



Barriers and solutions for the deployment of biofuels in Europe

Survey results





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The Biofuel Cities website can be accessed at: www.biofuel-cities.eu

A great deal of information on the European Union is available on the Internet. It can be accessed through the Europa server: <http://europa.eu.int>

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1. Introduction

Biofuel Cities is an European project - supported by the European Commission - that provides a platform for biofuel stakeholders. In particular, Biofuel Cities will integrate European research and pilot application of biofuels in European local governments. The project aims to accelerate the market introduction of biofuels and energy-efficient vehicles based on local sustainable mobility policies, and stimulate continued market penetration of biofuels through identifying strategic Research & Development needs and policy development. The project has started in June 2006, and will end in June 2009.

This report describes the results of a survey that was carried out in order to identify and collect information on technical and institutional (legislation, standards) barriers for the large scale implementation of biofuels. The results of this survey provide insight to all related stakeholders like policy makers, vehicle (fleet) owners and operators, biofuel producers and distributors and will support them by developing instruments for stimulation of the use of biofuels and by setting up initiatives for the application of biofuels at a local scale.

The Biofuel Cities European Partnership aims to:

- > gather and disseminate information on biofuels including scientific, policy, and practical developments;
- > encourage networking possibilities to maximise synergies with existing initiatives and to improve co-operation among local, national and international organisations;
- > provide mechanisms to facilitate the establishment of partnerships between different organisations; and
- > provide other useful tools and information, such as publications, details of events, and training and more to support work on biofuels.

In chapter 2 the research methodology is described and in chapter 3 the results will be discussed. Annex 1 gives an overview of all barriers and the average scores that were given to them by the respondents.

2. Research methodology

This study is based on a questionnaire that was developed in cooperation with relevant stakeholders. The questionnaire presents a list of different kinds of potential barriers classified in 5 different groups: Policy and Market, Vehicles, Fuels, Infrastructure and Feedstock Production. For each of the groups most relevant potential barriers have been defined in direct cooperation with the stakeholders.

The questionnaire was distributed via email and was accompanied by a letter with the invitation to contribute and an explanation about the set up of the questionnaire. Stakeholders were asked to indicate to what extent the different potential barriers are limiting or slowing down the introduction of biofuels. The importance of the different barriers is indicated by giving a score to each of the potential barriers. A score of 5 means that the barrier is 'very important' (very relevant), a score of 4 means that the barrier is 'important', 3 means that the barrier is 'relevant', 2 means that the barrier is



'not so relevant' and 1 means that the suggested barrier actually is not an barrier; 'not relevant'.

The results were analysed by calculating the average score of each of the potential barriers. The average value gives an indication of the relevance of the barrier, and barriers can be ranked by this average. However, the average value should not be used in a quantitative way. For all barriers the standard deviation for the average has been calculated as well. This gives an impression of whether the respondents' views vary greatly or not. In all cases the standard deviation was limited, so there are no big differences among the views of the respondents. Although the scores can not be used in a quantitative way, the averages are used to classify the different barriers in relevance groups. However this classification should not be seen as a black and white difference between the one group and the other.

The results are presented in the following chapter.



3. Outcomes of the survey

3.1. Response

The questionnaire was sent to 590 contacts and was returned by 40 of them, resulting in a response rate of 6.8%. Responses were received from various kinds of stakeholders from different countries in Europe. One questionnaire was filled in by a non-European country (Hong Kong – China). About 70% of the response comes from western and northern Europe, while southern Europe represents almost 20% of the responses. The distribution over the different regions is given in figure 3.1.

