

Biodiesel: EU Markets and Production

A report for
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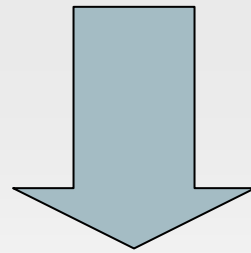
by

Business Development & Research
International Ltd



Summary for World & EU Market

- Total world market size for biodiesel consumption was over 3.6 MT in 2005
- Of this figure, 3.1 MT was consumed in the EU overall and 1.8 MT in Germany
- EU consumption driven by target for achieving 5.75% by energy content biofuels in transport fuels by 2010
- If achieved, will lead to total market of 13.5 MT by 2010, assuming ~60% biodiesel and ~40% bioethanol

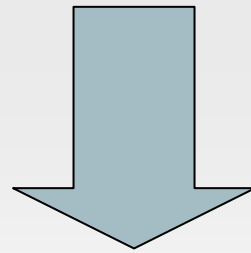


- **TAKEAWAY:** Worldwide biodiesel demand set to continue double digit growth for next 4-5 years at least



Summary for Technology

- Transesterification of vegetable or animal oil in methanol produces biodiesel and glycerine
- Liquid/liquid centrifuges used in larger plants to separate different density phases
- Centrifuges may also be used during pre-treatment of oil, and for soap and water removal depending on technology
- More production capacity being planned and although many licensor processes available, not all have centrifuges

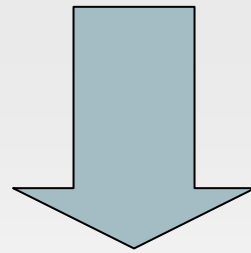


- **TAKEAWAY:** Need to contact licensors individually to determine centrifuge needs



Conclusion for EU Production

- Biodiesel production capacity rapidly increasing with Germany dominant due to early incentives
- 80% feedstock for European biodiesel is rapeseed oil
- All biodiesel sold must conform to EN 14214 which is currently being reviewed to allow for greater use of other vegetable oils as feedstocks
- Potential 1.6 MT vegetable oil imports by 2010 but type will depend on price



- **TAKEAWAY:** Capacity increasing although biodiesel and veg. oil imports may still be necessary, country dependant

