The label you drive – what can EU appliance labelling learn from the experience of EU consumer information on the fuel consumption of cars?

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Keywords

appliances, cars, labelling, consumer behaviour, consumer information, policy recommendations, label design

Abstract

Policy makers and their advisors are developing an increasingly sophisticated understanding of what influences consumer behaviour; this can feed through into the design and use of energy labels. This paper examines one area of research, EU CO_2 labelling of cars, to see what aspects might be usefully applied to appliance labelling. While the paper may be too late to feed into the latest revision of the EU Energy Labelling Directive, the findings could be used by Member States (MSs), local government, NGOs and others to frame and support the use of the energy label by providing additional information to consumers in person and online.

There are significant differences between buying new cars and appliances, such as a greater sense of personal identification with the car than a fridge, and the fact that a new appliance is more likely to be a distress purchase. This may seem to make comparisons unhelpful; however, there are many aspects in common: for example similar information sources and criteria for selection.

Further, some of the ideas that have been put forward for appliance labels have already been tried out on a large (MS) scale on car labels. MSs have considerable freedom on what information to include in the EU car label and how to present it, (in contrast to the appliance label which is standardised across the EU). This means that different information has been provided and diverse label designs have been used. For example, running costs may be included and MSs who use categorical labels have used both absolute and relative CO_2 performance to set label categories.

The paper reviews the different approaches of EU car labelling in different MSs and the studies which have tested out different car label options. It then explores the extent to which some of these aspects could be usefully transferred to support appliance labelling.

Introduction

Energy efficiency is often cost effective – the higher up front cost is offset by reduced running costs – but consumers don't always recognise that. The initial rationale for energy labels was to provide information on energy performance to the consumers – in economic terms to address 'information failure' (discussed for example in Boardman 2000). Manufacturers and retailers present consumers with information on some aspects of the goods they are selling (for example time to accelerate from 0–60 mph for cars (in the UK) or the picture quality of TVs) but before mandatory labelling this rarely included energy. Energy labels are designed to address this gap by providing energy information in a consistent way to the consumer at the point of sale. They also provide a common energy-efficiency benchmarks that enables government, utilities and NGOs to offer incentive programmes to encourage consumers to buy energy efficient products (Wiel and McMahon, 2005).

While energy labels provide information to address the information gap – so that rational householders can make informed decisions, more recently some economists have recognised and developed theories to address the fact that even when people have all the relevant information they make 'non-rational' decisions (something that psychologist, sociologists and marketers have long known). Several studies for policy makers have explored this approach: for environmental behaviour in

general (OECD 2008) and for the purchase of environmentally preferable goods in particular (Policy Studies Institute 2008, Mudgal et al 2011).

However, energy labels have been developed in the 'real world' and they already take account of real human behaviour – for example in their development they have generally used focus groups and consumer feedback in the development of their design (for example Dethman et al 2000). Also, taking a partially empirical approach, comparing the results from labels and their uses in different circumstances, can give insights and suggest ways for improvement. Several studies have done this for different regions of the world (du Pont 1998, Scheer 2009). This paper takes a comparative approach by looking at one region, the EU, over a roughly similar timescale[1] but for two different classes of energy using goods: cars and appliances.

There have been a number of reviews of the EU appliance label[2] undertaken with a view to whether/how to revise the regulations: these have been for specific product groups, e.g. refrigerators (Waide 2001), and for the directive overall, most recently the report published in June 2014 (Molenbroek et al), and the report specifically on consumer understanding and impact of the label in October 2014 (London Economics and Ipsos). Similarly there have been a number of reviews for car labelling[3]: in 2005 (Gärtner), 2010 (Grünig et al) and 2011 (Brannigan et al); these are the basis of the reviews in the paper together with related work in individual Member States.

Much of the data on consumer attitudes and behaviour in this paper is based on consumer surveys (for appliances from: Ipsos MORI 2008, Promotion 3E 2011, Schmitz and Stamminger 2014; for cars: Anable et al 2008, Dixon and Hill 2009, Lane et al 2012, Codagnone et al 2013) and should therefore be treated with some scepticism – it is widely recognised that in surveys, particularly those relating to environmental aspects, that consumers tend to respond in ways that they think they should – their actual behaviour may differ considerably from what they indicate on the survey (Anable et al 2006). The survey data is probably the best data available and provides valuable insight but should be regarded as, at best, only indicative of real life behaviour.

Another restriction of using these surveys to compare consumer preferences and behaviour for cars and appliances is that they were undertaken independently of each other so they asked questions of slightly different audiences[4], in different ways[5]. This lack of direct equivalence is the differences shown in the results (Tables 1–6). However the author considers that the similarities between the data are strong enough to make some meaningful comparisons.

Differences and similarities (for labelling) between consumer behaviour when buying cars and appliances

In order to make a sensible comparison between the use of and response to energy labels on cars and appliances in the EU it is necessary to allow for differences in consumer attitudes and behaviour to the different products. This section of the paper considers how four aspects are similar or differ for cars and appliances: the psychological identification with the different products; the reason for buying a new product; the information consulted when considering the purchase and the criteria used for selection.