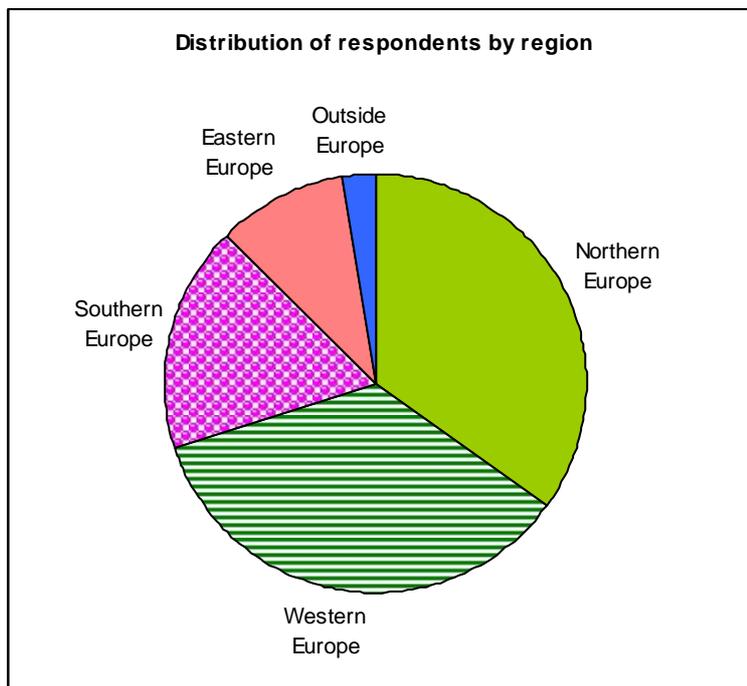


Figure 3.1: Distribution of response by region.

Respondents were asked to indicate which type of organisation they work for. Figure 3.2 shows that the type of organisation has a large variation. However, 'biofuel and oil industry', 'governments' and 'research and development' organisations are represented most. The group 'government' mainly covers local governments. The 'others' group is represented by 'vehicle and technology manufacturers', 'plant constructors' and 'enzyme producers'. Although the response shows a large variety, the feedstock producing sector is missing.

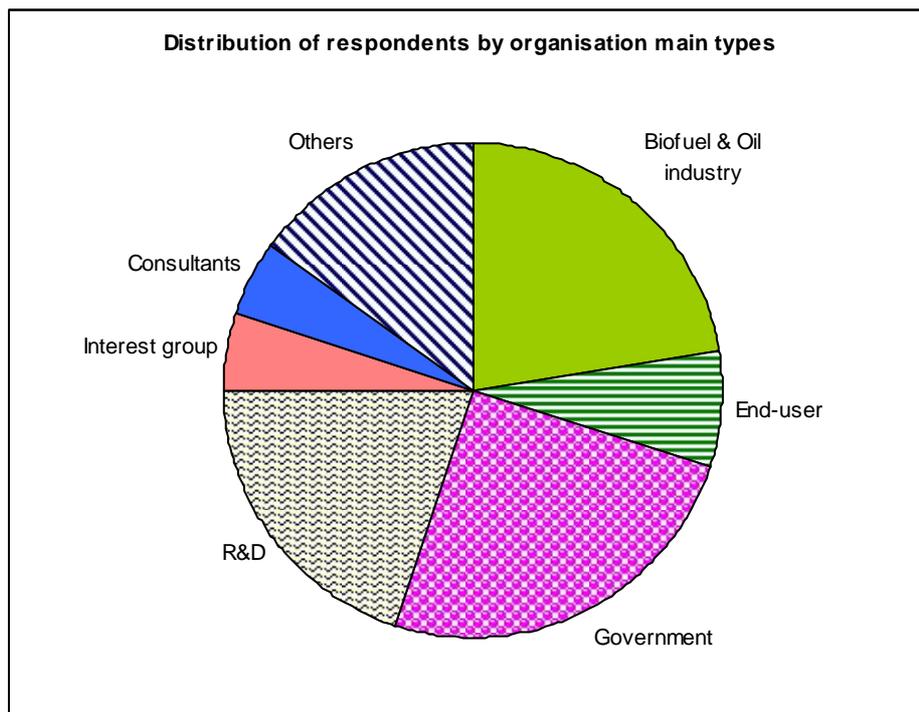


Figure 3.2: Distribution of respondents by organisation main type.

