European
BIOENERGY Networks

EUBIONET – Final report

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Contents

Executive summary

Increasing the use of renewable energy sources is one of the main objectives of the European Union energy policy. Renewable energy sources are important both in limiting carbon dioxide emissions and for ensuring the security of energy supply. Key promotion measures are development and commercialising of new technology, energy taxation, investment subsidies, support for electricity production by renewable energy sources and dissemination of information. Moreover, utilisation of renewable energy sources, especially bioenergy, has positive effects on employment on the local level.

European Bioenergy Networks AFBnet (Solid biofuels), Waste for Energy (Biogas) and NTB (Liquid biofuels) were established in 1995 by the European Commission to promote the utilisation of bioenergy in Europe. These networks were integrated together under the cluster EUBIONET - European bioenergy networks as of the beginning of the year 2002. The EUBIONET has continued and consolidated the systems of communication set up since the creation of the networks. The major aim is to share knowledge and experience, spread of information, transfer of knowledge and know-how in the bioenergy sector, and besides that, also to detect barriers and define strategies to overcome them and to promote contacts between operators, planners and public organisations at all levels.

Solid Biofuels Network was focusing on market surveys of biofuels and on collecting price data on biofuels [6]. Country specific reports and a summary report were published [5], a Workshop on Biomass Trade in Europe [8] was organised, and numerous inquiries from industry were answered and business contracts were transfered. In many countries work has been done in co-operation with biomass associations. In addition to market data, financial incentives and measures were surveyed and Biofinance guide was published both on CDROM and in Internet [4]. National actions include promoting actual solid biofuels issues: improving the quality of pellets and training of pellet system installers; promoting increased use of agricultural biomasses (reed canary grass, straw, grain screenings); promoting combined heat and power generation from wood fuels and agricultural biomasses as well as new technology and environmentally friendly combustion methods for the use of wood fuels in households; producing training material on bioenergy, developing logistics for harvesting wood fuels and for entrepreneurship activities; informing about applications of gasification technology; and estimating and informing about national and EU bioenergy policies[14].

The EU target for electricity generation from bioenergy is to increase it ten-fold from year 1995 by 2010. In order to fulfil this target the use of biomass should be increased especially in large-scale applications. In these applications biomass can seldom meet the whole fuel demand, so

consequently biomass is co-fired with coal or other fossil fuels. There are several technological solutions for this purpose either available or under development. EUBIONET – Solid has produced a 28-page guidebook [7] on biomass co-firing, which gives concise data on alternatives of co-combustion technologies and fuels, points out risks in using alkali-containing biofuels, and proposes solutions for reducing risks.

The Biogas activity [11] has focused on the present biogas situation in Europe in terms of research and development, legislation and regulation, market penetration and utilisation of anaerobic digestion technologies, in particular utilisation and upgrading/conversion of biogas and recycling of digestate. For example, issues like the changing laws and regulations for the delivery of electric power produced from biogas plants, delivery of upgraded biogas into the available distribution grids, evaluation of separation processes for upgrading biogas, characterisation and measuring of the quality of upgraded biogas, methane conversion to hydrogen, and biogas as vehicle fuel were focused upon.

The interest in separation of slurry and digestate has been increasing in Europe during the recent years, and the main techniques are taken from the industry sector and developed to be suitable for liquid digestate. Issues related to optimisation of microbiological activity in the digester, aspects of work safety and security, factors of risk, preventing exposure to harmful substances in organic wastes/animal wastes, managing the quality of digestate, rights and responsibilities of biogas plant operators etc were also studied more targeted. Especially, numerous good examples of biogas plants have been disseminated through study tours [10].

The Biogas network also organised a workshop [9]. More than 50 biogas-interested and biogas experts from all over the world attended the workshop, and interesting discussions were carried out during the workshop. Speakers from different European countries presented recent development in the area of biogas from anaerobic digestion in Europe outlining some of the remaining technical, economical and legislative barriers as well as the new EU animal waste directive and its consequences for the biogas sector. The workshop highlighted the strategies that should be applied in order to make possible the future development and the widespread penetration of the biogas technologies on the European energy market [9].