Another aspect which is very different for new cars and appliances is the purchase price – cars are much more expensive (by a factor of between 10 and 1,000 times approximately) than appliances and this fact will affect most of these aspects, but this is not explicitly addressed by the reviews on the literature, which deal with cars and appliances separately, so this cannot be addressed using evidence from this literature. (The author mentions this point in the paper when she considers it to be relevant.)

PSYCHOLOGICAL IDENTIFICATION WITH THE PRODUCT

Personal experience suggests that the identification of the self with cars is much greater than for appliances – and this is backed up in the literature. A study on car buyers' attitudes in the UK (Anable et al 2008) undertook a small qualitative survey using semi-structured interviews of 28 recent purchasers of new and used cars. They found a strong identification between owners and their cars: "Throughout the discussions, respondents repeatedly referred to symbolic dimensions of their purchase. Cars were seen as reflection of their owner's personality or as a statement of where their owners wanted to be." And "just as some cars were clearly felt to match one's personality others were felt to represent less attractive aspects of other people's personalities. Or can be associated with an inappropriate gender or occupation stereotype." While brand (see Table 3) and aesthetic design (see Table 4) can be factors in the purchase decision for appliances this strong association of the purchaser's self-image with the product has not been reported for appliances.

REASON FOR BUYING A NEW PRODUCT

There is a considerable difference in the reason for buying a new product between appliances and cars: a survey in 7 Member States[6] about 8 different appliance types[7] undertaken in 2009 found the most common reason (40–60 %) given for buying a new was that the old one broke[8] (Promotion 3e, 2011) (termed a 'distress purchase'). The second and third ranked

1. The first mandatory appliance labels, for refrigerators and freezers, were introduced from 1995 onwards (date varied by Member State); those for cars from 2001 onwards.

2. Throughout this paper 'appliance labels' will be used a shorthand for mandatory energy labels for energy using appliances under the framework directive: initially 92/75/EEC, recast as 2010/30/EU on 19 May 2010.

3. Throughout this paper 'car labels' will be used a shorthand for mandatory energy labels for cars under the Directive re Information on the fuel consumption and CO2 emissions of new cars 1999/94/EC.

4. For example some were addressed to people who had recently made a purchase or were intending to make a purchase soon; others were to a more general audience.

5. For example, possibly providing different lists of sources of information consulted for respondents to choose from. In most papers/reports the text of the questionnaire used is not available so it isn't clear whether people were asked to choose from a list or suggested sources themselves.

6. From the partner countries of Portugal, Spain, France, Greece, Italy, Germany Poland, UK, of customers in electrical appliance stores.

7. Washing machines, drying machines, dish washers, refrigerators, electric ovens, air conditioning devices and light bulbs.

8. All of these are 'utilitarian' appliances – unlike, say TVs or other consumer electronics devices which may be bought more impulsively or for 'fun'.

Table 1. Primary source of information used when considering purchase of an appliance (Promotion 3e 2011).

Information source	*% used*
Store employees	35.8
Internet	26.6
Family/relatives	9.3
Friends	8.9
Pamphlets/brochures	7.8
Speciality magazines	5.5
TV ads	2.7
Other source	2.7

reasons were: to buy a product for the first time to equip their home and to buy a better quality/more innovative product.

The 2008 UK car purchasers' survey mentioned above (Anable et al 2008) found a large number of reasons for purchasing a new or used car were given. In the interviews saving money was mentioned 8 times, previous car being too old/ un-repairable 6 times, previous car written off/accident (3), reliability issues (3) safety issues (3), life change (3), and change in family size (3). Other issues (such as change in work location, downsizing, visiting friends) were mentioned less frequently, as was reducing environmental impact, which was mentioned only by one participant as one reason for buying a new car. While this is a small survey it suggests that a car as a replacement for one that is no longer operational (around a third) is significantly less common than for appliances – and this includes buyers of used cars; it is possible that if only buyers of new cars were included the proportion would be lower.

(This has implications for the amount of time that a consumer is prepared to spend researching and considering the purchase – if the need to buy is urgent there is less time to research the market. So it is possible that the label, being visible at the point of sale, has potentially greater influence on 'rushed' appliance sales. The amount of time spent on research for cars could also be influenced by the much higher cost of cars – it seems reasonable that the more money spent the more people feel inclined to spend time making sure that they are making a wise decision. However none of the authors of the surveys reviewed for this paper reported results on how long consumers took to choose the product so this could not be tested directly.)

SOURCES OF INFORMATION CONSULTED

Indicative data for the sources of information consulted before buying, based on surveys, is shown in Table 1[9] for appliances (based on Promotion 3E) and Table 2 for cars (based on a UK only survey[10], Dixon and Hill 2009) respectively.

CRITERIA USED TO SELECT PRODUCT

The Promotion 3e (2011) survey provides data on the key factors consumers say they a) search for information on and b) use when choosing a new product (for a range of appliances) which is shown in Table 3. (It should be noted that the top four factors are in the same order for both information search and product choice but the importance of most of the other factors is different [marked in italics in the 'relevant for choice' column]). Information on attributes of high importance for a survey (Schmitz and Stamminger 2014) for washing machines and dishwashers only[11] is shown in Table 4[12].

Table 4 shows considerable variation by Member State in the % of consumers who consider a given attribute important in absolute numbers and by ranking. However, the top four attributes averaged across all Member States are in common with the top factors from Promotion 3e, so there is some consistency for the most popular attributes. The low match between factors reported in the 2011 and 2014 reported surveys (due partly to the different appliance mix) makes it difficult to comment further on consistency between them.