3.2. Barriers

Respondents were asked to indicate to which barriers they are confronted with most. In the questionnaire a distinction is made between barriers in the different parts of the system chain. Respondents were asked to indicate the most important barriers in relation to vehicles, fuels, infrastructure, feedstock and policy and market conditions. In the following section an overview will be given of which barrier groups are most relevant as well as the relative importance of the barriers. The sections thereafter will focus on the most important barriers (those barriers that were rated between 4 and 5), and the relevant barriers (those barriers that were rated between 3 and 4). For the latter two sections the barriers are ranked on the average score they got from the respondents. Only two barriers got a score of 4.0 (meaning this is an important barrier). Many more barriers were ranked between 3 and 4. Of course the difference between 3.9 and 4.0, e.g., does not justify the conclusion that the one barrier is 'important' and the other one just 'relevant'; however, this distinction has been made for the sake of readability. Barriers with a relatively low score (1-3) are not discussed explicitly in this paper; however the results are presented in Annex 1 (overview of barriers and their ranking).

3.2.1. General barriers information

Table 3.1 below gives an overview of the average ranking of the barriers per barrier group (category). This overview indicates that the dispersion between the relevance of the different barriers groups is not significantly but that 'Policy and Market' and 'Infrastructure' related barriers might be seen as most relevant.



<i>Category</i>	<i>Average ranking</i>
Policy & Market	3.4
Infrastructure	3.2
Fuel	3.0
Vehicle	2.9
Feedstock production	2.7

Table 3.1: Relevance of the different barriers groups (category).

Table 3.2 gives an indication of the dispersion of the barriers among the relevance groups. This information shows that most of the suggested potential barriers are either seen as 'Relevant' or as 'Not that important'. However, as these figures are based on averages per barrier the maximum scores (those barriers that got a 5 from any of the respondents) can not be extracted from this table.

<i>Relevance group</i>	<i>Average ranking</i>
Very important (5)	0%
Important (4-5)	4%
Relevant (3-4)	44%
Not that important (2-3)	48%
Not important (1-2)	4%

Table 3.2: Overview of the number, in terms of percentage, of barriers per relevance group.

3.2.2. 'Important' barriers

In the table below (3.2) an overview is given of those barriers that are generally considered to be the most important ones if it comes to the introduction of biofuels. On a scale from 1 to 5 'Limited availability of biofuel vehicles with producer warranties' and 'fossil fuel standards limit the use of biofuel blends' get an average score of 4.0. This score indicates that among all possible barriers this barrier is seen as 'important'. The value of the standard deviation indicates that the respondents, in general, have a similar view on this. The reactions vary from relevant barrier to very important barrier. Only one respondent, a biofuel producer, indicated that these issues have no relevance.

<i>Category</i>	<i>Barrier</i>	<i>Importance</i>
Vehicle	Limited availability of biofuel vehicles with producer warranties	4.0
Fuels	Fossil fuel standards limit the use of biofuel blends	4.0

Importance: average score between 0 (low importance) – 5 (high importance).

Table 3.3: 'Important' barriers per category.

Some of the respondents made some remarks and suggestions how the barriers could be overcome or indicated some specific issues behind the problem. It was mentioned that concrete incentives should be put in place to stimulate manufacturers to produce



biofuel-compatible vehicles, therefore international standards might be necessary and it might be wise to set standards for a limited number of fuels in order to facilitate that manufacturers can focus on some fuels instead of having to develop all kinds of engines. Manufacturers might foresee additional maintenance problems due to the introduction of advanced (cleaner) engine technologies (like soot filters). It is also mentioned that, while some manufacturers provide vehicles that are able to run on biofuels (e.g. flexifuel vehicles) their competitors are lacking behind. This might indicate that it is not only about technology development but also about willingness to change. The fact that in Brazil ethanol cars have been on the roads for several decades seems to confirm this.

The fact that high blends of biofuels do not comply with EU fuel quality standards for petrol and diesel limits an increasing share of biofuels in the market. The respondents indicate that it is of high importance that new standards, e.g. for E10, should be developed.

3.2.3. 'Relevant' barriers

Quite a lot of the barriers were marked as being 'relevant' (3) to 'important' (4). For readability the 'relevant' barriers are grouped by category.

