22nd of September 1992, when the Council of the European Union unanimously adopted a framework directive for the mandatory energy labelling of household products (92/75/EEC). The Directive delegated the responsibility to prepare and adopt detailed application directives for specific product types to the European Commission. These applications were then implemented in the UK through statutory instruments made under section 2(2) of the European Communities Act 1972.

2.13 The Energy Label became mandatory for cold appliances for the Members States in 1995, with effective introduction in European countries dependent upon national legislation. In the UK, display of the energy label became compulsory for all cold and wet (washing machines, dryers) appliances and is currently under consideration for different appliances.

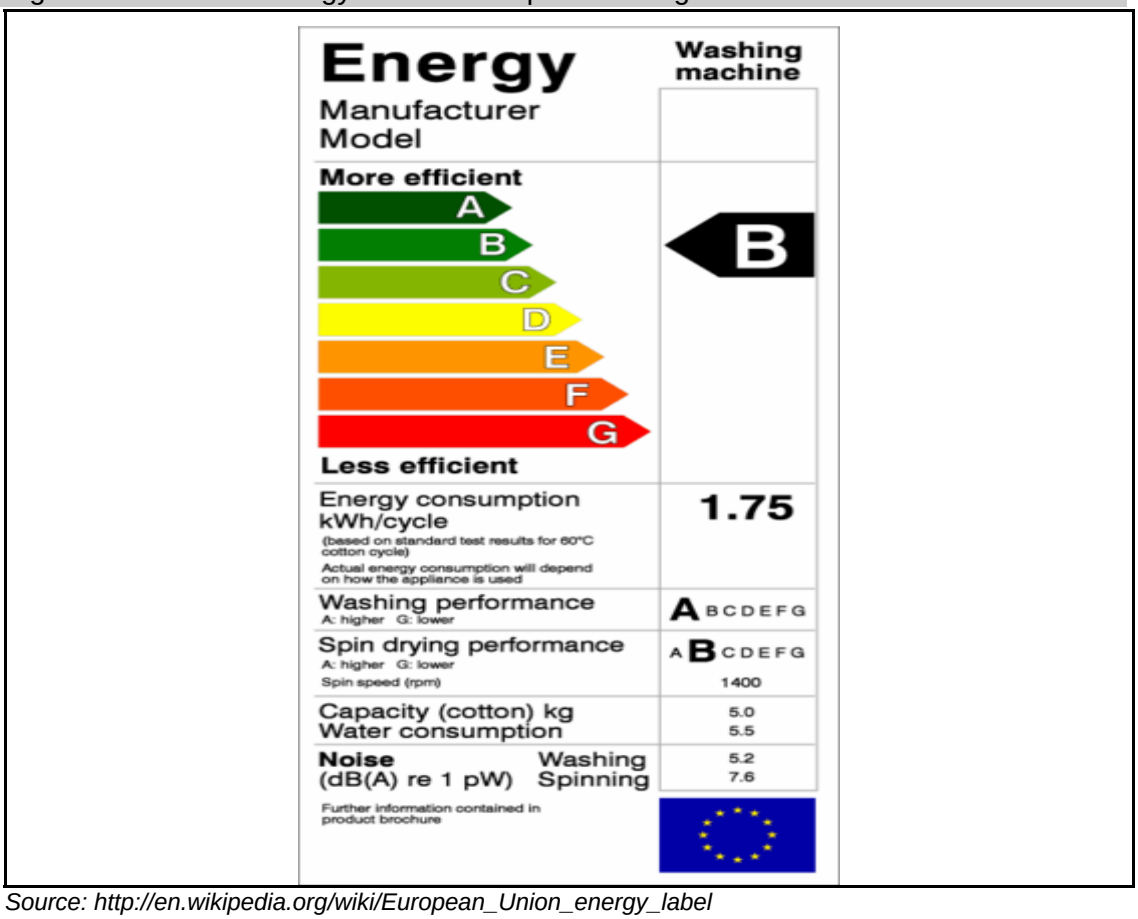
2.14 The aim of the labelling programme is to facilitate the comparison of energy consumption between different appliances in the European Member countries.

The most important part of the label is the **energy efficiency rating scale** which provides a simple index of efficiency, thus enabling consumers to make a considered choice in making a purchasing decision. This mechanism sought to stimulate purchase, and as a consequence, the manufacturing and retailing of more energy-efficient appliances. The Label was also aimed at removing energy consuming models from the market and as such to facilitate the introduction of minimum energy performance standards (MEPS) at the European level.

2.15 MEPS sought to remove the most inefficient products from the market by stipulating that manufacturers, importers and retailers were no longer allowed to sell cold appliances belonging to energy classes G, F, E and D from September 1999.

2.16 The Energy Label was designed in the wake of the failure of the original Energy Guide Label in the US, which had been too complex in its nature. Therefore, careful consideration was taken to ensure the format and content were clear and easily accessible to the target audience. The resultant Label, the 'Master Label' is the same throughout Europe, where energy efficiency is categorised on a scale from A (high efficiency) to G (low efficiency), with a corresponding colour code (from green to red) – this is illustrated below:

Figure 2-4: The EU energy label – example: washing machine



Source: http://en.wikipedia.org/wiki/European_Union_energy_label

Policy implementation

2.17 Suppliers are required to provide labels and information notices relating to the energy consumption and certain other performance characteristics, as appropriate, of their products.

- **Suppliers** are defined as the manufacturers of a product, the manufacturer's authorised representative in the Community or the person who places the product on the Community market.

2.18 Dealers must ensure that all products displayed to end-users are appropriately labelled (i.e. the correct label is used and it is attached to the top or front of the product and is not obscured), and that consumers are provided with suppliers' information where available.

- **Dealers** are defined as retailers or other persons who offer for sale, display or sell a labelled product to end-users.

2.19 Officers from local authority Trading Standards Services (Department of Enterprise, Trade and Investment in Northern Ireland) carry out enforcement of the statutory instruments. There are powers for officers to seize and detain records, and in certain cases, appliances.

Policy eligibility and exemptions: the affected appliances

2.20 The Directive applies to the following types of household appliances, even where these are sold for non-household uses:

- refrigerators, freezers and their combinations
- washing machines, dryers and their combinations
- dishwashers;
- ovens;
- water heaters and hot-water storage appliances
- lighting sources
- air-conditioning appliances.

Complementary energy labels

2.21 In addition to the combination of the EL and MEPS, the UK has also implemented a set of voluntary labels – for example, the Energy Saving label (indicating a Grade A or better - shown in Figure 2-5) and industry are given

the opportunity to develop voluntary measures and implement schemes in advance of statutory measures so as to gain front runner advantages.