The main activity of Liquid Biofuels focused on the recent developments in biodiesel standardisation and experiences, and expectations of biodiesel producers on the future standard; an overview of most updated expertise on environmental and energy aspects of liquid biofuels; and examination of fuel uses other than biodiesel production for vegetable oils or animal fats, either in virgin condition or recycled [12].

Biodiesel has become a fast growing renewable liquid biofuel within the European Community. In order to ensure customers' acceptance, standardisation and quality assurance is the key factor to the market introduction of biodiesel as a transport and heating fuel. Liquid Biofuel received a

liaison status by CEN/TC 19 and CEN/TC307 concerning minimum requirements and test methods for biodiesel [12].

Within the favourable legal framework instituted by the EC and considering that the use of liquid biofuels will increase in the transport sector, and a strict evaluation of the related environmental impacts is needed. Several studies on the energy and environmental efficiency of alternative fuels have been carried out. Environmental characteristics of biofuels are more and more well known while engine technologies as well as production facilities and agriculture are evolving. However, new tests have to be performed regularly to procure most updated environmental data [12].

The EUBIONET partners are national, impartial bioenergy centres with good contacts both to bioenergy research and product development organisations, associations and enterprises in the field. The expertise of network members has been utilised in communications within the EU to promote business opportunities and transfer knowledge and experience, contribute to the collaboration/co-ordination of the national activities in relation with biomass explotation.

Numerous public surveys issued by the Network have been of use for enterprises, national institutions and the Commission. Good knowledge of local information sources has facilitated quick data collection. As the network has been operating over a number of years, methods have been developed for collecting information quickly and in comparable form. EUBIONET has also operated as an intermediate in forwarding targets concerning renewable energy sources, set by the European Commission, to national bioenergy organisations.

The EUBIONET Network has proven to be an excellent way to improve communication between the different partners, giving the opportunity to gain experience from new problems and solutions, and promoting a good level of mutual understanding and collaboration.

EUBIONET Network has given the network members an opportunity to work with other interested parties in the sector to promote the development of bioenergy development in their countries and in Europe to create new business opportunities.

1. Introduction

The European Commission has established three bioenergy networks in 1995 to promote the use of bioenergy and to support the Campaign Take-Off and dissemination of the information of directives related to bioenergy. In the beginning of 2002, these networks were joined together under the cluster EUBIONET–European bioenergy networks. The objectives of the EUBIONET were

- Transfer of knowledge and experience in particular on industrial/commercial exploitation of biomass
- Detection/promotion of business opportunities, involving biomass business partners from different countries
- Contributing to the collaboration/co-ordination of the national activities in relation with biomass exploitation
- Undertaking analysis of the barriers (in particular non-technical) to biomass deployment, and ensuring relevant dissemination of results.

The main means for achieving these objectives have been: workshops, business forum/exhibitions, visits to operational plants and biomass production sites, mini-training actions, seminars, newsletters, websites and systematic liaison between participants. Several studies of non-technical barriers, biomass utilisation and prices, etc., have also been carried out. This work has also supported the Commission's work.

Main tasks of the EUBIONET were

- Overall co-ordination of the network (cluster co-ordinator, VTT Processes)
- EUBIONET –Solid biofuels (VTT co-ordinator, 14 participants, see App.1)
- EUBIONET –Biogas (SDU co-ordinator, 10 participants, see. App.1)
- EUBIONET –Liquid biofuels (ADEME, co-ordinator, 10 participants, see. App.1)
- Update of the financial guide (Novem, co-ordinator, EUBIONET Solid participated)

2. Promoting the EUBIONET by web-pages, leaflets and workshops

A common EUBIONET web gate, awareness and results leaflets [13, 16] and post cards [15] were produced in collaboration with the EUBIONET networks - Solid biofuels, Biogas and Liquid biofuels. The EUBIONET web page was launched in June 2002, creating an excellent

platform for raising awareness and continuous dissemination of bioenergy knowledge, new innovative ideas and pioneer technologies, as well as existing, mature technologies.

The main page of the EUBIONET was provided by VTT at their virtual server, *(http://eubionet.vtt.fi*). The EUBIONET – Biogas established their own network web pages, based on the model of the EUBIONET main web pages. The EUBIONET – Liquid biofuels already had own websites and these were updated and linked to the main page. A special "bioenergy facts" part was established on the web pages. These include statistical information of bioenergy use in the EU-15 as a form of overhead transparencies.