The similar results for cars are shown in Table 5[13], for the UK only (Dixon and Hill 2009) and results from a survey of 8,000 people from 10 Member States[14] are shown in Table 6 (Codagnone et al 2013). The latter results are preferable in some ways – being more recent and a broader representation of the EU – but less directly relevant in that they were not of recent car purchasers – in fact 7.6 % of those surveyed were not car owners.

The criteria/factors chosen by the two surveys differ (for example brand was not included in Codagnone et al 2013) which makes it difficult to compare the results, but these data show reasonable agreement between the results in terms of the highest ranking factors.

9. Of the 67 % of the customers reported having searched for information prior to buying an appliance.

10. A survey of 2,000 respondents of whom 1,500 had bought or were intending to buy a new car and 500 had bought or were intending to buy a used car.

11. Responses from 2,290 households in 10 Member States as shown in the table.

12. Attributes with high importance for the consumer when buying a new household appliance (washing machine or dishwasher) (Schmitz and Stamminger 2014): Re-ordered by popularity of attribute across all Member States.

13. MPG = Miles per gallon consumption.

14. Belgium, Germany, France, Italy, Netherlands, Poland, Romania, Spain, Sweden, United Kingdom.

Table 2. Primary sources of information used when considering purchase of a car NB UK only (Dixon and Hill 2009).

Information source	*% used*			
Year	**2006**	**2007**	**2008**	**2009**
Sales person/dealership	59	59	57	56
Consumer guides/magazines	49	48	44	43
Manufacturer's/independent website	41	42	43	43
Sales brochure/spec details	44	43	44	41
Family/friends/work colleagues	41	42	36	32
Newspaper articles	16	14	14	12
Garage/mechanic	9	9	7	8
Government/Vehicle Certification website	4	5	5	7
TV/Radio/Billboard Adverts	12	8	9	6
Car label	9	6	6	6
Government/Vehicle Certification guide book	1	1	2	3

DISCUSSION OF COMPARISONS

This quick review reveals some significant differences but also some strong similarities:

- There is a degree of personal identification with a car which is not reported for appliances. This will complicate the decision making process and will probably make the buyer less 'rational' and take less account of information on operating costs and environmental impact.
- The reason for buying new products are similar but appliances are more likely to be 'distress purchases' to replace a broken product than new cars. If replacement is the reason there is likely to be a time pressure which may restrict the amount of research undertaken and the number of factors taken into account. This suggests that more effort may be put into new car purchase and that buyers of appliances may be more susceptible to the influence of sales persons and energy labels (the customer being less well briefed at the point of sale).
- The types of sources consulted are similar – with the addition of 'garage/mechanic' for the car case. There are apparent differences in the number of sources consulted, with more for cars, but this may not be a genuine difference; it is not clear for appliances if respondents were asked to name only the main (singular) information source (Table 1); whereas it is clear that respondents were asked to give all the sources for cars (Table 2).
- The criteria used to select the product have some strong similarities with purchase price, performance (expressed in different ways), and reliability all featuring strongly and brand and appearance lower down the list for both cars and appliances. Safety is an issue which features for cars but not appliances and is not directly relevant to this discussion. There are several other difference between the two product groups however which do relate to energy labelling.

The concern with operational cost is expressed differently (although this may be at least partially an artefact of the designs of the surveys): for appliances it is not stated directly as costs but as factors that will affect cost (energy efficiency, water use); for cars it is explicitly stated as such (Codagnone et al 2013) or, as the most important aspect of this is fuel consumption, expressed as distance travelled per given volume of fuel (Dixon and Hill 2009). (A recent paper [Schouten et al 2014] has explored the importance of how fuel consumption is expressed: the more familiar distance travelled per fuel used or the less used but more helpful fuel per distance). The EU car label is required to show both fuel economy as litres per 100 km and CO_2 emissions (in grams per kilometre or mile) for the vehicle. A UK survey of 1,000 people who had recently purchased a car (Lane et al 2012) found that – despite the car label being mandatory for over a decade and the fact that UK road tax is based (in a banded system) on CO_2 emissions that awareness was low: while nearly 70 % of respondents could accurately give the fuel consumption in miles per gallon, only 20 % could give the CO_2

Table 3. Types of information mostly searched when choosing appliances (Promotion 3e 2011).

Factor	*% searched information*	*% relevant for choice*
Cost	26.7	42.3
Quality	25.5	39.9
Price vs quality	20.0	32.5
Energy consumption	16.7	25.1
Power rating	13.5	*14.7*
Energy efficiency class	12.2	*14.9*
Capacity	11.6	*12.1*
Brand and/or model	10.9	*14.0*
Warranty	10.5	*16.5*
Technological innovation	9.8	*13.3*
Number of functions	7.7	*11.5*
Dimensions	7.7	*9.4*
User friendliness	7.3	*16.4*
Water consumption	6.6	*10.2*
Customer support	5.8	*7.9*
Design/colour decoration	4.6	*13.5*
Users' opinions	3.8	*4.3*
Other type of information	3.2	*4.1*
Safety	3.1	*6.9*
Accessories	3.1	3.7
Cleanliness	2.0	2.3

emissions of their newly bought car[15]. This suggests that the adoption by consumers of the message of the CO_2 label for cars lags substantially behind that for appliances.

