

# Creating a virtuous circle for climate change with consumers, manufacturers and sufficiency

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## Abstract

Electricity consumption per household is rising due to the increasing ownership of appliances and compounded by the growth in household numbers. The resultant higher carbon emissions are causing even more climate change, at a time when the evidence points to the need for greater and faster reductions in greenhouse gases.

Policies and perspectives need to encourage a change in this situation and ensure that higher standards of energy service are combined with declining household energy consumption. Some of this can be achieved by lower energy use per appliance, as a result of European regulation and manufacturer trends. This alone will not achieve the required energy reduction, there is also the need to consider whether we have sufficient appliances. Three approaches are considered: energy labels on all energy-using appliances sold; products can only be brought to market that have a proven benefit for the environment; personal carbon allowances. This will include the role of European policy, for instance the introduction of labels that are based on energy consumption (kWh) rather than energy efficiency (kWh/unit of service).

For consumers, the objective of policy would be to encourage personal responsibility so that the number of energy-using pieces of equipment per household does not just continue to rise. This trend is aided by the decline in household size, both in terms of people and floor area. For manufacturers, the effects will be for the focus to switch to downsizing and to a greater awareness that innovation must benefit the environment.

## Context

Per household, energy demand is either flat or growing in many European countries. This is despite substantial policy interventions over the last 30 years and the achievement of a high standard of living for the majority of citizens. The greatest increases are occurring with electricity use, particularly in lights and appliances (including for cooking). This growth is often occurring in countries where compliance with the Kyoto Protocol is proving challenging, so new initiatives are needed that could come into effect and be influential by 2008.

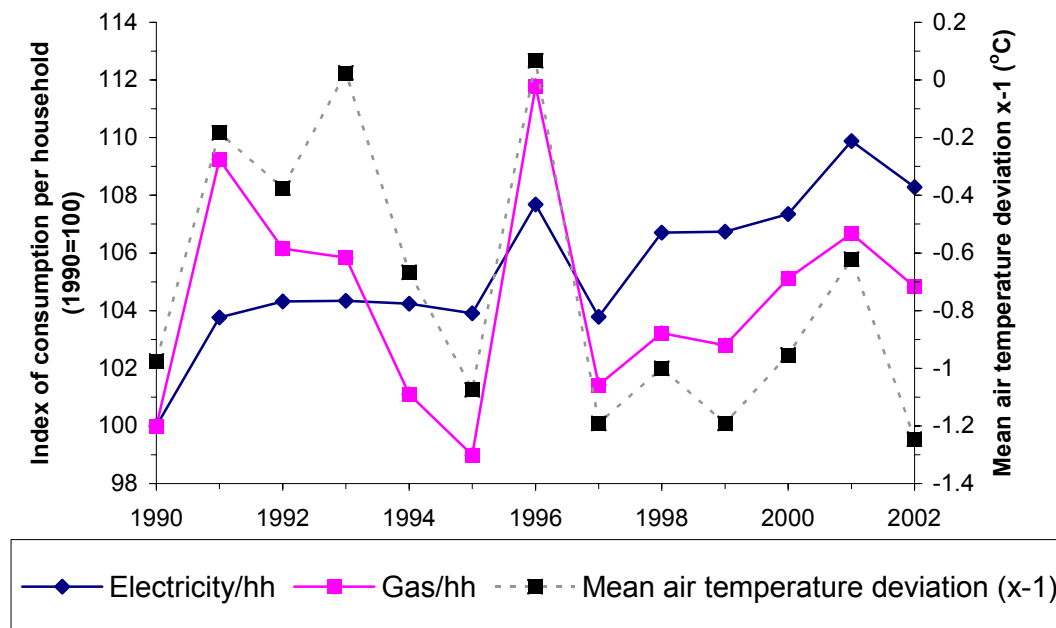
To avoid dangerous climate change – as agreed at Rio de Janeiro in 1992 – the scale of carbon dioxide emissions reductions may need to be 80-90% lower by 2050 [1]. Already, many of the countries in the EU have targets that require major reductions by 2050, for instance the 75% target in France [2] and the 60% commitment in the UK [3].