Figure 2-5: The Energy Saving label

Source: http://www.energysavingtrust.org.uk/energy_saving_products/other_energy_labels

2.22 At the European level (and therefore within the UK), the US Energy Star Programme (please see below for further details) has been adopted for office equipment such as computers, monitors, fax machines, scanners, photocopiers and printers and industry are voluntarily increasing their efficiency standards.

2.23 The EU has also implemented an 'Ecolabel' which indicates that a product has been independently assessed and found to meet strict environmental criteria (considering more than just energy consumption), putting it among the best in its class. The Ecolabel uses a flower logo to signify that a product meets the scheme's standards, where ecolabelled electrical appliances indicate that the achievement of very high energy efficiency levels.

Figure 2-6: The European Ecolabel

Source: http://www.defra.gov.uk/environment/consumerprod/ecolabel/index.htm

Comparative instruments used across other countries[6]

The USA

Mandatory instruments

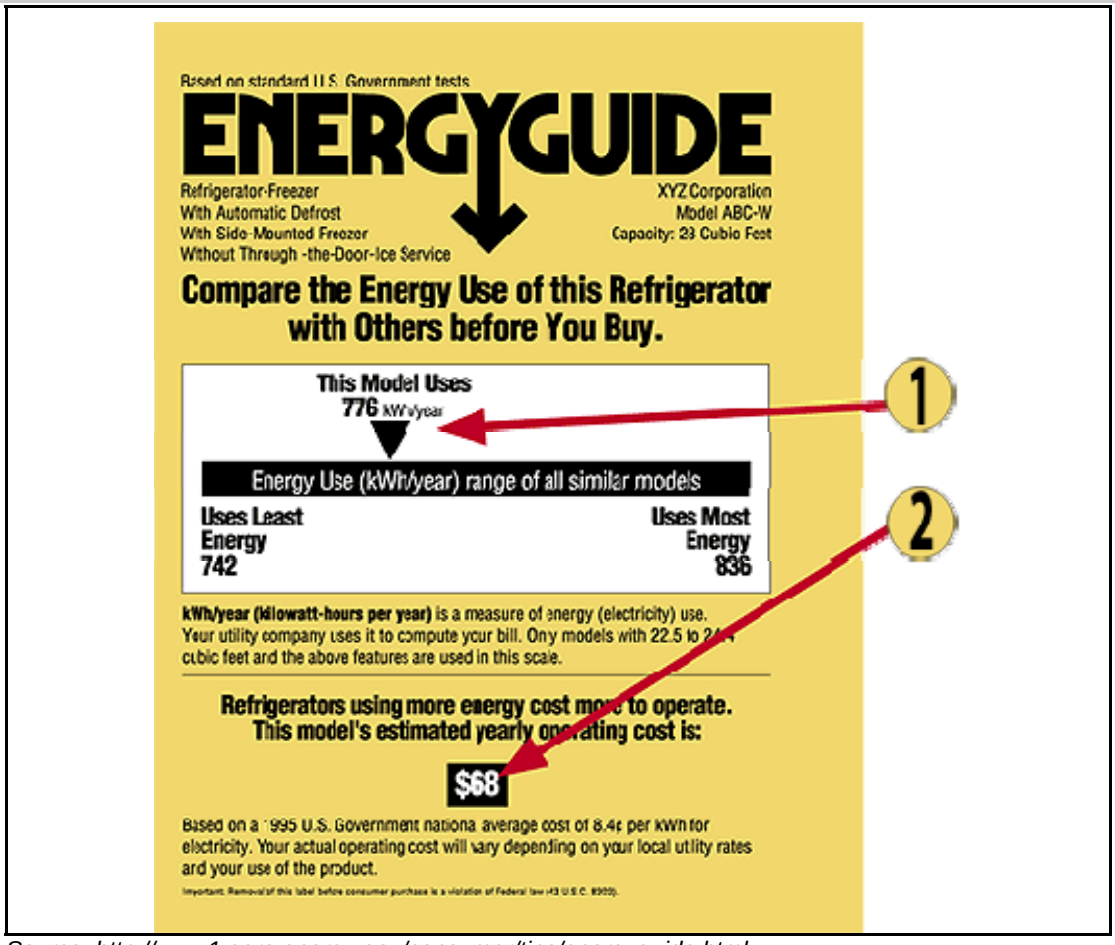
2.24 The mandatory energy labelling of appliances was implemented in May 1980 as the Energy-Guide program. This required the energy usage labelling of refrigerators, freezers, dishwashers, water heaters, room air conditioners, clothes washers and furnaces and further additions have included fluorescent lamp ballasts and lamps, compact fluorescent lamps and general service incandescent lamps.

2.25 This instrument was accompanied by the introduction of MEPS as part of the National Appliance Energy Conservation Act (NAECA) in 1987, which were formally implemented for most major types of residential energy products during the 1990s. Refrigerators, freezers, water heaters and room air conditioners were subject to MEPS in 1990, which were updated in 1993 and in 2001.

2.26 The Energy Guide Label (EGL) has been updated to provide two pieces of information (please see Figure 2-7 below): firstly, energy usage information sourced from government tests, which is similar to the EU EL concept, except that this is displayed as a point on a continuous scale of Kilowatts per year; and secondly the estimated energy cost in dollars that the appliance would potentially use in a year.

[6] The material in this section is sourced from case studies conducted on behalf of the World Energy Council, alongside information gathered from international consultations.

Figure 2-7: The Energy Guide Label



Source: http://www1.eere.energy.gov/consumer/tips/energyguide.html

2.27 The Department of Energy (DOE) collects annual data each year for the EGL to enable continuous updating of the energy usage range of Kilowatts (i.e. this falls to a lower range each year) and hence ensure the label takes market transformation into account. This annual review also feeds into the setting of the Energy Star label (please see subsequent section for further details), which is intended to include roughly the most efficient 25% of the market.

Voluntary instruments

2.28 In 1992 the US Environmental Protection Agency (EPA) introduced Energy Star™ (ES) as a voluntary labelling program designed to identify and promote energy efficient products to reduce greenhouse gas emissions[7]. Computers and monitors were the first labelled products. Figure 2-8 illustrates the label:

[7] http://www.energystar.gov/index.cfm?c=about.ab_history

Figure 2-8: The Energy Star label

Source: http://www.energystar.gov/index.cfm?c=windows.display_unit_labels

2.29 Throughout 1995 EPA expanded the coverage of the label to include additional office equipment products and residential heating and cooling equipment. In 1996 EPA partnered with the US Department of Energy for particular product categories. The ES label is now covers all major appliances, office equipment, lighting, home electronics, and therefore covers a broader range of products than the MEPS. EPA has also extended the label to cover new homes and commercial and industrial buildings.

