



Biofuels: Needs for standardization

Biofuel Cities Reports
& Recommendations





Biofuels: Needs for standardization

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1. Introduction

This report “Biofuels: Needs for standardization” is developed as part of the European Commission funded project, Biofuel Cities (www.biofuel-cities.eu), which aims to produce an online platform / resource centre to provide information on biofuels and to develop tools to assist organisations in the implementation of biofuels initiatives.

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;
- provide other useful tools and information, such as publications, details of events and training and more to support work on biofuels.

Developments of biofuels are increasing; not only in volume, but also in terms of feedstock, processing technologies and applications. Standards play an important role in the (future) development of the biofuels market consisting of amongst others producers, end-users and governments.

This report describes the research that has been carried to identify further needs for standardization in the field of biofuels. Based on these results conclusions and recommendations are made to follow-up these needs.



2. Methodology

In order to obtain the information needed to identify new possibilities for standardization in the field of biofuels, a study has been carried out divided in three phases:

1. A desk study has been performed, based on work programmes of relevant technical committees of (inter)national standardization organisations and the results of the barriers and solutions survey being carried out as part of the Biofuel Cities project. With studying the work programmes, work items that have already been adopted could be excluded from this study. The survey did not provide detailed information on the specific needs for standards.
2. A selection has been made from the projects and contacts database of the Biofuel Cities website to identify possibly interested contacts to be interviewed to obtain more detailed information. Over a hundred contacts have been approached for participating in this interview. At the end, seventeen interviews have been conducted or questionnaires have been completed. This information provided better insight in the needs for standardization.
3. A workshop has been organised on March 19th 2009 at the CEN Management Centre (CMC) in Brussels. The workshop was aiming at identifying possibilities for standardization in the field of biofuels, e.g. by means of a CEN Workshop Agreement (CWA)¹. The workshop attracted 23 attendants.

¹ CWA is a consensus based agreement usable in the entire market on specific solutions and widely available from the 30 member bodies of CEN, the European Committee for Standardization. Within CEN/TC 19 "Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin" already standardization developments take place in the field of biofuels, also by drafting CWAs.

3. Results

3.1. Desk study

The desk study consisted of the analysis of the work programmes of relevant technical committees of standardization organisations and the results of the barriers and solution survey as part of the Biofuel Cities project.

Standards available or under development

Most of the standardization developments in the field of biofuels takes place within CEN, but also within ISO developments are in progress. In the field of vehicle materials no specific standards exist or are under development in relation to use of (higher) biofuel blends and pure biofuels, so far known. However, the automotive industry is strongly involved in developing standards on biofuels.

International standards

ISO/TC 28 "Petroleum products and lubricants" has created a subcommittee on biofuels. The work programme consists of determining which of the existing test methods for fossil fuels are applicable to biofuels as well.

ISO/TC 193 "Natural gas" has developed a draft CNG specification that is used in some markets as a fuelling station specification, but is in essence meant as an engine development supporting document.

European standards

CEN/TC 19 "Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin" has various (joint) working groups in the field of biofuels, like:

- WG 21 ETF – Specification for ethanol to be used as a blending component in petrol;
- WG 21 E85 TF – Specification for ethanol (E85) automotive fuel;
- WG 24 TF FAME – Specifications for biodiesel (FAME and FAEE);
- JWG FAME – Joint working group with CEN/TC 307 on biodiesel test methods.



The standards published or under development within CEN/TC 19 in relation with biofuels are focusing on determination methods for specification of fuels on the regular European market, meaning with a widespread use in terms of cars, countries and communities. Separately, CEN

has adopted work on pre-standards for water in diesel fuel emulsions and paraffinic diesel fuel (i.e. GTL, BTL and HVO).

CEN/TC 307 "Oilseeds, vegetable and animal fats and oils and their by-products" is also developing standards in the field of FAME concerning the method of sampling and analysis. This CEN/TC has published ten standards in this field, of which three are currently being revised.