– Purchasers select a car class/type first – then select within this group (Gärtner 2005 and Codagnone et al 2013). While there are parallels with some appliances (e.g. the physical dimensions that a product has have to fit in an existing space, the fuel source for a cooker) this is less common[16]. The importance of this for the label will be discussed later in the paper.

15. 80 % could state the cost of annual road tax but only 45 % could give the road tax band (which relates directly to the A–L class on the label). Only about 5 % could give the fuel economy expressed in litres per 100 km.

16. One of the car surveys (Dixon and Hill 2009) listed size (twinned with practicality) as the top factor; whereas dimensions were joint 11th in importance in one of the appliances surveys (Promotion 3e 2011).

Table 4. Attributes with high importance for the consumer when buying a new household appliance (washing machine or dishwasher) (Schmitz and Stamminger 2014).

Attribute											
Member State	**DE**	**UK**	**FR**	**ES**	**IT**	**PL**	**SE**	**HU**	**FI**	**CZ**	**All**
Low water and/or energy consumption	89	67	86	72	81	93	83	93	78	95	**84**
Very good cleaning/washing performance	75	72	56	55	56	62	50	74	80	69	**65**
Low operating noise emission	34	31	46	50	47	38	64	43	62	59	**48**
Low purchase price	38	47	38	43	39	47	36	47	33	37	**40**
Good assessment result on the energy label	35	29	41	46	33	30	36	39	33	24	**35**
Good dishes/textile protection	32	10	30	22	18	19	23	18	23	29	**23**
Short programme duration	18	32	25	16	20	24	27	23	27	15	**23**
Low detergent consumption	26	10	13	12	22	18	20	22	5	17	**16**
Large number of different (washing) programmes and (appliance) options	13	24	11	9	21	20	6	11	8	12	**13**
Higher capacity of the appliance	7	18	11	13	13	10	9	9	14	5	**11**
Innovative aesthetic design	1	4	6	3	7	10	4	3	5	6	**5**

– Environmental concerns are much lower down the ranking for cars than appliances. With the proviso mentioned above that people's preferences in surveys do not always reflect their actual behaviour, purchasers of appliances appear to take account of environmental impact (energy water and detergent use) much more than car purchasers.

All these factors will be taken into account when considering what the findings from car labels can be carried over to appliance labels.

The experience of car labelling

The appliance label design is not expected to be open for discussion when this paper is presented the decision on how to revise it is scheduled to have already been made. However, while the layout of the mandatory appliance label may be fixed there is scope for organisations (Member States, Local Authorities, NGOs, retailers) to provide supplementary data on a voluntary basis alongside the energy label[17]. For example, a small trial of the effect of displaying lifetime costs at point of sale was conducted in the UK recently (DECC 2014) and there is an Intelligent Energy Europe Project working in ten EU countries trialling a different approach to displaying energy cost information – Yearly Appliance Energy Cost Indication[18] (YAECI) – which is due to report this year. So while the design of the mandatory label may be fixed there is scope for other organisations to offer supplementary information, if it can be demonstrated that this is helpful.

THE LABEL AND OTHER REQUIREMENTS OF THE DIRECTIVE

The labels adopted in different Member States

A major difference between the EU appliance and car labels is that the appearance of the former is standardised across all Member States. On the latter some consistent aspects have to be presented but there is considerable choice in what the label looks like and what other information is included. There have been a number of studies on car label design undertaken at the Member State level – for example for the UK (MORI 2003 and Lane et al 2012) and for the EU for DG CLIMA (Codagnone et al 2013).

17. This could be physically at the point of sale, via an online database (possibly accessed via a QR code) or some other means.

18. See http://www.appliance-energy-costs.eu/ for details.

The review of the car label for DG CLIMA (Brannigan et al 2011) provided a summary of the variations in the energy label adopted in the eight Member States they chose as their case studies – this is shown in Table 7.

The variety in car labels is illustrated by labels from three different Member States shown in Figure 1.

In all cases where there is a categorical label, the CO_2 emissions are the criteria used to categorise the performance. Denmark, France, Romania and the UK all use an absolute label format, whereby each car is categorized according to a comparison against all cars. Two of the Member States use relative labelling schemes – these are Germany and Spain. The relative scheme is where a car is categorized according to a comparison of 'similar' cars. The German scheme came into force at the end of 2011 and shows the CO_2 performance and potential for improvement within a vehicle class based on weight. The Spanish relative scheme is based upon the vehicle's footprint/area. The reference level for the Netherlands's relative scheme (Grünig 2010) is the weighted average of the average CO_2 emissions of all cars in the same size class (weight of this part is 75 %) and the average CO_2 emissions of all cars.

The justification for a relative scheme is that, as mentioned above, experience is that purchasers do not look at all types of car – they decide which class of car they are interested in and then look exclusively within that class (Boardman et al 2000). Using relative scaling within that class gives a better benchmark and allows a great number of categories within a class. It does however mean that a car in a one class (of larger cars) with higher CO_2 emissions may have a better label category than a car in a smaller class with lower CO_2 emissions – which runs the risk of causing confusion, discussed in Carroll et al (2014). The relative rating also opens up the possibility of manufacturers 'playing the system' i.e. deliberately increasing the size of the weight of a car to change its class so it gets a better fuel economy category (Gärtner 2005).