Vehicle

The barriers mentioned in the vehicle category (see table 3.4) are 'Vehicle compatibility: manufacturers' reluctance to give approval for biofuel use' and 'Limited availability of biofuel vehicles with producer warranties – light commercial vehicles'. These two barriers are directly related. The first one indicates the reluctance of manufacturers to give approval for existing, older, vehicles, whereas the second barrier relates to new sold vehicles. The difference of the second barrier compared to the first barrier in the previous section is that this one specifically applies to light commercial vehicles.

Category	Barrier	Importance
Vehicle	Vehicle compatibility: manufacturers' reluctance to give approval for biofuel use	3.9
Vehicle	Limited availability of biofuel vehicles with producer warranties - light commercial vehicles	3.9

Importance: average score between 0 (low importance) – 5 (high importance).

Table 3.4: 'Relevant' barriers for the category 'Vehicle'.

Infrastructure

Table 3.5 gives an overview of 'relevant' barriers in the category infrastructure. Respondents indicate that available number of fuelling stations for biofuels is limited and that establishing such fuelling stations is expensive. So, end-users that would like to start using biofuels and which have to rely on publicly available fuelling infrastructure do have limited possibilities. Establishing fuelling stations themselves is for many of the respondents too expensive. In some cases the established fossil fuel industry has been indicated as not cooperative in introducing biofuels in their fuel distribution networks. This might be due to fuel quality concerns. Some respondents indicate the lack of feedstock and production capacity for biofuel production. These barriers are assumed to be very location specific as in general terms feedstock is available in large quantities on the global market.



<i>Category</i>	<i>Barrier</i>	<i>Importance</i>
Infrastructure	Insufficient availability refuelling infrastructure	3.9
Infrastructure	High costs to construct a refuelling infrastructure, or convert existing infrastructure.	3.5
Infrastructure	Fossil fuel industries oppose the introduction of biofuels into the fuel distribution network (e.g. biogas in natural gas network)	3.3
Infrastructure	Insufficient biofuel production capacity	3.2
Infrastructure	Lack of sufficient feedstock for the biofuel production units	3.0

Importance: average score between 0 (low importance) – 5 (high importance).

Table 3.5: 'Relevant' barriers for the category 'Infrastructure'.

Respondents have indicated several solutions for overcoming the barrier of limited availability of fuelling infrastructure. Suggestions basically address two issues: 'governmental responsibility' and 'flexifuel technologies'. Governments should take the lead in realization of fuel infrastructure by developing adequate policies. Policy instruments could vary from subsidies for the establishment of filling stations, a mandatory target for filling station owners (like in Sweden) to supply alternative fuels or by stimulating (mandate, subsidies or fiscal incentives) the use (and market demand) of alternative fuels. Which policy instruments are most applicable depends on the country or region and the local policy conditions. The second suggestion is that more flexifuel vehicles should be developed. Those vehicles should be able to switch to conventional fuels in the case that filling stations for alternative fuels are not abundant. Different types of flexifuel vehicles exist already (petrol-natural gas, petrol-ethanol) and some manufacturers are even developing multifuel vehicles; vehicles that run on up to 5 different kinds of fuel. As flexifuel technologies might be more expensive than conventional technologies and as long as a broad fuelling network is not available, governments should take the lead in stimulating purchasing of these vehicles and awareness raising.

For the second barrier, high costs to construct a refuelling infrastructure, or convert existing infrastructure, generally the same suggestions to overcome the barrier are given by the respondents: refuelling infrastructure should be stimulated financially and/or it should be mandated by governments.

In relation to the barrier 'Fossil fuel industries oppose the introduction of biofuels into the fuel distribution network' the stakeholders have given varying remarks. Some do not recognise the problem with respect to their own region (or country) whereas others have the opinion that the established oil industry is reluctant to cooperate in bringing alternative fuels to the market as this might have a negative impact on their (future) market position.