CEN/TC 383 "Sustainably produced biomass for energy applications" has recently been created to develop standards in the field of sustainability criteria for biomass, like greenhouse gases calculations, biodiversity, environmental aspects, social and economic aspects and indirect effects.

National standards

Next to international standardization, especially DIN (Germany) and BNPé (France) are developing standards in the field of biofuels, like pure vegetable oil, E5, E10, E85, and B7. These initiatives are strongly driven by regulatory demand and the results are quite often early-stage, incomplete specifications,

notwithstanding the fact that the DIN (pre-) standards are also used in countries outside Germany. SIS (Sweden) has developed a standard on E85 and biogas. NEN (the Netherlands) has made a workshop agreement on sustainability criteria.

Barriers and solutions survey

One of the deliverables of the Biofuel Cities project is the survey to barriers and solutions for the deployment of biofuels in Europe. This survey included five themes: vehicle, fuel, infrastructure, feedstock, and policy & market. The biofuels concerned were biodiesel including pure vegetable oil, bioethanol, and biogas. Standards or a lack of standards could be a barrier for the application of biofuels.

From the survey, the following major issues appear in the field of standardization:

- Vehicle materials versus specifications for different biofuel blends – Application of biofuels could negatively affect existing vehicle materials (e.g. durability, maintenance). Vehicle manufacturers are reluctant in providing producer warranties in case of biofuel use, especially by using higher blends (from 10% or even 5% biofuel). Standards can overcome this problem. However, should vehicle materials be adjusted to comply with the biofuels



already onto the market or should biofuels specifications be adjusted to comply with existing vehicle materials?

- New vehicles (factory built) versus existing vehicles (conversion/ adaption) – The average lifetime of a passenger car is about fifteen years. Taking into account some development time for optimizing vehicle materials, in a period of about twenty years most of the passenger cars on the market could be replaced with vehicles, which are appropriate for different blends of biofuels (flexi-fuel). In addition to the abovementioned, the issue is whether the application of biofuels should focus on new vehicles only, or also on the conversion/ adaptation of vehicles already on the market?
- Lower blends versus higher blends & pure biofuels – Use of lower blends (5% up to 10% biofuels) seems not to be a problem for vehicle performance. In each of the member states the alternative fuel consumption including biofuels should be at least 10% of the total transport fuel consumption in 2020 (binding target). So, use of higher blends and pure biofuels is necessary in order to achieve this target. Standards are a useful tool to support the use of higher blends, if consensus could be achieved between the parties concerned.
- Standards for fossil fuels limit use of biofuel blends – It appears that standards for fossil fuels (diesel, gasoline) contain specifications which are hard to fulfil in case of blending (e.g. density). So, standards for fossil fuels should be revised to make the use of blends possible. Or new standards should be defined for different kind of blends and pure biofuels, which are meant for specific usage so that standards for fossil fuels will not apply.



First analysis from desk study

Looking into more detail to the results of the barriers survey, it was hard to distinguish a special need for a type of biofuel (i.e. bio(m)ethanol, biodiesel, PPO or biomethane). Most of the respondents did not mention a specific biofuel in which they experience a lack of standards, but respond in general terms. This could also be interpreted that the need of drafting standards for all types of biofuels is of equal importance.

Bioethanol

Using bioethanol will in general result in reduced well-to-wheel emissions of greenhouse gases. Besides this positive effect, there is also in the short and mid term perspective a good potential for achieving low emission levels of regulated as well as most non-regulated emission, including volatile organic compounds (VOCs). E85 is a much used light vehicle solution, but this fuel is already being standardized at CEN level.

The use of the so-called "E-diesel", ethanol diesel blends for use in compression ignition engines, in fleet tests has not been reported within the project. The use of hydrous ethanol (15–25% ethanol-gasoline blends with a relatively high water content) is rather new and therefore limited experience could be generated. Both products also have a single fuel supplier.

