Biodiesel's growth in Europe and its impact on the oilseed industry[1]

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Abstract: *Biodiesel will change the oilseed and oils/fat markets in Europe from food/feed oriented to energy driven. The future and the R&D in farming and crushing of oilseeds in Europe will depend on this new orientation.*

Key words: *European biofuels program, ethanol, biodiesel, rapeseed potential*

Biodiesel in Europe is part of the European biofuels program. The growth and development of Biodiesel and other biofuels are interdependent on each other. I therefore have to start a bit wider.

The EU transport sector accounts for more than 30% of the total energy consumption of the EU.

It is at 98% dependent on fossil fuels.

It is the main reason for Europe to fail the Kyoto targets because it has contribute about 90% of the increase of CO_2 emissions between 1990 and 2000 in Europe.

It is almost entirely dependent on imports.

This is the reason that Europe defined ambitious targets for the development of biofuels from mainly home grown biomass as it aims:
– to improve domestic energy security;
– to improve the CO_2 balance in the transport sector;
– to improve farm prospects and competitiveness.

In 2003 the EU agreed on two Directives:
– promoting the use of biofuel for transport applications by replacing diesel and gasoline to the level of 2% by 2005 and 5,75% by 2010 (Dir. 2003/30 EC) and;
– enabling the detaxation of biofuels (Dir. 2003/96 EC).

Local governments have to adopt this goal to their national legislation. Individually they can decide how to implement it:
– by mandates without any tax incentives;
– by tax incentives;
– a combination of both.

The measures or – if detaxation is chosen – the rates applied can change depending to the type of biofuel concerned. It can be a mix or just one, it can be allocated to diesel or gasoline or be a new fuel for newly developed engines. As well the composition of the different biofuels is subject to the individual member states and will depend on which is the most appropriate one to their region.

Two generations of biofuels

Biofuels discussed about are divided in two generations *(table 1)*.
The first Generation: mainly food and feed type feedstock plus their waste and the second generation: made of residues of current agriculture and forestry, biomass to Liquids (BTL), etc.
Products from the second generation are still under development and not yet available at commercial quantities. Production costs are high and not by far competitive. Nevertheless they show a large political presents. Car industry, mineral oil companies and "progressive politicians" – driven by some NGO's – refer to them as argument against the promotion of the biofuels of the first generation. They expect the 2 nd generation to take over the further expenditure after 2010 if not to completely replace biodiesel from vegetable oil in the years to come.

Only the first generation offers commercial products for the near future (5-10 years).
– Ethanol is incorporated in the gasoline pool without engine modifications. Very small quantities are used as an 85% blend in flexible blend cars and in diesel buses with ignition improver. The most frequent use in Europe at present is, however, as ETBE (ethyl tertiary butyl ether).
– Pure vegetable oil as such has been tested in diesel driven vehicle fleets with controversial results. Because of its economic price (ca. 50% of diesel) it is gaining more and more popularity. We consider a volume of 500,000 tons has been used in 2005 although the entire car industry opposes.
– Biodiesel is the only product widely accepted by consumers as well as by diesel engineers. For technical reasons it is in Europe mainly based on the feedstock rapeseed oil (RME). Biodiesel is fully compatible with fossil diesel and used both in pure form as B100 and admixed to

Table 1. *Biofuels, their feedstock and production process.*

First generation:	**mainly food and feed type feedstock plus their waste**	
1. Bioethanol	sugar	fermentation
3. Pure Vegetable Oil	oils seeds	cold pressing/extraction
3. Biodiesel (FAME)	vegetable or recycling oils	esterification/transesterificated
(NE×BTL)	vegetable or recycling oils	hydrogenation/hydrocracking
4. Biogas	organic residues/energy crops	digestion/gasification
Second Generation:	**residues of current and foresty Biomass to Liquids (BTL), etc.**	
5. Synthetic Biodiesel	lignocellulosic material	gasification & synthesis
6. Synthetic Bioethanol	lignocellulosic material	advanced hydrolysis/fermentation
7. Biohydrogen	lignocellulosic material	Biological process

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Table 2. *Energy demand for transport and its Biodiesel portions.*

