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# Internet-orientated Hungarian car drivers' knowledge and attitudes towards biofuels



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## ABSTRACT

The respondents rated the most important questions of the questionnaire on a Likert scale. The responses greatly deviated from the normal distribution; therefore, the Kruskal–Wallis  $H$  and Mann–Whitney  $U$  were used to test the differences of knowledge about and interest in biofuels and of differences between the most important characteristics of the analysed clusters. As opposed to other studies in this topic, respondents' self-knowledge and real awareness about biofuels were examined jointly. As a result, it was concluded that 78% of those who rated their knowledge appropriate are relatively realistic about the depth of their knowledge. Significantly less respondents had practical experience with biodiesel than ethanol, but the results of the crosstable analysis suggest that these respondents know biofuels more than those who had practical experience with ethanol. Although respondents are basically positive about biofuels, there are significant differences between them. Based on the result of the attitude analysis, respondents were classified into three typical clusters: the indecisive, the supporters and the sceptics. The three clusters can be clearly distinguished from each other in terms of their ways of thinking and they probably represent the opinions of the drivers about biofuels well. Compared with other countries' surveys, the results suggest that there are many similarities and differences between Hungarian car drivers' perceptions to biofuels. It is our opinion that the findings of our examinations are capable of focusing decision-makers' attention, as they corroborate the significance of conveying knowledge and influencing others online.

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## Contents

1. Introduction.....	17
1.1. Brief presentation of biofuels.....	18
1.2. Consumer environmental awareness vs. knowledge.....	18
1.3. Examination of consumers' attitude and knowledge concerning biofuels.....	19
2. Methods.....	20
2.1. Sampling and questionnaire methods.....	20
2.2. Procedures used in evaluation.....	20
3. Results and discussions.....	21
4. Conclusions and policy implications.....	24
References.....	25

**Abbreviations:** GHG, greenhouse gases; WWF, World Wide Fund for Nature; ACEA, European Automobile Manufacturer's Association; COPA-COGECA, The united voice of farmers and their co-operatives in the European Union; USDA, United States Department of Agriculture; B-10, fuel with 10% biodiesel and 90% fossil diesel content; DDGS, Dried Distillers Grains with Solubles; RED, Renewable Energy Directive (EU); ILUC, Indirect Land Use Change; DLUC, Direct Land Use Change E-85, fuel with 85% bio-ethanol and 15% gasoline content

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## 1. Introduction

Biofuel production and use dramatically increased in the last years. In 2006, 39 billion l bioethanol and 5760 thousand t biodiesel were produced globally, increasing to 86 billion l bioethanol and 18,500 thousand t biodiesel by 2012 [1–3]. The development of the sector was accompanied by the need for energetic independence, the significant role of diesel (60%) in the EU's fuel consumption, as well as the fact that several oil companies and transport enterprises

started to take part in research and development. As a matter of course, this sudden development causes changes in land use, trade and industry, thereby placing the entire biofuel sector in the crossfire between serious debates. The scientific interest elicited by these debates is still present in the areas of environmental protection [4–6], land use [7,8], food administration [5,9], as well as economy and trade [10–14] arguments from these scientific fields are used to prove or disprove the necessity of biofuels. For this reason, the mainstream of research left consumers unaffected and there were only a few surveys aiming at their knowledge of and opinions regarding this topic. Therefore, the objective of this paper is to fill the gap and examine the knowledge and attitudes of Hungarian car drivers concerning biofuels. Even though there are numerous studies dealing with car drivers' knowledge, no one has ever performed the simultaneous examination of their self-knowledge and real knowledge. There is a vast amount of information of various quality about biofuels on the Internet which greatly influence consumer preferences; therefore, we considered it to be important to ask those respondents who regularly visit online car portals. It is our opinion that the findings of our examinations are capable of focusing decision-makers' attention, as they corroborate the significance of conveying knowledge and influencing others online.

Today, almost all of the commercially available biofuels are produced from either starch or sugar-rich crops (for bioethanol), or oilseeds (for biodiesel). Recent research has found that these bioenergy sources have their drawbacks [15,16] and turned attention to the use of ligno-cellulosic feedstocks, such as perennial grasses and short rotation woody crops for bioenergy production [17,18]. Removing CO<sub>2</sub> from the atmosphere (negative emissions) implies that human-induced uptake of CO<sub>2</sub> would have to be larger than the amount of human-induced GHG emissions. One of the few technologies that may result in negative emissions is the combination of bioenergy and carbon capture and storage [19].