High percentage ethanol fuel for heavy duty vehicles is a class 1 fuel in contrast to diesel fuel. The use of ethanol in heavy duty and buses is noted as a missing link, mainly due to the availability of vehicles. With only one manufacturer on the market so far, authorities would not take the risk. Also the limited driving range and energy content score higher than average as disadvantage for fleet usage. These shall thus be guaranteed by product standards. For the moment there is no common European quality standard for neat ethanol (E95) to be used in compression ignition engines. The standard can also generate momentum for other manufacturers to produce vehicles as it has to address the safety issues around the use of ethanol in these compression-type engines. As a basis for such standardization work the CEN workshop agreement on E85 as well as the national Swedish standard on E95 could be used.



Biodiesel and oils

Use of pure (vegetable and animal) oils and used oils seems to lead to more cost- and GHG-effective solutions from the feedstock production point of view, apart from the flexibility of supply. Many respondents would use it for light and heavy duty vehicles. Use of "waste" oils seems a good change for restricted communities (e.g. islands, small towns). For dedicated fleets and adapted vehicles (especially those that overcome the cold flow problems) it might be useful to consider a quality specification separate from, but based on, biodiesel standard (FAME, i.e. EN 14214).

The majority of the respondents favours blends to be used for the vehicle fleets over pure products. Here, the extra infrastructure and attention needed for storage and fuelling of pure



biodiesel seem to be a major hesitation. For some communities and fleet owners blending might have tax benefits over 100% usage. Also long-distance busses would be able to run on blend combinations.

Next, material compatibility concerns seem to be something of a concern that can be handled by an informative, publicly accepted overall document, eventually completed with maintenance procedures.

CNG/Biomethane

Within Europe there is now a wide offer of factory produced light duty vehicles able to run on methane. Dedicated spark injection engines burning methane today meet the so called enhanced environmentally friendly vehicles requirements and are very much appreciated in urban heavy duty use applications due to reduced noise, vibrations, and pollution. In general, the respondents see much less barriers for methane usage in fleets than for other fuels. The barriers are related to vehicle certification (type approval) and in some cases availability.

From the legal side, no large hinders exist towards the use of waste of residues for methane production. The major point is the introduction into the natural gas grid of the final product. Here standards can play a role, as the natural gas standards often do not address contaminants that seem to be an obstacle for such a grid introduction, not to mention the use in a car engine. However, the national gas



standards as such are not perceived as a large obstacle, but they merely address details regarding calorific value which hardly translate into a fuel quality specification.

3.2. Interviews & questionnaires

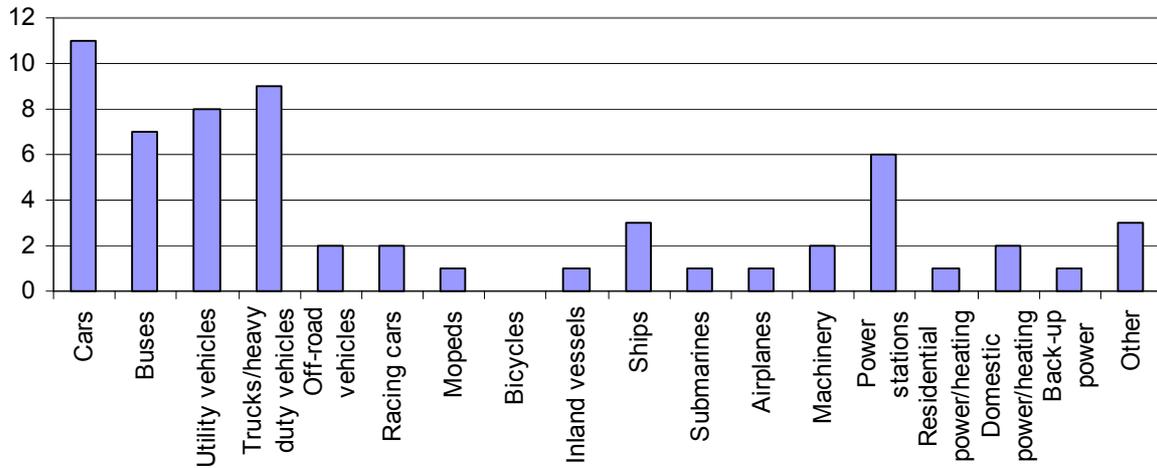
The general objective of the interview or questionnaire was to identify and analyze the use and needs of standards and/or codes in four automotive fuel applications that have been identified, using the Biofuels Cities database and survey, as possible fields of immediate standardization: pure oils and animal fats, waste or recovered fuels, biogas and E95.