There are two distinct parallels to the relative vs absolute issue with appliances. One relates to the 'class of products' issue: for example should gas and electric ovens have separate labels? or should all equivalent domestic heating sources – gas boilers, oil boilers, heat pumps – have the same or different labels? The other relates to a more fundamental point – the CO_2 emissions factor is an absolute measure (although on the label categories it may be presented in a relative scale). The appliance label measures energy efficiency – an intrinsically relative measure. An equivalent value for car emissions might be along the lines of CO_2/km/kg of car weight. Given the tendency in consumer markets for products to increase in size there have long been calls for the energy label (and associated minimum energy performance standards [MEPS]) to reflect the absolute energy use – or if not then at least to have a progressive requirement of efficiency with size and/or an energy cap (for example Spengler et al 2014).

Additional information is included on a number of the Member States' labels. Running costs, including information on fuel economy and taxation costs, is one such example. Denmark, Germany and the UK include information on estimated annual running costs and annual tax. Estimated annual running costs are based on price per 20,000 km in Denmark and 12,000 miles in the UK. Running costs in Germany refer to the annual average energy costs, including fuel and electricity. Annual vehicle circulation tax information is provided in Denmark and the vehicle circulation tax (Vehicle Excise Duty) for 12 months in the UK (1st year and standard rate). The German label provides information on the annual tax costs.

Table 5. Factors used to choose a new car NB UK only (Dixon and Hill 2009).

Factor	*% used*	
	Current car	*Next car*
Size/practicality	77	76
Price	76	77
Reliability	66	70
Comfort	57	58
MPG/fuel consumption	57	66
Style/appearance/colour	50	46
Performance/power	35	37
Insurance costs/insurance group	34	36
Cost of road tax	31	40
Brand name/image/style	24	22
Cost of company car tax	4	5

Table 6. Attributes of a new car in order of importance (Codagnone et al 2013).

Attribute	% selected
Price	59.20
Fuel consumption	45.80
Safety	41.60
Running costs	35.60
Size	28.70
Engine type	24.50
Tax incentives	20.10
Lifestyle	18.30
Performance	16.80
Environmental impact	16.70
Customisation	11.70

Other requirements

The Car Labelling Directive also requires:

- A poster (or a display) showing the official fuel consumption and CO_2 emission data of all new passenger car models displayed or offered for sale or lease at or through the respective point of sale.

Table 7. Overview of Member State car label features (Brannigan et al 2011).

Member State	Label type	No of coloured bands	Relative/ absolute	Running costs	Other cost info (incl. tax)	Applicable to other vehicles?
Belgium	Continuous comparative label	N/A	Absolute	No	No	No
Denmark	EU Energy Labelling style	7 (A to G)	Absolute	Yes	Yes	Vans under 3.5 tonnes
France	EU Energy Labelling style	7 (A to G)	Absolute	No	No	No
Germany	EU Energy Labelling style	8 (A* to G)	Relative	Yes	Yes	No
Hungary	List format	N/A	N/A	No	No	No
Romania	EU Energy Labelling style	7 (A to G)	Absolute	No	No	No
Spain	EU Energy Labelling style	7 (A to G)	Relative	No	No	No
UK	EU Energy Labelling style	7 (A to G)	Absolute	Yes	Yes	Used cars (voluntary)

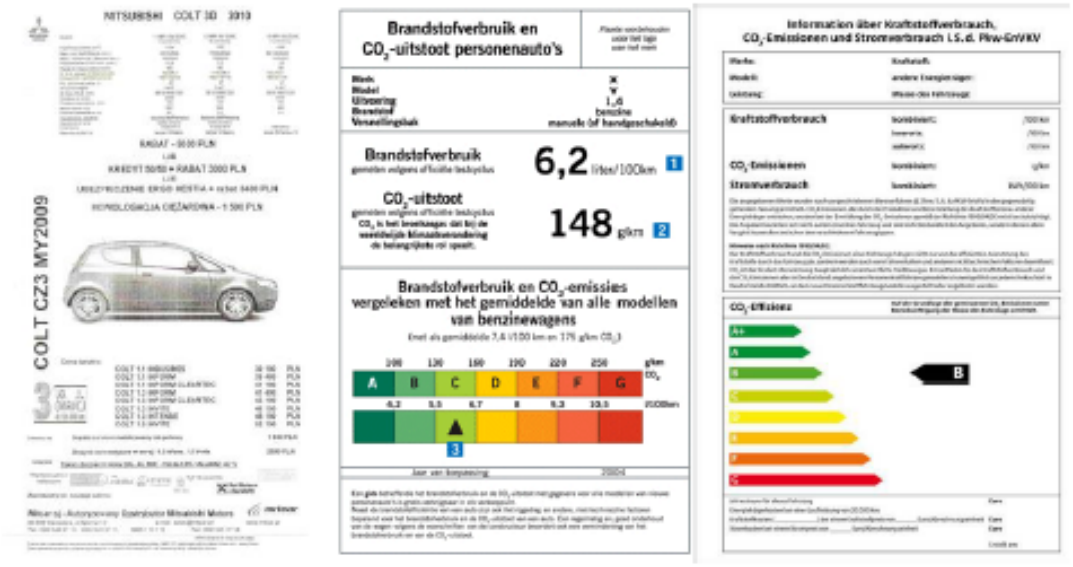

Figure 1. Comparison between car labels in Poland (left), Belgium (centre) and Germany (right) (Carroll et al 2014).