2.30 The ES brand is managed by the EPA and DOE in a similar fashion to general corporate branding and therefore once a manufacturer has signed up to the scheme, they must adhere to the strict guidelines surrounding the usage of the logo. Our consultation process indicated that ES promoted competition in the market and that manufacturers used the logo as a marketing tool as it was seen as a positive feature of a product in the sense that it denoted a certain level of quality.

2.31 The EPA has used all the available forms of media to raise awareness of the label and has actively involved firms in this promotion. This marketing has been successful, where the EPA in 2007 reported that approximately 70% of US adult consumers recognise the logo.

2.32 Updates to the ES minimum efficiency level are made by DOE only when market conditions warrant this, for example when changes occur in innovation, technology, consumer behaviour, demand or energy costs. The voluntary ES level is always set above the mandatory MEPS, therefore any

increases in the MEPS are mirrored by ES in order to continue to promote innovation.

2.33 Continuous industry consultation is conducted by the EPA in the form of an 'open door policy' where industry representative bodies as well as individual firms are encouraged to engage in the process. The voice of manufacturers is also noted as part of the federal government consultation process, who relay relevant information to the EPA. The EPA also request and encourage firms to provide them with advance information on new technologies to ensure the accurate re-setting of the ES level.

2.34 Canada has mirrored the implementation of the majority of US mandatory and voluntary EL schemes as a result of having a common market for tradable goods with the US and therefore witnessing similar market trends. Therefore the Canadian market has experienced a similar transformation as the US.

Japan

2.35 MEPS for appliances were introduced in 1979 under the Energy Conservation Law as a reaction to the oil shocks. Unlike other similar schemes, Japanese standards set a lower limit for the average efficiency of each manufacturer's shipment when each appliance is subject to either the European or US systems.

2.36 The original Law imposed standards on both refrigerators and air-conditioners, however, the former was removed form the scheme in 1984 as a result of all manufacturers exceeding the targets. The removal of refrigerators was accompanied by the inclusion of fluorescent lamps, televisions, heat pumps, copiers and computers.

2.37 Revisions were made to the Law in June 1998 to reinforce previous standards, which were accompanied by the establishment of the Top-Runner Program (TRP), where standards are set according to the efficiency level of the most efficient products available in a given category. TRP also includes the stand-by consumption in the calculation of the energy efficiency index for equipment such as televisions, video recorders and computers, as a result of stand-by mode representing up to 85% of annual energy consumption (for VCRs).

2.38 The standards are considered mandatory in the sense that manufacturers would not risk the negative publicity associated with the failure to achieve the standards.

2.39 The remainder of the report will focus on the EL and the associated MEPS Programme in the UK, accompanied where possible by a comparative discussion of other systems.

3 Effectiveness of policy

Effectiveness of policy form and design in achieving environmental outcomes

Policy design and implementation

3.1 A consultation exercise was conducted prior to the implementation of the Directive in the UK, primarily as a means of creating an advanced warning to industry. This facilitated the opportunity for manufacturers to react and adapt to fulfil the requirements of the impending regulation. This consultation exercise was limited in its scope as the Master Label was designed at the European level and hence was largely influenced by European Associations.

3.2 Our discussions highlighted the short-sighted nature of the design of the Master Label, which was originally designed for implementation in the cold appliances sector and consequently, has not been as applicable for other products which have now been included in the Directive. However, maintaining the same label for all relevant products has ensured consistency for manufacturers, which has minimised the legislative burden imposed by the scheme.

3.3 As part of the implementation procedure, Defra produced guidelines and set up the Market Transformation Programme (MTP) in 1998 in anticipation of more labelling directives being developed. Therefore, this development acted as a pre-emptive measure to ensure the collation, monitoring and dissemination of data on the scheme. Defra also operate an open consultation process through the MTP, which gathers evidence about affected products and consults with industry about this information to see whether they consider the evidence to be realistic.

3.4 The labelling scheme is viewed to be relatively flexible in its nature to accommodate a range of products, where for example, the scheme has recently been applied to buildings. However, it was generally felt that flexibility had been constrained by involvement at the European level and the associated requirement to adhere to the over-arching EU Directive.

3.5 The categorisation and associated energy efficiency rating scales were set at the time of implementation of the regulation and hence were informed by the industry spread that prevailed at that time - there were a certain proportion of products which already lay at the top of the categories and moreover, categorisation setting was heavily influenced by industry.

3.6 Local Authority Trading Standards (TS) enforcement of the regulation has been complex owing to the nature of locally based budgets and resources to police the scheme, which may affect the comprehensiveness of monitoring procedures. It was also felt that the Local Authority nature of the TS may also impede the use of a joined-up approach to enforcement. However, it was felt that this had improved over time, which had been furthered by the recent involvement of the MTP who have begun to spot check appliances and are working closely with TS to pursue appliances that are not meeting standards. The monitoring procedures of the Directive are currently under review.

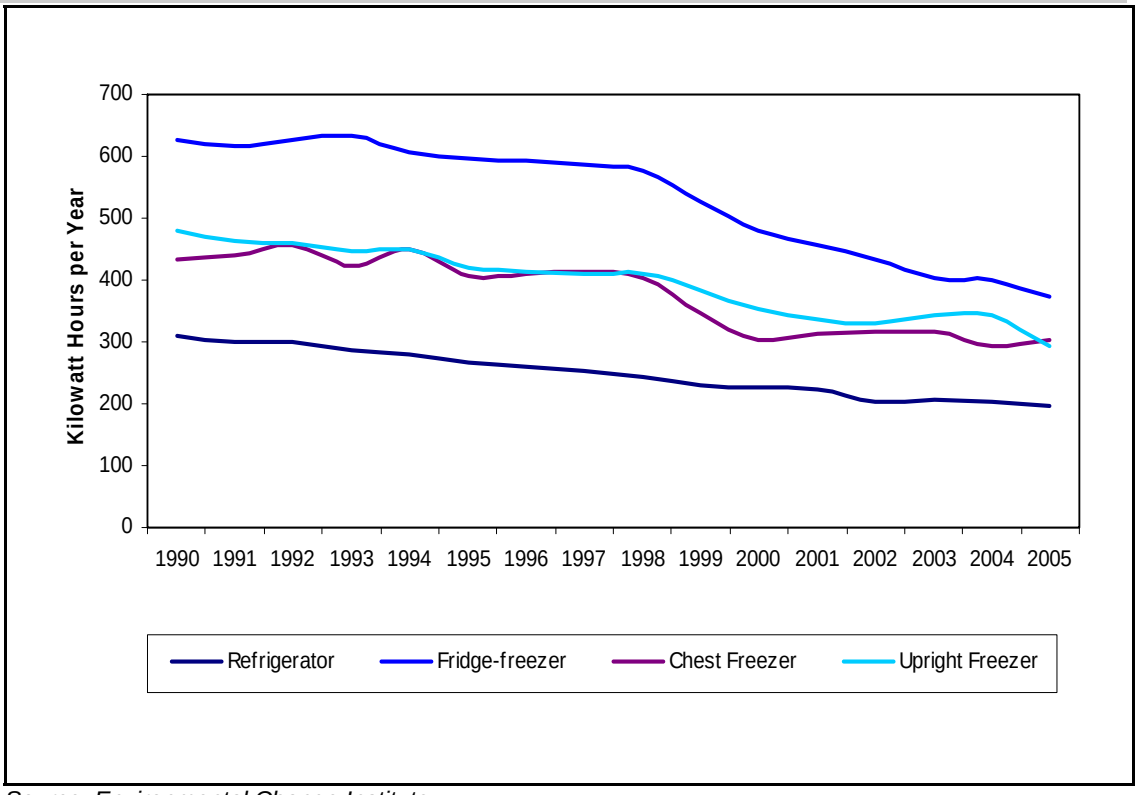
3.7 Looking specifically at compliance, during the first years of the legislation, there was a significant proportion of models which were not or improperly labelled either because the manufacturers had failed to provide the label or as a result of reluctance on the part of the retailer to display the label on the least efficient models. Therefore, as the EL and MEPS are rolled out to more products, enforcement may need to become more comprehensive in order to reduce the temptation for people to cheat.

