

BEST CASE STUDIES ON BIODIESEL PRODUCTION PLANTS IN EUROPE

Prepared for

IEA Bioenergy Task 39, Subtask „Biodiesel“

Prepared by

Austrian Biofuels Institute, www.biodiesel.at

W. Körbitz^a

Ch. Berger^a

E. Waginger^b

M. Wörgetter^c

^a Austrian Biofuels Institute, Vienna

^b Institute for Technology, University of Economy, Vienna

^c Federal Institute for Agricultural Engineering, Wieselburg

EDITORIAL:

IEA Bioenergy, an implementation agreement of the International Energy Agency and an international collaboration in Bioenergy, aims to accelerate the use of environmentally sound and cost-competitive bioenergy on a sustainable basis, and thereby achieve a substantial contribution to future energy demands. (www.ieabioenergy.com/).

The main objectives of Task 39 "Liquid Biofuels" are to work jointly with governments and industry to identify and eliminate non-technical environmental and institutional barriers which impede the use of liquid fuels from biomass in the transportation sector, and to identify remaining technological barriers to Liquid Biofuels technologies. IEA Bioenergy Task 39 "Liquid Biofuels" is currently composed of 10 countries (Austria, Canada, Denmark, European Union, Finland, Ireland, The Netherlands, Sweden, USA and UK) interested in working together to successfully introduce biofuels for transportation into the marketplace. This Task reviews technical and policy/regulatory issues and provides participants with comprehensive information that will assist them with the development and deployment of biofuels for motor fuel use (www.forestry.ubc.ca/task39/GT4/Frames/home.html).

The extent to which biofuels have entered the marketplace varies significantly by country. The reasons for these differences are complex and include a variety of policy and market issues. While biofuels offer significant potential, the prices of biofuels are higher than their petroleum equivalents. As a result, biofuels have been successfully implemented only in those countries that have recognized the value of the benefits and have made appropriate policy decisions to support biofuels (www.liquid-biofuels.com/FinalReport1.html).

The lack of knowledge on the successful implementation of biodiesel on national and international markets limits the further development. To overcome this barrier the Austrian Biofuels Institute (ABI) was commissioned by Task 39 with a detailed documentation of the Biodiesel industry in Europe. Initially we aimed at "Biodiesel Best Cases" including aspects of planning and financing, as well as technology and operation. During the study it became evident that the ambitious goal cannot be reached easily. The hard competition between the different companies of the Biodiesel industry does not allow a deep insight into success factors. Thanks to the extraordinary confidence which could be reached by the Austrian Biofuels Institute during the past decade the authors gained an overview of selected examples of the impressive European Biodiesel industry. Data on companies, feedstock supply, installed technology, capacity, quality management and financial issues could be collected. The success of the study is based on the indefatigable commitment of Werner Körbitz of the Austrian Biofuels Institute, the support as provided by Mrs. Waginger of the University of Economy in Vienna and from Biodiesel production plant owners, managers and engineers, who invested their time and confidence in this study.

M. Wörgetter

Wieselburg, March 13, 2004

TABLE OF CONTENTS

Editorial:	3
Table of Contents	5
1 Abstract:	7
2 Method:	9
3 Best Case Reports by Country:	14
3.1 <i>Austria</i>	14
1. Biodiesel Kärnten GmbH in Arnoldstein	15
2. Biodiesel Raffinerie GmbH in Zistersdorf	18
3.2 <i>Czech Republic</i>	22
3. AGROPODNIK, akciová spoločnosť, in Jihlava	23
France	26
4. Diester Industrie in Grand-Couronne	27
3.3 <i>Germany</i>	30
5. ADM Oelmühle Leer Connemann GmbH & Co. KG	32
6. Bio-Ölwerk Magdeburg GmbH	36
7. EOP Elbe-Oel Prignitz AG in Falkenhagen	39
8. MUW Mitteldeutsche Umesterungswerke GmbH&CoKG in Greppin.....	43
9. NEW- Natural Energy West GmbH in Marl	46
10. Rheinische Bioester GmbH in Neuss	50
11. SARIA Bioindustries GmbH in Malchin	53
12. Thüringer Methylesterwerke GmbH&Co.KG in Niederpöllnitz.....	57
3.4 <i>Italy</i>	61
13. Fox Petroli S.p.A. in Pesaro	62
14. Novaol SRL in Livorno	66
3.5 <i>Slovakia</i>	69
15. Ekoil Biodiesel, s.r.o. in Zohor.....	70
3.6 <i>Spain</i>	73
16. Stocks del Valles S.A. in Montmelo	74
4 Acknowledgements:	77
5 References:	77
6 List of Illustrations	78
7 Appendix:	80

1 ABSTRACT:

The Liquid Biofuels Task of IEA Bioenergy commissioned the Austrian Biodiesel Institute (ABI) to complete a detailed study “Best Case Biodiesel Production Plants in Europe” with the objective to give a comprehensive overview on the European Biodiesel industry and to select typical case examples out of the many existing Biodiesel industries.

Following an accelerating growth of Biodiesel production plants in number and volume over the past years in Europe this study had the task to present the impressive development of the European Biodiesel industry in the past decade according to well defined criteria and make this available to the interested Biodiesel community.

The European Biodiesel industry was carefully screened in a first step in order to identify candidate Biodiesel plants to be contacted in a second step and to finally ask to fill in a questionnaire, which was carefully developed at the ABI together with the Institute for Technology, University of Economy, Vienna according a well defined set of success criteria.

The questionnaire was completed in mostly very close communication between the Biodiesel plant managers in charge and the ABI-team. Additionally 10 plants were visited for further detailed search on the spot.

Basic company data, feedstock supply and usage, installed process technology, capacity, actual production and yield figures, Biodiesel quality management, financial issues and ownership structure were asked for as well as a self-evaluation by the Biodiesel plant manager along a list of best/worst criteria.

As a result this study contains detailed reports of 16 selected Biodiesel production plants in the range of 12.000 to 250.000 t Biodiesel production capacity from 7 European countries: Austria, Czech Republic, France, Germany, Italy, Slovakia, and Spain.

They vary significantly by e.g. type of feedstock used (refined or semi-refined oils, rapeseed or other vegetable oils, recycling oils, animal fats, trap grease, a.o.), feedstock supply (integrated oil mill, flexible oil purchasing), installed process technology (batch or continuous process, different catalysts, a.o.), size of production capacity, synergistic alliances (e.g. integrated fuel distributor as shareholder, joint glycerine refinery), transport cost (sea or river harbour site), they vary however not at all when it comes to quality assurance.

It becomes evident that there is no single best case solution, but careful consideration of all the potential positive and negative factors has to be made in order to exploit synergistic opportunities and to avoid risks.

2 METHOD:

Having completed the preceding study “Review on Commercial Production of Biodiesel World-wide” completed in December 2003 the ABI-team was already very well aware of any existing and many intended Biodiesel production sites in Europe.

➤ **Criteria for defining a “Best Case”:**

In order to complete this study in a satisfactory way and to sort out typical cases a set of criteria was developed, which contained the following factors:

- Feedstock supply:
 - Level of supply security in feedstock volume
 - Level of supply security in purchasing cost
 - Flexibility in processing various feedstock sources
 - Flexibility in storage facility options
- Marketing:
 - Marketing strategy (quality, market segmentation, customer needs, brands, promotion, distribution, pricing)
- Process technology
 - Level of yields obtained during the reaction
 - Flexibility to handle multi-feedstock oils and fats
 - Flexible process and multi-feedstock recipes control
 - Reliability in quality assurance
- Location:
 - Extent in exploiting synergies of existing industrial areas
 - Low transport cost locations
- Financing:
 - Extent of subsidies obtained (European Commission, national and regional governments, private placements)
 - Structure of shareholders and potential synergies

As the various variable parameters can have quite a different impact on the profitability of a Biodiesel production plant it is important to know their quantitative influence. The following graph highlights the weight of the single parameters in comparison to others and illustrates the high priority of feedstock cost, of process yield (i.e. to what degree the triglyceride and free fatty acids molecules are processed into the valuable methyl-ester molecules), while the parameters of e.g. energy cost and manpower (operator) cost are of minor importance. Not surprisingly this graph also highlights the great weight of the Biodiesel selling price and hence the importance of a well defined marketing strategy in order to optimise earnings from Biodiesel sales:

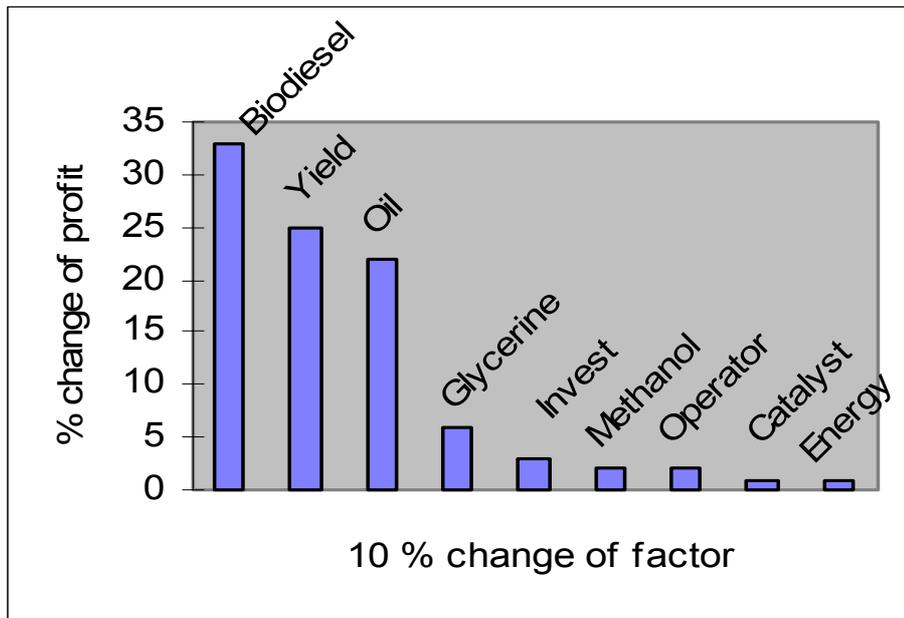


Illustration 1: Sensitivity of various input/output factors in influencing profitability (ABI)

➤ **Developing the questionnaire:**

The Austrian Biofuels Institute (ABI) developed a detailed and specific questionnaire together with the *Institute for Technology of the University for Economy* in Vienna, in which basic company data, feedstock usage, process technology and production figures, Biodiesel quality management and financial issues were asked and in which also a self-evaluation along a list of best/worst criteria was requested. It was highlighted that only non-confidential data would be included in this report.

The questionnaire was structured on 3 pages only, with the goal of covering both quantitative and qualitative aspects, while assuring an easy and short interview in less than 8 minutes (see the ABI-questionnaire in the appendix section).

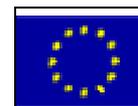
➤ **Distribution of the questionnaire and final selection of “Best Case”:**

After a first round for narrowing down the number of candidate Biodiesel plants and a second round with a number of telephone interviews the ABI-team finally selected 18 Biodiesel plants in 7 countries representing quite a variety in feedstock usage, in applied marketing strategy, in process technology, in site selection and in financial concepts.

The target companies received the questionnaire, most of them obtained a follow-up phone support and 10 were visited personally with a detailed interview at the site concluded with a Biodiesel production plant tour, at which occasion many of the informative photographs were taken.

➤ **Follow-up and completion of “Best Case” questionnaires:**

The final documentation was cross-checked a last time for technical and confidentiality items. With the purpose to produce a short and readable study these 18 companies are described on 2 – 3 pages each, highlighting the important factors and illustrating the site with a few pictures.



BIODIESEL IN EUROPE – THE BACKGROUND:

1. Policies and legislation:

Numerous European legislative measures have been developed in recent years and are now carried out. They vary according to the different policy objectives and motivations, with the following examples:

- a) Reduction of risks caused by harmful exhaust emissions as required by the Directive on Quality of Fuels and the EURO-emission standards for personal cars and heavy duty vehicles.
- b) Reduction of risks caused by greenhouse gas emissions and the resulting climate change as required by the new Directive on the Promotion of the Use of Biofuels.
- c) Reduction of risks in supply of energy for the transport sector as required by the new Directive on the Promotion of the Use of Biofuels.

2. Feedstock supply and suitability:

Rapeseed-oil is by far the leading feedstock for Biodiesel production, and this position has become even stronger in the last 2 years, when analysing the 2 leading nations Germany and France. However, a clear trend to a larger variety and to tailor-made blends of different feedstock sources, such as sunflower-oil, recycling oils and animal fats but also imported soy-oil and palm-oil, can be observed.

3. Process technology development:

Industrial process technology has advanced significantly since the early days of Biodiesel production in 1988.

The increasing requirement to produce high quality according to strict Biodiesel fuel standards has been the driving force for switching from batch processing to continuous process technologies with fast liquid-liquid separation of methyl-ester and glycerine, and with accurate cleaning steps for the final Biodiesel meeting at least the standard EN 14214 or better than that (e.g. in water content, total contamination).

High yielding process technologies have obtained preferential attention because of their impact on profitability.

4. Biodiesel fuel standardisation and quality management:

The assurance for quality of the fuel was a key issue for developing confidence in Biodiesel among all customer groups, specifically the Diesel engine and vehicle producer as well as the fuel trade.

With the official publication of the new standard EN 14214 for Fatty-acid-methyl-ester (FAME) in autumn 2003 a common European agreement for understanding of Biodiesel quality has been established, which is strictly observed by “Best Case” Biodiesel production plants and their quality assurance laboratories in order to win and assure customer confidence.

5. Marketing strategies:

Not unexpectedly quite a variation of different marketing approaches can be observed, which can be described as follows:

a) Commodity Strategy:

- Biodiesel is sold as a pure fuel at separate pumps, but no visible product differentiation from the competitive fossil Diesel is practised. In this case Biodiesel is usually sold only because of a lower price as a cheap fuel (e.g. Austria).
- Another commodity strategy is to blend Biodiesel in refineries into fossil Diesel up to 5% and sell it anonymised at fuel pumps (e.g. France), i.e. with no information to the customer.

b) Quality Strategy:

- Quality seal strategy: Biodiesel is sold as a 100-% pure fuel and is differentiated as a quality product, which is highlighted by a quality seal at the pump (e.g. Germany).
- Brand Strategy: The fuel (pure or blended between 1 – 20% with fossil Diesel) is differentiated by a specific trademark (e.g. United Kingdom: “Bio-Plus”, “GlobalDiesel”). Differential advantages are promoted and linked to a differentiating pricing strategy.

6. Production development:

Since 1992 Biodiesel production has strongly increased with an interim decline in 1997/1998, when the crude oil price dipped below US\$ 10,00 per barrel.

The estimations for the total European production in 2001 are approx. 780.000 t, representing 14 times the production levels of 1992.

The present trend is characterised by a faster growth of capacity than of actual production and marketing of Biodiesel. It appears that market development moves at a slower pace than capacity development.

In 2001 the main Biodiesel producing countries in the EU-15 were Germany (market share: 45 %), France (40 %), Italy (10 %), Austria (4 %) and Sweden (1%).

As shown in the graph below capacity growth has developed progressively to approx. 2 mill t of Biodiesel, mainly with Germany as the driving force, while production and therefore actual consumption lagged behind, as the main activity focus was given to plant investment and less to market development.