Roadfuel	**2000**	**2005**	**2010**	
Gasoline	130.0	138.0	142.0	Mt
Diesel	148.0	167.0	180.0	Mt
Total	273.0	305.0	322.0	Mt
There off Biofuels as per EU demand (2% or 5.75%)				
For Gasoline (ethanol gas)	0.00	2.76	8.16	Mt
For Diesel (biodiesel veg Oil)	0.00	3.34	10.35	Mt
Total	0.00	6.10	18.51	Mt
Biofuels equivalent in volume tons (on individual fuel separately)				
Bioethanol (factor 0.6)		4.60	13.60	Mt
Biodiesel veg oil (factor 0.812)	0.00	4.11	12.75	Mt

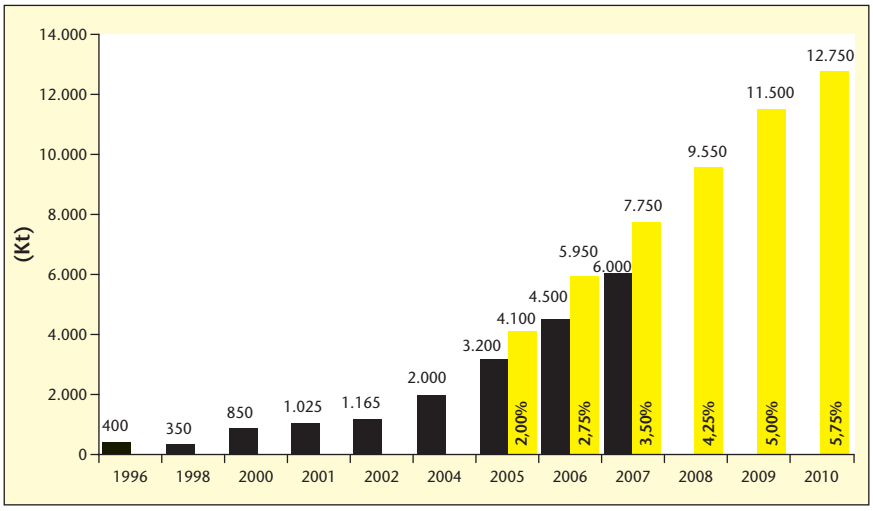

Figure 1. *Biodiesel EU-Production/Consumption compared to Targets set by the EU (reduced to diesel consumption only).*

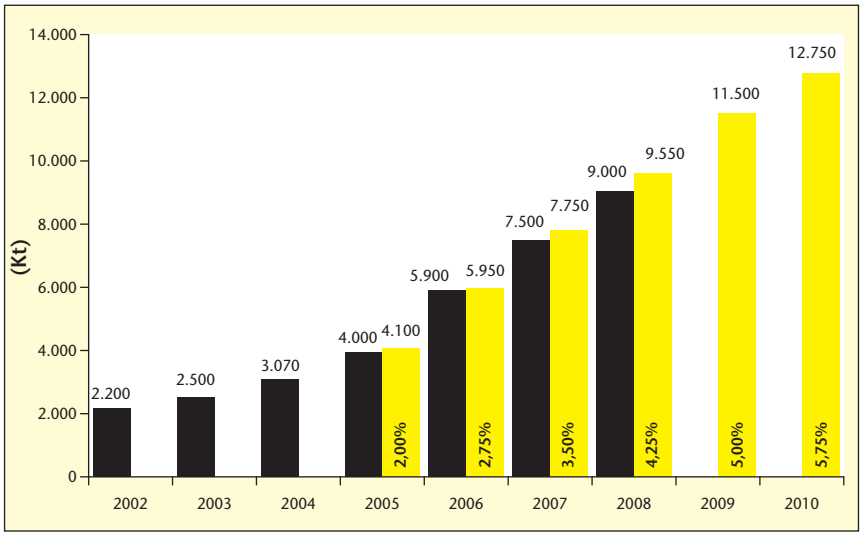

Figure 2. *Biodiesel EU-Capacities existing and planned compared to Targets set by EU.*

fossil diesel. Most common is the 5% blend based on the current diesel norm EN 590.