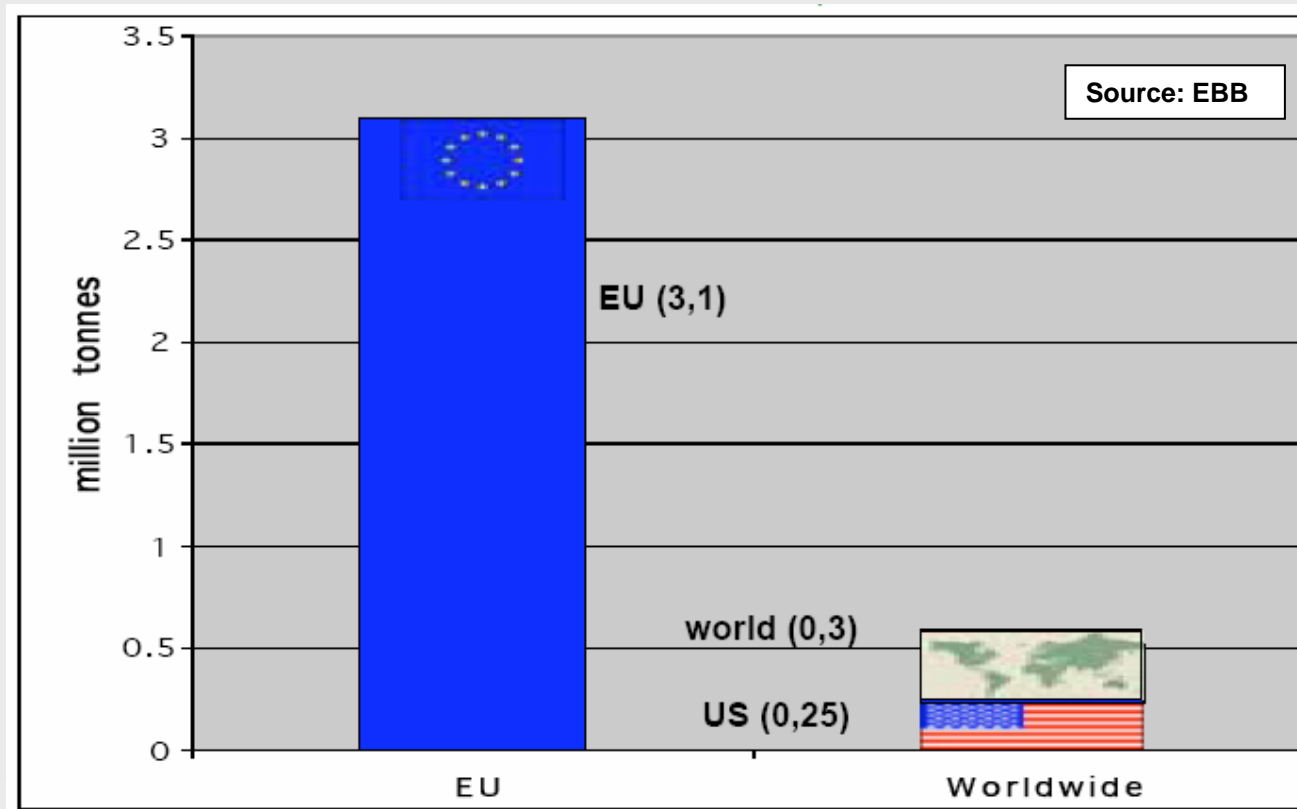


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1. World & EU Market Perspective for Biodiesel
2. Biodiesel Process Technology and Licensors
3. EU Biodiesel Production and Possible Issues