VTT produced *a postcard of web pages* [15] and *three posters* on the network. A common layout for the network was also established, e.g., logo and model for overhead transparencies and *a flyers* on the network [13, 16]. Flyers and postcards were distributed at several events and by network partners.

EUBIONET stand at Amsterdam Bioenergy Conference. Photo: SDU.

3. Financial Guide – Renewable Energy, focus on biomass

The Financial guide – Renewable Energy, focus on biomass (*BioFinancial Guide*), is an initiative of the EUBIONET carried out by Novem in co-operation with the partners of the EUBIONET – Solid network. PriceWaterhouseCoopers of the Netherlands was the contractor collecting the information and preparing the web pages. The countries included in the BioFinancial Guide are: European Union, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and United Kingdom [4].

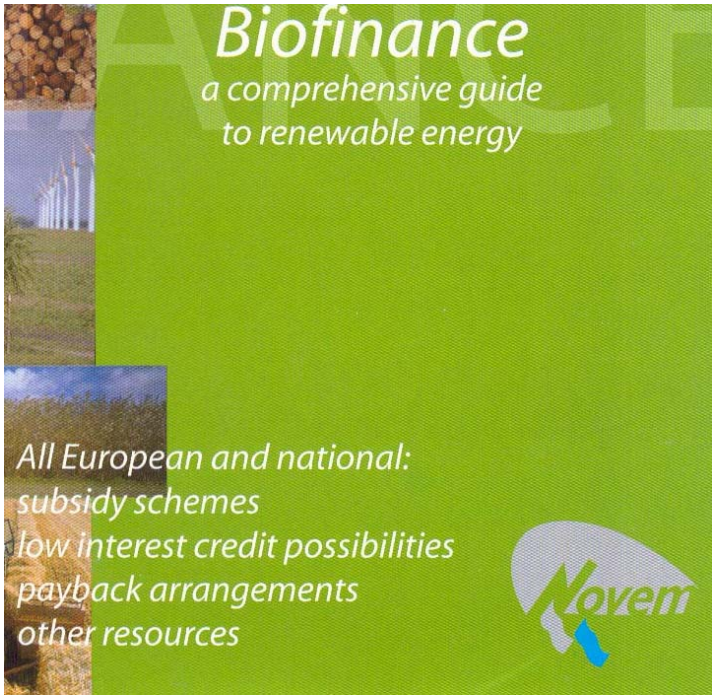


Photo of the CDROM cover page. Novem.

Information included in BioFinancial Guide [4]:

- Per country: a short description of policies including a downloadable pdf-file with a more detailed description of country policies;
- Per country: a summary of financial instruments (subsidy schemes, low-interest credit possibilities, pay-back arrangements, fiscal incentives, feed-in regulations, set-aside regulations) for bioenergy and for wind energy (wind energy not complete). A complete fact-sheet of each financial instrument can be downloaded as a pdf file.

Products:

- A Web site at http://www.novem.org/biofinance/ containing search options that enable to make queries with parameters "Country" (as in list above), "Renewable energy option" (wind or biomass) and "Type of a incentive" (subsidy schemes, low-interest credit possibilities, … etc. as mentioned above).
- A CD-ROM with all the information mentioned was published in March 2003, and 150 copies of CDROM was distributed in Europe.

4. EUBIONET –Solid biofuels

4.1 Guidebook to co-firing

The main reasons for the growing international interest in utilising renewable fuels are the objectives of promoting the use of renewable fuels which is the main line with the statements in the European Commission's White Paper and of meeting emission limits and targets set by the EU directives. Emission allowance trading may also pose new challenges to power producers in the future. It can already be stated with great confidence that power producers will have to cope with an increasing number of EU-level regulations concerning emission levels in general, and especially greenhouse gas emissions. Usually these regulatory actions aim at favouring the use of biomass.

On one hand, co-firing, which is usually defined as simultaneous combustion of different fuels in the same boiler, provides one alternative to achieve emission reductions. This is not only accomplished by replacing fossil fuel with biomass, but also as a result of the interaction of fuel reactants of different origin, e.g., biomass and coal. On the other hand, utilisation of solid biofuels and wastes sets new demands for boiler process control and boiler design, as well as for combustion technologies, fuel blend control and fuel handling systems. The possibility of co-firing biomass in coal-fired boilers offers a huge potential on the European level as well as worldwide. It is probably one of the most realistic ways to contribute to achieving the objective on doubling the share of renewable energy sources in the EU energy balance.