Biodiesel in Europe - The Background

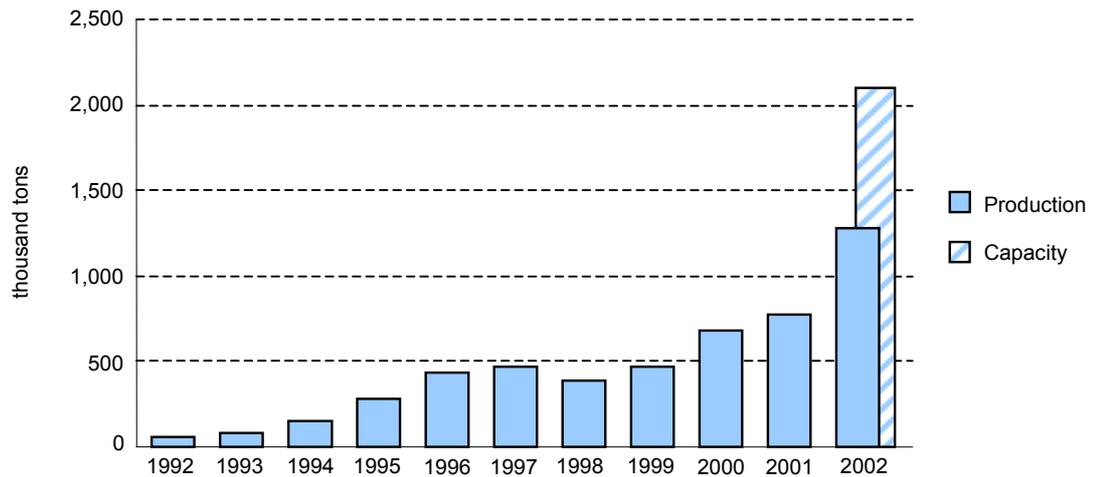


Illustration 2: Capacity and Production in Europe 1992-2002 (ABI)

With a set of new Directives regarding transport & energy, the environment, agriculture and taxation, the European Commission has developed a solid and committing framework for the further strong development of liquid biofuels in the European Union.

The EU Directive minimum target quantities for Biodiesel production needed from 2005 to 2010 can be determined by country (EU-15) as follows:

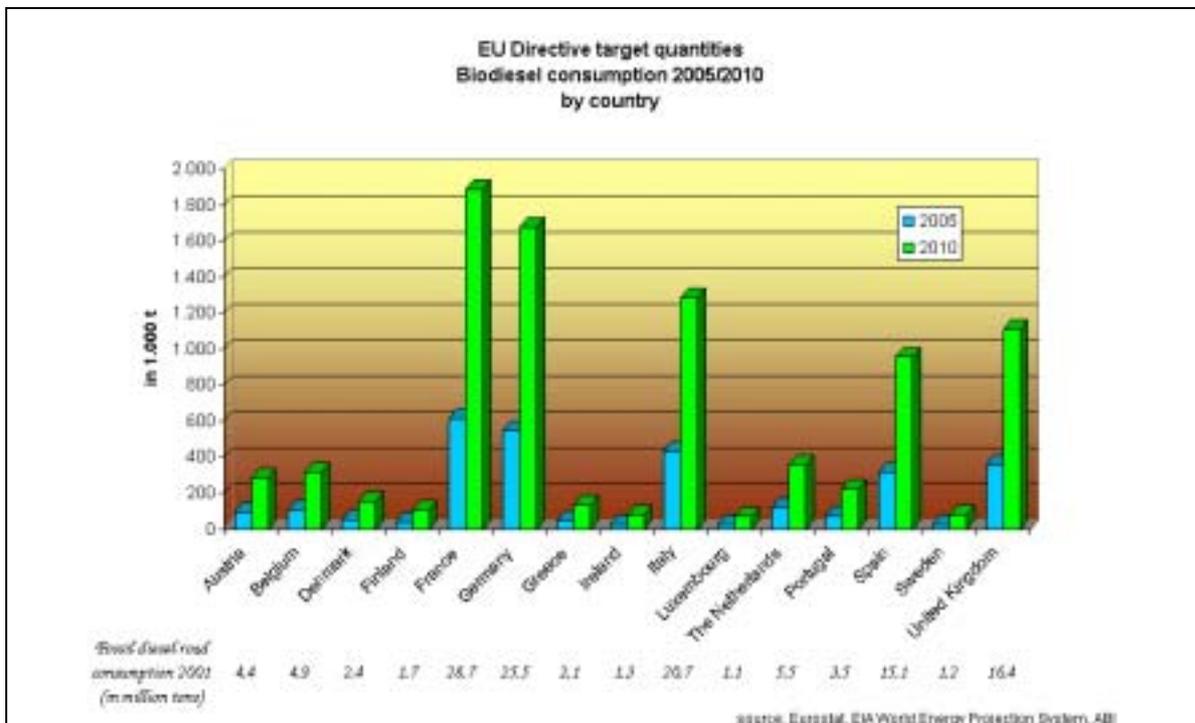


Illustration 3: EU Directive Target Biodiesel Consumption

With the accession of the 10 candidate countries (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia) on May 1st 2004 the overall committed volume for biofuels within the EU-25 will be increased furthermore.

3 BEST CASE REPORTS BY COUNTRY:

3.1 Austria



Background

Beginning as early as 1988 several commercial Biodiesel production plants were established: Initially some smaller farmers' cooperatives production units were built (Asperhofen 500 t/a, Güssing 500 t/a, Schönkirchen 300 t/a and Mureck 500 t/a) and in 1990 the construction of the first industrial scale Biodiesel-plant (10.000 t) was started in Aschach, but had to close down because of continuing losses. The by then largest commercial plant (15.000 t) in Bruck started production soon after in 1993 and produces 25.000 t today.

Beginning with January 1st 2000 the utilization of fuels from renewable raw materials is tax exempt if it is used as sole (bio-)fuel at 100 % or up to 2% Biodiesel blended with fossil diesel fuel.

Initially mainly rapeseed and occasionally sunflower oil was tested as feedstock, but later on low-cost recycled frying oil was increasingly used successfully.

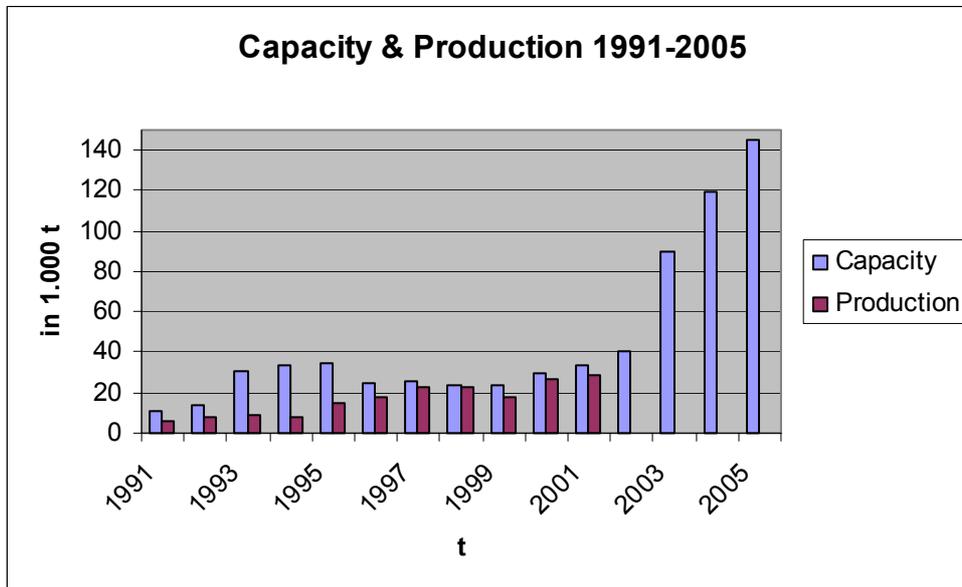


Illustration 4: Capacity and production 1991-2005 (ABI)

1. Biodiesel Kärnten GmbH in Arnoldstein

1. Address and location

Name: Biodiesel Kärnten GmbH
Address: Industriestrasse 29
A-9601 Arnoldstein, Austria
website: <http://www.biodiesel-kaernten.at>
e-mail : office@biodiesel-kaernten.at



Tel: +43 4255 90812-0 / Fax: +43 4255 90812-22

The so far newest Austrian Biodiesel production plant is located in the South of Austria with easy access to the Northern Italian provinces and Slovenia for potential feedstock supply and eventually Biodiesel marketing. The plant itself is embedded in a newly created industrial area of 550.000 m² close to the village of Arnoldstein.

The Biodiesel plant combines production, storage and administration buildings. Transportation is handled by trucks only as there are no rail connections. The motorway with connections to the South, the West and the North can be reached within 5 minutes.



Illustration 5: View of the production building and tank farm

2. Feedstock data

The basic feedstock concept is focusing on multi-feedstock. Recycled oils and fats are used as the main feedstock at a level of approx. 70% of the total input volume, vary a lot depending on applied recycling systems and can reach a level of up to 20 % Free Fatty Acids (FFA). The remaining feedstock consists of approx. 20% animal fat (lard and beef tallow) and 10% rapeseed oil. A wide range of blending recipes for optimal feedstock is stored in the process control computer and they can be changed quickly depending on the availability of varying feedstock qualities on the market.

The storage capacity for the different kinds of feedstock has a volume of 6.000 m³.



Illustration 6: Electronic control of feedstock unloading and processing

3. Biodiesel production data

The process technology, the engineering and construction was provided by the company BDI (Bio-Diesel-International Ges.m.b.H.) based in Grambach near Graz, Austria. Recycling oils, animal fat or rapeseed oil as well as any other vegetable oil can be converted into Biodiesel in a semi continuous process. The production was started in August 2003.

The applied process technology is characterised by fully automatic process control and high processing security, high flexibility in adapting the process according to the used feedstock quality, starting and stopping the process whenever required without any loss in product or quality, high profitability related to low energy consumption and practically zero waste streams (filter, bleaching, soaps, etc.).

Flexible and reliable process control is assuring high yields, which is expressed by the conversion of e.g. 1.000 kg pre-cleaned recycled oil into 920 kg Biodiesel.

Free fatty acids are as well processed into Biodiesel. Residues as a result of the final Biodiesel distillation are used as energy source.



Illustration 7: Aerial view of the tank farm

The present plant design allows a capacity expansion to 50.000 t Biodiesel production.

The installed storage capacity for Biodiesel is 2.000 m³. An additional tank farm with 20.000m³ can be used to store various feedstock materials.

Biodiesel in 1.000 t	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	25	25	50
Production	7	25	50

Total annual turnover will reach Euro 13 mill at full production at an employment level of 14 employees.

4. Product quality

The required product quality as defined by EN 14214 FAME is guaranteed by regular quality control by the own laboratory. Production data and samples of each production batch are stored for quality assurance reasons.

The crude glycerine is being processed into 80% purity glycerine according to the quality standard BS 2621.

5. Finance & ownership

The financial foundation of the Biodiesel Kärnten GesmbH was established by 2 shareholders:

- Rudolf Münzer Bioenergie GmbH as a professional and large recycling oil collector assuring continuous feedstock supply, and
- Paul Rudolf AG as a mineral oil fuel and Biodiesel distributor with an own distribution network

The total investment reached a volume of Euro 14,5 million.

The county government of the federal state Carinthia (Kärnten) subsidised this investment via its Technology Carinthia GmbH with 21 %.

2. Biodiesel Raffinerie GmbH in Zistersdorf

1. Address and location



Name: Biodiesel Raffinerie GmbH
Address: Inkustraße 1 - 7 / A-3400 Klosterneuburg (headquarter), Austria
Industrieweg 10 / A-2225 Zistersdorf (production)
website: <http://www.donauwind.at>
e-mail : mail@donauwind.at

Tel: +43 2243 440 200 / Fax: +43 2243 440 550

This Biodiesel plant was established close to the village Zistersdorf in the Northeast of Austria and close to the Slovak border. The site is located in an agricultural area but also amidst the few remaining mineral oil wells in Austria.

The plant houses both the production and administration buildings as well as storage facilities. Transportation of feedstock, Biodiesel and crude glycerine is handled by trucks.



Illustration 8: View of the Biodiesel plant near Zistersdorf

2. Feedstock data

Generally this Biodiesel plant was designed from the very beginning to process multi-feedstock, i.e. a variety of virgin and recycled oils and fats of vegetable and animal origin. For the time being mainly recycled oils of varying quality are used as feedstock (90% of the total feedstock used), which are delivered by 12 different suppliers. The remaining 10% is rapeseed oil. Recipes are selected depending on the quality of the incoming feedstock and adapted accordingly.

The upper limit of FFA-level in virgin oils to be processed in this plant is 5%. The whole FFA is processed into Biodiesel resulting in optimal yield levels. New ENERGEA process technologies, which were developed in the Zistersdorf plant, are able to process feedstock with up to 12 % FFA or also up to 20 % FFA and beyond into high quality Biodiesel.

3. Biodiesel production data

The new process technology with an innovative continuous and fast process requiring limited space was provided by ENERGEA Environmental Technology GmbH based in Klosterneuburg, Austria.



Illustration 9: View of the reactor system within the container frames

The engineering and construction were completed by different companies. The Biodiesel production was started in mid 2002 and scaled up continuously.

Flexible and reliable process control is assuring high yields, which is expressed by the conversion of 1.000 kg feedstock oil or fat into 998 kg Biodiesel.

Biodiesel production installations

The process technology itself is characterised by:

- low energy consumption
- high flexibility and variability in feedstock intake
- low space demand by the compact “Continuous Trans Esterification Reactor” (CTER)
- lower investment cost through assembling process units in easy-to-ship industrial containers
- fast reaction timing caused by accelerated esterification

At present 12.000 t of Biodiesel are produced yearly in average. The production plant is used as a R & D ground for ongoing further improvements of the many individual process steps in order to improve process technology permanently. As a result process technology is available to produce Biodiesel from feedstock sources with very high FFA levels.

Production of Biodiesel in 1.000 t	Actual 2002	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	40	40	40	40
Production	4	12	30	40

The storage facilities consist of 18 storage tanks of which 8 are subsurface containers. The warehouse capacities can store less than one month for feedstock and less than one month production for Biodiesel.

There is a weigh-bridge, a cooling tower and a combined heat and power station.

Employment level: 10 employees are responsible for a turnover of 6,5 million EUR.

4. Product quality

The required product quality is guaranteed by regular quality control provided by the own laboratory as well external laboratories. Production data and samples of each production batch are stored for quality assurance reasons. The produced Biodiesel fulfils all requirements of the European Biodiesel fuel standard EN 14214 FAME or even better.

The crude glycerine is processed into 80% purity glycerine according to standard BS 2621.

5. Finance & ownership

The Biodiesel Raffinerie GmbH is owned 93% by DonauWind KEG, a company engaged in renewable energy production by wind mills, and 7% by Mr. Nurhan Ergün, the owner of the process technology. The plant was established by ENERGEA Environmental Technology GmbH as the process technology provider, in which Donau-Wind holds a share of 26 %. The total investment reached a volume of Euro 5 million and was partially subsidised by European funds, the Kommunalkredit-Bank Austria AG and the federal state of Lower Austria.



Illustration 10: View of the tank farm

3.2 Czech Republic



Background

In 1988 VÚZT - the Agricultural Research Institute in Prague - published the first pacesetter paper about Biodiesel in Czechoslovakia. In 1991 the "Oleoprogram" was launched in order to initiate a national Biodiesel production by providing attractive subsidies for non-food rapeseed production.

In this framework 16 of initial 18 production facilities were supported and realised and in total a capacity of 63.500 t FAME /year was established between 1992 and 1996. Based on this support programme 67.200 t of FAME were produced in 2000, of which 93 % with government support.

After the expiration of this program in September 2001 a revised grant system was introduced. This modification led to a massive drop in Biodiesel consumption. The largest producer in the country is Setuza which processes about 150.000 t/a rapeseed into 53.000 t/a of RME in 2 plants.