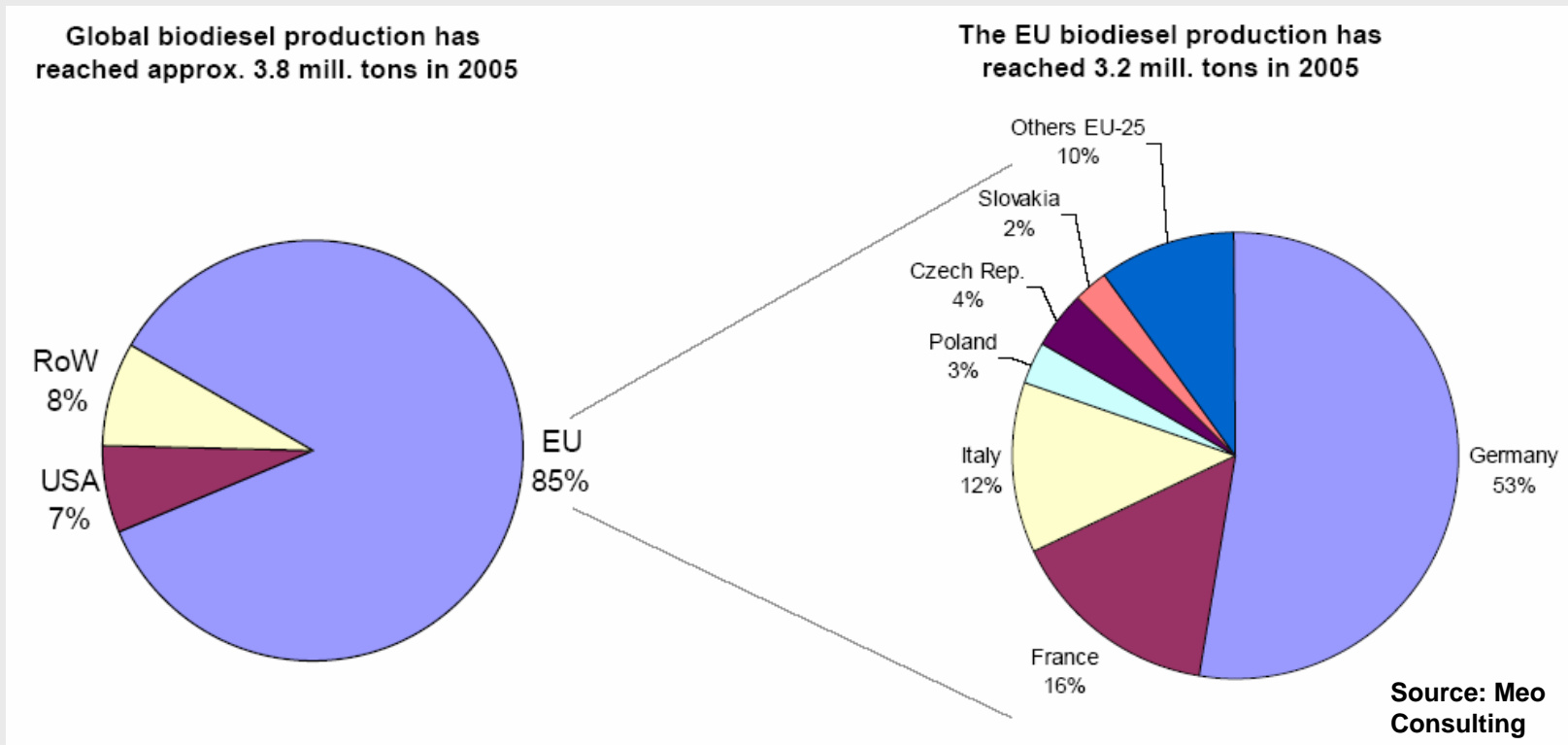
Worldwide Biodiesel Production - 2005



- The EU is the world leader in biodiesel production and consumption
- In 2005, Germany produced 1.6 MT of biodiesel which accounted for 45% of the world total



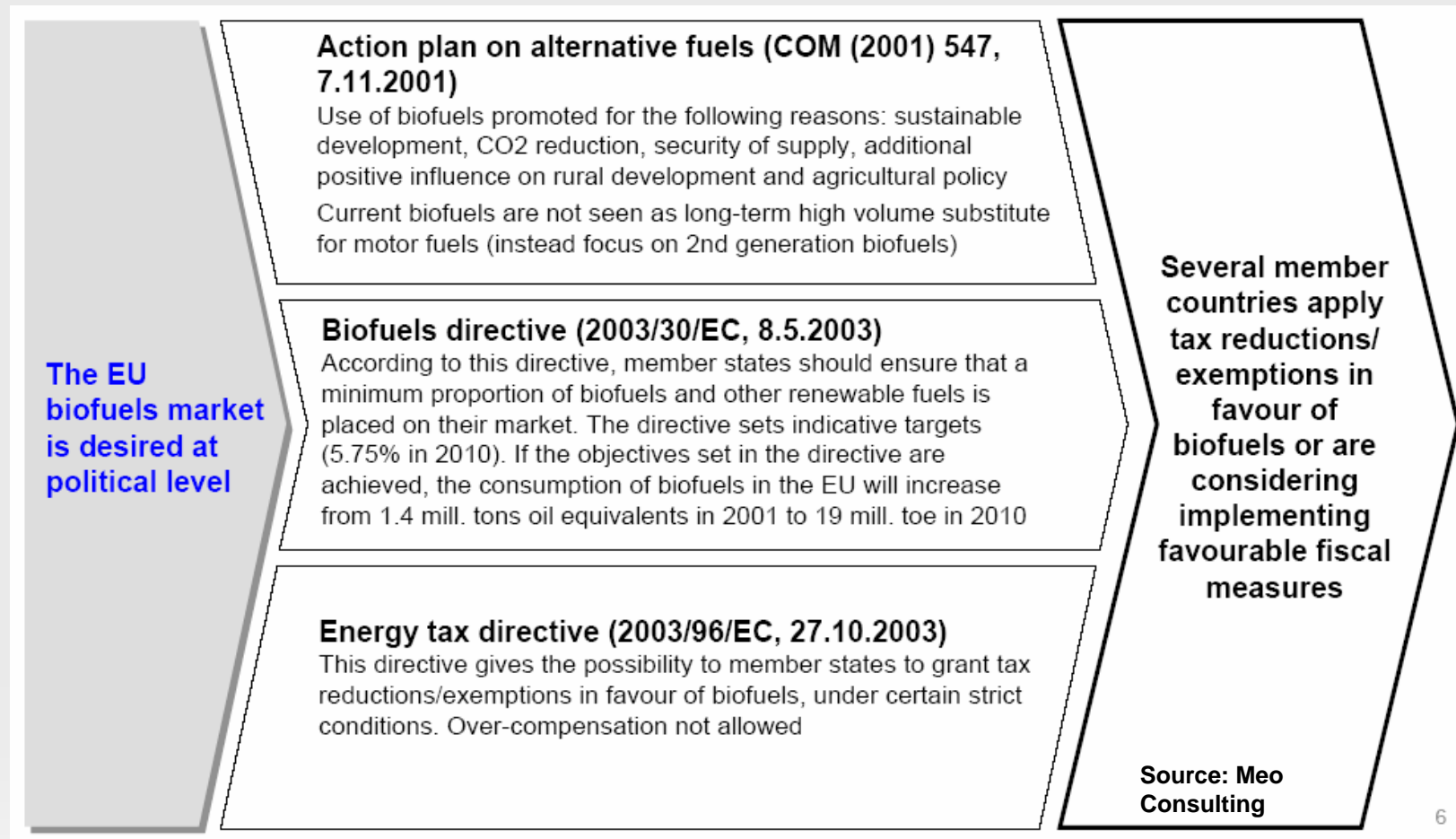
Worldwide Biodiesel Production - 2005



- In 2005, Germany, France, Italy and US accounted for 75% of biodiesel produced worldwide
- It was only in 2005, that the first large scale plant came on line in the UK (45 kT pa Argent plant in Motherwell)