VTT has produced a 28-page wide *guidebook to biomass co-firing* "Biomass co-firing – an efficient way to reduce greenhouse gas emissions"[7]. This guidebook summarises the main results of biomass co-firing research with case projects. 1200 copies have been printed and disseminated in Europe. The guide to co-firing provides concise information on alternatives of co-combustion technologies, concise data on alternatives of different biofuels, points out of risks in using alkali-containing biofuels, and proposes solutions for reducing risks.

4.2 Surveys of current biomass situation and trade in Europe

In 1999 EUBIONET carried out a survey concerning the imports and exports possibities of solid biofuels, and fuel prices. The report on the survey was a best seller, and was used as an information source by a number of organisations. Results of this study were also presented at the Bioenergy Conference in Amsterdam [2]. The survey has been continued by country-specific studies of the effect of the new EU Directives on national targets and policies for biofuels (*Biosurvey*) [1, 5]. The price survey of fuels [6] was also updated, and a seminar on biofuel trade was organised in Skellefteå, Sweden [8].

Numerous inquiries from industry were answered and business contracts were transfered. In many countries work has been done in co-operation with biomass associations. National actions include promoting actual solid biofuels issues: improving the quality of pellets and training of pellet system installers; promoting increased use of agricultural biomasses (reed canary grass, straw, grain screenings); promoting combined heat and power generation from wood fuels and agricultural biomasses as well as new technology and environmentally friendly combustion methods for the use of wood fuels in households; producing training material on bioenergy, developing logistics for harvesting wood fuels and for entrepreneurship activities; informing about applications of gasification technology; and estimating and informing about national and EU bioenergy policies[15].

One common task for all national co-ordinators was to provide updated summary of the bioenergy situation in Europe including country specific summaries (Biosurvey) [5]. VTT prepared instructions and template for reporting for the use of the partners. The summary report and country-specific reports were published in January 2003 on the EUBIONET web pages [1].

The statistics and standards of wood energy use are still under development in Europe, and unfortunately no accurate and complete figures are available. In many countries, wood is reported in statistics together with waste. Local potential of forest residues for energy use is neither estimated in entire Europe [1].

The trade of solid biofuels has increased rapidly during the past few years. In many countries the customs statistics do not record trade in sufficient detail so that different biomass types could be identified. The European standardisation and classification of different solid biofuels (CEN 335) gives a clear basis for price setting and improves possibilities for uniform statistics system in different countries [1].

The workshop on *Biomass Trade in Europe* was organised in connection with the International Conference on Market Expansion Strategies for Solid and Liquid Biofuels in Europe (BioMarket) on 5th November 2002, in Skellefteå, Sweden. The workshop was planned by VTT in close co-operation with the BioMarket conference organisers Swedish Energy Agency and Skellefteå Kraft [8].

The objectives of the workshop were firstly to provide a brief review of the actual situation in European biomass trade, from the market perspective with implications on governmental policy making, and secondly to formulate needs and demands for the development of a fair biomass trade on long-term basis [8].

In the presentations and during the round table discussions, several important aspects were brought out. The main aim should be to establish a system of fair trade on sustainable basis. For

this purpose, many partners, both governmental and market actors, must be involved to establish a working system.

The concluding round table discussions pointed out the major needs and demands for the next 20 years. It is necessary to remember that for the market actors, the main reason for biomass trade is the possibility to earn money. If the trade is not profitable, the market actors will abandon the business. Economically functioning driving forces are needed, but these forces may be different in different countries. For example, rising oil prices increase the demand for pellet production and expand the bioenergy market. For continuous development, however, some stable driving forces are needed.

Biomass trade is already taking place in the Scandinavian countries. An important prerequisite for working on the bioenergy market is a close co-operation between forestry, forest industry and energy sectors. The European forest industry has already established a supply chain for raw material, and this existing structure could also be used also in biomass trade for fuel.