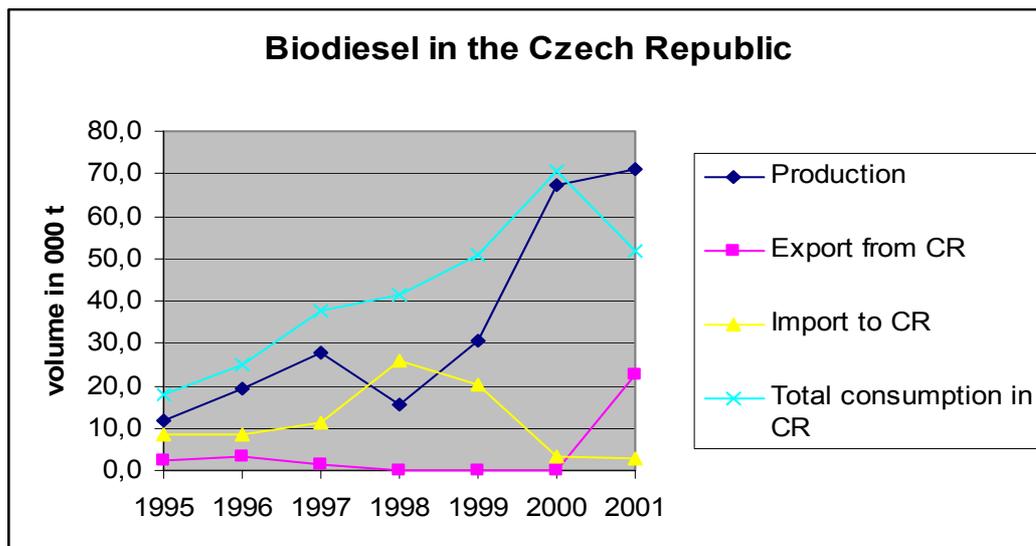


Illustration 11: FAME production, import, export and consumption / Czech Republic 1995-2001 (ABI)

Realistic estimations define approx. 120.000 t/a as the maximum of the potential national Biodiesel production.

3. AGROPODNIK, akciová společnost, in Jihlava

1. Address and location

Name: AGROPODNIK, akciová společnost, Jihlava
Address: Dobronín 315
CZ- 588 13 Polná
Website: <http://www.edb.cz/agropod>
e-mail: agp@agropodnik.ji.cz
tel: +42 567 212 132 / fax: +42 567 221 030



Illustration 12: Aerial view of the combined oil mill and Biodiesel installations

The production site is located in the middle of a productive agricultural area close to the village Polná. Both administration and production buildings are on this site. The Biodiesel plant has a road and rail transport connection.

2. Feedstock and oil mill data

Rapeseed, which is harvested in this agricultural area, is transported by truck or train to and stored in the silos of the oil mill for further processing into semi-refined rapeseed oil. The oil mill is equipped with 3 presses of the German company Reinartz (type AP 25 and AP 30). The seed is pressed without heat-conditioning in a cold pressing process, with 2 presses performing the pre-pressing and the third press the finishing pressing.

Both the oil mill and the Biodiesel plant have one common control centre. Only vegetable oils are used as feedstock for the Biodiesel production and for the time being it is exclusively rapeseed oil, which is produced.

The storage facilities can hold 2.200 t of rapeseed, 900 m³ of rapeseed oil and 900 t of oilseed cake as feed. The storage capacity for Biodiesel is less than a one-month's production.



Illustration 13: Rapeseed storage silos

3. Biodiesel production data

Approx. 50 % of the required volume of rapeseed oil is produced in the own oil mill, while the other 50 % are purchased on the open market. The upper limit of the free fatty acid content (FFA) in the oil, which can be processed, is limited with 2 % FFA max. Concerning the yield level achieved it is reported that 1.000 kg feedstock are processed into 980 kg Biodiesel. Basically also other feedstock sources could be used, and in an initial test run recycled frying oil was processed successfully.

The free fatty acids are sold as a side product for further processing. The production is run in a discontinuous batch process. The equipment was delivered and installed by the German company AT Agrartechnik in Schlaitdorf, owner of the process Campa Biodiesel. The Biodiesel production was started in the year 1994.

A flexible and reliable process control is assuring high yield levels and the required quality level. The significant expansion of the Biodiesel production capacity was realised during the years 2001-2002 by installing a new production unit and by vertical enlargement of existing units.

The Biodiesel plant employs full-time 12 persons in a 3-shift cycle and has achieved a turnover of 25 mio Euro in 2003.

Biodiesel production statistics (in 1.000 t)					
	2001	2002	2003	2004	2005
Capacity	3	5	50	50	50
Production	3	5	30	25	30



Illustration 14: Biodiesel production on level 2 after capacity expansion

4. Product quality

The required fuel quality of the produced Biodiesel is achieved by final washing, drying and fine filtration. Biodiesel quality is controlled in regular intervals by the own laboratory as well as by independent external laboratories. Production data are continuously documented and samples of each production batch are stored for quality assurance reasons. The European Biodiesel standard EN 14214 was adopted as the Czech standard CSN EN 14214, which is used as reference, but some parameters show a superior quality such as water content, which is below 300 ppm instead of the required 500 ppm.

The side product glycerine is produced with 80 % concentration.

The quality control is carried out in compliance with the Regulation No. 227/2001 of the Ministry of Industry and Trade, stipulating requirements for fuels for vehicles operations on roads and method of their quality monitoring. Inspekta, a joint-stock company, was commissioned by the State agricultural intervention fund to perform the quality control.

The complete plant is in accordance with the established and severe ecological standards, particularly in case of the waste water purity.

5. Finance & ownership

The company Interlacdo in Prague is the majority owner holding 90 % of the shares. The investment cost of the first phase amounted to 75 mio CZK (at present approx. 2,3 mio €), of which 80 % were granted by the Ministry of Agriculture as interest free loan with a 10-year repayment period.

The second stage investment amounted to 158 mio CZK (approx. 5 mio €) and was granted by own sources and bank credits without any state support for investment.

France



Background

It was in the mid-80s that France was looking for new markets for agricultural products. The oil producing and processing industry decided to promote rapeseed oil that was underrepresented in the food-market at European level. From 1991 to 1995, a development program with the participation of all stakeholders involved tried to figure out the most favourable way to produce, distribute and use Biodiesel. As a consequence a Biodiesel production program with an initial pilot plant and an agreement to incorporate a blend of up to 5% Biodiesel with fossil diesel was started. After the first pilot plant had been established in Compiègne and Biodiesel production and application experience had been collected the next step to larger production units was made.

Today 4 production plants are representing a capacity for more than 420.000 t/a of Biodiesel

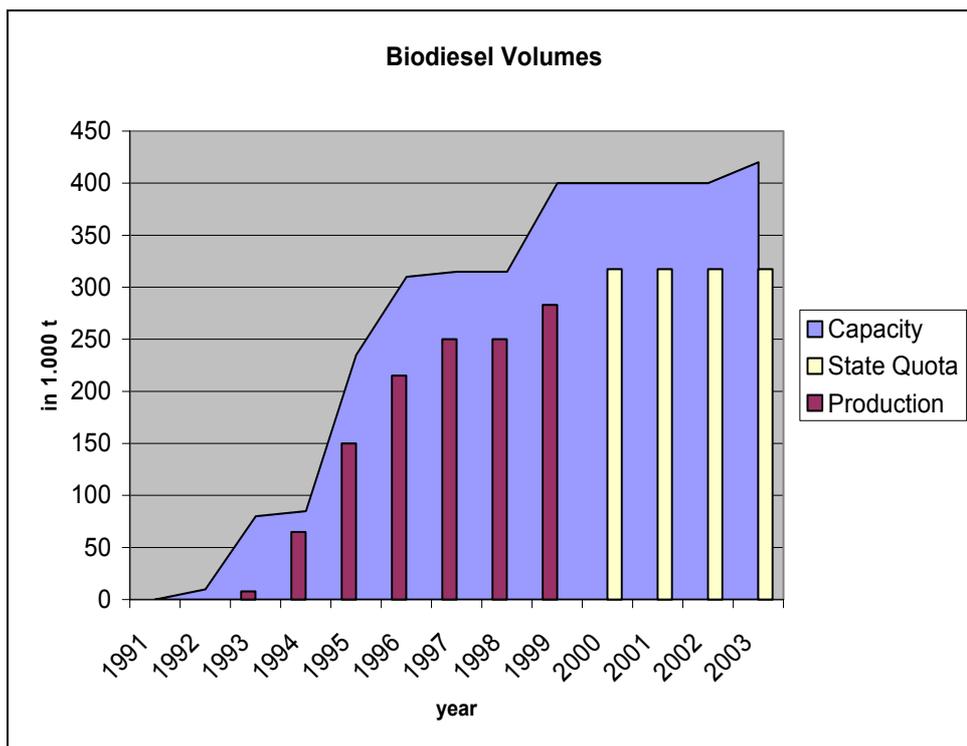


Illustration 15: France's Biodiesel volumes 1991-2003 (ABI)

For more than fourteen years, France has been developing Biodiesel. Its unique industry structure represented by a few large producers and a joint marketing strategy combined with a solid legal framework promoting Biodiesel. To achieve the 2% target by 2005 would require the cultivation of oilseeds on approximately 440.000 ha, which appears to be a realistic figure.

4. Diester Industrie in Grand-Couronne

1. Address and location



Name: Diester Industrie
Address: 12, Avenue George V, F-75008 Paris (headquarter)
Address: Boulevard Maritime, F-76530 Grand-Couronne (production plant)
website: <http://www.prolea.com>
e-mail : m.vandecandelaere@prolea.tm.com

Tel: +33 1 60 69 69 28 / Fax: +33 1 60 69 69 12

This site is located within an industrial area of the city of Grand-Couronne near Rouen and combines production and administration buildings, - the company's headquarter is based in Paris.

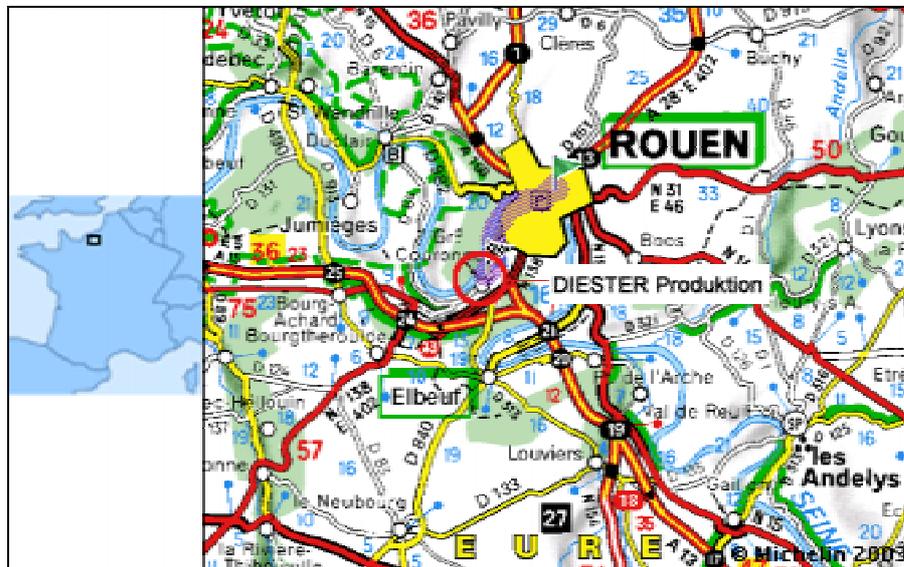


Illustration 16: Map with details of the Biodiesel plant's location

The plant is linked with a harbour for ocean ships, which can assure flexible supply from various oilseed regions at low transport cost; - additionally there is a rail connection. The refineries of the large mineral oil companies Total France and Shell are located nearby in Grand-Couronne and represent the 2 most important customers using Biodiesel for up to 5 % blends into fossil Diesel.

2. Feedstock and oil mill data

A fully integrated large scale oil mill is installed having industrial, logistical and quality control synergy effects.

Multi-feedstock is used for vegetable oils which are the only feedstock sources for the time being. The annual feedstock quantity consists of 70% rapeseed oil, 20% sunflower oil and 10% other vegetable oils. However, the recipe procedures change for each delivery by using an automatic mixing station.

The warehouse capacities can store less than one month of feedstock material and as well less than one month production for Biodiesel.



Illustration 17: Aerial view of the oil mill and the Biodiesel plant at the harbour site

3. Biodiesel production data

The installation was completed by company Henkel. Rapeseed oil is converted to Biodiesel in a continuous process. The start of production took place in 1995. At present 230.000 to of Biodiesel are produced annually in average. The free fatty acids are sold as a side product for further processing. Since 1995 the volume capacity was continuously increased by de-bottlenecking.

Biodiesel Production in 1.000 t	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	250	N.A.	N.A.
Production	230	N.A.	N.A.

Employment level: 35 employees (production, quality control, shipping of goods) were responsible for a turn over of Euro 180 million in the year 2002

4. Product quality

The required product quality is guaranteed by regular quality control in the own laboratory and by an external independent laboratory as well. Production data and samples of each production batch are taken every six hours and stored for quality assurance reasons in case of complaints later on. The produced Biodiesel fulfils all requirements of the European Biodiesel fuel standard EN 14214 or is even better depending on client and market requests.

5. Finance

Diester Industrie is a joint stock company; the financing of the plant was arranged by the owners. There were no data available on potential state aids for investment funding.

3.3 Germany



Background:

In 1990 the UFOP (Union For the promotion of Oilseed- and Protein plants) as an alliance between farmers and oilseed breeders was founded, which organization became the strongest Biodiesel promoter in Germany.

In 1995 Oelmühle Leer Connemann started its commercial scale Biodiesel production with a total capacity of 80.000 t/a based on an own process technology.

Mineral-oil tax: German law defines that mineral-oil taxation applies only to mineral-oil based fuels; consequently Biodiesel enjoys full de-taxation since the very beginning.

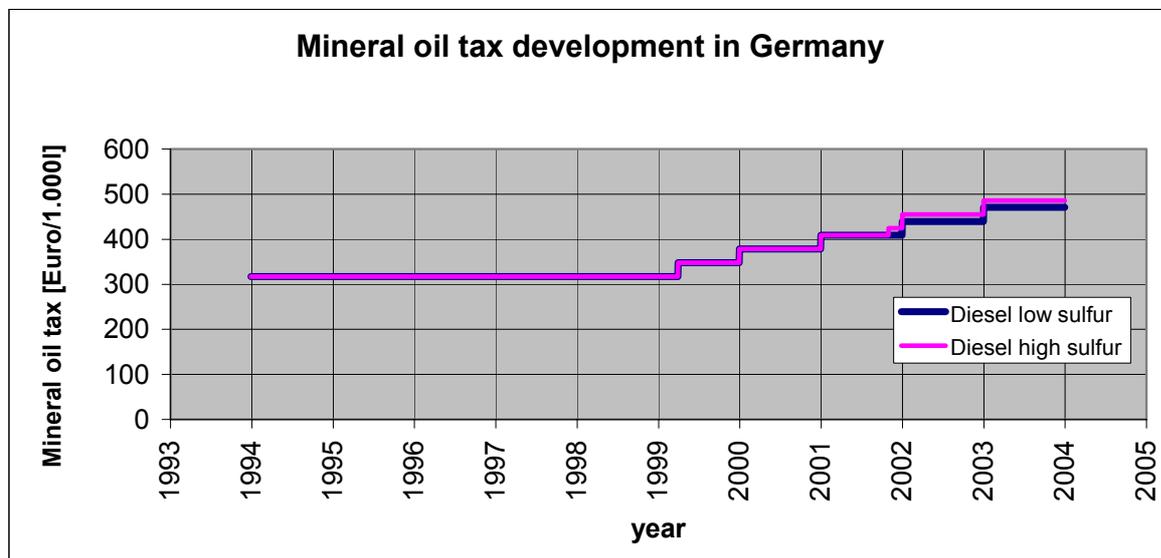


Illustration 18: Development of mineral oil tax for fossil diesel in Germany

Rapeseed oil is by far the dominating feedstock source, as specifically in Northern Germany rapeseed finds ideal growing conditions, but there is growing interest regarding recycled oil as feedstock basis; one company (Saria) is producing Biodiesel from recycled animal fats.

There are 23 Biodiesel plants in Germany with a total installed production capacity of 1,056.000 t/a. Additionally it is reported that there are 3 more plants under construction with a total capacity of 240.000 t/a.