Experience in fuels and their application

The interviewees had most experience in pure vegetable oils (53%), waste based liquid fuels (41%), and biogas (29%). None of the interviewees used E95.



Application fields of fuels



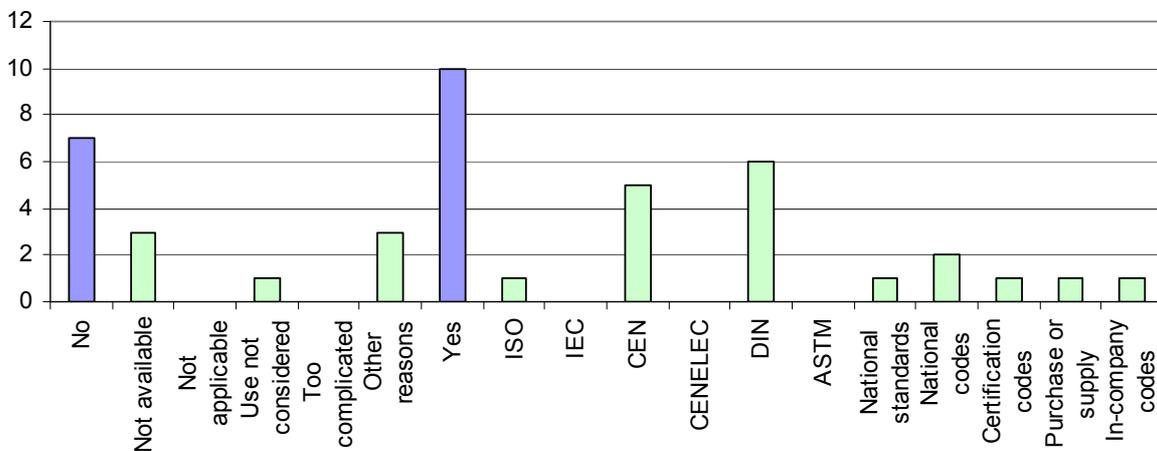
The biofuels were mostly applied in passenger cars (65%), trucks and heavy duty vehicles (53%), utility vehicles (47%) and buses (41%), but also in power stations (35%).

Application of standards and codes

Almost three out of five interviewees applied standards and codes in their biofuels projects. The German pre-standard for pure vegetable oil (DIN-V 51605) is applied by two third of the users of pure vegetable oil, and the European standard for biodiesel (EN 14214) is applied by almost half of the users of waste based liquid oil or animal fats. Related to biogas both international and national standards on natural gas were applied.

Four out of five interviewees is in favour of using national standards and codes, which they have applied in their projects, in the development of European standards.