The respondents indicate that the issue of biofuel production capacity and the availability of feedstock for fuel production mainly have to do with economics. As long as financial perspectives are good feedstock will be available and production capacity will be realised. However, some of the respondents also indicate that they see a competition between food, feed and fuel and that this competition (or increased market demand) will lead to an increased feedstock price. However, recent high feedstock



prices are mainly due to a shortage in production of biomass (due to poor harvests) and an increasing demand for crops for food and feed.

Policy & Market

Most of the policy and market related barriers that were mentioned in the questionnaire are seen as important (see table 3.6). One of the issues is that in general the stakeholders are missing an alternative fuels strategy from the government on a national level as well as on a more regional level. Most of the remarks indicate that strategies by the government should be in line with the strategy of the EU. However, some of the respondents indicate that things take too long and that local governments should not wait for strategy development on a higher level. It is also indicated that uncertainties and unclearness of short to medium term policies hampers the further development of the sector. As long as the policy forecasts do not cover the return of investment period, investment decisions are hard to take. One of the respondents indicates that experience shows that early progress stems more from municipal initiatives than from actions on the national level. The framework conditions created on a national level are, however, crucial.

Due to the lack of strategies for alternative fuels, according to the respondents, the market and infrastructure build up only develops slowly. A supportive policy framework accompanied by relevant policy instruments might speed up this process.

<i>Category</i>	<i>Barrier</i>	<i>Importance</i>
Policy & Market	Lack of an alternative fuels strategy on national level	3.8
Policy & Market	Slow market and infrastructure development	3.8
Policy & Market	Lack of an alternative fuels strategy on regional or local level	3.5
Policy & Market	Lack of experience on the market	3.5
Policy & Market	Lack of customer awareness and market acceptance	3.4
Policy & Market	Lack of a proactive approach within many local authorities/major business to biofuel use in general	3.4
Policy & Market	Lack of harmonisation throughout the EU concerning fuel taxes, biofuel tax reductions and obligation systems	3.4
Policy & Market	Lack of readily available (independent) information	3.3
Policy & Market	Lack of harmonisation throughout the EU concerning biofuel targets, applied biofuel blends and fuel standards	3.3
Policy & Market	Consumer passivity	3.2
Policy & Market	Certification of biofuel vehicles on fossil fuels (emission performance on biofuels not regulated)	3.1

Importance: average score between 0 (low importance) – 5 (high importance).

Table 3.6: 'Relevant' barriers for the category 'Policy and Market'.



Some of the respondents indicate that local authorities and major businesses are not proactively supporting or developing initiatives with alternative fuels. This might be because of a lack of information or because of fear that wrong decisions might be made.

The respondents indicate that harmonisation of policy targets and policy measures are important issues. Harmonisation is necessary to obtain a level playing field for economic bodies throughout Europe.

One of the barriers that is indicated is the potential lack of readily available (independent) information. This issue has to do with information that could be used by policy makers as well as vehicle operators. The respondents mention that more reliable and independent information should become available and that education is needed. These remarks underline the importance of an information and knowledge platform like the Biofuel Cities Partnership.

In relation to consumer passivity, being one of the relevant barriers, respondents indicate that public awareness should be raised, e.g. by awareness campaigns, and that marketing actions are needed to convince the public to buy or demand for biofuels. However, it is also mentioned that quality and price levels that are comparable with the conventional fuel levels are prerequisites to stimulate consumer action.

Fuels

Fuel quality standards for fossil fuels limit the blending percentage of biofuels. Also, no standards for high blends of biofuels are available yet. These issues limit the increase of biofuels and the use of high blends of biofuels. For fuel suppliers and vehicle manufacturers it is more difficult to determine the focus of their efforts as long as these standards are not set. The respondents provide varying suggestions how to solve this problem; in general the advice is to set standards for, e.g., E10, biogas and biodiesel blends.

<i>Category</i>	<i>Barrier</i>	<i>Importance</i>
Fuels	Lack of standards for high blend biofuels (E85, B30, biogas, etc.)	3.4
Fuels	Fossil fuel standards limit the use of biofuel blends- gasoline standard EN228	3.4
Fuels	High biofuel price at the pump, compared to fossil fuels	3.3
Fuels	Fossil fuel standards limit the use of biofuel blends- diesel standard EN590	3.2
Fuels	Lack of sustainability requirements for biofuels	3.0

Importance: average score between 0 (low importance) – 5 (high importance).

