



CO₂ labelling of passenger cars in Europe: Status, challenges, and future prospects



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HIGHLIGHTS

- Car labelling Directive 1999/94 implemented by all 28 EU Member States.
- National labelling schemes vary from each other in design and amount of information displayed to consumers.
- Future revisions should ensure labelling accurately reflects on-road energy use and CO₂ emissions of cars.
- Expansion of labelling scale toward zero CO₂ emissions would allow differentiating between hybrid and plug-in hybrid cars.

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ABSTRACT

Directive 1999/94/EC requires Member States of the European Union (EU) to ensure that consumers are informed about the fuel consumption and CO₂ emissions of new passenger cars. The European Commission is currently evaluating the directive. In support of this effort, we assess the status of car labelling in the EU. We find that all EU Member States have formally implemented national car labelling schemes. However, relevant information is not presented to consumers in a uniform manner. Only 13 Member States have implemented graphic labels that differ in their design, metrics, and classification of vehicles. The fuel consumption data displayed to consumers underrate yearly fuel costs in the order of several hundred Euros per car. We argue that car labelling can be made more effective if Member States adopt: (i) a uniform label that mirrors, as far as feasible, the design of the EU energy label, (ii) data and classification metrics that accurately reflect the fuel consumption and CO₂ emissions observed by consumers, and (iii) a labelling scale that allows differentiation between efficient hybrid and plug-in hybrid vehicles. By following these recommendations, the European car labelling can receive wider recognition and foster well-informed consumer choices.

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1. Introduction

In 1999, the European Union (EU) introduced Directive 1999/94/EC (EC, 1999) to inform consumers about the fuel consumption and carbon dioxide (CO₂) emissions of new passenger cars. This so-called car labelling directive should enable informed consumer choices and contribute to achieving a 40% reduction in the economy-wide greenhouse gas (GHG) emissions by 2030 compared to 1990 levels (EC, 2010a, 2015). Recently, policy makers have taken a renewed interest in the car labelling directive

for several reasons:

- The 250 million passenger cars in use account for 14% (6.4 EJ) of the final energy use and 12% (450 Mt) of the fuel-related CO₂ emissions of the EU (ACEA, 2014; EC, 2014a, 2014b); increasing the fuel efficiency of cars can reduce CO₂ emissions and fuel costs, thereby making passenger road transport more resilient to increasing oil prices.
- Passenger cars represent the single largest energy consumer and CO₂ emitter among all energy-demand technologies labelled in the EU.
- Member States have implemented labelling schemes by applying a range of designs and metrics. However, experience with the various schemes, specifically in view of their effectiveness remains limited (see, e.g., ADAC, 2005; AEA, 2011; Codagnone et al., 2013).

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In 2015, the European Commission (EC) initiated a comprehensive review of the car labelling Directive 1999/94/EC. In support of this effort, we assess and evaluate here the status of car labelling in the EU based on a scoping review of peer-refereed articles, research reports, and official policy documents, complemented by own analyses. In addition, we draw upon the experience gained from labelling of other energy-demand technologies and discuss the effectiveness of product labels in influencing consumer choices.

The article continues with a short description of our methods (Section 2) and principle considerations about environmental labelling (Section 3). Section 4 provides an overview of the regulatory provisions defined in the car labelling Directive 1999/94/EC (EC, 1999). We address the implementation of the car labelling directive by EU Member States in Section 5. The article ends with a discussion and conclusions for researchers and policy makers in Sections 7 and 8.

2. Methods

This paper focuses on the mandatory labelling scheme established with respect to CO₂ emissions and fuel consumption of new passenger cars within the EU. We refer to the relevant Directive 1999/94/EC (EC, 1999) as the car labelling directive. We seek to analyse the modalities of implementation and subsequently the effectiveness of car labelling across EU Member States based on a scoping review (Grant and Booth, 2009) of the English literature, including:

- peer-refereed articles identified through 'scopus' and 'researchgate';
- scientific reports, presentations, workshop documents, and working papers identified through a standard 'google' search;
- legal documents such as directives, regulations, and official communications that are publicly available through the web servers of EU Member States and the European Commission.