- All promotional literature must contain the official fuel consumption and specific CO_2 emission data for the passenger car model to which it refers.
- A guide on fuel economy and CO_2 emissions for potential buyers.

The value of the first of these, the poster, has been questioned by some Member States and it has been suggested that this be made a voluntary option (Grünig et al 2010); the second is similar to the requirement for appliances, (the appliance label was extended to online information from January 2015). When consulted a majority of stakeholders were in favour of providing information on other media (including the internet) for cars too (DG CLIMA 2008).

The final requirement is of more relevance to appliance labelling – while all Member States provide hard copies of the guide (as required), several Member States have voluntarily supplemented this with an online searchable database[19] of all cars available for sale with regular updates (Brannigan et al 2011). These have similarities to the product registration database for appliances which was one of the recommendations of the

19. These databases are enabled by the EU requirement that all car sales within the EU have to be registered and Member States have access to this data.

Ecodesign and Energy Label review (Molenbroek et al 2014). An online database has considerable advantages over printed material in terms of the ability to keep it up to date (for example updating fuel costs, which alter considerably and quickly, or changing tax levels) and making it easier for consumers to compare cars. For example in France, ADEME provides a searchable online database[20] to help consumer identify the least polluting vehicle fulfilling their requirements. The consumer enters the criteria they want the vehicle to have; they can include a specific brand and model. The tool will generate the CO_2 impact for that vehicle but will also show other cars that could be considered that are best and worse choice (Brannigan et al 2011).

SUPPORTING POLICIES

EU Policies

The EU's other main policy designed to reduce car emissions is the Fleet Emission Standards for New Passenger Cars (regulation no 443/2009). The Regulation aims to reduce the average CO_2 emissions from new cars to 130 g/km by 2015 (approx. 5.6 litres per 100 km for petrol cars and 5.0 litres per 100 km for diesel cars). 2012–14 was a 'phase in' period when 65 % (2012), 75 % (2013) and 80 % (2014) of cars from each manufacturer have to comply. The target for 2021 is 95 g/km with a requirement for 95 % of the fleet to meet the target in 2020.

The target is an average for all cars sold, not a fixed limit that no car may exceed. Manufacturers can average the CO_2 emissions from all cars they sell. Manufacturers can also file for joint-compliance with other manufacturers, in order to average their emissions over a larger pool of vehicles. Manufacturers are required to report to each Member State annually and these data are then collated for the European Commission. (Prior to the introduction of this directive there was a voluntary agreement with manufacturers and CO_2 emission of new cars were monitored – data is available on an annual basis from 1999 onwards)

Member State policies

Many Member States have introduced voluntary, additional, policies which interact with and support the car label. These are listed for selected (case study) Member States (Brannigan et al 2011) in Table 8[21].

Awareness and effectiveness of the car and appliance labels

CONSUMER AWARENESS OF LABELS

The consumer surveys on appliances and cars identified in this research did not measure the same parameters: Table 9 shows the result of a survey of 1,000 people in each of seven EU Member States on appliance labels who were shown an appliance energy label and asked "Have you ever seen this label before?" (Ipsos MORI 2008).

Whereas the multi-Member State survey on car labels (Codagnone et al 2013) asked respondents if they were familiar with car labels (as much as 49 % of the sample disagreed), if they are easily recognisable (almost 40 % disagreed), and if the car labels were unfamiliar to them (44.5 % agreed).

So the data is not clear-cut. But it does suggest that consumers show much lower awareness and recognition of the car label than the appliances label.

EFFECTIVENESS OF LABELS

Car label

As the car label directive has been in place alongside Member State policies, a voluntary agreement and latterly the fleet average directive, it is not possible to ascribe savings to a specific policy, such as car labelling. It is possible to say that there has been a dramatic decrease in new car emissions. The average new car emissions in 1995 (for the then 14 Member States) was 186 g CO_2/km. The average specific emissions of the new European car fleet in 2013 was 126.7 g CO_2/km (a reduction of 4.1 % compared to 2012) (EEA 2014). This meant that the EU car fleet met the 130 g CO_2/km target of the Fleet Average Directive, two years ahead of the 2015 deadline.

The 2005 review of the car label directive (Gärtner) (before the introduction of the Fleet Average directive, but with an industry voluntary agreement in place) found that the technological evolution agreed in the voluntary agreement of the automobile industry was a major contributor to the reduction on emissions between 1999 and 2003 (when the average was 164 g CO_2/km). Car labelling was thought to have had only a modest effect.

Along the same lines the Society of Motor Manufacturers and Traders Limited (SMMT 2014) attributes the fall in emissions in 2013 (for the UK) to:

- Technology – enhanced technologies delivered across manufacturers' model ranges, especially new drive trains (including introduction of more alternatively-fuelled cars).
- Market shift – consumer preference for lower CO_2 emitting models strengthened by challenging economic conditions and desire to reduce running costs. Improved mpg = lower CO_2 emissions.
- New Car CO_2 Regulation and other legislation encourage lower CO_2 emitting cars.
- CO_2-based taxes and enhanced information also drives move to more efficient cars.
- Introduction of fiscal incentives for ultra-low emitting vehicles have encouraged their up-take.