Application of standards and codes

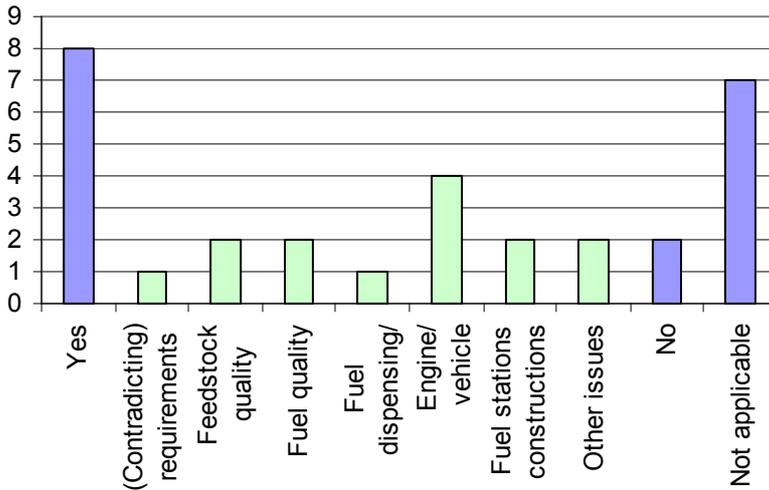




Problems with application of standards and codes

Also four out of five interviewees who have applied standards and codes in their projects faces problems with the application. Most problems are related to engine or vehicle requirement (half of the projects with problems). Other problems mentioned more than once are related to feedstock quality, fuel quality and fuelling station construction.

Problems with application of standards and codes

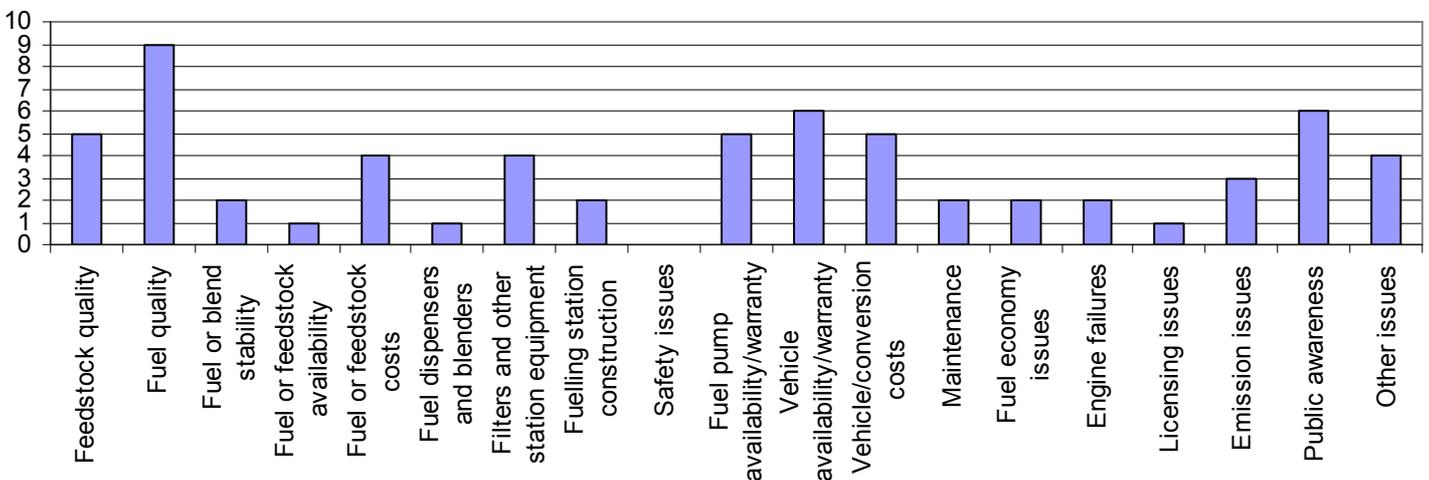


Reasons for problems are *inter alia* lack of European (or international) standards, engines not optimized for pure oils or multi-fuels, different safety distances along countries for (gaseous) fuelling stations, and standards optimized for one specific feedstock (e.g. rapeseed in DIN-V 51605).

Problems in biofuel projects

Almost all the interviewees face one of more problems during their biofuel project(s). The major problems are related to fuel quality (56%), vehicle availability or warranty (38%), public awareness (38%), feedstock quality (31%), fuel pump availability or warranty (31%), vehicle conversion costs (31%), feedstock or fuel costs (25%), filters and other station equipment (25%), and emissions issues (19%).