**Table 1: Long-term carbon reduction targets, EU member states**

Country	CO <sub>2</sub> reduction targets
Czech Republic	30% per capita by 2020 (vs 2000) 25% in aggregate
France	1.8tCO <sub>2</sub> per capita by 2050 (75%)
Germany	45-60% by 2050 (vs 1990) [40% by 2020 if EU is 35%]
Netherlands	40% by 2030 60% by 2050
Poland	40% by 2020 (vs 1988)
Sweden	50% by 2050, all GHG
UK	60% by 2050

Sources: [4], amended by the author

As an example of the growth in household electricity demand, the UK residential sector showed a 6% increase in consumption in the third quarter of 2005 (July, August, September) over the same period in 2004. For a year-on-year change this is substantial and worrying. There has been a general upward trend, since at least 1990, for electricity consumption per household (Figure 1). 1996 may have been an anomaly, as a result of confusion over customer numbers with liberalisation, so it might be best to think of 1995-8 as a smoothed increasing line. Gas usage per gas-owning household is strongly correlated with external temperature, and little else. The improvements in insulation and reduced heat loss have, it would appear, been offset by some combination of higher internal temperatures and additional hot water use (both are provided by gas-fired systems in the majority of UK homes).



**Figure 1: UK household electricity and gas consumption and external temperatures**

An example of the factors that influence the growth in electricity consumption comes from the purchase and use of larger and larger TVs, particularly inefficient plasma TVs. In simple terms, the larger the TV, the more power hungry it is. However, any purchasers of large screen TVs that chose to buy the liquid crystal display (LCD) technology could be drawing under half the electricity of a (smaller) cathode ray tube and less than a fifth of a plasma TV [4, 5]. Thus, the new level of consumer service – large screens – imposes a considerable energy penalty, but the greatest increase in demand comes from the new, but unnecessary, technology of plasma TVs.

Another example of unhelpful recent developments is patio heaters, which are as powerful as many of the boilers used to heat homes (Table 2). In total, 630,000 patio heaters have been sold to the UK domestic sector to date. Based on the above assumptions the annual energy consumption is 0.67TWh, with equivalent emissions of 0.14 MtCO<sub>2</sub>.

**Table 2: Estimated consumption/emissions per patio heater per year**

Average power of patio heater, (S)	8.90	kW
Days per year in use (D)	30	days
Hours per day in use (H)	4	hours
Energy used per year (E = S x D x H)	1,068	kWh
CO <sub>2</sub> emissions per year (= E * 0.214)	229	Kg CO <sub>2</sub>

Source: LCF team

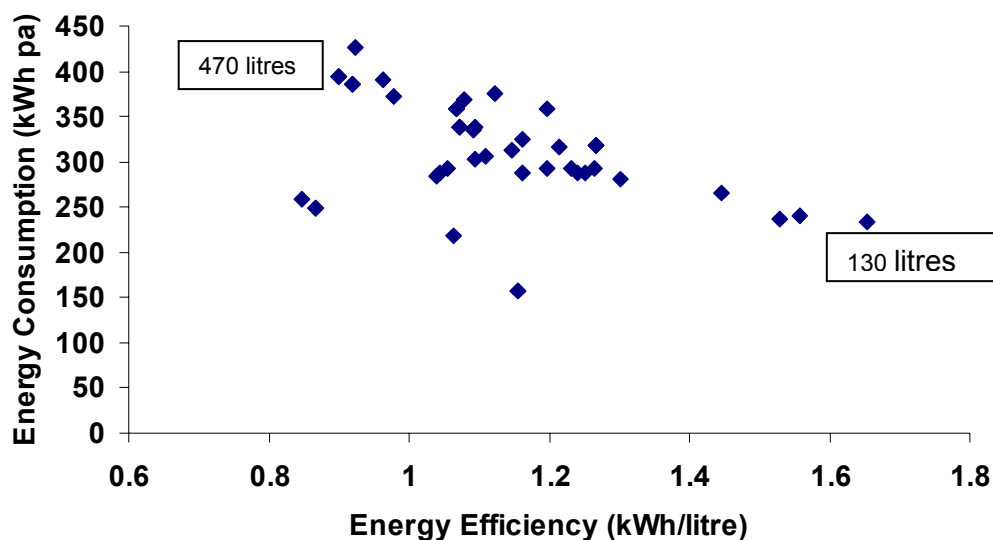
There are two important lessons from these examples:

- The individual purchasers have no idea that they are making a decision with such considerable energy implications. There are no energy consumption labels and, in all probability, the staff in retail outlets are either ignorant, for instance of the relative impacts of plasma and LCD, or they choose not to discuss the information with the customer;
- The regulators need to move from a reactive approach to policy – only acting when a problem emerges – to a pro-active approach so that manufacturers do not put such power-hungry devices as the plasma TV and patio heater on the market.

New policies are needed so that manufacturers are required to innovate in a way that reduces, rather than increases, emissions, that consumers have appropriate information at the point of purchase and to encourage householders to recognize the need to take responsibility for their impact on the environment.

## New directions for energy labels

Before discussing these options, there is one generic development that would be beneficial. The EU Energy Label is an energy efficiency label, in terms of the A-G rating. The actual consumption is given on several labelled products, in kWh of electricity use per annum. However, most consumers are encouraged to respond to the A-G scale and this is all that is available on some products, for instance light bulbs. This is a relative measure (eg kWh per litre of cold space or per wash cycle) that is then used to rank the appliance in terms of the range on the market, to give the A-G categories. The result has been that many manufacturers have increased the size of the products that are sold, as this makes it easier to get into a good energy efficiency category. For instance, most washing machines are now 5-6kg drums, whereas they were typically 4.5kg drums before the label was introduced. The average household size is dropping throughout Europe, so there is unlikely to be a consumer pull for bigger drums. The same trend can be observed with refrigeration equipment, where large American-style two-door machines are increasingly being sold in the UK and Europe. Other nations emphasise the total likely consumption per appliance on their energy labels (perhaps excluding any measure of energy efficiency), encouraging consumers to select smaller appliances. The decrease in energy efficiency that has been achieved through the growth in larger fridge-freezers and higher energy consumption is shown in Figure 2 for models sold on the UK market.



**Figure 2: Energy consumption and fridge-freezers, by size, UK 2004**

Source: A Peacock, 40% house presentation

The European Commission is drafting a new labelling directive and it would be entirely appropriate if this is based on absolute consumption of electricity or gas, not the amount used per unit of service. This would make it clear to customers the extra consumption that is associated with larger equipment, whereas it is obscured somewhat with the present energy efficiency label.

Currently, there are three logical components to reducing the unnecessary growth in energy consumption, which may need to be combined in practice.

### **Energy labels for everything**

The simplest solution would be to make sure that every piece of energy-using equipment has its energy consumption clearly labelled and that it cannot be brought to market without this label. Some of this information is already on the appliance somewhere, as the maximum demand (in Watts) has to be identified under existing regulations. The difficulty at present is that consumers do not consider this information when making a purchase, it is not clearly drawn to their attention by retail staff and the data are often hidden deep down in the manufacturer's manual.

In addition, the power demand does not easily translate into an annual consumption figure and the maximum power demand is never achieved in most pieces of equipment. For instance, with a refrigerator, the maximum demand monitored in a machine is during the occasional periods of warming, when the panels are heated to ensure the ice melts. This could be for a period of less than one hour per fortnight.

To implement these energy labels with sufficient accuracy, would require the test procedure for new appliances to be developed much more quickly than at present. At present, the procedure involves the manufacturers and can take easily five years to establish. This is one reason why rapidly-developing technologies, for instance audio-visual, are difficult to label: the technology is changing more rapidly than the test procedure could be developed. Hence, the present system will always leave the consumers in ignorance on many new products.