With an anticipated Biodiesel production capacity of around 1,1 million t, the total capacity will have increased more than tenfold since 1998:

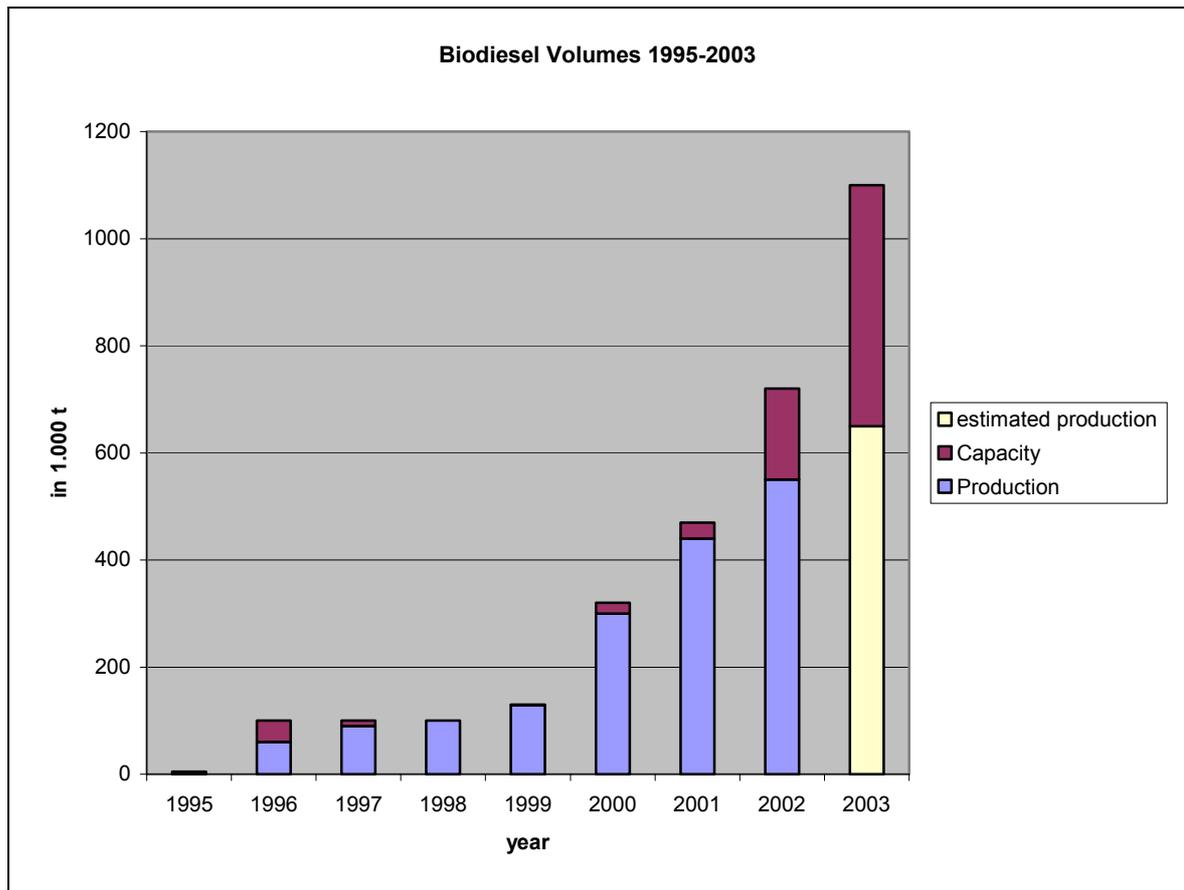


Illustration 19: Biodiesel volumes 1995-2003 (ABI)

Marketing Strategy

The main characteristic of Germany is to market 100% pure Biodiesel which is on sale in Germany at over 1.500 public filling stations.

For the so-called “free stations”, Biodiesel has become an important supplementary product for survival in the tough competition between filling stations; therefore the marketing of Biodiesel through the public filling station network will be certainly extended in the future.

One main drive for initial demand was certainly the cost savings realized when switching from fossil diesel to Biodiesel, which is an attractive argument for the long-distance trucks. Since then, the price gap has even increased further.

5. ADM Oelmühle Leer Connemann GmbH & Co. KG

1. Address and location

Name: ADM Oelmühle Leer Connemann GmbH & Co. KG
Address: Sägemühlenstrasse. 45
D-26789 Leer, Germany
website: <http://www.biodiesel.de>
e-mail : detlef_evers@corp.admworld.com
Tel: +49 491 8002 121 / Fax: +49 491 8002 140

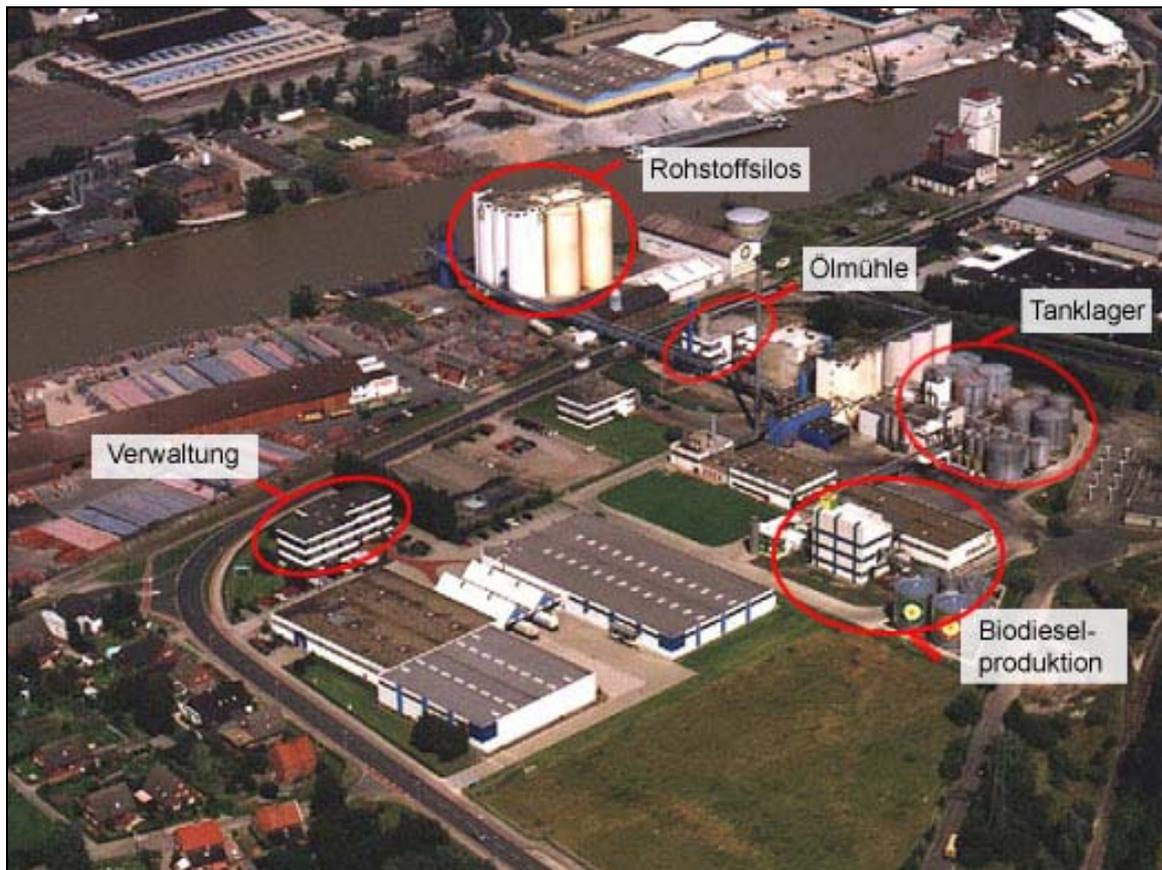


Illustration 20: View of the oilseed silos at the harbour, the oil mill and tank farm, the Biodiesel production plant and the administration building

Description of above picture: The storage silos for oilseeds (rapeseed, sunflower) are located close to the harbour of the city Leer at the river Ems with access to the North Sea; the oil mill (including the process steps of de-gumming, bleaching and fatty acid distillation) is located between the silos to the left and the tanks for oil and Biodiesel to the right; the Biodiesel production plant itself is situated below the tank farm; the administration buildings can be seen at the very left side. There exists a railway connection as well.



Illustration 21: Map with the location of the Biodiesel plant in Leer

2. Feedstock and oil mill data

Refined rapeseed oil from the existing production is used as feedstock for the Biodiesel production. The upper limit of free fatty acid (FFA) in the oil, which can be processed, is approx. 1%. In the mass balance 1.040 kg crude oil is processed into 1.000 kg Biodiesel with 40 kg fatty acids and 130 kg crude glycerine as side products. There is the option to use a variety of other feedstock sources.



Illustration 22: View of the Biodiesel production building

The capacity of the oil mill is 400 t oil / day as well as 600 t meal / day (rapeseed and sunflower meal).

3. Biodiesel production data

Initially a research pilot plant of 1.000 l / day capacity was started in 1991. As a next step the technical pilot plant with a capacity of 5.000 l / day was put into operation in 1993 as the first European industrial demonstration plant.

The commercial Biodiesel plant today was started in 1995 and is using the CD Process System Connemann-ADM technology, which is a continuous process using Westfalia centrifuges and works at a range between 70° - 100°C. Daily output is reaching approx. 310 t Biodiesel. The Biodiesel plant was built close to the existing oil mill. Both units have separate control systems.

The engineering company Feld & Hahn was responsible for the engineering and construction of the plant.



Illustration 23: Westfalia centrifuges in action in the 2-step transesterification and 2 washing steps

Flexible and reliable process control assures high yield levels. Biodiesel delivery can take place by lorry, rail or ship. The whole operation (oil mill and Biodiesel) employs 75 persons.

Production of Biodiesel (in 1.000 t)			
Year	2003	2004	2005
Capacity	110	110	110
Production	110	110	110

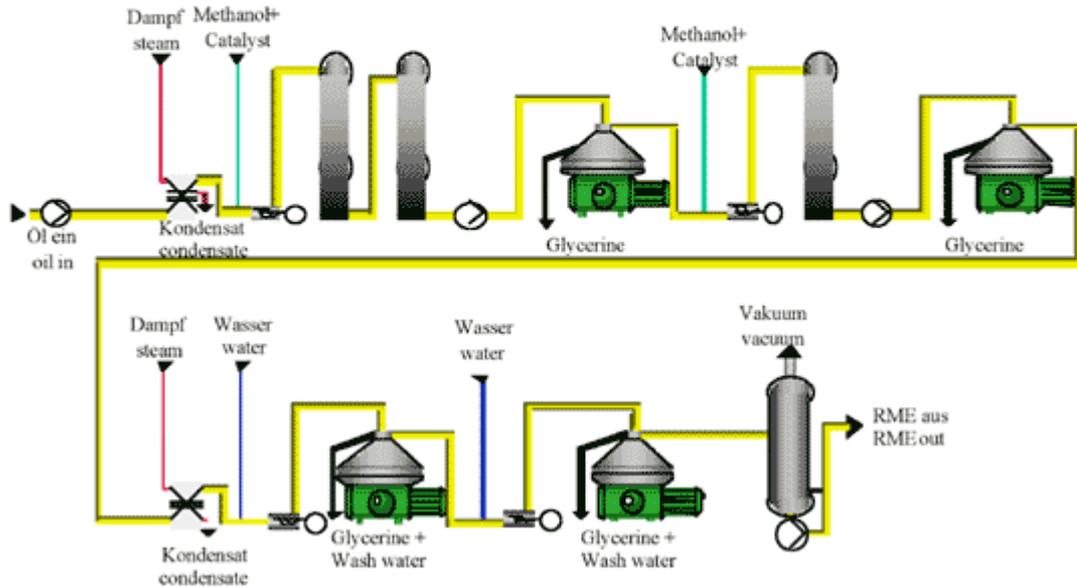


Illustration 24: CD Connemann process flow diagramm

4. Product quality

ADM Oelmühle Leer is a member of the quality association AGQM with its strict quality management rules, requiring regular analysis of Biodiesel production in the plant in the own laboratory as well as of Biodiesel sold at the fuel pumps, which is sampled and analysed by independent laboratories. Biodiesel production data and samples of each numbered production batch are stored for quality assurance reasons.

The produced Biodiesel fulfils all requirements of the German EN DIN 51606 and the European EN 14214 or is even better e.g. the water content is less than 200 ppm and for total contamination after micro-filtration.

The crude glycerine is being purified and reaches the specifications of BS 2625 (> 99,0 % purity).

5. Financing

The overall investment volume amounted to approx. 10 mill Euro, which was partially funded by the European Union and the federal state of Lower-Saxony.

ADM Oelmühle Leer Connemann GmbH & Co. KG
Germany

6. Bio-Ölwerk Magdeburg GmbH

1. Address and location

Name: Bio-Ölwerk Magdeburg GmbH
Address: Am Hansehafen 8 / D-39126 Magdeburg, Germany
website: <http://www.Bio-Oelwerk-MD.de>
e-mail : baeumler@Bio-Oelwerk-MD.de



Tel: +49 391 8381 103 / Fax: +49 391 8381 444

Both production and administration buildings are located within an industrial area close to the city of Magdeburg. There is the opportunity to load and unload ships with oil seed, vegetable oil and Biodiesel at the river Elbe as a low cost transport option in addition to road transport.



Illustration 25: Biodiesel and oil storage tanks with filling station

2. Feedstock and oil mill data

A fully integrated oil mill is installed, which has a non-hexane-extraction crushing technology. The produced rapeseed oil is fully refined to a level of less than 0,05% Free Fatty Acid (FFA) and is the only feedstock used for the time being; it is basically possible to process a multi-feedstock blend of various virgin vegetable oils. The present crushing capacity of the oil mill is 225 t seed / day. It is intended to double the present capacity up to 450 t seed / day in near future.

The daily production of FFA is approx. 1 t from the physical refining and approx. 2 t from the separation process of the glycerine-water-phase. The FFA is sold for further processing to the oleo-chemical industry.

There is one joint control centre for both the oil mill and Biodiesel production, which is based in the centre of the building. The oilseed crushing plant is located in the left part of the building, while the production steps continuous de-gumming, bleaching, deodorization and oleo-chemistry (fatty acid treatment, Biodiesel and glycerine production) are based in the right part of the building.

The warehouses capacities are 1.200 m³ for rapeseed-meal and 2.000 m³ for rapeseed.



Illustration 26: 3-D view of the total plant installations

3. Biodiesel production data

The construction was completed by the company Cimbria Sket, which is based in Magdeburg. Rapeseed oil is converted to Biodiesel in a continuous process using the Connemann CD-process under normal pressure with separators provided by Westfalia Separator Food Tec GmbH. The start of production took place in February 2003.

Flexible and reliable process control is assuring high yields, which is expressed by the conversion of 1.000 kg rapeseed oil into 980 kg Biodiesel.

At present 180 t of Biodiesel are produced daily in average. The oil mill output is approx. 80 t / day. Additionally 100 t / day of rapeseed oil are bought from other sources.

There is a pipeline to a tank farm for fossil diesel in the neighbourhood, where Biodiesel could be blended in, if such a blend is required by law or market forces in near future.

Production of Biodiesel in 1.000 t	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	50	50	50
Production	35	45	50

Employment level: 21 employees are responsible for an estimated turn over of Euro 30 million in 2003.



Illustration 27: View of the separator line

4. Product quality

The company is a member of the AGQM and has to comply with strict quality rules. (AGQM is the Biodiesel fuel quality association in Germany, which is positioning and marketing Biodiesel as a reliable high quality fuel at public fuel pumps.)

Very high product quality is guaranteed by regular quality control by the own analytical laboratory. Production data and samples of each production batch are stored for quality assurance reasons in case of complaints later on.