– Upgraded biogas can as well be used as fuel. It is a niche market although it could be better assessed in competition to natural gas.

What does the EU Directive mean in terms of quantities in the EU?

The Energy demand for transport and Biodiesel portions are illustrated by *table 2*.

As "Seed Crushers and Oil Producers Association" our main focus is directed to those products replacing diesel and based on the feedstock of our industry oilseeds and vegetable oil or Biodiesel and to a lesser extend Pure vegetable oil.

Here Europe demonstrated an impressive development *(figures 1 and 2)*. It was only made possible because of a strong and pronounced political will to establish alternative fuels in the market. This will was demonstrated by implementing government programs which at the beginning concentrated on exemptions or at least reductions of the excise tax.

France, Germany and Italy started already in the mid 90th (before the EU picked up) with encouraging incentive programs but only in the last few years the development was fuelled by exploding mineral oil prices and expended all over Europe *(figure 3)*.

While the fuel use of pure vegetable oil is difficult to detect as quantities are taken from the food supply chain and not recorded, it was evident for Biodiesel.

As you can see, Biodiesel meanwhile is well established in the EU. The shown large demand and promising future will enable modern and large scale production facilities which can make use of higher efficiency and reduced cost structures. In addition mineral oil price – although certainly with large fluctuations – will maintain a high level and show increasing trends. But

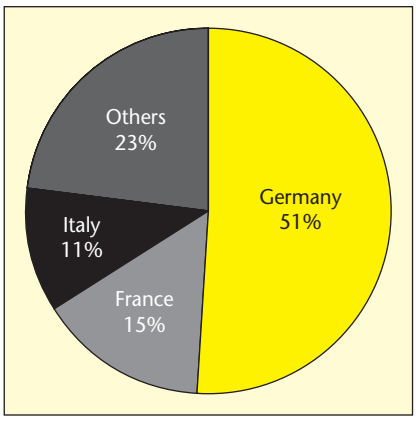

Figure 3. *2005 Eu Biodiesel Production by Contry.*

never the less, for the years to come Biodiesel and even more so the demanded increase will further highly depend on governmental support – be it a mandatory regulation or a financial incentive. Without support Biodiesel can not survive.

It is still a fact that the development of biodiesel – and as well of all the other biofuels – is still subject of governmental actions. And fact is as well: governments are short of money and loose popularity if fuel prices increase. It therefore gets visible that all over Europe governments look for ways to avoid or limit the expenditures which follow the ambitious goals of the EU and especially the exploding growth of biodiesel. Some countries hesitate to implement the EU-Directive and others like France and Germany with exploding biodiesel consumption look for measures to limit the tax shortfall and to control increases. Furthermore those parties get more and more followers, that demand to transfer the government support to Biodiesel of the 2nd generation – away from food crops to cellulosic not used today or yielding more energy per ha.

Let me repeat and make very clear:

– The EU Directive is no law by itself but a strong political will. It has to be implemented in national legislation but there it meets budget constraints.

– To enforce the implementation the EU Commission needs a new EU decision.

– The process can take years.

– The boom might become a temporary one. Cellulosic might take over and give vegetable oil back to food.

But as we sense a general interest in most EU countries and under the impression of the latest energy price surge I feel entitled to believe in a coexistence of both generations for many years until the 2nd generation of Biodiesel is ready for the market.

Let us assume that never the less the EU-wide biodiesel consumption will meet or even slightly exceed the above mentioned goal to substitute almost 10,35 Mt or the volume of 12,75 Mt of diesel in 2010.

Let us assume to need 12,75 Mt of oil for biodiesel or 13,5 Mt with the use of pure vegetable oils (0,75 Mt).

We expect some countries to exceed their portion of biodiesel on account of ethanol; others will not reach it but exceed on ethanol; others will not comply with any of them.

For example France announced to substitute 8% of diesel by biodiesel in 2010 and Germany's investment projects – including the announced ones – exceed already 5 Mt capacity with 4 Mt on stream or having passed the point of no return. Denmark on the contrary has declared not to initiate biofuel consumption at all.

But in average the volume might be reached.

The feedstock demand

What does the above assumption mean in terms of feedstock demand?