Table 3.7: 'Relevant' barriers for the category 'Fuels'.

High biofuel prices are seen as a relevant barrier. This barrier is related to some of the barriers mentioned in the section on 'policy and market'. As long as biofuel prices are not competitive with prices of fossil fuels, the biofuels market will not grow rapidly. In some countries excise incentives are provided, while other countries favour forced introduction of biofuels by means of a biofuel obligation. The kind of policy instrument determines the way how biofuels will be brought to the market in the different



countries. For example, a biofuels obligation might be more favourable for biofuel blends, whereas fiscal incentives might be useful for high blends as well.

The respondents recognise the potential problems of biofuels in relation to sustainability and some of them indicate that policies should be developed to ensure sustainable biofuels production.

Feedstock

Limited availability of locally produced feedstock is seen as a relevant barrier. Although biomass is available on the global market, the respondents apparently prefer locally produced biomass.

Solutions that are suggested to increase the local production vary from providing of information to local producers to a more effective (financially stimulating) policy framework (see table 3.8).

<i>Category</i>	<i>Barrier</i>	<i>Importance</i>
Feedstock	Limited availability of locally produced feedstock	3.2

Importance: average score between 0 (low importance) – 5 (high importance).

Table 3.8: 'Relevant' barriers for the category 'Feedstock'.



4. Conclusions

This report describes the outcomes of a survey that was carried out among participants of the Biofuel Cities European Partnership to assess the experienced barriers and potential solutions for these barriers for the introduction of biofuels. Respondents were asked to score the different barriers. The average scores are used to identify the most relevant barriers.

The survey results show that most of the pre-identified potential barriers are seen as 'relevant' or 'not that important', while only two barriers are seen as 'important'. These two important barriers are: 'Limited availability of biofuel vehicles with producer warranties' and 'Fossil fuel standards limit the use of biofuel blends'.

The barriers are grouped in 5 different categories: 'Policy & Market', 'Infrastructure', 'Fuel', 'Vehicle' and 'Feedstock production'. Most of the barriers that were given certain importance are subject of the first 3 categories. 'Feedstock production' is seen as the category with the least important barriers. However, this might be due to the fact that feedstock producers were lacking in the pool of respondents.

In general the survey has shown that people are facing several barriers which need solutions to speed up the further deployment of biofuels. The results, however, did not show a very clear difference between the relative importances of these barriers, as the average scores do not differ that much. The perceptions of the different respondents of which barriers are seen as the most relevant ones are quite in line.



Annex 1 - Overview of barriers and their ranking

Category	Barrier	Average score
Vehicles	Limited availability of biofuel vehicles with producer warranties	4,00
Fuels	Fossil fuel standards limit the use of biofuel blends	4,00
Vehicles	Vehicle compatibility: manufacturers' reluctance to give approval for biofuel use	3,91
Vehicles	Limited availability of biofuel vehicles with producer warranties - light commercial vehicles	3,88
Infrastructure	Insufficient availability of refuelling infrastructure	3,86
Policy and Market	Lack of an alternative fuels strategy on national level	3,82
Policy and Market	Slow market and infrastructure development	3,82
Infrastructure	High costs to construct a refuelling infrastructure, or convert existing infrastructure.	3,49
Policy and Market	Lack of an alternative fuels strategy on regional or local level	3,45
Policy and Market	Lack of experience on the market	3,45
Policy and Market	Lack of customer awareness and market acceptance	3,44
Policy and Market	Lack of a proactive approach within many local authorities/major business to biofuel use in general	3,42
Policy and Market	Lack of harmonisation throughout the EU concerning fuel taxes, biofuel tax reductions and obligation systems	3,42
Fuels	Lack of standards for high blend biofuels (E85, B30, biogas, etc.)	3,38