The produced Biodiesel fulfils all requirements of the German DIN-Standard EN DIN 51606 FAME or is even better (e.g.: water content is less than 200 ppm).

The crude glycerine is being purified and concentrated according to the specifications of the pharmaceutical industry (BS 2623 – 99 %) in a volume of 17 t per day.

5. Finance & ownership

The financial foundation was established by six investors and partially subsidised by the federal state of Saxony-Anhalt. The total investment reached a volume of Euro 20 mill, of which Euro 15 mill were used for the plant installation and Euro 5 mill for the buildings.

7. EOP Elbe-Oel Prignitz AG in Falkenhagen

1. Address and location

Name: EOP ElbeOel Prignitz AG
 Address: Am Hünengrab 9 / D-16928 Falkenhagen, Germany
 website: <http://www.elbeoel.com>
 e-mail : info@elbeoel.com
 Tel: +49 339 865 055-0 / Fax: +49 339 865 055-99

The EOP ElbeOel Prignitz AG considers itself as a middle class enterprise with innovative and ecological orientation. Administration facilities, the oil mill and the Biodiesel plant are united at the same site.



Illustration 28: General view of the seed storage silos and the oil mill complex

The plant is located between Berlin and Hamburg, in the middle of the large plain fields of Eastern Germany, which is a major rapeseed growing area with excellent climatic conditions.

2. Feedstock and oil mill data

The plant design integrates a non-hexane oil mill with pre-heating of the seed, large rapeseed storage capacities and the Biodiesel production plant. The capacity of the oil mill is approx. 85 t oil / day at present, while the Biodiesel plant could process up to 100 t oil / day.

The produced crude rapeseed oil is refined (de-gumming and neutralisation) to an upper limit of FFA (Free Fatty Acid) of max. 1,0 % and this is the only feedstock used for the time being.

Production data of the oil mill at EOP Prignitz AG	
(in t p.a.)	
Storage capacity rapeseed	40.000
Crushing capacity (00 rapeseed)	80.000
Production rapeseed oil	30.000
Production rapeseed cake	50.000

From one joint control centre both the oil mill and Biodiesel production are managed.

The warehouse capacities (as shown in above picture) can take up to 40.000 t of rapeseed; this large storage capacity provides very good purchasing flexibility.



Illustration 29: 3D-view of the Biodiesel production plant

(Courtesy: ENA-Biodiesel, Graz, Austria)

3. Biodiesel production data

Parts of the installation were completed by the company Cimbria Sket based in Magdeburg, which is specialising on oil mill technology. The start of production took place in May 2003.

The installed flexible and reliable process control is assuring high yields, which is expressed by the conversion of 1.000 kg rapeseed oil into 995 kg Biodiesel. At present 85 t of Biodiesel are produced daily in average. Additionally 15 t/day of rapeseed oil are bought from other sources.

Biodiesel production in 1.000 t	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	30	30	30
Production	7	30	30

Employment level: In the year 2004 a turnover of approx. Euro 30 mill per year will be reached with a total of only 9 employees, responsible for both the oil mill and the Biodiesel production.



Illustration 30: Biodiesel production installations

4. Product quality

The required Biodiesel quality is guaranteed by regular quality control covered by the own laboratory. The produced Biodiesel fulfils all requirements of the German Standard EN DIN 51606 and the European EN 14214 or is even better e.g. the water content is less than 200 ppm as shown in the following analytical certificate:

Prüfparameter	Methode	Prüfergebnis	Einheit	E DIN 51 606	
				min.	max.
Wassergehalt K.-F.	EN ISO 12937	118	mg/kg	-	300
Flammpunkt P.-M.	DIN EN 22719	160	°C	110	-
Oxidationsstabilität	prEN 14112	7,6	h	(6)	-
Phosphorgehalt	prEN 14107	<0,5	mg/kg	-	10
Freies Glycerin		0,008	Gew.-%	-	0,02
Monoglyceride		0,37	Gew.-%	-	0,8
Diglyceride	prEN 14105	0,15	Gew.-%	-	0,4
Triglyceride		0,11	Gew.-%	-	0,4
Gesamtglycerin		0,14	Gew.-%	-	0,25
Natriumgehalt		<0,5	mg/kg	-	5
Kaliumgehalt	prEN 14538	<0,5	mg/kg	-	(5)
Calciumgehalt		<0,5	mg/kg	-	(5)
Magnesiumgehalt		<0,5	mg/kg	-	(5)
Gesamtverschmutzung	EN 12662	4	mg/kg	-	20
Säurezahl	prEN 14104	0,143	mg KOH/g	-	0,5

Biodiesel production data and samples of each numbered production batch are stored for quality assurance reasons.

The crude glycerine is being purified and reaches the specifications of BS 2621 (80 % purity).

5. Finance & ownership

The financial foundation was established by a few private investors and additionally a larger number of smaller shareholders in the region, with 500.000 shares sold in 2001.

The total investment reached a volume of Euro 30 mill; 50 % of the financial investment support was provided by European funds and the government of the federal state of Brandenburg.

8. MUW Mitteldeutsche Umesterungswerke GmbH&CoKG in Greppin

1. Address and location

Name: Mtteldeutsche Umesterungswerke GmbH & Co KG
Address: Chemiepark Bitterfeld Wolfen, Areal B, Stickstoffstraße,
D-06803 Greppin, Germany
website: <http://www.muw-biodiesel.de>
e-mail : Georg.Pollert@MUW-biodiesel.de

Tel: +49 3493 74740 / Fax: +49 3493 74749

The industrial area of the cities of Bitterfeld and Wolfen has offered an attractive site for this large Biodiesel facility, which combines both production and administration buildings. The plant has its own railway connection.



Illustration 31: Overall outside view of the Biodiesel plant

2. Feedstock

Crude rapeseed oil is the only feedstock used for the time being. It is delivered to the Biodiesel plant either by rail or truck.

The rapeseed oil is refined to an upper limit of Free Fatty Acid (FFA) of 3%. The separated FFA is sold for further processing to the oleo-chemical industry.

Other vegetable oils could be processed as well but this option is not used at present.

The warehouse capacities for raw materials can cover the demand for less than one month production. The total tank farm capacity is approx. 12.000 m³ and assures rather high storage flexibility.

3. Biodiesel production data

The construction was completed by the company itself in less than 8 months. Production started in October 2001. Rapeseed oil is converted to Biodiesel in a continuous process, as invented by Dr.-Ing. Pollert, by simply using permanent gravity separation - instead of centrifuge separation- in big sedimentation tanks under normal pressure. Natrium-methylate is used as a catalyst for the transesterification reaction at special temperatures. Waste water streams are avoided as the washing water is recycled into the process. This transesterification process produces also crude glycerine of higher quality.



Illustration 32: Glycerine production installations

Flexible and reliable process control is assuring high yields, which is expressed by the conversion rate of 1.000 kg rapeseed oil into 980 kg Biodiesel.

Since its start in March 2002 the daily production reached 400.000 l Biodiesel according to DIN 51.606 and later on to DIN EN 14214 quality parameters.

Biodiesel Production in 1.000 t	Actual 2001	Actual 2002	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	100	100	150	150	150
Production	8	54	75	120	150

Employment level: 21 employees are responsible for a turnover of Euro 70 million per year.

4. Product quality

The company is member of the AGQM and has to obtain strict quality rules. (AGQM is the Biodiesel fuel quality association in Germany, which is positioning and marketing Biodiesel as a reliable high quality fuel at public fuel pumps.) The required high product quality is guaranteed by regular quality control as assured by the own laboratory. Production data and samples of each production batch are stored for quality assurance reasons in case of complaints later on. The produced Biodiesel fulfils all requirements of the German DIN-Standard E DIN 51606 or is even better (e.g.: water content is less than 200 ppm, also flash point and total contamination).



Illustration 33: View of the glycerine-water evaporation

The crude glycerine is being purified and concentrated according to the specifications of the pharmaceutical industry.

5. Finance & ownership

The financial foundation was established by the Sauter Group and Dr.-Ing Pollert. It was partially subsidised by the federal state of Saxony-Anhalt and European funds. The total investment reached a volume of Euro 25 million.

9. NEW- Natural Energy West GmbH in Marl

1. Address and location

Name: Natural Energy West GmbH
Address
Production: Chemiepark Marl; Paul-Baumannstrasse 1/ D-4576 Marl, Germany
Administration: Industriestrasse 34, D-41460 Neuss
website: <http://www.thywissen.de/new/marl.htm>
Tel: +49 2131 2604 1 / Fax: +49 2131 2604 220

The production plant is located within the chemical industry park of Marl, which has access to a canal (Wesel-Datteln-Kanal) for transport of oil seeds, of oil and Bio-diesel and to an own rail connection. The administration is located in Neuss.



Illustration 34: General view of Biodiesel production site

2. Feedstock data

The feedstock presently processed is exclusively rapeseed oil, which is delivered from the oil mill C. Thywissen at Neuss by ship to a harbour and from there it is pumped through a 3 km long pipeline to the feedstock tanks of the Biodiesel plant. The storage capacities have a volume of 3.000 m³ of oil. Basically the use of other vegetable oils is possible.

3. Biodiesel production data

The Biodiesel production unit was engineered by the company Lurgi Life Science using a continuous process design. The construction was completed as a turn-key concept including planning, deliveries, assembling and construction as well as start-up of the whole plant.

With the favourable location within a chemical industry park the authority approvals were rather short. As a result only 13 months were needed between investment decision and start of production, of which construction time took 9 months.

The plant was built as an open construction, leading to lower construction cost, to better air ventilation and reduced explosion risks when handling methanol.

The process is characterised by high yields, outstanding Biodiesel quality at low energy consumption and lowest possible emissions. There are no liquid nor solid waste streams as those materials are recycled.

The upper limit of free fatty acids in feedstock is approx. 0,05 % with an overall yield of 995 kg Biodiesel out of 1.000 kg feedstock input. The produced volumes of free fatty acids are sold for further processing.

Since March 2002 Biodiesel is produced according to DIN 51.606. Overall production capacity is 100.000 t/year. The storage capacity consists of 2 production tanks with 100 m³ each and 2 storage tanks with 2.000 m³ each.

The annual production of glycerine amounts to approx. 10.000 t.

Supply of steam, electricity and waste management is provided by the existing chemical industry park installations.

Biodiesel production in 1.000 t	Actual 2002	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	100	100	100	100
Production	45	95	100	100

The Biodiesel plant manager, the production manager and further 12 employees are responsible for overall production, quality management and deliveries by truck, which is semi-automatic and does not require additional personnel. In the year 2003 a turnover of approx. Euro 50 mill per year was reached. with a total of only 9 employees, responsible for both the oil mill and the Biodiesel production.

4. Product quality

NEW is a member of the AGQM with its strict quality management guidelines. The required Biodiesel quality is guaranteed by regular quality control of all incoming feedstock as a first step.

Any Biodiesel produced is stored in a production tank and is released to the storage tanks only after quality control covered by the own laboratory. The final Biodiesel is only released for delivery after a control by an external and certified laboratory.

NEW-Produktionsstätte Marl
 Analysenzertifikat gem. E DIN 51606
 Prüfmuster: Rapsmethylester (Biodiesel) Verladetank 20T11

Eigenschaft	Methode	Mßeinheit	DIN Werte		Resultat
			Mn.	Max.	
Dichte 15°C	EN ISO 3675	g/ml	0,875	0,9	0,884
Viskosität (40°C)	EN ISO 3104	mm ² /s	3,5	5	4,35
Flammpunkt	DIN EN 22719	°C	110		155
CFPP	EN 116	°C		0	-14
Schwefel	ISO CD 20846	mg/kg		100	15
Koksrückstand	EN ISO 10370	Gew. %		0,05	<0,01
Cetanzahl	EN ISO 5165		48		55
Asche	ISO 3687	Gew. %		0,03	<0,01
Wassergehalt	EN ISO 12937	mg/kg		300	185
Gesamtverschmutzung	EN 12652	mg/kg		20	6
Kupfer-Korrosion	EN ISO 2180			1	1
Oxidationsstabilität	prEN 14112	h	6		8,9
Neutralisationszahl	prEN 14104	mg KOH/kg		0,5	0,2
Methand	prEN 14110	Gew. %		0,3	0,1
Mono glyceride	prEN 14105	Gew. %		0,8	0,41
Diglyceride	prEN 14105	Gew. %		0,4	0,08
Triglyceride	prEN 14105	Gew. %		0,4	0,04
Freies Glycerin	prEN 14105	Gew. %		0,02	0,011
Gesamtglycerin	prEN 14105	Gew. %		0,25	0,14
Iodzahl	prEN 14111	g Iod/100g	115		114
Phosphorgehalt	prEN 14107	mg/kg		10	3
Alkaligehalt (Natrium)	prEN 14108	mg/kg		5	2

Das vorliegende Werks-Zertifikat ist zur Kunden-Information bestimmt und bezieht sich ausschließlich auf die ausgelieferte Ware. Seine Weitergabe zur Produktbezeichnung ist nur zulässig, wenn die Ware in unveränderter Form, d.h. insbesondere ohne Vermischung mit anderen Stoffen und ohne Transport- und Lagerschäden an die nächste Handelsstufe übergeben wird.

Datum: 9.09.03

Unterschrift: 
 Dr. Muke

Versandung
 Industriestraße 3a
 41480 Neuss
 Tel. 02131/2604-1
 Fax 02131/2604-230

Händlername: Landtechnik
 Konto Nr. 105320
 BLZ 250 501 00

Bezeichnung:
 Paul-Baumann-Strasse 1
 45754 Marl
 Tel. 023 65 99-866 54
 Fax 023 65 99-866 70

Bezeichnung:
 Bernd Kille
 Stb und Registrierungsamt
 Neuss HRB 10744

The produced Biodiesel fulfils all requirements of the German Standard EN DIN 51606 or is even better e.g. the water content is less than 200 ppm compared to the required max. 300 ppm.

Biodiesel production data and samples of each numbered production batch are fully documented and stored for quality assurance reasons.

The crude glycerine is being refined to a concentration of 85,2 % purity.

5. Finance & ownership

The total investment reached a volume of Euro 12 mill. The financial foundation was established by the 4 owners holding a 25 % share each. The details of the 4 owners, which show a high level of potential synergetic factors:

Name	Location	Core activities	Function related to NEW
Bunge	New York/ Hamburg	International oil seed trade and oil mills	International risk management for feedstock supply
 Diester	Paris	Biodiesel-production	Marketing of glycerine to the chemical-pharmaceutical industry
RCG	Münster	Agricultural co-operative	Marketing of Biodiesel to cooperatives, mineral oil trade and large truck and bus fleet owners
 C.Thywissen	Neuss	Oil mill	Supply of semi-refined rapeseed oil



Illustration 35: View of the Biodiesel production installations

10. Rheinische Bioester GmbH in Neuss

1. Address and location

Name: Rheinische Bioester GmbH & Co KG
Address: Duisburger Straße 15, D-41460 Neuss, Germany
website: <http://www.rbe-neuss.de>
e-mail : postmaster@rbe-neuss.de

Tel: +49 2131 66523 0 / Fax: +49 2131 66523 320

The site is located within an industrial area of the city of Neuss and combines both production and administration buildings.

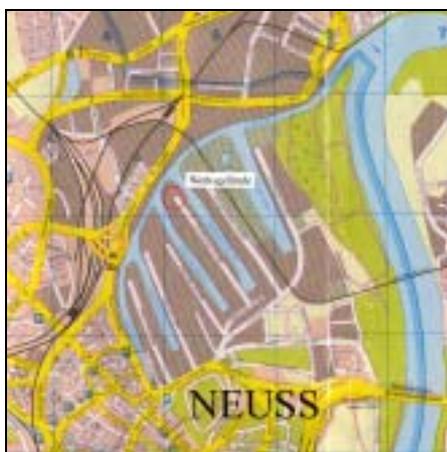


Illustration 36: Map with details of the Biodiesel plant's location

There is the possibility to load and unload ships (feedstock, Biodiesel) at the river Rhine as an attractive low cost transport option in addition to the existing railway connection.