Where does – at a conversion of vegetable oil to biodiesel of 1:1 – all these 13,5 Mt vegetable oil come from and what will be the effect on our agricultural markets?

The original and dominant vegetable oil used for biodiesel is *Rape Oil.* It is very suitable for Europe's climate and because of its advantages properties such as oxidation stability and filtering characteristics. *In addition it is home grown.* Although the CEN norm for Biodiesel (EN14214) is bases on Fatty Methyl Esther (FAME) the Rape Methyl Esther (RME) is the preferred Biodiesel by the car industry who demand RME to qualify for warranties if used as B100. Only for blends up to 5% the car industry has accepted the FAME quality. Even for the future the preference of Rape Oil will maintain but – with growing experience, larger volumes to be delivered at one location and in view of increasing price differences between the oils – this preference will be diminishing. Alternative feedstock or blends of feedstock will gain importance *(table 3).*

Can the European oils and fat markets make available the vegetable oils needed for Biodiesel?

The EU's agricultural rapeseed potential (the home grown supply)

As per the EU statistics the area under arable crops and set aside in the EU-25 is about 71,5 Mio. ha.

In 2005 here off 7 M ha were under the "set aside" program with 6 M ha real set aside and ca. 1 M ha used for technical crops. Finally there remained an area of 65 M ha for cereals, oilseeds, silage and a few others. This land plus/minus the changes in set aside land is what rapeseed has to compete for *(table 4).*

The increase in arable land used for rape seed reflects the expectation that higher energy prices will provide the incentive to exploit both fertile and marginal land. In future some further increase might be possible.

Furthermore we expect rapeseed breeders to enable significant yield increases not only in tons per ha but also referring the oil yield which in both cases overrule the effect of the marginal land used.

Table 3. *Feedstock-Mix for Biodiesel (Kt).*

	2000		2005		2006		2010	
Rape oil	91.0%	779	81.2 %	2.600	77.5 %	3.487	55.0 %	7.015
Soya/Sun Oil/	2.4%	20	11.1 %	355	15.0 %	675	27.5 %	3.505
Palm oil				45	1.5 %	68	13.5 %	1.720
Recycling Oil + Fat	6.0%	51		200	6.0 %	270	4.0 %	510
Total		850		3.200		4.500		12.750

Table 4. *Long term potential of rape oil production in the EU-25.*

Crop Year	Area under arable crops 1.000 ha	Rapeseed-area 1.000 ha	%	Production yield t/ha	of seed 1.000 t	oil yield	Potential oil 1.000 t	Produced oil local + imported seed 1.000 t
2003	64.400	4.185	6.5%	2.67	11.175	42.0%	4.700	4.650
2004	65.800	4.455	6.8%	3.41	15.200	42.0%	6.385	5.500
2005	65.200	4.630	7.1%	3.30	15.275	42.0%	6.415	5.800
2006	64.400	5.100	7.9%	3.10	15.810	42.3%	6.680	6.700
2008	65.500	5.800	8.9%	3.20	18.550	42.7%	7.920	8.000
2010	66.000	6.600	10.3%	3.32	22.575	43.0%	9.710	9.900

Table 5. *EU 25 rape oil supply and demand (Kt).*

Eu 25		1990	2000	2005	2006	2010
production		2.360	3.740	5.800	6.700	9.900
+ import		10	5	60	400	200
– traditional consumers						
	– food demand	– 1.220	– 2.350	– 2.550	– 2.600	– 2.400
	– technical product	– 110	– 140	– 200	– 230	– 300
available for new applications		1.040	1.255	3.110	4.270	7400
– energy	– pure vegetable oil	0	– 25	– 350	– 450	– 500
	– biodiesel	0	– 779	– 2.600	– 3.450	– 7.015
	+ net import biodiesel (based on rape oil)	0	0	30	50	200
excess		1.040	451	190	420	80
	registered export	940	360	50		
portion of total Rape oil supply						
	ENERGY	0.00%	21.47%	50.34%	54.93%	74.41%

A sustainable cultivation of rapeseed will be limited to slightly more than 10% of the area under arable land – I believe. Not only crop rotation but as well competition for land from other crops needed to supply energy (cereals, silage, energy celluloses, forestry) will determine the area achievable.