3.8 Although the Label has not been subject to review since its inception, two further categories, A+ and A++, were added to the efficiency scale in 2004, as a means of stimulating further improvements in efficiency.

Progress towards environmental outcomes: the evidence

3.9 There has been a general trend in the increase in the energy efficiency of domestic appliances (i.e. the reduction in the electricity used per year by an appliance) in the developed world. This is due to improvements in technology allowing manufacturers to produce more efficient appliances before the introduction of energy labelling and MEPS. Over the period 1990 to 2005, a downward trend can be observed in the electricity consumption of cold household appliances (the appliance group that energy labelling in the EU first applied to). Figure 3-1 below shows this trend for four types of cold appliances measure in kilowatt hours per year. Energy efficiency for new cold appliances improved most for chest freezers and fridge-freezers, which consumed 39% and 40% less electricity respectively in 2005 than they did in 1990.

Figure 3-1: Energy usage of new cold appliances, 1990 to 2005



Source: Environmental Change Institute

3.10 The question to address now therefore is whether any of the trend described above is attributable to the EU interventions regulations discussed in this case study. There is evidence that the EU energy labelling system has led to improvements in the energy efficiency of products used by households as well as purchasing behaviour and hence the manufacture of more efficient products in place of less efficient ones.

3.11 Ricci in his 2006 presentation to the European Union, Latin America and Caribbean Experts' Seminar on Energy[8] demonstrated the projected trends between 2000 and 2025 for the France-wide energy savings of both the energy labelling policy and the MEPS in the EU based on extrapolated trends up until 2006. EU Energy labelling was projected to save 0.5 million tonnes oil equivalent over the period compared to the 'no measures' energy consumption trend, whilst the minimum efficiency standards were predicted to save 3.1 million tonnes oil equivalent. It is clear therefore that given current trends, MEPS are expected to create a much larger saving in the long term than the EU energy labelling policy. The predictions in Ricci's piece are based on the assumption that all sales of cold and wet appliances in France will be 'A' rated by 2020 compared to a market share in 2000 of 18% for cold appliances and 35% for wet appliances.

[8] A.Ricci (2006) 'Evaluating the Impact of Energy Efficiency Policies', Istituto di Studi per l'Integrazione dei Sistemi.

3.12 It is also possible to track more closely the energy efficiency levels of appliances produced around the time that the EU Energy labelling became mandatory (1995) to analyse the change in behaviour that the labelling policy brought about. Waide in his lecture on the Market Analysis and effect of EU labelling and standards[9] looked at cold appliance sales in 11 EU countries including the UK in 1994, 1995 and 1996 (i.e. a year either side of the mandatory labelling being introduced) and compared this to a period of the same length in 1990-1992 for historical comparison. Waide found that there was a distinct increase in the energy efficiency of appliances produced in the form of an increase in percentage share of sales of C, B, and A rated appliances (in that order) compared to a reduction in D, E, and F rated appliances over the 1994-96 period. The reduction in sales of D, E, F and G appliances and the converse increase in A, B and C rated appliance sales was particularly marked between 1990/2 and 1996. For example, C rated appliances represented 16% of the market share over 1990-92 and this rose to 31% in 1996.

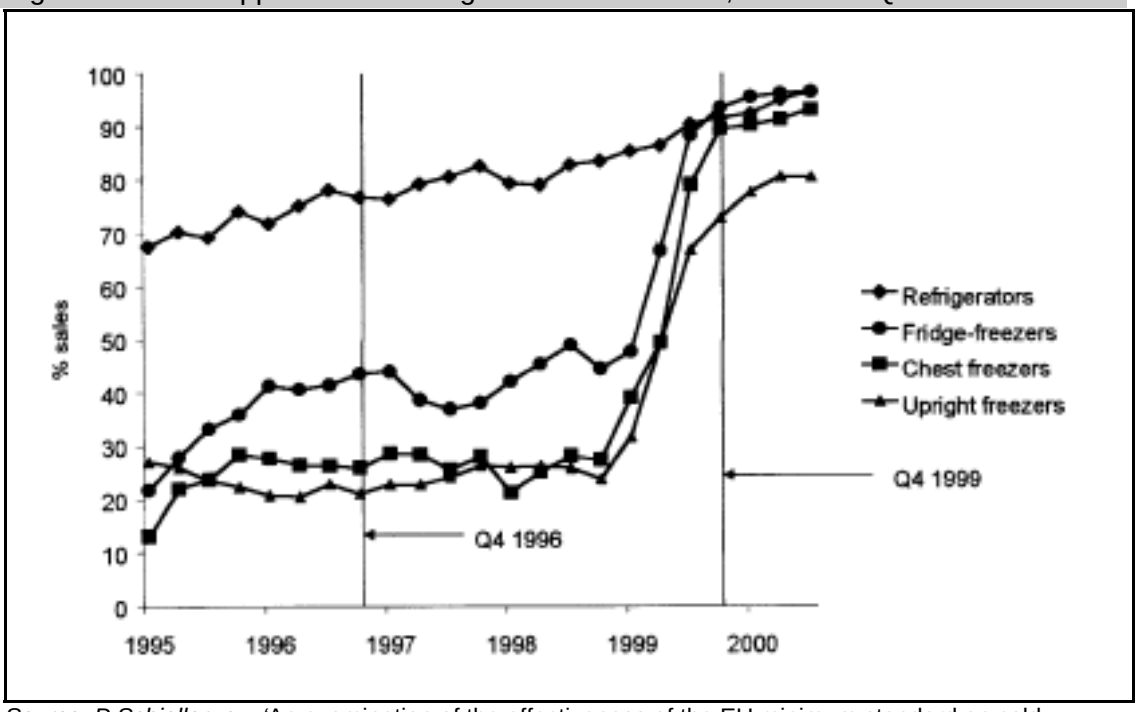
3.13 Waide also used an energy efficiency index to measure improvements in energy efficiency on a constant scale. This gives a percentage above 100% if the appliance consumes an above average amount of energy over a year (where the average appliance is in the 'D' category). He demonstrates the shift in the average efficiency of appliances for each of the 11 EU countries used to make up his dataset. The UK lagged behind most other EU countries in 1996 immediately after the introduction of the mandatory labelling, in terms of the average energy efficiency of a cold appliance (reduction from 107.5% to 101.7% average index score from 1990-1996). The EU average fell further - from 100.2% to 90.7% over 1990-1996. The highest reduction in the index was observed in Germany where the average index score fell from 95.4% to 77.8% over the same period. This means that despite identical mandatory labelling in both the UK and Germany, the average cold appliance in the former used 31% more energy than in the latter in 1996.