2. Feedstock and oil mill data

A fully integrated oil mill with non hexane-extraction technology is installed opposite the Biodiesel production plant and linked to it with a direct pipeline. The oil mill belongs to only one of the 11 owners (O.L. Sels). Additionally needed volumes of rapeseed oil are bought from other sources such as the oil mill of the company C. Thywissen GmbH on the same road.

The produced rapeseed oil is semi-refined with an upper limit of FFA-level of 3% and this is the only feedstock used for the time being; it is however possible to process multi-feedstock blends of various virgin vegetable oils, which could be delivered by ship.

The FFA is sold for further processing to the oleo-chemical industry. There are two separate control centres for the oil mill and another one for Biodiesel production. Steam, air pressure and cooling water are provided by the oil mill.

The warehouse capacities can store 2.000 m³ rapeseed-oil and has additionally 4 tanks at 40 m³ each within the production line.



Illustration 37: View of the main production building and rapeseed-oil pipe bridge

3. Biodiesel production data

The construction was completed by the company itself. The Biodiesel production started in March 2003. Rapeseed oil is converted into Biodiesel in a continuous process by simply using gravity separation in big sedimentation tanks under normal pressure.

After drying of the rapeseed oil Natrium-methylat is used for the first transesterification step at special temperatures. After several steps of sedimentation, separation, washing, drying and filtering the produced Biodiesel is pumped into the daily storage container for quality control and from there into the large tanks of 3.000 m³ Biodiesel as provided by the company Petro-Plus (as one of the 11 co-owners).



Illustration 38: Biodiesel production installations

Flexible and reliable process control is assuring high yields, which is expressed by the conversion of 1.000 kg rapeseed oil into 978 kg Biodiesel.

Biodiesel Production in 1.000 t	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	100	100	100
Production	75	100	100

Employment level: 9 employees and 1 plant manager are running the operation unit



Illustration 39: Petro-Plus tank storage, Biodiesel loading station and administration buildings

4. Product quality

The company is AGQM member and has to obtain strict quality rules. (AGQM is the Biodiesel fuel quality association in Germany, which is positioning and marketing Biodiesel as a reliable fuel at public fuel pumps.) The required Biodiesel quality is guaranteed by regular quality control by the own laboratory. Production data and samples of each production batch are stored for quality assurance reasons in case of complaints later on. The produced Biodiesel fulfils all requirements of the German DIN-Standard EN DIN 51606 or is even better (e.g.: water content is less than 300 ppm).

The crude glycerine is being produced according to BS 2621 (80% purity).

5. Finance & ownership

The financial foundation was established by 11 investors without any state or European subsidies. One of the owners is the company Petro-Plus, which is marketing Biodiesel in the United Kingdom as up to 5 % blend to fossil Diesel under the trademark "Bio-Plus".

11. SARIA Bioindustries GmbH in Malchin

1. Address and location



Name: SARIA Bioindustries GmbH

Address: Wernerstraße 95 / D-59379 Selm (headquarter), Germany

An der Landwehr / D-17139 Malchin (production)

website: <http://www.saria.de>

e-mail : joerg.binnewies@saria.de

Tel: +49 3994 2096 15 / Fax: +49 3994 2096 20

The Biodiesel plant was built next to the existing rendering plant, which is located within an agricultural area close to the village of Malchin in the North of the federal state Mecklenburg-Vorpommern. It combines both production and administration buildings. Transportation is handled by truck, i.e. SARIA's own large fleet of special trucks, as there are no other possibilities available.



Illustration 40: Biodiesel production site with tank farm

2. Feedstock data

The exclusive feedstock for Biodiesel production in this specific case is animal fat derived from animal waste treatment processes. SARIA Germany provides 20% of the total animal fat production, which is used as feedstock for the Biodiesel production in Malchin. This animal fat has an upper limit of 20% FFA (Free Fatty Acid) and is the only feedstock used for the time being.

The storage capacity for raw material is 460 m³.

3. Biodiesel production data

The installation was completed by the Austrian company BDI (Bio-Diesel-International G.m.b.H.) based in Grambach near Graz. Animal fat is converted into Biodiesel in a batch process.

Sulphuric acid is used as catalyst for the initial pre-esterification step of the FFA in an acid environment into Biodiesel in batch sizes of approx. 8,5 – 9 tons.

The following final step of transesterification is running in alkaline environment using potassium-hydroxide. After sedimentation Biodiesel is washed firstly with water and a second time with sulphuric acid. A final distillation produces clean and high quality Biodiesel. The heated tank farm can store 700 m³ Biodiesel. The start of production was in October 2001.



Illustration 41: Biodiesel production installations

Flexible and reliable process control is assuring high yields, which is expressed by the conversion of 1.000 kg raw material oil into 970 kg Biodiesel.

At present 12.000 to of Biodiesel are produced annually in average and exclusively used in SARIA trucks. With that production the fuel consumption of approx. 1.000 trucks of SARIA Bio-Industries AG & Co and Rethmann Entsorgungs AG & Co. (mainly Mercedes, MAN and Perkins) can be covered. SARIA tank trucks are responsible for the distribution of Biodiesel to 14 company owned gasoline stations in Northern Germany.

During winter time the Biodiesel has to be mixed with fossil diesel because of the low temperature properties of the saturated fatty acid methyl esters.

However, the available raw material from all SARIA productions in Germany could lead to a production of 150.000 to Biodiesel a year.

Production of Biodiesel in 1.000 t

Forecast	2003	2004	2005
Capacity	12	12	12
Production	12	12	12

Employment level: 10 employees are running the production facilities.

4. Product quality

There is no need to be a member of any quality ring as the whole production is for use in the own truck fleets only. Nevertheless the required high product quality is guaranteed by regular quality control in the own and external laboratories. Production data and samples of each production batch are stored for quality assurance reasons. The produced Biodiesel fulfils all requirements of the German DIN-Standard EN DIN 51606 or is even better (e.g.: water content is less than 100 ppm) except for CFPP (Cold Filter Plugging Point) in winter time.

The crude glycerine is being produced according to BS 2621 (80% purity).



Illustration 42: SARIA Biodiesel tank truck in action

5. Finance & ownership

The financial foundation was established by the SARIA Bioindustrie AG & Co., which is a family owned enterprise, and was partially subsidised by the federal state of Mecklenburg-Vorpommern. The total investment reached a volume of Euro 10 million.

12. Thüringer Methylesterwerke GmbH&Co.KG in Niederpöllnitz

1. Address and location

Name: Thüringer Methylesterwerke GmbH & Co. KG
Address: Am Bahnhof 13
D-07570 Niederpöllnitz, Germany
website: <http://www.TME-Biodiesel.de>
e-mail : detlef.lange@tme-biodiesel.de



Tel: +49 36607 7263 / Fax: +43 36607 7266

The Biodiesel production plant has been placed in the industrial zone of Niederpöllnitz close to a trading and storage company for agricultural products. Both production and administration buildings are located in the same place. The plant has its own railway connection.



Illustration 43: Main building and tank farm

2. Feedstock data

Concerning feedstock supply a multi-feedstock strategy is implemented. Both RME (as a requirement for being a member of the AGQM) and FAME are produced. The oil mill of Nawaro GmbH is the provider of 30.000 t of rapeseed oil to the Biodiesel company. Additionally rapeseed oil is bought from other sources.

When FAME is produced a variety of different recycled oils and animal fats are used as feedstock at an approx. 50% / 50%-share.

Four recycled oil collecting companies are under contract at present in assuring supply security.

The storage capacities can cover less than one month feedstock supply for the Biodiesel production and less than one month of Biodiesel production.

3. Biodiesel production data

The engineering and construction work as well as the process technology was provided by the Austrian company BDI (Bio-Diesel-International G.m.b.H.) based in Grambach near Graz.

A variety of feedstock sources such as recycled oils, animal fats or rapeseed oil can be converted into Biodiesel in a continuous and fully automatic controlled process.

The Biodiesel production was started in June 2002. Steam, air pressure, cooling water and central heating is provided by the oil mill facility. All tanks and containers are filled with a nitrogen layer for optimum security levels.

Flexible and reliable process control is assuring high yields, which is expressed by the conversion of 1.000 kg raw material oils, fats and FFA into 1.000 kg Biodiesel.



Illustration 44: Biodiesel production installations

The flexibility in processing a wide variety of different feedstock qualities is high as feedstock sources with up to 20% of free fatty acids (FFA) can be processed into Biodiesel.

The whole production is delivered by truck or train and sold solely to the company Diersch & Schröder GmbH & Co KG in Bremen, which is one of the owners.

Biodiesel Production in 1.000 t	Actual 2002	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	45	45	45	45
Production	25	42	45	45

Employment level: 22 full time and 3 part time employees are running the production facilities and are responsible for a turnover of Euro 30 million per year.



Illustration 45: Biodiesel production installations

4. Product quality

The company is member of the AGQM and has to obtain strict quality rules. (AGQM is the Biodiesel fuel quality association in Germany, which is positioning and marketing Biodiesel as a reliable fuel at public fuel pumps.) The required product quality is guaranteed by regular quality control as assured by an own laboratory in the plant and external ones as well. Production data and samples of each production batch are stored for quality assurance reasons in case of complaints later on. The produced Biodiesel fulfils all requirements of the German DIN-Standard E DIN 51606 and the European Biodiesel standard EN 14214 or is even better (e.g.: water content is less than 50 -100 ppm, total contamination < 10 ppm).

The crude glycerine is being produced according to BS 2621 (80 % purity). Additionally crude glycerine from other sources with a purity of 50 -60% is purchased and upgraded as well.

5. Finance & ownership

80% of the investment was established by the owners, Helmut Mittelberger – Agrarhandel GesmbH and Diersch & Schröder GmbH & Co KG.

20 % of the investment were subsidised by the federal state of Thuringia in Eastern Germany. The total investment reached a volume of Euro 14,5 million.

3.4 Italy



Background

The Biodiesel production in Italy was initiated in 1992 within a European project of Italian and French participants, which was funded by the European Commission.

Production was started with some smaller existing but non-dedicated methylester plants in Northern Italy, followed by the big-scale dedicated plant in the harbour of Livorno. This production site was constructed by Novaol – then an affiliate of Cereol – and is processing both rapeseed and sunflower oil of fully refined quality. In 1994 Biodiesel was fully tax exempt without any volume limitations.

One year later the Italian Government modified the law and introduced a quota of 125.000 t Biodiesel for tax exemption. The last finance act of 2001 extended the tax exemption to 300.000 t/a FAME thereby improving the competitive position of FAME. Presently there are 7 companies producing Biodiesel.

In 2002 production was 220.000 t of Biodiesel with an overall production capacity of 600.000t/a; due to the constant market situation there are no additional capacity investments planned in the short term.

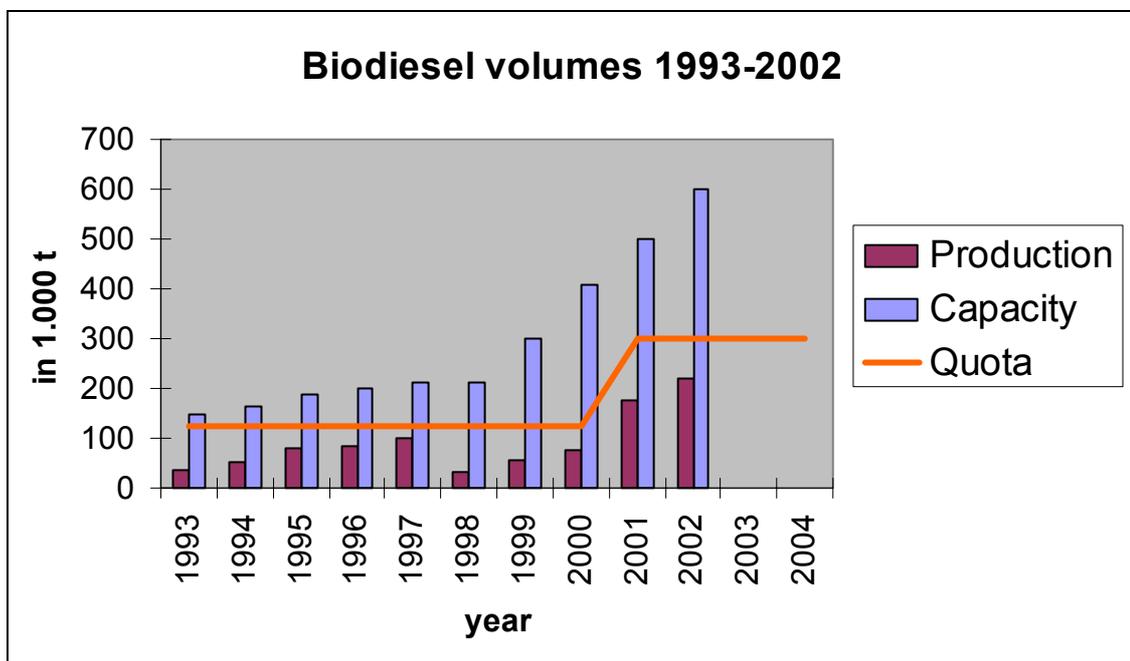


Illustration 46: Italian Biodiesel capacity and production 1993-2002 (ABI)

13. Fox Petroli S.p.A. in Pesaro

1. Address and location

Name: Fox Petroli S.p.A.
Address
Production: Via Osca, 74
I-66045 Vasto, Italy
Administration: Via Senigallia, 29
I-61100 Pesaro, Italy
website: <http://www.foxpetroli.com>
e-mail : g.berloni@foxpetroli.com



Tel: +39 0721 40871 / Fax: +39 0721 403505

The Biodiesel production plant is located within an existing industrial area and is linked to the harbour of Vasto at the Italian east coast of the Adriatic Sea.



Illustration 47: Main building and tank farm

2. Feedstock data

Concerning feedstock supply only vegetable oils are processed of which 90 % is rapeseed oil and approx. 10 % is soybean oil at present within a flexible feedstock concept and a monthly adaptation of feedstock recipes. Recycled oils are not processed in this plant.

3. Biodiesel production data

A variety of feedstock sources of virgin vegetable oils can be converted into Biodiesel in a batch process.

The Biodiesel production was started early already in 1998 and was continuously expanded from an initial capacity of 55.000 t Biodiesel/year to 70.000 t in the year 2002, to 100.000 t in 2003 and will reach the capacity level of 120.000 t Biodiesel/year in 2004.



Illustration 48: Tank farm of Fox Petroli

The storage capacities can cover less than one month of Biodiesel production.

Biodiesel Production in 1.000 t

	Actual 1998	Actual 1999	Actual 2000	Actual 2001	Actual 2002	Forecast 2003	Forecast 2004	Forecast 2005
Capacity	55	55	55	55	70	100	120	120
Production	10	15	20	52	66	90	120	120

The employment level: 32 employees are running the whole production facilities and are responsible for a turnover of Euro 46 million per year.



Illustration 49: Night view of the Biodiesel production plant of Fox Petroli

4. Product quality

The produced Biodiesel fulfils all requirements of the European EN 14214 and is even better in some parameters. The required product quality is guaranteed by regular quality control of each batch in the own laboratory. Production data and samples of each production batch are stored for quality assurance reasons in case of complaints later on. The product is marketed under the trademark "Bio-Fox".

The crude glycerine is being produced according to BS 2622 (88 % purity). Cooperation with other crude glycerine producers is established.

5. Finance & ownership

These data are handled as confidential and were not disclosed.

14. Novaol SRL in Livorno

1. Address and location

Name: Novaol SRL
Address of Production: Via Leonardo da Vinci, 35/A
I-57100 Livorno, Italy
Administration: Via Madre Cabrini 10,
I-20122 Milano, Italy
website: <http://www.novaol.it>
e-mail : claudio.rocchietta@bunge.com
Tel: +39 02 5821051

Novaol

The Biodiesel production plant is located within an existing industrial area and has access to the harbour of Livorno at the Italian west coast. There is a rail connection as well.