Category	Barrier	Average score
Fuels	Fossil fuel standards limit the use of biofuel blends- gasoline standard EN228	3,35
Policy and Market	Lack of readily available (independent) information	3,32
Fuels	High biofuel price at the pump, compared to fossil fuels	3,30
Policy and Market	Lack of harmonisation throughout the EU concerning biofuel targets, applied biofuel blends and fuel standards	3,29
Infrastructure	Fossil fuel industries oppose the introduction of biofuels into the fuel distribution network (e.g. biogas in natural gas network)	3,27
Policy and Market	Consumer passivity	3,24
Feedstock	Limited availability of locally produced feedstock	3,21
Infrastructure	Insufficient biofuel production capacity	3,20
Fuels	Fossil fuel standards limit the use of biofuel blends- diesel standard EN590	3,15
Policy and Market	Certification of biofuel vehicles on fossil fuels (emission performance on biofuels not regulated)	3,14
Fuels	Lack of sustainability requirements for biofuels	3,03
Infrastructure	Lack of sufficient feedstock for the biofuel production units	3,03
Policy and Market	EU import duties limit the availability of biofuels and feedstock for biofuels	2,97
Vehicles	High converting costs or purchasing costs of biofuel vehicles compared to conventional vehicles	2,88
Feedstock	Legislation hinders the use of certain waste streams for production of biofuels	2,88
Fuels	Cost of biofuel affected by volatility in the price of feedstock	2,84
Infrastructure	High cost to construct biofuel production facilities	2,81



Category	Barrier	Average score
Fuels	Poor fuel properties of biofuels - cold properties	2,74
Feedstock	Competition with food production or other feedstock applications (e.g. bio-materials production, stationary bio-energy, ...)	2,71
Fuels	Fossil fuel standards limit the use of biofuel blends- natural gas standard	2,67
Vehicles	Limited driving range because of lower energy contents	2,66
Feedstock	Too high risks for agricultural cooperation (insufficient profitability, crop risk, ...)	2,65
Feedstock	Lack of logistic supply chain (feedstock to biofuel production facilities)	2,65
Fuels	Poor fuel properties of biofuels	2,63
Vehicles	Cold weather performance concerns	2,61
Fuels	Poor fuel properties of biofuels - energy content	2,56
Feedstock	Sustainability of feedstock production	2,56
Feedstock	Competition of local feedstock with cheaper imports	2,55
Fuels	Specific sectors, like public transport, agriculture, have already lower taxes for fossil fuels	2,53
Vehicles	Higher costs for vehicle maintenance	2,50
Feedstock	Current crops not optimized for energy purposes	2,48
Feedstock	Current biofuel standards (e.g. EN14214 for biodiesel) hinder the use of certain feedstock	2,38
Fuels	Poor fuel properties of biofuels - material compatibility	2,30
Vehicles	Higher exhaust gas emissions leading to negative impact on local air quality – NO _x	2,29
Fuels	Poor fuel properties of biofuels – other	2,29
Vehicles	Higher exhaust gas emissions leading to negative impact on local air quality	2,25



Category	Barrier	Average score
Vehicles	Poor technical reliability of biofuel vehicles	2,03
Vehicles	Higher exhaust gas emissions leading to negative impact on local air quality - particulate matter (PM)	1,95
Vehicles	Higher exhaust gas emissions leading to negative impact on local air quality - other emissions	1,74

Figure A1.1: Overview of all barriers



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This report describes the results of a survey that was carried out in order to identify and collect information on technical and institutional (legislation, standards) barriers for the large scale implementation of biofuels. The results of this survey provide insight to all related stakeholders like policy makers, vehicle (fleet) owners and operators, biofuel producers and distributors and will support them by developing instruments for stimulation of the use of biofuels and by setting up initiatives for the application of biofuels at a local scale.

The Biofuel Cities European Partnership is a forum for the application of biofuels. Open to all stakeholders in the area of biofuels for vehicles, it offers:

- **www.biofuel-cities.eu** - your one-stop shop for information on biofuels application;
- online facilities, workshops and study tours to exchange and network with your peers and learn from experts;
- news, publications and tools to provide information, guidance and support.

European Partnership participants have full access to all features. Participation is free

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