We search the internet for these documents by using the key words: "car labelling", "CO₂ labelling", "CO₂ labelling directive" in combination with the terms "passenger cars", "assessment", "European Union", and "European Commission". We identify a total of 86 relevant documents that were published before April 2015. Out of these, 36 constitute peer-refereed articles, 23 research reports, 13 legal documents of the European Commission or EU Member States, and 14 other sources of information such as websites, books, presentations, and data sheets. Out of the 86 documents, 7 specifically assess the EU car labelling scheme and its implementation (see Table A1 in the Appendix).

We complement our internet search on car labelling in two main areas. First, we survey key literature on product labelling in general to identify the strengths and limitations of labelling, specifically its effectiveness in affecting consumer choices and decreasing the environmental impacts of production and consumption. This survey does not aim at a comprehensive analysis of product labelling but rather seeks to add rationale to the literature on car labelling wherever this appeared necessary. Second, we conduct an analysis of the implementation status of car labelling in the various EU Member States. To this end, we verify with authorities whether and, if so, in what form information about the fuel consumption and CO₂ emissions of new cars is provided to consumers. For selected countries that apply a graphic label, we identify the assigned label class for twenty car models in ten segments, ranging from mini cars up to luxury cars and sport utility vehicles. This analysis can verify whether the labels applied in EU Member States diverge in the classification of car models. Based on the findings of both the literature review and our

complementary analysis, we provide recommendations on how to increase the effectiveness of car labelling in the EU.

3. Environmental labelling

Environmental labelling intends to provide consumers with information on the environmental impact of products and services based on verifiable criteria. It represents a low-cost and often easily implementable policy option to overcome information asymmetry and market failure by 'nudging' consumers to informed pro-environmental choices (Sammer and Wüstenhagen, 2006; Amstel et al., 2008). The effect of environmental labels on consumers depends on the amount and manner in which information is provided and on the frequency with which consumers are exposed to the label (Teisl and Roe, 1998; Allcott and Mullainathan, 2010; Waechter et al., 2015). Moreover, the accuracy of information conveyed to consumers is of critical importance as inaccurate information can misdirect consumers away from environmentally optimal choices (Bougherara et al., 2005; Pedersen et al., 2006; Davis and Metcalf, 2014).

A diversity of mandatory and voluntary environmental labels exists worldwide; these are also referred to as eco-labels, energy labels, green stickers, or product labels. Within the EU, the ecolabel, energy label, and car label are prominent examples of labels that provide consumers with information on the environmental impact of products and services (e.g., EC, 1992a, 1992b, 1999; Raimund, 1999; Thøgersen et al., 2002, 2009; Cohen and Vandenberg, 2012). Two types of environmental labels can be distinguished: endorsement and comparison labels. *Endorsement labels* indicate that a product or service meets a pre-defined standard (BIS, 2011). The EU ecolabel represents an example of an endorsement label (EC, 1992b). Introduced in 1992, the ecolabel constitutes a voluntary labelling scheme of products and services with a reduced environmental impact relative to a predefined standard. To date, over 2000 ecolabel licences have been awarded in the EU, covering more than 44,000 products and services that range from tourist accommodation and all-purpose cleaners to (and beyond) tissue paper, textiles, and footwear (EC, 2016). *Comparison labels* tend to provide information on the quantitative performance of a product in view of one or multiple parameters, therefore allowing consumers to compare products. The EU car label (EC, 1999) and the EU energy label (EC, 1992a, 2010b) represent comparison labels, providing information on the energy efficiency of cars and household appliances.

The EU energy label has been successful in 'nudging' consumers to the purchase of energy efficient domestic appliances (e.g., refrigerators, freezers, dishwashers and washing machines) for approximately 90% of appliances sold in the EU are now labelled as class A (Allcott and Mullainathan, 2010; EC, 2010c). Although causality is difficult to establish, EC (2008a) estimates that the EU energy label has contributed to first-order CO₂ emission reductions of some 14 Mt annually between 1996 and 2004. Still, an estimated 10% of saving potentials are lost due to poor enforcement across EU Member States (Ecofys, 2014). Labelling products with an A-G scale thereby appears to be more effective than applying a label with an A+++ to D scale (LE/IPSOS, 2014). This observation may be explained by consumers relating the plus signs to extraordinary high efficiency that exceeds the standard for efficient products typically labelled as class A.

Moreover, Waechter et al. (2015) found that consumers judge the absolute energy consumption of appliances based on the coloured graphic efficiency label rather than the numerical information provided on the label sticker, and in turn, tend to choose larger appliances with a higher absolute energy consumption if

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