Illustration 50: Map with details of the Biodiesel plant's location

2. Feedstock data

Concerning feedstock supply a variety of oils can be processed in a multi-feedstock approach and recipes are adapted accordingly on a weekly schedule. Recycled oils are not processed in this plant. Neutralised rapeseed oil is still the main source for Biodiesel-production today, but also de-waxed and neutralised sunflower oil is used. There is no oil mill at the site.

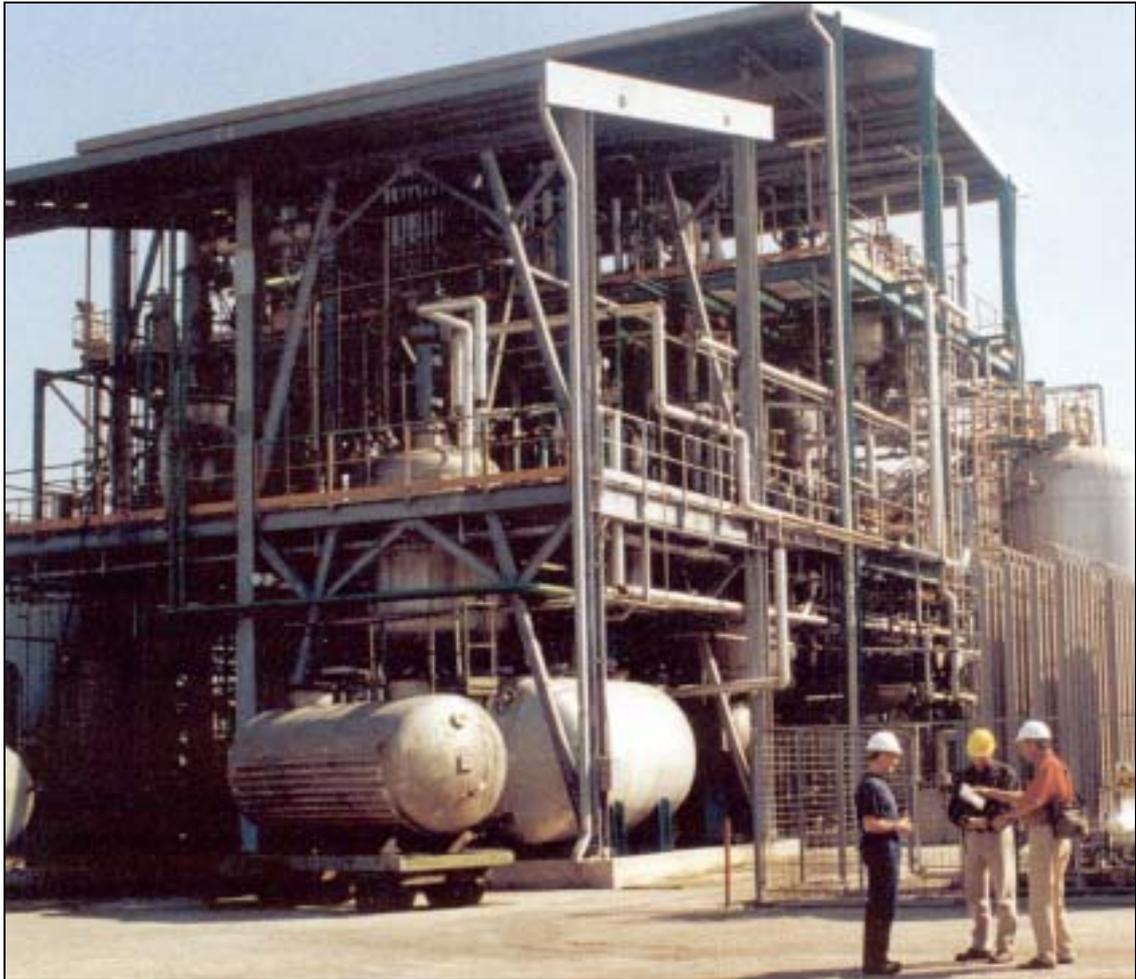


Illustration 51: View of the Biodiesel plant installations

3. Biodiesel production data

It was one of the earliest Biodiesel production start-ups in the world, when Novaol inaugurated the new plant in 1992 using an own process technology. A variety of feedstock sources of oils was converted into Biodiesel so far in a batch process. The plant obtained the ISO 9002 certification in 2001.

Being the largest Biodiesel producer in Italy, Novaol announced in November 2003 that a new “continuous” production line is going to be installed, able to manage different kinds of oils as feedstock. Thanks to the extension, Novaol production capacity will reach approx. 250.000 tons/year.

In the implementation of the factory extension project, Novaol paid particular attention to the control of the environmental impact, with maximum reduction of utilities consumption and no effluents. The new industrial plant is based on Novaol proprietary know-how, developed in Livorno since 1992; the well-known engineering companies Ballestra and Cofathec are participating to the implementation of the project, due to start up in May/June 2004.

The storage capacities can cover less than one month of Biodiesel production.

Biodiesel Production in 1.000 t

	Actual 1992	Actual 1993	Actual 1994	Actual 2002	Forecast 2003	Forecast 2004	Forecast 2005	Forecast 2006
Capacity	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	250
Production	59	60	70	80	80	120	160	n.a.

The employment level: 35 employees are running the whole production facilities and are responsible for a turnover of Euro 100 million per year.



Illustration 52: Novaol Biodiesel plant in Livorno

4. Product quality

The produced Biodiesel fulfils all requirements of the European EN 14214 FAME. The required product quality is guaranteed by regular quality control of each batch in the integrated laboratory. Production data and samples of each production batch are stored for quality assurance reasons.

The product is sold under the trade mark Diesel-Bi:



The crude glycerine is being produced according to BS 2621 (80 % purity).

5. Finance & ownership

Novaol is a subsidiary of Bunge Group.

The total investment for the new operation, including infrastructure's improvement and new tanks installation, is approx. Euro 7 million.

3.5 Slovakia



Background:

Already in 1991, under the former federal system of the Czechoslovakian Government, an oleo-programme was launched, which was supported by the University of Bratislava. The first small scale plant went into operation in 1992 followed by additional production facilities for rapeseed methyl ester (RME).

In 2001 total production capacity amounted to more than impressive 127.000 t Biodiesel, but changes in tax exemption legislation paralysed the whole Biodiesel production at the end of 2001.

In the meantime the Ministry of Agriculture prepared a new legislative programme for Biodiesel production with the intention to revitalise the Biodiesel, which did not get the approval of the Ministry of Finance so far.

Two different Biodiesel production concepts can be observed in Slovakia: Small capacity units with a production capacity of 500 – 5.000 t/a; and large industrial scale units with a capacity of 10.000 – 50.000 t/a.

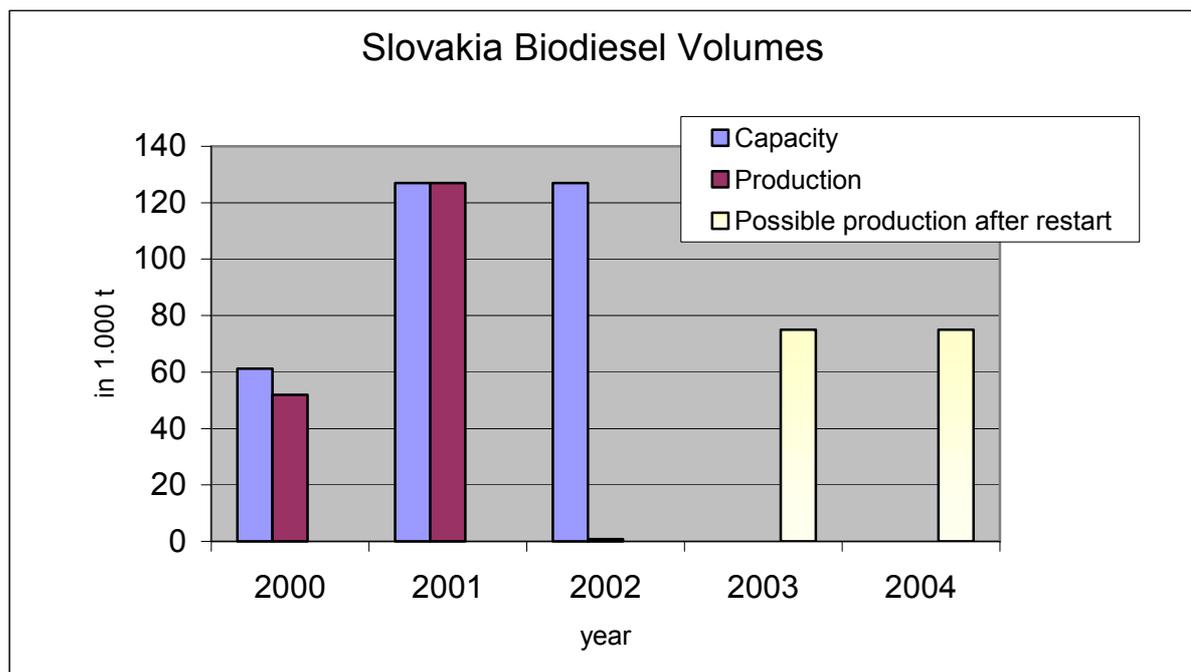


Illustration 53: Biodiesel capacity & production 2000-2002 in t/a (ABI)

The production capacity of Biodiesel after an expected law modification and re-launch of the production is estimated to be at the level of approx. 75.000 t/a.

15. Ekoil Biodiesel, s.r.o. in Zohor

1. Address and location

Name: Ekoil Biodiesel, s.r.o.
Address of
Production: Labska 21, SQ-90051 Zohor
Administration: Gazdovsky rad 1587, SQ-93101 Samorin
website: <http://www.biodiesel.sk>
e-mail production: biodiesel@biodiesel.sk
Tel administration: +421 4255 90812 0 / Fax: +421 4255 90812 22



The location of the Biodiesel plant is just north of the city of Bratislava, the capital of Slovakia, close at the border to Austria.

2. Feedstock

There is quite a variety of feedstock sources, which are processed: 40 % are virgin vegetable oils for the time being, and rapeseed oil is taking a share of 30 %. The dominant feedstock however is recycled frying oil. Additionally free fatty acids are purchased for esterification into Biodiesel.

Storage capacities for feedstock can take more than 1 month Biodiesel production.



Illustration 54: View of the Biodiesel production plant

3. Biodiesel production data

The Biodiesel process as developed by Ekoil is a continuous one and can process vegetable and recycled oils. Recipes are adapted continuously according to the requirements of the incoming feedstock.

After production start in 1996 the process technology was continuously improved and the capacity was increased to 40.000 t Biodiesel/year.

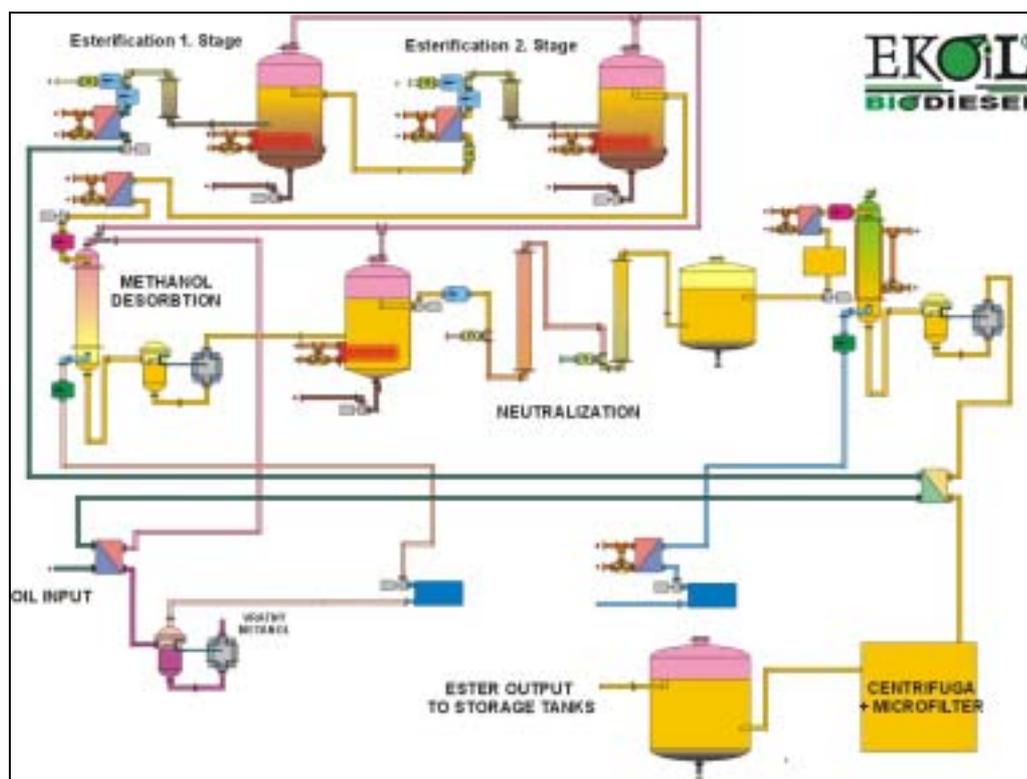


Illustration 55: Flow chart of the Ekoil Biodiesel process

The Ekoil Biodiesel process is characterised by

- computerised process control with flow speed variability,
- very low energy consumption,
- no waste water streams.

The upper limit of FFA in feedstock for processing is 6 %; the yield performance is given by a input/output-ratio of 1.000 kg feedstock produced into 970 kg Biodiesel.

Production of Biodiesel (in 1.000 t)								
	1998	1999	2000	2001	2002	2003	2004	2005
Capacity	3	6	15	40	40	25	25	25
Actual production	3	6	15	40	40	6	0	0

The storage capacity is designed for a one-month production volume. The company employs 20 persons in the production; since the year 2001 the overall annual turnover was approx. Euro 650.000.



Illustration 56: Thin layer vacuum distillation for RME & FAME

4. Product quality

As quality standard the European standard EN 14214 is fully accepted and Biodiesel is produced accordingly to this quality parameters.

Quality of the Biodiesel production is controlled by an internal and an external laboratory. Biodiesel production data and samples of each numbered production batch are recorded and stored for quality assurance reasons.

The crude glycerine is being refined up to a 80 % level according to the BS 2621 specification.

5. Financing

The overall investment volume amounted to approx. Euro 2 mill. There was no state or provincial funding available.

3.6 Spain



Background:

Beginning in 1999 a few initiatives for the development of Biodiesel were recognised: In an announcement of 13th of November 2000, the Ministry of the Environment of Catalonia published through the Catalan Waste Agency "Junta de Residus" a call for tender for the development of the Biodiesel production.

The two companies selected were "BIONET EUROPA, SL" (located in Reus) and "STOKS DEL VALLÈS, SA" (located in Montmeló).

On a national level the Spanish Promotion Plan for Renewable Energies was setting an objective to produce a volume of 100.000 t Biodiesel/a for the period from 1999 to 2010. Nearly all plants in operation and in planning phase will rely primarily on recycled oils and fats as their main feedstock.