Problems in biofuel projects





Considering the specific fuels, projects with pure oils encounter mainly problems on fuel quality, public awareness, fuel pump availability or warranty, and filters and other station equipment. Concerning biogas the reported problems are in the field of vehicle availability or warranty, fuel quality, and public awareness. For waste based liquid fuels the problems are relatively limited; most problems are related to feedstock and fuel quality.

Role of standards and codes

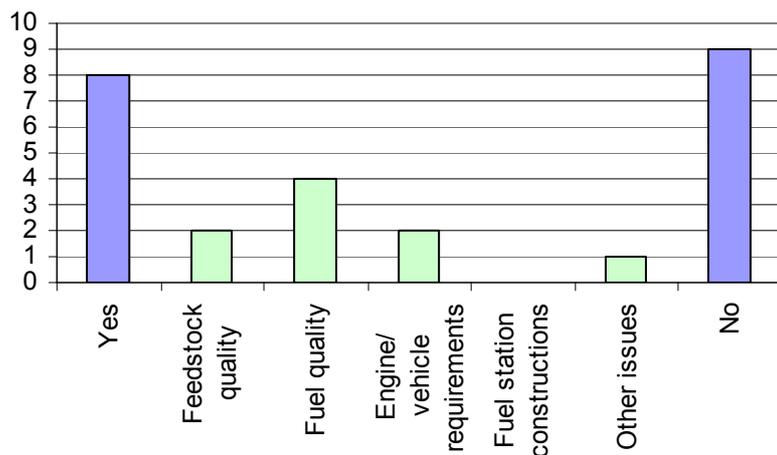
About two out of five interviewees indicated that standards and codes could play a role in solving legislative problems. These legislative problems could be both in terms of licensing issues and in terms of health, safety and environmental issues.

(Local) governments

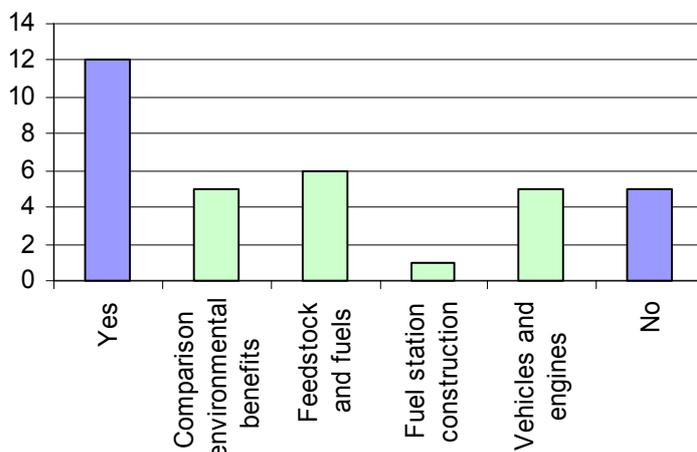
sometimes fall back on requirements that are not specific designed for biofuels and in this way hampering the application of biofuels.

Almost half of the interviewees indicated that technical problems are also due to lack of standards and codes. According to these interviewees standards or codes are missing in the field of fuel quality (50%), feedstock quality (25%) and engine or vehicle requirements (25%).

Technical problems because of lack of standards and codes



Consideration lack of standards and codes as problem in future market development



More than two third of the interviewees consider lack of standards and codes as a problem in future market development. These interviewees mentioned feedstock and fuels (50%), comparison of environmental benefits (42%), and vehicles and engines (42%) as fields, in which standards and codes are needed to improve market development of biofuels and their application.

Level of standardization

Most of the interviewees who consider lack of standards as a problem for future market development indicate that those standards should be developed at European level. Some prefer international (world-wide) standards as well, whereas others had no preference. The need for either world-wide or European guidance documents or industrial standards is limited.

More than two third of the interviewees are willing to participate in future standardization.

3.3. Workshop

The aim of the workshop was to identify possibilities for standardization in the field of pure vegetable oils, biofuels derived from waste and residues, and biogas, e.g. by means of a CEN Workshop Agreement (CWA). The workshop has been organised at the CEN Management Centre in Brussels on 19 March 2009 and attracted 23 persons in totally including five guest speakers and two organisers. The participants were from Austria, Belgium, France, Iceland, the Netherlands, Romania, Spain, and Sweden. Next, various persons showed interest in attending the meeting, also from outside Europe, but were not able to do so.