As new countries (e.g. Baltic countries and Russia) are joining the European market, it is important that all the players understand the "language". It is not only a question of different regional backgrounds, but also different sectors (agricultural, forestry, energy, authorities, etc.) need a common set of terminology. Some kind of bioenergy dictionary would be needed for all the actors to be able to understand each other.

Compared with Europe, the Asian market needs more imported bioenergy technologies, instead of biomass fuels. Efficient natural gas and biomass CHP plants would improve the sustainability of the Asian energy sector. Some kind of database of biomass potentials in Asia would be needed, together with information dissemination to improve the general consciousness.

The European Union has defined a strategy of boosting the bioenergy market. Commitment on the initial targets has been achieved. Still, there are several problems and difficulties, but they can be analysed one by one to find solutions. No single action is enough, a whole range of them is required – and it cannot be done in just a few years.

A short summary report of the workshop was disseminated to the seminar participants and the Commission by e-mail. The report is available on the EUBIONET website as pdf-file [8].

4.3 Links to IEA Bioenergy Agreement

The EUBIONET has participated in the planning of several workshops in co-operation with IEA Bioenergy Agreement tasks: "Biomass Combustion and Cofiring" and "Techno-Economic Assessments" at Amsterdam Bioenergy Conference. EUBIONET has provided two speakers for

the Cofiring workshop and also participated in Biomass Trade workshop panel discussion. Information of the IEA Task 35 (Techno-Economic Assessments for Bioenergy Applications) was also distributed in the Skellefteå event by oral presentations and by a flyer. In 23 January 2003 a lecture of cost reduction in the bioenergy systems was held at a "Energy Policy Analysis and Design" workshop, which was organised in co-operation with EU-EXTOOL and IEA EXCETP.

5. EUBIONET –Biogas

5.1 Targets and tasks of Biogas network

The Biogas activity focused on disseminating information about new and innovative ideas and technologies related to biogas production as well as about the transfer of the existing mature and well established technologies, knowledge and know how. The focus of the activity was on topics like:

- Quality management of digestate and treatment of animal by products in anaerobic digestion plants
- Biogas upgrading to natural gas quality and future energy production by fuel cells
- Farm-scale biogas production systems

At the same time, active participation and engagement in the national biogas sector and all the important national biogas activities and events had a high priority for the activity of all the country members of the network EUBIONET – Biogas. The target groups were various biogas actors and interested parties from all EU and candidate countries, while interested people from all over the world were also welcomed to attend the events and to benefit from the dissemination of knowledge and information.

The European biogas sector contributes to the realisation of a range of environmental and socio-economical goals, such as:

- Fulfilment of the Kyoto protocol of reduction of emission of green house gases.
- Renewable energy production (mainly combined heat and power production – CHP)
- Ensuring an optimal and safe recycling of suitable organic waste and by-products from agriculture, food and pharmaceutical industries, catering and households and
- Advantages for farmers via higher nutrient efficiency, better distribution and less loss of nutrients in the farm cropping systems.
- Reduced risks of pathogen contamination and odour nuisance from slurry application.

- Employment in rural areas (managing, back-up and logistics) and technology export within EU and from EU countries to the rest of the world

The activity of the Biogas network [11] focused on the actual biogas situation in Europe, in terms of research and development, legislation and regulation, market penetration and utilisation of anaerobic digestion technologies, in particular utilisation and up-grading/conversion of biogas and recycling of digestate. Within the above-mentioned areas, those topics that were identified as being innovative or of increased interest for the biogas sector in the member countries and generally in Europe were targeted by the activity of the network. For example, issues like the changing laws and regulations for the delivery of electric power produced from biogas plants, delivery of upgraded biogas into the available distribution grids, evaluation of separation processes for upgrading biogas, characterisation and measuring of the upgraded biogas quality, methane conversion to hydrogen, and biogas as vehicle fuel were focused upon. The interest in separation of slurry and digestate has been increasing in Europe during the recent years and the main techniques are taken from the industry sector and developed to be suitable for liquid digestate. Issues related to optimisation of microbiological activity in the digester, aspects of work safety and security, factors of risk, preventing exposure to harmful substances in organic wastes/animal wastes, managing the quality of digestate, rights and responsibilities of biogas plant operators etc were further more targeted.

Participants in the EUBIONET – Biogas Workshop: Anaerobic Digestion in Amsterdam.SDU.