Besides for biofuels, the EU is running a very promising Bio Energy Program to stimulate heat and electricity production. It was designed to use unexploited agricultural and forestry residues to start with, but rising energy prices encourage to use as well whole plants (primary product and residues) for biomass conversion. In addition specific non-food, high-yield energy plants will start to compete for land.

The EU 25 vegetable oils supply and demand perspectives

EU-25 rape oil supply and demand

In principle the EU can produce all the rape oil it needs to meet the substitution of diesel we expect. Some imports of seed and oil from neighbouring European countries included *(table 5).*

EU-25 soya oil supply and demand

Although an increase of the EU crush of 3 Mio. Tons is anticipated, additional large soya oil imports will be necessary to satisfy the demand of biodiesel. For southern Europe a modified high oleic sunseed has been developed. Its oil might replace some of the soya oil imports projected and reduce the import dependency correspondently. Breeders speak of promising results of their research teams *(table 6).*

EU-25 palm oil supply and demand

Palmoil as well has to carry a large part of the European oil demand. Transport and power will have to compete with food for coverage. Imports of palm oil need to almost double *(table 7).*

Interesting to note

These tables demonstrate as well, that the food demand has been very stable over the decades:

Table 6. *EU-25 soya oil supply and demand (Kt).*

Eu 25		1990	2000	2005	2006	2010
production		2.310	2.710	2.600	6.700	3.200
+ import		10	20	150	150	2.000
– traditional consumers						
	– food demand	– 1.485	– 1.500	– 1.600	– 1.550	– 1.500
	– technical product	– 100	– 100	– 130	– 150	– 230
available for new aplictions		735	1.130	1.020	1.050	3.470
– energy	– pure vegetable oil	0	0	– 150	– 200	– 250
	– biodiesel	0	0	– 355	– 675	– 3.505
	+ net import biodiesel (based on rape oil)	0	0	0	35	350
excess		735	1.130	515	210	65
	registered export	940	360	465		
portion of total Rape oil supply						
	ENERGY	0.00%	0.00%	18.36%	31.82%	72.21%

Table 7. *EU-25 palm oil supply and demand (Kt).*

Eu 25			**1990**	**2000**	**2005**	**2006**	**2010**
import					4.325	4.850	7.500
– traditionnel consumers							
	– food demand				– 3.650	– 3.820	– 4.400
	– technical product				– 130	– 150	– 250
available for new aplictions			0	0	545	880	2.850
– energy	– pure vegetable oil		0	0	– 525	– 770	– 1.350
	– biodiesel		0	0	45	– 68	– 1.720
	+ net import biodiesel		0	0	10	10	275
excess			0	0	– 15	52	65
portion of total Rape oil supply							
	ENERGY	heat electicity			12.14%	15.88%	18.00%
		biodiesel			1.04%	1.40%	22.93%
		TOTAL			13.18%	17.28%	40.93%

slowly declining for seed oils in favour of tropical oils, mainly Palm. All the future and the R&D in farming and crushing of oilseeds in Europe depend on the new market: ENERGY.

Conclusion

My conclusion stand in these few statements:

– Biodiesel will change the oilseed and oils/fat markets in Europe from food/feed oriented to energy driven.

– Energy prices will determine vegetable oil prices.

– Governmental energy legislation will strongly influence oilseeds and oil markets.

– Food industry will switch to individually designed oils and fats with special functions and properties, away form the large volume bulk products. Palm oil will gain on seed oils.

– The EU will further increase acreage and production of rapeseed and rapeoil.

– The EU will grow a new olein sunseed very suitable for biofuels.

– Anyhow the EU will move from a net exporting to a net importing region *for liquid oils* and sharply increase imports of Soya-seed and/or Soya-oil.

– In addition the EU will increase substantially the import of *Palmoil*.

– The move to competing feedstock for Biodiesel will narrow prices of the different vegetable oils.

– Rape-oil will maintain only a small logistically or technically justified price premium.

– Vegetable oil prices will stabilise. ■