3.14 The success of the MEPS, which came into force in September 1999, is documented empirically in the 2002 paper by P Schiellerup – '*An examination of the effectiveness of the EU minimum standard on cold appliances: the British case'*. This paper shows that the proportion of total sales of cold appliances meeting the minimum standard over the period 1995 – 2000 (Quarter 3) rose considerably. The background trends presented in Figure 3-1 show that on the basis of historical rates of efficiency improvements only the refrigerator market was close to meeting the minimum standard. Immediately

[9] P Waide, 'Market Analysis and effect of EU labelling and standards: The example of cold appliances, Energy Efficient Equipment – Overview and Labelling, No date.

prior to the deadline for the enforcement of MEPS, there was a significant jump in the proportion of sales meeting the minimum standard from Quarter 1 1999 to Quarter 3 1999. Schiellerup proposes that for the UK market "without minimum standards, the improvements shown from the first quarter of 1999 would have happened much more slowly".

Figure 3-2: Cold appliances meeting minimum standard, GB 1995–Q3-2000.



Source: P Schiellerup – 'An examination of the effectiveness of the EU minimum standard on cold appliances: the British case' 2002

3.15 Schiellerup's paper also presents the actual percentage reduction of average energy consumption between 1992 and Quarter 4 of 1999 when the MEPS were implemented. This shows all of four types of cold appliances (Refrigerators, Fridge-freezers, Chest Freezers and Upright freezers) reduced their average energy consumption over the period by between 20% and 33% (Chest freezers displayed the largest reduction). This reduction far exceeded the MEPS target of a 15% reduction of the 1992 level by Quarter 4 of 1999. Schiellerup also demonstrated that MEPS did not increase prices to consumers in the UK, thereby indicating the overall success of the instrument.

3.16 Looking at the Europe wide programme, data from 1994-1996 (Menanteau, 2000) on the sales of cold appliances by energy class indicated a significant shift in sales towards more efficient products. This has largely been a result of technical progress, an evolution in consumer preferences and the introduction of energy labelling combined with the anticipation of the introduction of MEPS. The report also shows that the average electricity consumption of new appliances has been decreasing over a period of 30 years in European

countries, where the UK has witnessed a decrease from 710 kWh/yr in 1975, to 645 kWh/yr in 1995 and 523 kWh/yr expected in 2010 for fridge-freezers.

3.17 The paper also concluded that the introduction of the Energy Label has encouraged this market transformation with a progressive shift of sales from low efficient to efficient classes: F and G from 20% to 15% between 1995 and 98, D and E from 57% to 50%, and B and C from 23% to 35%, respectively.

3.18 The Energy Efficiency Innovation Review conducted by the UK Government in December 2005 found that although market penetration by energy efficient class 'A' products has increased steadily since 1999, the A+ and A++ had proved less effective in comparison to the rest of Europe. This is likely to be the result of the uncompetitive costs associated with producing the appliances which meet the additional classes.

3.19 In relation to costs, a report on the installation of energy efficient appliances in new private sector homes in 2004 by National Energy Services[10] calculated the cost benefits to a household over a ten year period of installing 'A' rated instead of 'C' rated appliances in the UK. The largest cost saving was found to be for washing machines (£8.01 per year) and the lowest was for Dishwashers (£3.58 per year) once the notional additional cost of installing a 'better' appliance in the first place was taken into account.

Contextual influences

3.20 EU geographic variations have held a significant influence on the effectiveness of the label - the cheaper electricity in the south has led consumers and manufacturers to place less of an importance on energy efficiency people, whereas Northern Europe has always been more conscientious and has suffered from higher energy prices, thereby creating a more significant influence towards efficiency. Although the UK used to mirror the southern European character in this field, it has recently moved to conform to the thinking of Northern Europe.

3.21 The influence of retail staff on the effectiveness of the energy label has been observed in several countries and therefore well-informed salespersons may enhance the effectiveness of the Label by inducing the purchase of more energy efficient appliances.

[10] National Energy Services and Pilkington Energy Efficiency Trust, 'The Appliance of Science: a research study into the installation of energy efficient appliances in private sector new homes', 2004.

Progress towards environmental outcomes: appropriateness of the policy instruments

3.22 Discussions with policy and industry stakeholders indicated that no one policy instrument is effective by itself and the effectiveness of a suite of measures will vary according to the relevant appliance. Anecdotal evidence supports this notion, where Menanteau (2000) advocated the use of both a labelling and MEPS scheme, where the former stimulates technological innovation and the introduction of new more efficient products, while standards complement this development by organising the gradual removal of the most inefficient products from the market.

3.23 As discussed in Chapter 2, the UK has also implemented a set of complementary energy related labels as a means of providing further stimulus to the market however, it is currently unclear how these additional measures have aided the decrease in the average consumption of energy. The UK is also considering the use of further mandatory/voluntary measures and are currently consulting retailers to assess what they currently sell as a means of initialising an agreement for them to buy a certain level of efficient products on average.