Car labels feature in this list only as a contributor part of one bullet point – 'enhanced information' (although it should be noted that the authors, representing manufacturers, are not impartial judges, and the information the labels provide supports other aspects such as regulation and taxes).

Appliance label

Similarly appliance labels have not operated on the market alone : there have been a wide range of policies in place including Member State information campaigns (see Winward et al

20. http://carlabelling.ademe.fr/recherche/index

21. Industry, Germany: Commitment of European Automobile Association (ACEA), Japanese Automobile Manufacturing Association (JAMA) and Korean Automobile Manufacturing Association (KAMA), regarding the reduction of CO_2 emissions of new cars. Commitment of German Association of the Automotive Industry (VDA), and The Association of International Motor Vehicle Manufacturers (VDIK), regarding the introduction of energy saving measures as standard equipment of new cars

Table 8. Member State additional policies supporting car labels (Brannigan et al 2011).

Member State	Fiscal incentive	BusinessTax allowance	Car (circulation) taxation	Procurement	Information	Industry
Belgium	Discount for individuals up to 15 % of price	Up to 90 %	N/A	Government only to buy A to C cars	Website calculations includes tax and other incentives	N/A
Denmark	N/A	N/A	Based on fuel economy	N/A	Campaigns via TV, radio and web	N/A
France	Subsidy (bonus) for low emissions, penalty (malus) for high emissions	N/A	On registration – for higher emitting cars only	N/A	Guide to incentives	N/A
Germany	N/A	N/A	Based on emission level and engine capacity	N/A	Campaign by German Energy Agency dena	Commitments
Hungary	N/A	N/A	N/A	N/A	N/A	N/A
Romania	N/A	N/A	N/A	N/A	N/A	N/A
Spain	N/A	N/A	Based on CO_2 emissions	N/A	N/A	N/A
UK		Based on emissions, extra allowances for v low emissions	Based on CO_2 emissions			

Table 9. Recognition of the EU appliance label (Ipsos MORI 2008).

Member state	Denmark	France	GB	Germany	Italy	Netherlands	Poland
'Yes' Response rate	95 %	95 %	87 %	87 %	87 %	95 %	81 %

1998 for a description of Member State information campaigns in the first few years from introduction of the appliance label), Member State financial incentives (see Luttmer 2006 for a description of the combination of policies including information campaigns and subsidies in the Netherlands), voluntary industry agreements and since 2005, the Ecodesign directive[22], setting minimum energy performance standards EU wide. Nevertheless it is widely recognised that appliance labelling has had a significant effect, increasing the market share of energy efficient products (Molenbroek et al 2013).

The evaluations completed to date are more definite in attributing energy savings to appliance labels than for cars.

22. Currently the framework directive is the Ecodesign of energy related products directive 2009/125/EC.

Figure 2. Recommended promotional material design for cars (Codagnone et al 2013).

A MODEL OF CONSUMER RESPONSE TO LABELS[23] AND OTHER FINDINGS FROM A CAR LABEL DESIGN STUDY WHICH COULD HELP IMPROVE THEIR EFFECTIVENESS

As part of a project to explore the options for car labelling and consumer information (Codagnone et al 2013) the authors used responses to their first consumer survey[24] to establish the relationship (i.e. the degree of cause and effect) between five variables: comprehension of the information on the label; other factors[25]; trust (in the information on the label); familiarity and label usage. They found that use of labels is largely influenced by trust, other factors and familiarity, with comprehension having only a small role. However comprehension has a strong influence on familiarity and trust – so if comprehension is low trust and familiarity will develop more slowly.

The project tested variations of design of two types of material – an emissions label with classification and promotional material. The latter was similar to manufacturers' car adverts but with different information about environmental impact and running costs. An example, the one recommended for use based on the project findings, is shown in Figure 2.

This initial survey was followed by laboratory experiments to develop the methodology further and a large scale online experiment, testing various aspects of the label and promotional material. All the experiments used control groups to identify aspects of design or information which had a statistically significant effect. The authors found that results were complex and non-systematic (i.e. not entirely consistent between the different experimental phases of the project). However the authors were able to draw the following conclusions for the label design:

- In terms of reasoned consumer response an absolute CO_2 emissions classification was better and was recommended.
- Additional information on fuel economy worked better than that on emissions performance.
- And on the promotional material:
- The results overall were stronger than for the label – there were more statistically significant effects from the different design aspects used.
- Including a graphic illustration of CO_2 emissions was effective.
- The use of a larger element showing the running costs over 5 years was also effective.

Based on the evidence and existing models of behaviour Codagnone et al hypothesised that the limited effect of changes in the label design were at least partly due to two aspects: the label was already complex and overloaded with information; and the design constraints of the label meant the additional information tested required a degree of attention that was not available from consumers. The changes to the promotional material were more effective because: the visual stimuli in them was simpler and easier for consumers to process; there was less constraint on design so there was more variation between the designs; the promotional material may have presented the information in a way that was more familiar to consumers.[26] They strongly rec-

23. In the report the authors described this as 'Explaining the determinants of labels usage'.

24. Based on questions asked before respondents were shown the different label and promotional material designs.

25. The importance of factors in car selection other than the information provided in the label (budget, aesthetic values, etc.).