Plenary session

The plenary session consisted of two parts. The first part could be regarded as a common introduction. A short insight in European standardization was given by presenting CEN and the way CEN contributes to develop innovative biofuels and develop new markets. Next the Biofuel Cities project was presented as an application of biofuels at the local level. Finally, the results of the study and enquiries on needs for standardization, as presented in this report as well, were highlighted.

In the second part, field experiences were exchanged for each of the three types of biofuels. First, the so-called "Veget-Ole[®]" project was presented, that will be introduced as "virgin oil liquid fuel" (VOLF) at European level. The principle is based on the local production and processing of



vegetable oils in order to stimulate the economy in rural areas and to reduce transportation distances. Next, the "EcoDrive" project was presented with the inspiring motto "from the frying pan into the tank". In this project, used cooking oils are collected and processed into biodiesel meeting the quality standard EN 14214. The last presentation was on the landfill methane vehicle fuel project. In this project, landfill gas is captured, upgraded and transported to fuel various types of vehicles with biogas.



The presentations are available at the resource centre of the Biofuel Cities website. From this site the workshop report with summaries of presentations can be downloaded as well.

Discussion in parallel sessions

The discussions were divided into three parallel sessions, namely pure vegetable oils, biofuels derived from waste and residues, and biogas. A summary of the outcomes of the discussions is given below.

Pure vegetable oils

The parallel session on pure vegetable oils attracted about 55% of the participants. The participants think that the biofuel is mainly for specific engines with modifications (e.g. multi-fuel diesel engines). They feel there is a need for European specifications (no national or worldwide specifications). The German pre-standard DIN V 51605 should be the basis for such



a European specification. This specification should be independent from the feedstock (e.g. rapeseed, sunflower, soy bean, jatropha). By drafting the specification reference to standards on sustainable production (currently under development) should be considered. Since pure vegetable oil is rather an innovative fuel, as first step a CWA could be developed that addresses the pure (100%) fuel. A

CWA could be transformed into a European standard in a next stage. The objectives of pure vegetable oil specifications are achieving less emission, expanding the market that is local nowadays, decreasing dependence of energy supply, and improving social economic situation of rural communities. Next, consideration has to be given to specifications for adaptations of engines.

Biofuels derived from waste and residues

The parallel session on biofuels derived from waste and residues attracted about 30% of the participants. The participants think that the production of biofuels should be independent of the raw materials used, either feedstock or waste and residues. So, no specific standards are needed to support the use of waste or residues for the production of biofuels. Also due to the background of the participants the discussions switched to biodiesel. The existing standard EN 14214 is seen as the minimum quality standard for biodiesel (B100). Some participants feel there is a need for a standard for allowing higher blends of biodiesel in the fuel, in the range from B7 to B30. Especially B30 could be an interesting biofuel to start a CEN Workshop. Other issues that play an important role in the future market development of biodiesel are the European directive on fuel quality and tax profit issues.



Biogas

The parallel session on biogas was attracted about 15% of the participants. The participants are of the opinion that the focus should be on the quality of biomethane. There might be a need for a range of caloric values, since the differences in European countries. When biogas is comparable to natural gas, the standards for natural gas, liquefied natural gas (LNG), and compressed natural gas (CNG) can be applied from that part of the chain to the end user. Important contaminants in biogas are water, H₂S, and siloxane. The technology for cleaning the biogas in order to comply with the minimum quality specifications should be a choice of the producer. It was noted that CEN is working on a standard for feeding biogas into the grid of natural gas. It would be desirable that this standard is applicable to vehicle purposes as well (i.e. fuelling biogas from the grid). At the end, the participants identified stakeholders and European countries that might be interested in biogas fuelled passenger cars.