In terms of activities, the focus of the first period of activity was on networking and broad collaboration with the member countries and with different biogas actors worldwide. An important event of this kind was the European Workshop: “Anaerobic Digestion – Biogas”, organised and carried out at the 12th European Conference and Technology Exhibition on Biomass for Energy, Industry and Climate Protection at Amsterdam RAI, in June 2002 [9]. The workshop focused on recent development within the area of biogas from anaerobic digestion in EU, on some of the remaining technical, economical and legislative barriers, as well as the new

EU regulation concerning animal waste not intended for human consumption. The strategies for a widespread penetration of biogas on the European energy market were discussed as well.

The workshop "Anaerobic Digestion – Biogas" was a joined effort of the European Bioenergy Networks (EUBIONET) as the Conference organiser and co-ordinator and with the assistance of the Biogas Network of Excellence (BIOEXELL), both funded by EU DG TREN, ALTENER Programme. More than 50 biogas interested and biogas experts from all over the world attended the workshop and interesting discussions were carried out during the workshop. Eight speakers from Germany, Switzerland, Denmark, the Netherlands and Austria presented the recent development in the area of biogas from anaerobic digestion in Europe outlining some of the remaining technical, economical and legislative barriers as well as the new EU animal waste directive and its consequences for the biogas sector. The workshop highlighted the strategies that should be applied in order to make the future development and the widespread penetration of the biogas technologies on the European energy market possible [9].

The second period was dominated by the organisation of three structured biogas study tours and training actions in Sweden, focusing on technologies for gas upgrading and utilization, in Denmark, focusing on separation and volume reduction of digestate, and in Germany, focusing on decentralised agricultural biogas sites with different bases of substrate. Within the supporting programme an overview on the actual situation in research, legislation and utilisation of anaerobic digestion in those countries and in Europe was given. Overall 73 participants from Europe and Asia took part in these two-day study tours. The positive feedback pointed out, that the programmes did live up to the expectations of the participants. The high turnout as well as the fact more international requests for such tours emerged as a consequence of these international contacts, proves the high utility and need of such arrangements [10].

5.2 Achievements and results of Biogas Network

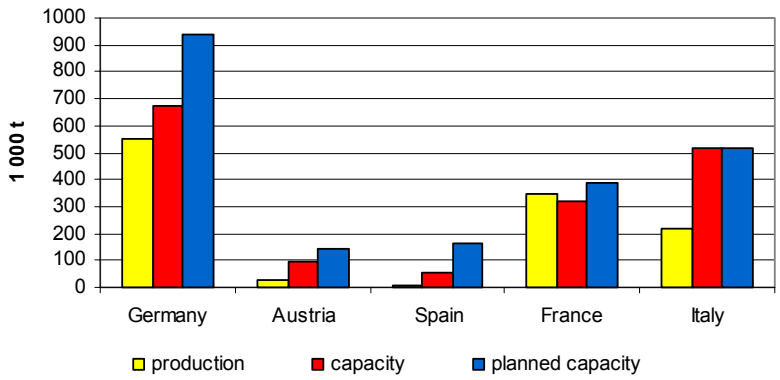
- The EUBIONET–Biogas network has proven to be an excellent way to improve communication between the different partners, giving the opportunity to gain experience with new problems and solutions, and promoting a good level of mutual understanding and collaboration.
- EUBIONET Network has given the network members an opportunity to work with other interested parties in the sector to progress the development of biogas development in their countries and in Europe.
- Discussions, dissemination of know-how, knowledge and information to biogas plant producers as well as biogas plant owners and the premises for developing new projects were created.

- Many organisations, educational institutions (universities, technical institutes and high schools) were involved by introducing biogas topics on the teaching curriculum, aiming to prepare potential biogas plant operators and future biogas specialists.
- Biogasification drew a lot of publicity. The use of biogas as vehicle fuel was demonstrated by various awareness campaigns and the potential of biogas for future utilisation for the energy production by fuel cells were highlighted.
- The EUBIONET–Biogas web page, linked to many other biogas relevant web pages, is an excellent platform for a continuous dissemination of biogas technologies and knowledge.