If all planned projects are implemented, the following capacity development can be anticipated:

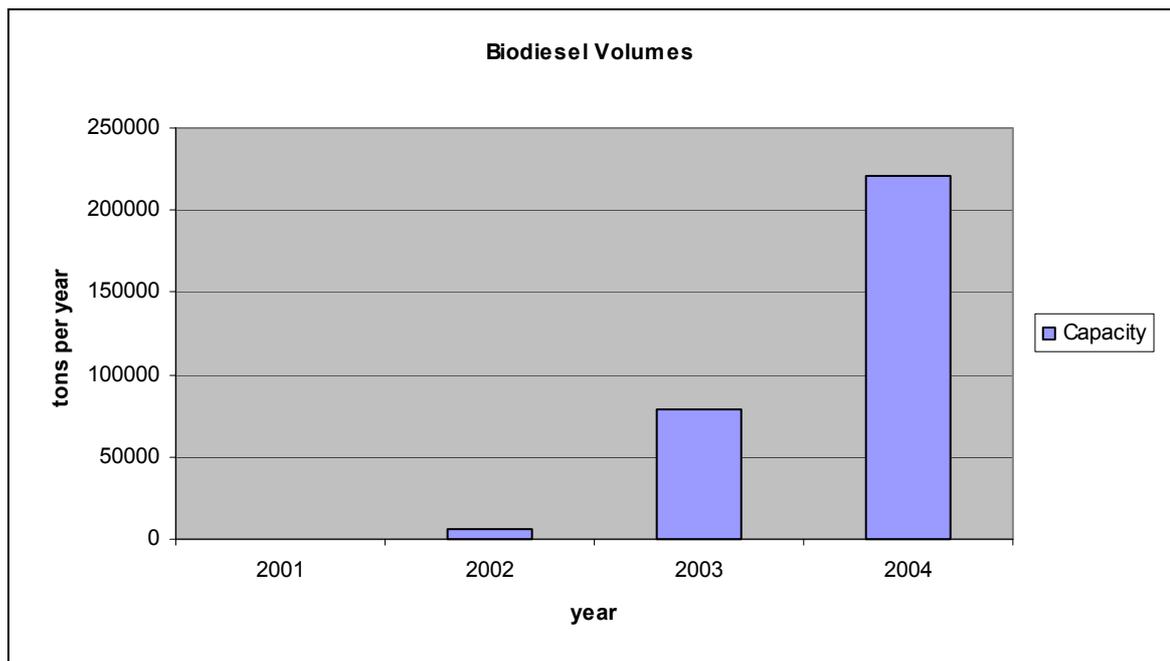


Illustration 57: Biodiesel Volumes in Spain 2001-2004 (ABI)

16. Stocks del Valles S.A. in Montmelo

1. Address and location

Name: Stocks del Valles S.A.
Address of
Production: IC / Progres, 19 – 21; E-08160 Montmelo, Spain
Administration: IC / Bou, 10; E-08520 Llerona
website: under construction
e-mail production: info@bdp-biodiesel.com
Tel administration: +93 849 3900 / Fax: +93 849 8659

The location of the Biodiesel plant is very close to the city of Barcelona in the province of Catalonia. Transport of feedstock and final product deliveries is carried out by truck only as there is no rail or waterway connection. The plant is situated within an industrial zone.



Illustration 58: Roadside view of plant at Montmelo

2. Feedstock data

As feedstock sources only recycled frying oils and recycled fats are used exclusively, which are delivered within cooperation agreements with companies specialising on collection logistics of recycled materials. Feedstock with up to 20 % FFA can be processed.

3. Biodiesel production data

The Biodiesel process runs in a discontinuous batch production with a volume of 13 t per batch. The plant was built by BDI (BioDiesel International GmbH) in Grambach near Graz, Austria.

Within this plant the following feedstock sources can be processed:

- virgin vegetable oils,
- recycled frying oil,
- animal fats,
- trap grease.

The process itself can be characterised by the following properties:

- fully automatic process control and high processing security,
- high flexibility in adapting the process according to the used feedstock quality,
- starting and stopping the process if required without any losses in product or quality,
- high profitability related to low energy consumption,
- practically zero waste streams (filter, bleaching, soaps, etc.).



Illustration 59: Inside view of the Biodiesel production line

The process is designed for single batch production, and process recipes are individually chosen depending on the incoming feedstock quality. Both the oil and free fatty acids are processed into Fatty-Acid-Methyl-Ester with a 100 % yield level.

The Biodiesel plant has a capacity of 6.000 t/year and went into operation in autumn 2002. Initially production was started with 2-shifts per day only, from mid 2003 onwards a 3 shift production is installed. It is intended to enlarge the capacity to 31.000 t/year in 2005.

Production of Biodiesel (in 1.000 t)				
Year	2002	2003	2004	2005
Capacity	6	6	6	31
Production	1	4,5	6	31

The storage capacity is designed for a one-month production volume. The company employs 14 persons in the production; overall annual turnover is Euro 3 million.

4. Product quality

The produced Biodiesel fulfils all requirements of the European standard EN 14214.

Quality of the Biodiesel production is controlled by an external laboratory. Biodiesel production data and samples of each numbered production batch are recorded and stored for quality assurance reasons.

The crude glycerine is being concentrated up to a 50 % level and is sold for further processing and purification.

5. Finance & ownership

The overall investment volume amounted to approx. Euro 4,5 mill. There was no state or provincial funding.

4 ACKNOWLEDGEMENTS:

The above report is a result of an intensive, direct and sometimes very personal research process in trying to screen a Biodiesel production plant carefully in detail while always obeying confidentiality rules for sensitive data.

Without this confidence level we would not have been able to obtain such an amount of information in a rather short time.

The acting team of the Austrian Biodiesel Institute wants to express therefore its appreciation for all the support obtained from Biodiesel production plant owners, managers and engineers, who have invested their time for sometimes long and detailed talks, for instructive and interesting plant tours and for having had a final look at the plant files before publication.

5 REFERENCES:

AUSTRIAN BIOFUELS INSTITUTE: "Livorno: Italy's largest Biodiesel plant is expanding", Vienna, Austria, Biodiesel-Courier Nr. 3/2001.

BOCKEY D.: "Comment from the Working Group for Quality Management of Biodiesel e.V. in Response to the Commission's Suggestion for Promoting Biofuels in the European Union", AGQM, Berlin, Germany, January 2002

JEVIC P., SEDIVA Z.: "Production and Marketing of Fatty Acid Rape Oil Methyl Ester in the Czech Republic", VUZT, Praha, Czech Republic, September 2003

KÖRBITZ W., et al.: "World-wide Review on Biodiesel Production", report for the IEA-Bioenergy - task liquid biofuels, Austrian Biodiesel Institute, Vienna, Austria, August 2003

6 LIST OF ILLUSTRATIONS

Illustration 1: Sensitivity of various input/output factors in influencing profitability (ABI).....	10
Illustration 2: Capacity and Production in Europe 1992-2002 (ABI)	13
Illustration 3: EU Directive Target Biodiesel Consumption	13
Illustration 4: Capacity and production 1991-2005 (ABI).....	14
Illustration 5: View of the production building and tank farm	15
Illustration 6: Electronic control of feedstock unloading and processing	16
Illustration 7: Aerial view of the tank farm.....	16
Illustration 8: View of the Biodiesel plant near Zistersdorf.....	18
Illustration 9: View of the reactor system within the container frames.....	19
Illustration 10: View of the tank farm	21
Illustration 11: FAME production, import, export and consumption / Czech Republic 1995-2001 (ABI).....	22
Illustration 12: Aerial view of the combined oil mill and Biodiesel installations	23
Illustration 13: Rapeseed storage silos	24
Illustration 14: Biodiesel production on level 2 after capacity expansion.....	25
Illustration 15: France´s Biodiesel volumes 1991-2003 (ABI)	26
Illustration 16: Map with details of the Biodiesel plant´s location.....	27
Illustration 17: Aerial view of the oil mill and the Biodiesel plant at the harbour site	28
Illustration 18: Development of mineral oil tax for fossil diesel in Germany.....	30
Illustration 19: Biodiesel volumes 1995-2003 (ABI)	31
Illustration 20: View of the oilseed silos at the harbour, the oil mill and tank farm, the Biodiesel production plant and the administration building	32
Illustration 21: Map with the location of the Biodiesel plant in Leer	33
Illustration 22: View of the Biodiesel production building	33
Illustration 23: Westfalia centrifuges in action in the 2-step transesterification and 2 washing steps.....	34
Illustration 24: CD Connemann process flow diagram.....	35
Illustration 25: Biodiesel and oil storage tanks with filling station	36
Illustration 26: 3-D view of the total plant installations	37
Illustration 27: View of the separator line	38
Illustration 28: General view of the seed storage silos and the oil mill complex	39
Illustration 29: 3D-view of the Biodiesel production plant	40
Illustration 30: Biodiesel production installations	41
Illustration 31: Overall outside view of the Biodiesel plant.....	43
Illustration 32: Glycerine production installations	44
Illustration 33: View of the glycerine-water evaporation	45
Illustration 34: General view of Biodiesel production site	46
Illustration 35: View of the Biodiesel production installations	49
Illustration 36: Map with details of the Biodiesel plant´s location.....	50
Illustration 37: View of the main production building and rapeseed-oil pipe bridge.....	51
Illustration 38: Biodiesel production installations	51
Illustration 39: Petro-Plus tank storage, Biodiesel loading station and administration buildings	52

Illustration 40: Biodiesel production site with tank farm	53
Illustration 41: Biodiesel production installations	54
Illustration 42: SARIA Biodiesel tank truck in action	56
Illustration 43: Main building and tank farm	57
Illustration 44: Biodiesel production installations	58
Illustration 45: Biodiesel production installations	59
Illustration 46: Italian Biodiesel capacity and production 1993-2002 (ABI).....	61
Illustration 47: Main building and tank farm	62
Illustration 48: Tank farm of Fox Petroli	63
Illustration 49: Night view of the Biodiesel production plant of Fox Petroli	64
Illustration 50: Map with details of the Biodiesel plant's location	66
Illustration 51: View of the Biodiesel plant installations.....	67
Illustration 52: Novaol Biodiesel plant in Livorno	68
Illustration 53: Biodiesel capacity & production 2000-2002 in t/a (ABI).....	69
Illustration 54: View of the Biodiesel production plant.....	70
Illustration 55: Flow chart of the Ekoil Biodiesel process	71
Illustration 56: Thin layer vacuum distillation for RME & FAME	72
Illustration 57: Biodiesel Volumes in Spain 2001-2004 (ABI).....	73
Illustration 58: Roadside view of plant at Montmelo	74
Illustration 59: Inside view of the Biodiesel production line	75

7 APPENDIX:

The questionnaire



**Österreichisches Biotreibstoff Institut
Austrian Biofuels Institute**

Questionnaire

Documentation „Biodiesel Best Case Study“

Commissioned by the Liquid Biofuels Division of IEA & European Bio-energy Commission

1. Basic Data

Name of company		owner	
Your name		First name	Function
Headquarter address		Area-code	City
Country			
Biodiesel plant address		Area-code	City
Country			
e-Mail		Website	
		http://	
Phone		Fax	
Existing pictures of the plant to be published			
Yes		No	
Number of employees in Biodiesel production		Total	yearly Biodiesel turnover in Euro
Your infrastructure			
<input type="checkbox"/> railroad connection			
<input type="checkbox"/> The Biodiesel plant is linked with a ship harbour			
The Biodiesel plant is			
<input type="radio"/> located in an industrial area		<input type="radio"/> located in an agricultural area	
<input type="radio"/> close to a city with less than 3 mill people		<input type="radio"/> close to a city with more than 3 m. people	
Warehouse capacity for raw materials			
<input type="radio"/> Less than one month's production		<input type="radio"/> Over one month's production	
Warehouse capacity for Biodiesel			
<input type="radio"/> Less than one month's production		<input type="radio"/> Over one month's production	

2. Raw materials

Type of feedstock used

Type of feedstock used	Vegetable oil	Animal fats	Waste oil and fats
% share of total%%%
which:	.....% rapeseed	.....% beef (tal-low)	.....% households
	.....% sunflower	.....% pig(lard)	.....% restaurants
	.....% soybean	.....% chicken	.....% trap fat.
	.....% palm oil%% ...
other%%% ...

Existing cooperation with waste oil companies

Yes No

If yes

Less than 10 companies More than 10 companies

Yield

Upper limit of FFA to be processed.....%
1.000 kg oil/fat processed to: .....kg Biodiesel
Utilisation of FFA:
<input type="checkbox"/> Biodiesel <input type="checkbox"/> heating fuel <input type="checkbox"/> other <input type="checkbox"/> waste

Type of feedstock options used

<input type="checkbox"/> Multi-feedstock (MFS)
<input type="checkbox"/> Flexible feedstock use possible
<input type="checkbox"/> How often are recipe procedures changed?
<input type="checkbox"/> daily <input type="checkbox"/> weekly <input type="checkbox"/> monthly <input type="checkbox"/>
<input type="checkbox"/> Oil mills on site? If yes what synergy effect does this have? (Outsourcing, distribution of work etc.)

3. Production data

Type of technology used

Continuous Batch processing

Process technology provider

Biodiesel product start-up date

month year

Total annual Biodiesel in 000tons

	1998	1999	2000	2001	2002	2003 est.	2004 est.	2005 est.
Capacity								
Production								

If volume/capacity has/is to be increased how was/will this be this achieved?

eg. Debottle-necking. New technology,

4. Product quality

Quality standard Biodiesel produced

<input type="checkbox"/> EN 14214 FAME (EU)	<input type="checkbox"/> DIN 51606 FAME (Germany)
<input type="checkbox"/> Parameter better than EN 14214	

Quality level of glycerine produced

<input type="radio"/> BS 2623 (99%)	<input type="radio"/> BS 2622 (88%)	<input type="radio"/> BS 2621 (80%)	<input type="radio"/> lower
-------------------------------------	-------------------------------------	-------------------------------------	-----------------------------

In the manufacture of glycerine: is there cooperation with other manufacturers?

<input type="radio"/> yes	<input type="radio"/> no
---------------------------	--------------------------

Quality management

<input type="radio"/> own laboratory	<input type="radio"/> external independent laboratory
<input type="checkbox"/> Batch control	<input type="checkbox"/> Sample control

Are you a member of a Quality management ring

<input type="radio"/> yes	<input type="radio"/> no
---------------------------	--------------------------

5. Finance

<input type="checkbox"/> Cooperation e.g. Share company
<input type="checkbox"/> Use of subsidies:
<input type="checkbox"/> EU subsidies to the value of: .€.....
<input type="checkbox"/> State subsidies to the value of: .€.....
<input type="checkbox"/> Other subsidies: €.....

6. „Best Case“ – barriers/problems

Your personal opinion, - pick which agrees most: (1 = very good, 5 = needs to be improved)

	1	2	3	4	5
Multi feedstock use	<input type="checkbox"/>				
Reasonable raw material prices	<input type="checkbox"/>				
Reliable Feedstock supplies	<input type="checkbox"/>				
Flexible buying strategy for raw materials and production materials	<input type="checkbox"/>				
Low logistic costs	<input type="checkbox"/>				
Safe production procedures	<input type="checkbox"/>				
Flexible & reliable production control	<input type="checkbox"/>				
High yields	<input type="checkbox"/>				
Low personal costs	<input type="checkbox"/>				
quality management	<input type="checkbox"/>				
Quality control	<input type="checkbox"/>				
Marketing strategy	<input type="checkbox"/>				
Reliable business partners	<input type="checkbox"/>				
High customer loyalty	<input type="checkbox"/>				
Economical funding	<input type="checkbox"/>				
Other: ...	<input type="checkbox"/>				

We thank you for having taken the time to complete this questionnaire

Please let us know if you are interested in one of these publications. If so, we would be glad to send them to you free of charge

Review on Commercial Production of Biodiesel World-wide (Nr. 2/2003)
Austrian Biofuels Institute (ABI), to be published in September 2003, 75 pages

Biodiesel – a Success Story; Development of Biodiesel in Germany
Austrian Biofuels Institute (ABI), 2001

 **Biodiesel Courier: weekly newsletter by e-Mail.**

New Trends in Developing Biodiesel World-wide
Austrian Biofuels Institute, Miami 2002, 9 pages

Handbook of Analytical Methods for Fatty-acid-methyl-esters Used as Diesel Fuel Substitutes
FICHTE - Vienna, 1994, 72 pages

We will send the material to the e-mail that you mentioned on page 1
If you want it to be sent to a different address, please fill in here:

For additional comments and information or questions about this survey, please contact:

werner.koerbitz@biodiesel.at