Developing faster test procedures could be undertaken by one or a small group of independent experts, in order to get the information and not hold up the marketing of a new appliance. It would probably require the manufacturers to notify the Commission of their intention to bring a new product to market – an extension of the type of process already undertaken to get certification according to electrical safety regulations [6]. In some case, simple guidance could be given. For instance, this set top box uses 30W of electricity, which means that it will consume 263kWh if left on all year (as the supplier requires).

Labelling everything will mean that consumers gradually become more energy-literate, as they see these energy labels frequently and begin to feel confident when thinking about consumption levels.

For simplicity and speed, these new labels would give straight information, eg kW and kWh, rather than rank the products on the market in an A-G category. This would be necessary with brand new products, as initially they will come from just one or two manufacturers – the range is not there.

For new products, for instance plasma TVs, there would be some difficult decisions about how to quantify usage patterns, particularly across Europe and even when a TV is used in different rooms in a UK home. Whatever number is used could be defined by Brussels and would have to be the same for all technologies in a category, eg TVs or space heaters. The information on the energy label could be given as consumption over the design or guaranteed life. This would avoid the confusion caused by pre-determining set patterns of consumption, eg this washing machine is used 5 times a week, or this light bulb is switched on for 4 hours a day, but would emphasise the established lifetime.

For other new products, for instance patio heaters, the usage pattern would be more problematic, as there was nothing comparable on the market before. The label could be defined in terms of 'this appliance will use a 80kg butane canister in ...hours', based on a standard likely supply source. This is comparable to the information on light bulbs, where the lifetime is given in terms of the numbers of hours of use. By making energy labels completely inclusive and covering all energy-using products, the definitions of individual categories would become clearer, for instance combining TVs and computer monitors as visual display products, as they provide dual functions.

Whatever the details of the measurement methods, the aim would be to make sure that every energy-using product has an energy label that is clear, bright and informative, for the customer. This procedure could be introduced relatively quickly and certainly by 2008. This would help consumers control their future consumption, by making more informed choices, in advance of the first Kyoto commitment period (2008-12).

### **Manufacturing environmentally-beneficial products only**

An alternative approach to controlling the growth of profligate energy-consuming equipment and the resultant carbon dioxide emissions would be for manufacturers to have to demonstrate to government that there is an environmental benefit as a result of manufacturing a new product. This is close to the recommendation of the UK's Energy Saving Trust that energy-profligate equipment should be outlawed [7]. All equipment has to have a certificate showing that it has been approved for sale within

the European Union (the CE mark) and this proposal would build on that approach: a new product has to be deemed safe for the environment (not profligate) before it can be sold to consumers. In the shops, this seal of approval would be identified by the CE mark, a kite mark or similar. Retailers would be required to ensure that all products sold in their stores had this environmentally-beneficial mark on them. Enforcement would be vital.

This approach is different from a procedure whereby the worst examples of an existing product range would be excluded (eg the G rated equipment). That is the task of minimum standards, which is a separate and important policy strand. What is being discussed here is the situation when a brand new product range is being proposed, for instance the plasma TVs or patio heaters, and the manufacturers would be required to demonstrate that this new product will be good for the environment and better than the nearest alternative. This would protect consumers and the environment from irresponsible manufacturing ideas. Manufacturers would be encouraged both to continually improve the energy performance of products, but also, for example, to increase the use of recycled materials and avoid harmful chemicals. It is similar to an Environmental Impact Statement, currently required for developments, but applied to products - with the onus on the manufacturer to improve each product release. Manufacturers would need to put much more focus in the research and development process on environmental performance rather than style or gadgets and this will change the entire nature of the commercial industry ethos.

The problem is particularly acute with brand new products. The present system of energy labels is responsive, not proactive: once the product is on the market, the EU can set up a study to identify appropriate policy initiatives and how to assign the energy label categories to the spread of models.

This is already too late, as shown with plasma TVs. There are no labels on them and already the estimated 3m households in the UK have bought a model are consuming 2.2GWh of unnecessary electricity, in comparison with the purchase of same size TVs with liquid crystal displays.