3.24 Anecdotal evidence highlights the need to consider the following factors during the design of an EL and MEPS scheme:

- **The phasing of the implementation of the package of instruments** - It is considered most effective and least disruptive to the market to introduce the label first in order to induce manufacturers to adapt, innovate and produce more energy efficient appliances and to follow this with the implementation of MEPS to instigate a step change to remove inefficient products from the market.

- It is also imperative that a **labelling scheme is valued by industry** and in conjunction with this, that **MEPS require strict enforcement** in order to be effective at cutting inefficient products out of the market.

- Consideration must also be given to the **speed at which the market transformation is required** - for a rapid transformation, there is a need for both financial incentives for consumers to induce them to buy a certain product and a set of manufacturing subsidies to encourage the production of more efficient products. Alternatively, when the transformation of the market is required over a longer period of time, incentives are not required, although they may increase the overall effectiveness of the regulation. In both cases, it is important to note that the earlier the regulation is discussed and announced before

implementation, the earlier a signal is made and the lower the cost implications for manufacturers.

Effectiveness of policy form and design in achieving economic outcomes

3.25 Discussions indicated that manufacturers were warned well in advance of implementation of the Label and hence sought to re-design their products and absorb the impact of the regulation prior to its implementation. Industry was also largely aware that the Labelling regulation would be closely followed by the introduction of MEPS and as a result sought to up-grade or remove inefficient models from their production lines in anticipation.

3.26 It was largely felt that the policy instruments had successfully influenced manufacturers to increase the efficiency of their products, which had resulted in a shift in the range of products available on the market consumers. However, although approximately 70-80% of all cold appliances are now 'A' rated in the UK, consumer preferences remain largely influenced by the cost of an appliance.

3.27 There is little evidence to support the notion that costs have been passed on to consumers. However, consideration must be given to the fact that a number of the higher efficiency products are more expensive per se, as manufacturers have had a tendency to include additional luxury features on their most efficient products, as a means of branding the product above its counterparts.

3.28 And finally, in considering changes in the demand for household appliances, the increase in demand witnessed in the market since the implementation of both the Label and MEPS can be attributed to the increase in the number of households and has not been the result of the policy instruments.

Comparisons with other systems

Japan

3.29 Although there has been relatively few evaluations of the Japanese instruments, Menanteau (2000) and the World Energy Council reported significant efficiency improvements between 1978 and 1983 (the first standards target year), where energy consumption decreased by 50% for refrigerators and 25% for air-conditioners.

3.30 Menateau also found that improvements required by the MEPS set up in 1994 were too small to significantly stimulate technical change and produce large energy savings. This may have been the result of the non-mandatory nature

The USA

Mandatory instruments

3.31 The original Energy Guide Labelling Program was considered a failure (Menanteau, 2000) as the label contained too much information and was rarely used at the time of purchase. Although this was simplified in 1994, this was accompanied by the introduction of MEPS and hence it is difficult to differentiate between the impact of the Label and the standards.

3.32 Looking specifically at MEPS, the DOE is charged with periodically reviewing and updating the efficiency standards according to the transformation of the market. Menanteau (2000) found that the standards enforced had been most successful for refrigerators and freezers, where the average rated electricity use of new refrigerators declined from about 1725 kWh/yr in 1972 to about 653 in 1994 and was expected to reach 475 kWh/yr in 2001. This large decline in electricity use was accompanied by a 10% increase in average refrigerator size and a drive towards the incorporation of additional efficiency features such as automatic defrost.

3.33 The development of additional features is considered to have been largely stimulated by MEPS and to a certain extent by the ES label also, with the EPA giving anecdotal evidence of manufacturers designing products specifically to meet the ES specifications. It also must be noted though that often increases in energy efficiency are often the secondary effect of another type improvement in the design of the product to meet demand for generally 'better' functioning products.

3.34 The 1990 standards required a 10% improvement in efficiency; which many existing models in 1989 and hence the standard was more effective at forcing the least efficient models out of the marketplace. However, the 1993 standards were set at a level (30% improvement) that no products available in 1989 could meet, which induced manufacturers to develop a generation of new products. The improvement in energy efficiency was not accompanied by an increase of prices.

3.35 Our consultation process indicated that MEPS are deemed highly effective and are seen to complement the ES label and other voluntary labelling systems. A mandatory/voluntary complement is considered the best type of

policy design, where a MEPS basis is needed in a consumer goods market to enhance the effectiveness of other voluntary policies and it is often this initial minimum standard that prompts transformation of the whole market. However it was also noted that market transformation can also occur following the establishment of a voluntary programme before mandatory policies become law. Therefore, voluntary schemes are viewed as useful tools to test out the market and gauge at what level any subsequent mandatory standards should be set.

Voluntary instruments

3.36 The reputation and effectiveness of the ES programme was furthered in 1993 when an Executive Order was passed, which ordered Government procurement officers to purchase Energy Star compliant products wherever possible[11]. This endorsement from Government resulted in the majority of product manufacturers achieving the Energy Star Label to create the opportunity to sell their products to the single largest purchaser of office equipment in the USA. Consultation discussions reiterated this as a significant step in raising awareness and the significance of ES.

3.37 In the US context, there are two levels at which voluntary and mandatory instruments can be administered – the state and the federal (national) level. Consultations with US based policy and industry stakeholders indicated that despite the forward looking environmental policy efforts at individual state level, any mandatory restrictions should be passed at the federal level so as to uniformly affect products for sale in every state.

[11] The *Energy productivity to 2010: Potential and Key issues* report

4 Evidence on the influence of regulatory form on innovation, productivity and competitiveness

Assessment of innovation, productivity and competitiveness effects

4.1 H. Geller & S. Attali (2005) in their paper on '*The Experience with Energy Efficiency, Policy and Programmes in IEA Countries*' cited the key drivers of energy efficiency to be:

- On-going technological progress
- Response to rising energy prices
- Competitive forces pressuring business to cut all costs including energy costs
- Government Programmes and interventions.

4.2 This list was largely similar to those expressed during discussions with stakeholders, who also added the growing demand from consumers and retailers for more energy efficient products. In the case of the latter driver, i.e. regulation, it was felt that innovation only occurred in anticipation of regulation and ceased to occur in times of constant regulation. It was also noted that regulation created a competitive pressure to produce energy efficient products and as a result, had driven manufacturers to innovate.

4.3 On the broader subject of the targeting of environmental policies, consultation with the EPA revealed an interesting theory; which suggested that the characteristics of a regulation most conducive to enhancing innovation are those that induce consumers to demand more environmentally friendly products. Therefore the most effective policies are those that display the benefits to consumers at the closest point to the sale of a product. For example, the US population is concerned with the rising price of oil and so behaviour at the gasoline pump is observed to be directly correlated to the latest price fluctuations; as consumers see the price per gallon and pay this at the same point in time. This price has more effect on consumer behaviour than the price of electricity which is seen monthly on a bill by consumers after they have consumed the resource and therefore, the provision of consumer information has a very powerful part to play in the design of voluntary standards.