This section offers a brief overview of biofuels, the development of the biofuel sector, the current anxieties and a non-exhaustive description of the main studies targeting consumer knowledge.

### 1.1. Brief presentation of biofuels

The transport sector is responsible for about 20% of world primary energy demand. Transport biofuels are currently the fastest growing bioenergy sectors even they represent just around 3–4% of total road transport fuel and only 5% of total bioenergy consumption today. They also are seeing small but increasing use in the aviation and marine sectors [20]. The increasing prices and environmental impacts of fossil fuels have made the production of biofuels to reach unprecedented volumes over the last years. Bioethanol- and biodiesel production raised from 39 billion litres to 85 billion litres and from 6 billion litres to 18 billion litres, respectively, between the period of 2006–2012 [3].

Growth in biofuels markets, investment, and new plant construction has slowed in several countries in response to a number of factors: policy uncertainty, increased competition for feedstock, impacts of drought conditions on crop productivity, concerns about competition with food production for land and water resources, and concerns about the sustainability of production more broadly. Currently, around 80% of the global production of liquid biofuels is in the form of ethanol. The two world's top ethanol producers, the U. S. and Brazil, account for around 85% of total production. Biodiesel production is far less concentrated than ethanol. The European Union remained the centre of global biodiesel production, with 7.9 million tonnes litres and representing 43% of total output in 2012 [3].

To drive development of biofuels that provide considerable emission savings and at the same time are socially and environmentally acceptable, support measures need to be based on the sustainable

performance of biofuels. Recent years have also seen increased attention to biofuels sustainability and environmental standards. However, neither specific advanced biofuel quota, nor performance based support measures on their own seem to be effective to address the higher production costs of advanced biofuels in the short term [21].

As regards the utilisation of biomass for energetic purposes, optimisation from environmental and economic aspects is also important [22]. Environmental and social aspects, and sometimes economic advantages, are often particularly emphasised, but sustainability can only be provided with the complex evaluation of these factors. Of economic factors, the role of logistic approach is more preferred in the process of biofuel production [23], since it cannot be neglected that the energy and cost input of the production of energy resources greatly depend on logistic parameters (e.g., distances of feedstock transport, characteristics of vehicle fleet) and the poorly developed (non-optimised) logistic system may reduce or defeat all other advantages of biofuels.

A key requirement for all biofuels to get access to the market will be compliance with international fuel quality standards. This will ensure vehicle and infrastructure compatibility among different regions and promote consumer acceptance for new fuels. End-use infrastructure requirements also need to be addressed to avoid bottlenecks caused by incompatibility with deployed biofuels. Evolution of fuel specifications and new fuel grades are taken into account in the developing of future vehicles, such as compatibility of vehicles in the fleet with higher biofuels blends or new limits for existing specifications. Backward compatibility of fuel changes is a very difficult issue, because it is extremely difficult to cover all the vehicle generations and models combined with reliability risks for the customers and a risk for vehicle manufacturers in meeting legal commitments (CO<sub>2</sub> emissions). Furthermore, this issue is costly. Automotive manufacturers need sufficient protection for the existing fleet at any point in time and a sufficient lead-time and clear fuel specifications for the future. At least 5 years lead-time should enable the automotive industry to adapt to new fuel standards. Electric vehicular solutions seem to be viable for light vehicles and short distances [3].

### 1.2. Consumer environmental awareness vs. knowledge

The consumers of developed countries became increasingly environmental-conscious during the last two decades [24–27]. This phenomenon has become a serious factor in the consumer attitude seen on the market of both food and other products, resulting in the development of the so-called “green market” segment [28–30]. The examined biofuels constitute a special sub-field of the green market segment, as the level of their acceptance is determined by numerous factors: crude oil prices, the renewable energetic objectives of each country and the EU, politics (also including the political views of consumers [31], as well as the press coverage of policy, intellectual and emotional debates around them.

The evaluation of biofuels shows a lot of diversity among the players of this sector. Conservationists, environmentalists, professionals involved in food administration, as well as automotive manufacturers, express their negative opinions, while agricultural producers and biofuel producers usually emphasise positive impacts in accordance with the following typical standpoints [32,33].

Based on the highly controversial paper of Pimentel et al. [34], 75% of the food price increase is caused by bioethanol. Furthermore, ethanol production from maize results in 10–30% price increase of basic food products in the US. WWF supports biofuel aid packages to developing countries, second generation biofuels and the tightening regulations of car manufacturers' emission reduction. According to Hungarian Energy Club, first generation

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