4. Conclusions & recommendations

4.1. Conclusions

After a desk study and various interviews and questionnaires three types of biofuels remained to be interesting for discussion at the standardization workshop to identify possibilities for standardization. It concerned pure vegetable oils, biofuels derived from waste and residues, and biogas. From the standardization workshop it can be concluded that especially pure vegetable oils seem to be interesting to start European standardization by means of a CEN Workshop. Furthermore, B30 (or another blend of biodiesel) might be an interesting biofuel to start a CEN Workshop. Concerning biogas there were no clear indications to start standardization, also due to link with natural gas.

Pure vegetable oils

NEN is also a project partner in the EU funded project "Demonstration of 2nd generation vegetable oil fuels in advanced engines" (2ndVegOil), see also www.2ndvegoil.eu. One task is



to develop a CWA on this second generation vegetable oil fuels with very low concentrations of contaminants. At the second project meeting in April 2009 NEN presented the outcomes of the standardization workshop and suggested to combine efforts. In this way, one CEN Workshop will be organised to develop a CWA that might include two quality standards for pure vegetable oils. This idea is

supported by the 2ndVegOil project partners. The start-up of this CEN Workshop is scheduled for early 2010, since first results of the 2ndVegOil projects are needed to be included in the CWA. However, some preparations can take place in 2009 to accelerate the process later on.

B30

Higher blends of biodiesel could be interesting, also to achieve the European targets for biofuels. The idea to start a CEN Workshop will be investigated by informing relevant stakeholders, both biofuel producers and original equipment manufacturers. These stakeholders are represented in CEN/TC 19, but also other means can be used. For example, a draft business plan for a CEN Workshop can be published to check the willingness of stakeholders to participate in such a CEN Workshop. At the CEN/TC 19 meeting in May 2009 the development of standards for higher blends (more than 10% biofuel) has been discussed, but appeared to be not top priority amongst the stakeholders. The idea to first initiate a CEN Workshop did not result in objections. NEN will take care of a draft business plan.



Biogas

At this moment, no further actions will be undertaken, since the link of biogas with natural gas and natural gas vehicles and the standardization that already takes place in these fields. Within CEN/TC 234 one working group is dealing with the injection of non-conventional gases into gas networks. The technical board of CEN has a working group on gas quality that is dealing with mandate M/400 of the European Commission inviting CEN to draw up European standards for gas quality parameters for H-gas that are the broadest possible within reasonable costs.

4.2. Recommendations

The idea to organize a standardization workshop for exchanging ideas to identify further needs for standardization was well appreciated by the participants. This kind of activities could be a useful instrument to involve potential stakeholders at an early stage in the standardization process. Next, this kind of activities could contribute to bridging the gap between research, development & demonstration (RD&D) results and market introduction.

With biofuels it is often meant (liquid) fuels for transportation purposes. Biofuels in a broader context, i.e. solid, liquid and gaseous biomass, may have other applications as well. For example, biodiesel, pure vegetable oils, animal fats, and biogas are all fuels that are suitable for combined heat and power (CHP) generation. Standardization in the field of biofuels mainly deals with requirements (quality issues, maximum concentration of contaminants) and testing methods (determination of specific contaminations). The standards are often independent on the raw materials used and the final application. In this way, the community concept of Biofuel Cities could be broadened to decentralized renewable energy generation and supply in both urban and rural communities.





Biofuels: Needs for standardization

This report is one of the deliverables in the framework of the Biofuel Cities projects. In the period of March 2008 to June 2009 project partner NEN performed a desk study, made enquiries by interviews and questionnaires, and organised a standardization workshop in order to identify further needs for standardization in the field of biofuels.

This report describes the results of each of the three stages and gives conclusions and recommendations for the steps to be taken. In summary, it can be concluded that especially pure vegetable oils seem to be interesting to start European standardization by means of a CEN Workshop. Furthermore, B30 (or another blend of biodiesel) might be an interesting biofuel to start a CEN Workshop as well.

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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