4.4 Focusing now on the Label and MEPS, Menanteau (2000) found that the energy label in general had positively influenced the innovation strategies of manufacturers. However, he also stated that a labelling programme on its own cannot wholly transform a market and as a result, should be complemented by MEPS.

4.5 Looking specifically at the impact of both labelling and MEPS on innovation in the UK, evidence suggests the household appliances sector witnessed an increase in innovation in anticipation of the implementation of MEPS. However, as a result of the non-stretching nature of the standards, this innovation has been limited and there has been more of an emphasis on cutting out the bottom of the market as opposed to stretching the top of the market. Therefore, in the future, it will be important to set stretching standards which clearly signal the target and intended direction of the market.

4.6 Consultations with key stakeholders revealed the following regulatory characteristics to be most appropriate for enhancing innovation in the household appliances sector:

- **Require a degree of flexibility of outcome** – the inclusion of a grading feature on the label creates the opportunity for a manufacturer to excel as opposed to simply be granted an efficiency status with a label or not. If this flexibility is not present, innovation will be sparse as all payers within a market will do the same things at the same time. Greater flexibility in compliance also benefits the smaller manufacturers in the market as they tend to find it more difficult to meet set standards within a time period compared to larger firms with more financial reserves and production capacity.

- **Stringency of enforcement**- to ensure there is no alternative i.e. ignore, other than to innovate.

4.7 Anecdotal evidence from the US also indicated that the flexibility and stringency of regulation have significant effects on the more vulnerable sections of the demand and supply sides of the market. That is, the success of a policy in all sections of the market needs to be balanced with the level of stringency in order to transform the market in a socially responsible way. For example, market experts have advised the DOE that a MEPS set too high will significantly discriminate against low income households who would currently be able to afford only a small range of appliances, but with the new standard would not be able to afford any appliances.

4.8 In the US, it was largely felt that the combination of the three main ES, MEPS and the EGL instruments had been successful in increasing energy efficiency

4.9 It was noted that a common practice in the US is to either sell or give an old, 'gas guzzling' appliance to another household when a new, more efficient product is purchased; or to continue running the old appliance as a 'spare' in the garage or basement in addition to the new more efficient appliance in another part of the household. Therefore, US based consultations suggested the need for not just consumer information on the true price of products to consumers, but as a means of inducing a long term change in behaviour towards the more environmentally friendly end of the spectrum, consumers require the information to raise their awareness of the implications of their continuing use of old inefficient appliances during the purchase of replacement appliances.

4.10 Anecdotal evidence on the voluntary US based ES programme indicated that manufacturers were actively and voluntarily engaged with the continually progressing ES system to the extent that the ES standard was taken as a target during the development of new products. Therefore, the ES programme is perceived to provide a continuous industry stimulus to develop increasingly energy efficient products, where the voluntary nature presents the opportunity for firms to gain a first-mover advantage in their associated market.

Current limitation of the UK policy instruments

4.11 In order to increase the innovatory effects of the UK (EU based) label (and MEPS) and maintain a cycle of continuous innovation, discussions indicated the need to update the Label efficiency rating categories, which have not been subject to review since their inception over ten years ago. In relation to the MEPS, there is a need to learn from the US example and set stretch targets, set a clear agenda (setting indicative future targets) and set a timetable of regular reviews as a means of taking market transformation and changing consumer preferences into account. It was also clear that the continuous review process will only stimulate innovation if prior warning is given to

industry of when this is to take place, to ensure the opportunity for first mover advantage is not removed from the market.

4.12 There is currently a ceiling on the most efficient rating which has meant that once a manufacturer has achieved this level there is no longer an incentive to innovate. That is, the 'end game' is that everything reaches an A rating, which is no longer difficult to achieve.

4.13 Discussions also highlighted the need to consider innovation in related products such as detergents and their influence on the reduction in the energy consumption.

The use of complementary instruments

4.14 The UK currently gives industry the opportunity to develop voluntary measures and implement schemes in advance of the implementation of statutory measures as a means of gaining front runner advantages. This mechanism is seen as an effective stimulus for innovation, where DEFRA has reported that such agreements with product manufacturers have resulted in improvements to the energy performance of digital TV services, external power supplies, televisions and DVD players; and the removal of inefficient domestic washing machines and dishwashers from the market.

4.15 Discussions highlighted the potential to use more voluntary instruments, which can be tailored to suit a particular market. For example the 'fleet consumption limit' which maintains an agreement across an industry, where firms sign up to produce a limited number of inefficient products. The measure, which is driven by the market and not by Government, has been a success in some sectors which have witnessed an increase in the value of their associated market. Therefore, innovation may be increased by using similar schemes in addition to the Label and MEPS.

4.16 Technology procurement mechanisms have been effectively used in the US in the case of Energy Star, where the purchasing power of the largest buyer in the market i.e. the Government, has been used to influence the products available in the market. As Europe has adopted the Energy Star voluntary measure, this instrument could also be replicated in the office equipment market.

4.17 The US has also implemented a further complement of measures to act alongside the EGL, MEPS and the ES:

- A **tax credit system** has also been introduced into the US market (Energy Policy Act 2005), proposed by AHAM (Association of Home Appliance Manufacturers). This currently provides a monetary

incentive for firms to produce products that either meet or surpass the minimum standard for Energy Star. At the federal level, for example, a manufacturer can claim back a $75 tax break for producing a dishwasher that is 20% more efficient than the Energy Star requirement. The tax credit levels are regularly reset to ensure that the top tax credits are set at a level which is stretches the prevailing industry, hence always providing the incentive to innovate further. This voluntary measure has thus far been deemed a success.

- **Subsidy schemes** are also in place in some US states, which seek to encourage the consumer to purchase the most efficient product on the market. However, owing to the nature of the subsidy - the consumer applies for the subsidy after they have paid the full cost of the product after the point of purchase – it was felt that this form of subsidy was not as effective in influencing consumer behaviour as if the cost of the product at the point of purchase was lowered through a subsidy.

4.18 In keeping with the theory that suggests the most significant influence on consumer purchasing behaviour is cost, the potential use of a further complementary measure in the form of changes to the current tax system imposed by an increase in the cost of energy itself, or the least energy efficient products, could also complement current energy efficiency measures.