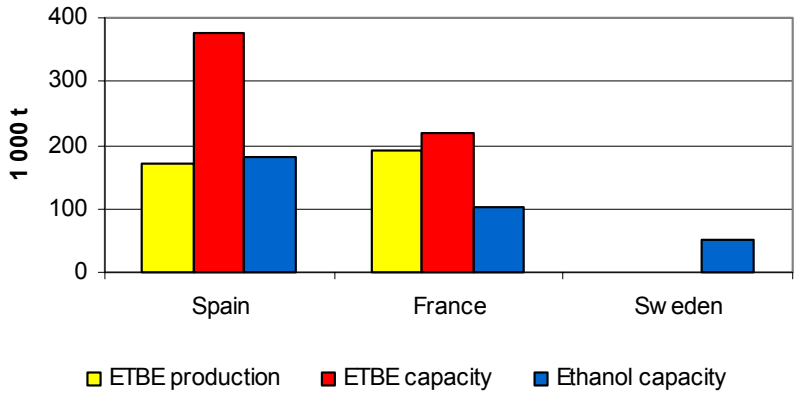
6. EUBIONET –Liquid biofuels

Created in December 1994, Liquid Biofuels Network was first launched to carry out a comparative review between the national liquid biofuels programmes, using the range of non-technical barriers established by the National teams in their country. Then work concentrated on identifying the actions by which the barriers might be overcome. The main objective was to share knowledge and experiences to establish co-ordinated actions in favouro of liquid biofuels.

The general liquid biofuels situation in EU countries has been updated and reported [12].



Biodiesel production and capacity in Europe in 2002. Ademe [12].



Ethanol and ETBE production and capacity in 2002 in EU countries. Ademe [12].

The main activity focused on three different topics:

- Summary and report of the recent development in biodiesel standardisation and experiences and expectations of the biodiesel producers on the future standard;
- Overview of most updated expertise on environmental and energy aspects of liquid;
- Examination of fuel uses other than biodiesel production for vegetable oils or animal fats, either in virgin condition or recycled.

6.1 Biodiesel Specification

Biodiesel has become a fast growing renewable liquid biofuel within the European Community. In order to ensure customers' acceptance, standardisation and quality assurance are the key factors to the market introduction of biodiesel as a transport and heating fuel. In 1997 the European Commission gave a mandate to CEN (Comité Européen de Normalisation) to develop standards concerning minimum requirements and test methods for biodiesel. Liquid Biofuel Network received a liaison status by CEN/TC19 and CEN/TC307 [12].

Biodiesel production is heterogeneous in Europe. Different raw materials as well as different production technology are used. It is important to receive feedback from the industry, which raw materials are processed and which problems are expected by establishing the new quality requirements. The work is now concentrated on summarising and reporting the recent development of biodiesel standardisation and reflecting the experiences and expectations of the biodiesel producers on the future standard.

In January 1998 the standardisation work was started by the initial meetings of the different working groups. The work was based on knowledge being gathered so far during the national

biodiesel standardisation. Nearly 50 meetings in total were needed to go through the difficult and comprehensive material. At the beginning of 2000, two drafts were presented by TC19/WG24 and WG25. Both drafts, prEN 14213 (FAME as heating fuel) and prEN 14214 (FAME as automotive fuel for diesel engines) have been subject to a 6-month inquiry process in 2001. The deadline for national comments was November 10, 2001. The replies were treated at two meetings of the appropriate working groups in November 2001. The final standards were subject to the formal vote and will appear during 2003.

Biodiesel is mainly produced from rapeseed oil in Europe. Other raw materials such as recycled vegetable oils or even animal fats are of interest but realised only on limited markets. A high quality is absolutely necessary to avoid problems and to ensure that biodiesel is accepted by the vehicle industry as well as by the public. Quality problems during the fuel distribution are often underestimated. The main challenge now and in future is the economy. Due to the increasing demand, the price of rapeseed oil will also increase. Currently biodiesel is exempted from mineral oil taxes but the situation will change in future.

6.2 Environmental balance

Within the favourable legal framework instituted by the EC and considering that the use of liquid biofuels will increase in the transport sector, a strict evaluation of their related environmental impacts is needed [12].

Several studies on the energy and environmental efficiency of alternative fuels have been carried out. Environmental characteristics of liquid biofuels are more and more well known, while engine technologies as well as production facilities and agriculture are evolving. However, new tests have to be performed regularly to procure most updated environmental data.