26. There is not space here to give full justice to the conclusions – this is a very simplified version of the findings. Interested readers are strongly recommended to read the report in full.

ommended using environmental information on promotional material because of this greater effectiveness, and because it could reinforce and speed up the process of familiarisation of the emissions rating, leading to greater consumer usage[27].

Conclusions and recommendations for appliances

The main conclusion from this review that the author has arrived at is that appliance labelling is considerably in advance of car labelling in terms of its effect on consumers. Most of the difference does not appear to be due to the way that the car label has been implemented – much of this appears to be due to the consumer's strong psychological identification with their car. This personal connection means that 'other factors' have the strongest influence on their decision and that the information supplied on the label has less impact than when they are purchasing appliances.

The work by Codagnone et al (2013) also suggests that once appliance labelling became established it benefitted from a psychological effect – familiarity and trust encouraged label usage. The evidence from the different from the car and appliance surveys is not clear-cut as the data is not directly comparable – the questions asked were not consistent and the factors affecting behaviour not directly equivalent. But it is suggestive. The high awareness figures for the appliance label found in surveys (e.g. Ipsos MORI 2008) could be consistent both with the popularity of energy consumption, water consumption and energy label grade, as criteria for selecting a new appliance (Promotion 3e 2011and Schmitz and Stamminger 2014) and with the judgement that labelling has had a strong effect on the market. Similarly the low familiarity of consumers with the car label (Codagnone et al 2013) could be consistent with environmental impact[28] not featuring in the purchasing criteria list for cars either at all (Dixon and Hill 2009) or very low on the list (Codagnone et al 2013) and the perceived weak effect of the label.

However, there are findings from the reviews of the car label which the evidence suggests could be of use when how to improve the effectiveness of appliance labelling. They are:

1. Using online product databases which would make it easier for consumers to find and to compare products on their environmental and cost performance.
2. Use of an absolute rather than relative environmental performance.
3. Use of an absolute or relative rating for the label categories between types of products providing the same service of product (e.g. gas or electric ovens for appliances).
4. Providing operational cost data (fuel, tax) on the label.
5. Providing promotional material.

The first two of these will be encompassed in the scope of the Energy Labelling and Ecodesign directives, the revision of which is expected to be announced before this paper is presented so will not be discussed further here. The third aspect has been decided so far on a case by case basis for each product group in appliance labelling and so is open for discussion. To date the tendency has been to use an absolute (technology blind) approach for the appliance label[29] and this matches the conclusion of the latest car label review (Codagnone et al 2013). However further examination of the experience in cars could be helpful when other products where this is applicable are under consideration.

Considering the fourth aspect, if cost information is not included on the appliance label there may be a positive consumer response if other agencies (Member States, Local Authorities, NGOs, retailers) provide this information. Member States have taken a variety of approaches on cost data on the car label as well as a number of studies considering label design. The evidence to date is complex – there is no clear front runner for which factor to use (per mile, per 5 years?), and there are considerable challenges in terms of choosing appropriate assumptions – particularly with a fuel price which can change hugely over time. However the wealth of experience here should be examined to pick out what lessons can be learnt for appliances. In some ways the lack of standardisation may be an advantage – values and approach can be customised to local circumstances.

The last aspect, promotional material, has no direct connection to the appliance label and thus is most open to use by other agencies provided that they can persuade manufacturers and retailers to be involved. As stated above Codagnone et al (2013) suggest that for cars this sort of material can have a stronger effect on consumers than the label and it seems reasonable that, while there are differences, this should also be true to some extent for appliances. Promotional materials also have the advantage the design is completely open – organisations can adapt the information to local preferences for what and how data are presented, how and how often the appliances are used[30] and update it as required[31]. There is also scope to include web links or QR codes to make it easy for consumers to access further information on line. This suggests that using this sort of material to support the appliance label, in whatever form it emerges from the latest revision, could be a good way forward. Against this is the fact that public agencies can not act independently – manufacturers and retailers produce these materials and they would need as many as possible to sign up to form a voluntary agreement or code of conduct for this to be effective.

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27. The trust (or lack of it) that consumers have in promotional material produced by manufacturers was not explicitly addressed by the authors. This may be an issue in that consumers may be wary of 'greenwash', that is manufacturers over stating the environmental benefits of their products.

28. Explicitly, rather than expressed as fuel or operating cost.

29. With some exceptions e.g. in air conditioning room units are on a separate scale to single/double ducts.

30. For example to calculate running costs of a lamp based on average hours usage per year which is reflects the situation for that particular Member State or region.

31. For example to react to major changes in energy costs.

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Acknowledgements

This paper draws in part on research undertaken for LBNL on energy labels for appliances in 2010. Thanks to Kevin Lane for reviewing and commenting on the abstract. Finally, I would like to thank the anonymous reviewers and the eceee panel leaders for their feedback on this paper.

32. UK Department of Energy and Climate Change

33. European Environment Agency

34. The Society of Motor Manufacturers and Traders Limited (UK).