Future developments of the EL Directive and MEPS

Europe

4.19 The recent Action Plan for EU Efficiency detailed a set of measures which seek to achieve the saving of 20% of EU annual primary energy consumption by 2020. These initiatives are to be implemented over the next six years and will include:

- Appliance and equipment labelling and eco-design requirements – to be developed by 2007 where the Commission will start adopting performance requirements for 14 priority product groups with a view to having them all approved by 2008.

4.20 Although it is likely that the MEPS will also be reviewed as part of this Plan, it is currently unclear when this process may occur.

The UK

4.21 The Energy Efficiency Innovation Review (Dec 2005), concluded that the existing MEPS and labels no longer acted to drive innovation as the existing technologies had achieved the highest standards set out by the regulation.

Therefore, there was a need to update the standards so as to induce further innovation in the market.

4.22 Current feeling within the Government indicates that in order to bring about further improvements in energy efficiency, the solution needs to be driven by countries working together as the market is now global, with the manufacturing industry in particular moving to the Far East. For example, the US based Energy Star Programme could be used as a procurement tool as Europe gains from scheme when US products are sold in Europe.

4.23 Defra is currently looking at standards across the world and compiling a database to use as an evidence base during negotiations, where they wish to set a trajectory of what MEPS should be over a period of time so as to improve standards on a regular basis (similar to the Japanese Top Runner Programme).

5 Concluding statements

The impact of the EL and MEPS

5.1 The UK EL in conjunction with MEPS has been effective in bringing about an increase in the energy efficiency of the household appliances sector, where the most significant market transformation has occurred in the refrigerator market. However, evidence suggests that the EL would not have been effective as a stand alone instrument and that staging its introduction in advance of the MEPS induced the process of market transformation and therefore minimised the level of disruption caused by the MEPS.

5.2 Evidence also suggests that the household appliances sector in the UK witnessed an increase in innovation in anticipation of the implementation of MEPS. However, as a result of the non-stretching nature of the standards and the fact that there has been no review of the standards, this innovation has been limited and there has been more of an emphasis on cutting out the bottom of the market as opposed to stretching the top of the market. Therefore, in the future, it will be important to update and set stretching standards which clearly signal the targets and intended direction of the market – this will induce innovation at the top end of the market.

5.3 US based evidence highlights the success of the combination of the revised mandatory Energy Guide Label and the voluntary Energy Star label, where their design and implementation constitute examples of good practice.

The research propositions

5.4 The remainder of this chapter seeks to summarise the findings of the report within the three research propositions:

- Proposition 1: What are the factors that are likely to be influenced by environmental regulation that prompt firms to innovate and be more productive and why?
- Proposition 2: How much does regulation influence innovation and productivity improvements in firms? Does this influence vary between sectors/markets? How important are other contextual factors? Does this influence vary by regulatory form, stringency and/or enforcement methods?

- Proposition 3: If the variance is explained largely by form, what is the nature of this form and design? What characteristics of policy instruments are most appropriate in enhancing productivity and innovation? Which policy instruments are more effective than others in prompting firms to innovate and be productive and why? Is it the case the 'one size fits all' does not work? Are there substantial differences with regard firm and sector characteristics?

5.5 The following set of regulatory characteristics associated with the EL and MEPS were identified as those which potentially enhanced innovation in the household appliances sector:

- The **content and format of the Label is key and must be simple**, as was illustrated by the early failure of the original Energy Guide Label in the US, which was deemed to be too complex in its nature.
- **An effective mandatory EL requires a degree of flexibility of outcome –** where the grading feature on the European EL created the opportunity for a manufacturer to excel.
- **Careful consideration should be given to the way standards are set** – the European model, which used the prevailing industry spread to set standards, may not be as effective as the Japanese Top Runner Programme, which is viewed as one of the most innovative developments in the field.
- **Advance warning of the implementation of the EL and the subsequent implementation of MEPS** gave manufacturers the opportunity to re-design their products and absorb the impact of the regulation prior to its implementation. This also ensured that costs were not passed onto consumers.
- **Stringent enforcement of MEPS is necessary** so as to avoid the temptation for manufacturers and retailers to produce/display inefficient products.
- **A basket of measures is more effective at enhancing innovation,** for example:
  - The **mixed use of both mandatory and voluntary measures** has proved a success in the US and has led to the inducement of innovation in several sectors.
  - **Technology procurement mechanisms are effective at encouraging innovation** when used alongside a voluntary measure – for example, the success of the Energy Star Program

was significantly increased post-endorsement by the technology procurement Order of the Government.

  - The **use of additional marketing to raise the awareness of an energy label** and its contents could influence consumer preferences and as a result, lead to an increased pressure on manufacturers to produce only the most efficient appliances.

- **Regularly updating the minimum efficiency level of MEPS** when market conditions warrant this, for example, when changes occur in innovation, technology, consumer behaviour, demand or energy costs – this has proven effective in the US, where the continual updating of the standards has led (where possible) to the production of a continuous cycle of efficiency improvements in the household appliance market.

- **The EL and the complementary labels must be valued by industry** to ensure they create a pressure on industry to acquire the highest level of efficiency and to enable manufacturers to use a label as a form of 'environmental quality kite-mark'.

5.6 The prevailing European EL and the associated MEPS have led to an increase in innovation on the part of the manufacturers. However this effect has been limited in its nature for the following reasons:

- **Main constraint to innovation has been the fact that MEPS have not been updated since their inception in 1999** – therefore, they have not taken the market transformation or changing consumer preferences into account and are now out-of-date. This finding is supported by the continuing success of the US ES programme, which regularly updates its standards and as a result, induces a continuous cycle of efficiency improvements in its target markets.

- Although the efficiency rating scale has been updated to include the A+ and A++ categories, the **uptake of A+ and A++ classes has been limited in the UK due to the costs** associated with producing products which achieve these standards - incentives in the form of manufacturing subsidies could seek to increase the production of appliances which attain the additional efficiency categories.

- **The EU Master Label was designed for the cold appliances market** and hence the Label has **not been as appropriate in the secondary markets** within which it has been implemented– therefore, it may be more appropriate to tailor the label to different product markets whilst keeping the efficiency scale consistent.

Annex A: List of Consultees

Table A-1: Stakeholders consulted as part of the case study

Name	Organisation
Ian Byrne	National Energy Foundation
Martyn Webb	Defra
Stuart MacConnacher	AMDEA (Association of Manufacturers of Domestic Appliances)
Andrew Warren	Association for conservation of energy
Professor Robert Schock	World Energy Council
Chris Evans	Consumer Research Associates
Kevin Lane	AEAT Technology and MTP
Andrew Fanara	USA Environmental Protection Agency
Rachel Schmeltz	USA Environmental Protection Agency
Chris Hudgins	Association of Home Appliance Manufacturers (USA)
Jim Gray	Environment Agency

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