Nine partners were solicited in order to give a large panel of results representative of their country, France, Belgium, Austria, Germany, Greece, Portugal, Spain, Italy and Netherlands.

Liquid biofuels, which were analysed in these studies, were biodiesel and vegetable oil from rapeseed, sunflower or soybean, bioethanol and ETBE from sugar beet and wheat. Various parameters were investigated: energy balance, greenhouse gas balance, exhaust emissions tested on biofuels used as sole fuel or as various blends. Each study was compiled into one or two pages stipulating the title, authors, ordering parties and references, a short description was produced, and the main results are presented and discussed.

This work gives some instructive data related to environmental and energy aspects of liquid biofuels. It is an overview of most updated expertise on this subject.

6.3 Non-biodiesel fuel uses of oils/fats

Biodiesel is gaining increasing acceptance as a vehicle fuel extender/replacement on all sectors of the transport industry. In some situations, however, biodiesel production may not be the most attractive option and other possibilities may find a role. The purpose of this task was to examine fuel uses other than biodiesel production for vegetable oils or animal fats, either in virgin condition or recycled after an initial cooking use [12].

The following uses were envisaged as potential alternatives:

- Virgin or recovered vegetable oils without esterification in converted diesel engines, CHP systems and heating systems.
- Beef tallow in heating and CHP systems
- Trap grease as heating fuel.

It has not been possible to review all these options in detail within the resources of the present task group. The use of vegetable oils in converted vehicle engines has been reviewed in some depth. In addition, some information on the use of recovered vegetable oil, olive pomace oil and trap grease for energy purposes is included.

List of the EUBIONET publications

Solid biofuels

1. *Alakangas, E. & Vesterinen, P.* EUBIONET Biomass Survey in Europe, Summary report. VTT Processes, Jyväskylä, April 2003. 26 p. + app. 6 p.
2. *Alakangas, E., Hillgring, B. & Nikolaisen, L.* Trade of solid biofuels, and fuel prices in Europe, 12th European Conference and Technology Exhibition on Biomass for Energy, Industry and Climate Protection, Amsterdam RAI International Exhibition and Congress Centre, 17– 21 June 2002, 4 p.
3. Alakangas, E. EUBIONET- Biomass heat entrepreneurship in Finland, Jyväskylä, March 2003. 48 p. + app. 1 p.
4. *Biofinance* – a comprehensive guide to renewable energy. Novem & PriceWaterHouseCoopers and co-ordinators of EUBIONET. March 2003 (CDROM).
5. EUBIONET Biomass Survey in 14 member countries. National co-ordinators of EUBIONET Solid biofuels. January 2003.
6. EUBIONET – Fuel prices in Europe 2002/2003. National co-ordinators of EUBIONET, March 2003, 18 p.
7. *Veijonen, K, Vainikka, P., Järvinen, T. & Alakangas, E.* Biomass co-firing – an efficient way to reduce greenhouse gas emissions. VTT Processes, Jyväskylä, March 2003. 28p.
8. *Vesterinen, P. & Alakangas, E.* EUBIONET Biomass Trade in Europe, Skellefteå, Sweden, 5.11.2002, Workshop report, VTT Processes, December 2002. 19 p.

Biogas

9. Workshop Anaerobic Digestion – Biogas, Final report of 12th European Conference and Technology Exhibition on Biomass for Energy, Industry and Climate Protection, Amsterdam RAI International Exhibition and Congress Centre, 17th – 21st June 2002. SDU.
10. Biogas study tours and training actions, Report of Danish, German and Swedish study tours.
11. Biogas activity report and conclusions, April 2003, SDU & national co-ordinators.

Liquid biofuels

12. One single report has been formulated “Liquid Biofuels Network – Activity Report” (157 p.), which includes four main parts related to the topics mentioned above :

- 2001/2002 General Biofuels situation in Europe
- Specification of Biodiesel
- Environmental balances of liquid biofuels
- Non biodiesel fuel uses of oils/fats

Cluster

13. EUBIONET – Flyer No 1, June 2002. 4 p.
14. EUBIONET – Interim report. December 2002. 49 p.
15. EUBIONET – web post card, June 2002.
16. EUBIONET – Flyer No 2. June 2003. 4 p.

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