It would not be difficult to draw up the clear, transparent guidelines for environmental assessment and even an announcement that this approach is being considered would at least identify the future risks for manufacturers. TV screens as large as 100" are already being developed, with all the additional electricity consumption that this implies [8]. The agreement at Gleneagles in 2005, that the G8 countries would promote the 1 watt initiative is an example of a move in the right direction. The limited progress in 2006 demonstrates how governments need to be proactive to protect the environment and millions of consumers from unnecessary energy use.

The aspiration behind the requirement for environmentally-beneficial products would be to encourage innovation that is good for the environment.

## **Personal carbon allowances (pca)**

The third proposal is for the introduction of individual carbon allowances, to encourage personal responsibility. Each adult would receive a plastic card with an equal allowance of, say, two tonnes of carbon dioxide on it. Every time electricity, gas, petrol or a flight is purchased, the appropriate quantity of carbon dioxide would be taken off the card [4, 9]. When the free allowance has been used up, the individual could still continue to purchase these goods, but they would cost more. The scheme could be described as a carbon tax, with a substantial tax-free allowance. The carbon allowance would decrease each year, in line with the Government's international obligations. As the carbon credit card covers over half of the economy's carbon dioxide emissions (more if aviation is included), then this policy provides the Government with considerable certainty about the country's ability to comply with its legal obligations. The strict adherence to an equal allowance for all adults provides the least polluting households (for instance the 20% of adults that neither drive nor fly, usually people on a low income) with a surplus of carbon, that can be sold. Pcas have two strong assets, therefore: certainty and equity.

One of the major advantages of a pca is that it would require householders to learn how they are consuming energy. Initially, at least, product policy would have to support this educational process, for instance by putting the energy consumption labels on all equipment. After a period of time, people would have a much better understanding of which are the high energy-using pieces of equipment in the home. They would also be more inquisitive at the point of purchase, making sure that new appliances help, rather than hinder, the careful use of energy.

Even if pcas are to be introduced, it will take several years before the scheme is operative. And even then, only direct energy purchases would be covered, for the sake of scheme simplicity: over half of the country's emissions have to be covered by other policies, such as the EU Emissions Trading Scheme. Therefore, what is needed is for an immediate response to signal clearly to manufacturers

that protecting the environment is the task for all of us. At the same time, procedure to build up consumer literacy on energy consumption will help them as well as restricting climate change.

## Conclusions

The present system of energy labels helps consumers to rank very few appliances, but is encouraging manufacturers to produce every bigger pieces of equipment. This is because the energy labels are based on the level of energy service per unit volume (or similar) and larger machines are, by definition with this scheme, more energy efficient.

Energy consumption per household continues to grow across most of Europe, despite the lower number of people per household. So, just when there should be reduced consumption per household as a result of smaller equipment, the trend is in the reverse direction, aided and abetted by the design of a policy tool, the energy label. Other factors contribute, such as increasing household wealth and the growth in per capita space, so there is an increase in the number of pieces of equipment owned per household. The net effect is a growth in energy demand. The slow introduction of mandatory minimum efficiency standards also permits this growth in demand.

In some cases, this higher levels of appliance ownership does represent an increase in the standard of living. However, there are a growing number of examples where consumers are being encouraged, by manufacturers, to purchase and use unnecessary appliances, or ones that use profligate amounts of energy.

To constrain this growth, policy needs to be more actively involved with the decisions being made by manufacturers and customers. Three options have been discussed:

- No energy-consuming product is sold without a label confirming this level of demand;
- Manufacturers cannot produce a new line without demonstrating its environmental benefits and gaining permission from the government;
- Consumers have a personal carbon allowance, which encourages personal responsibility.

There are advantages and disadvantages with all three systems. The first two proposals focus on product standards and the third on behaviour by householders. The ideal combination, in preparation for greater personal responsibility by consumers, would be to start with aspects of all three: manufacturers will produce new products and range that are confirmed by government as having environmental benefits; each product will carry an energy label before it is placed on the market, and policies to encourage consumer energy literacy will all proceed together. Then, policy would prevent today's householders unwittingly causing unnecessary carbon dioxide emissions to the detriment of the environment.

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