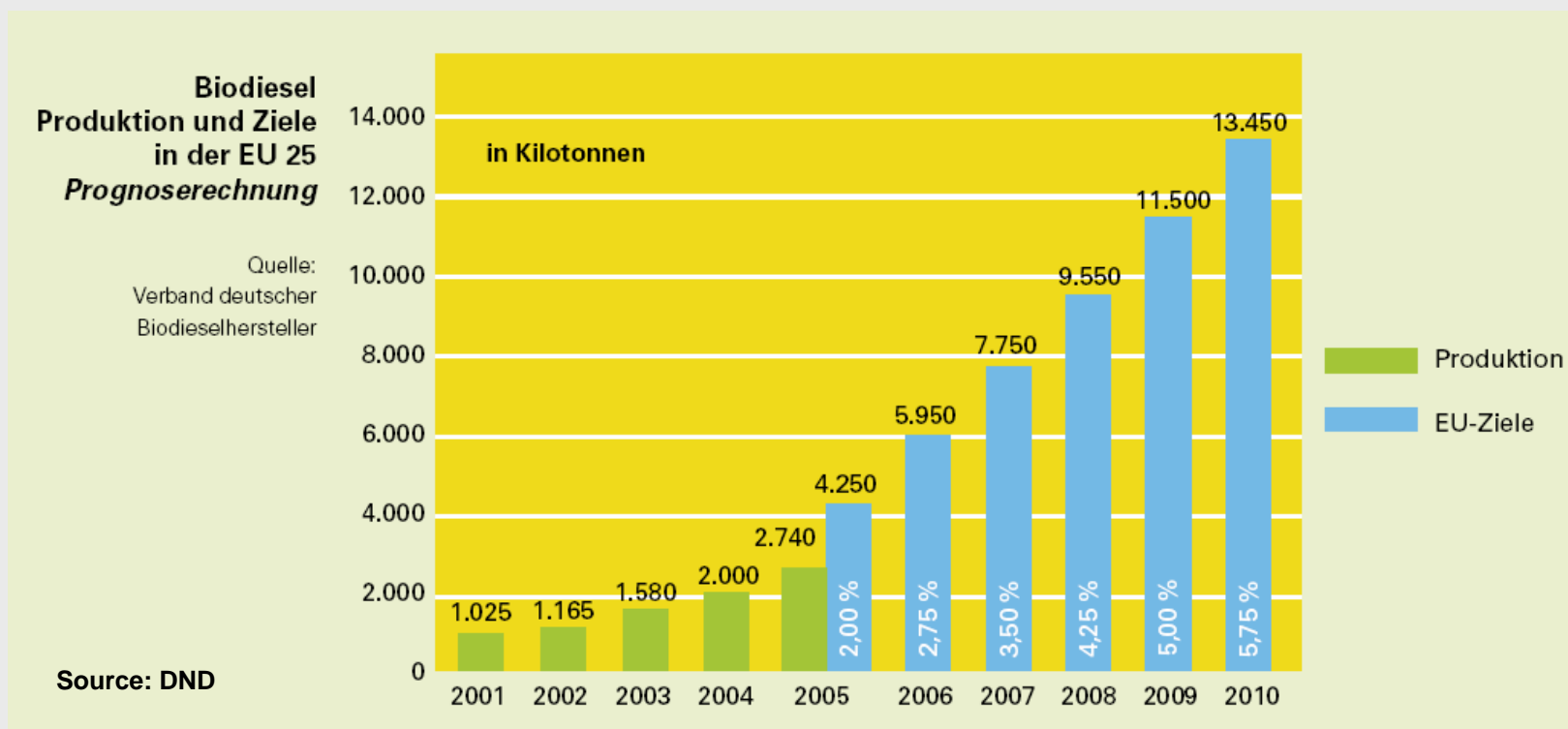
EU-25 Biofuels Legislation



- EU adopted comprehensive legislation in 2003 aimed at creating a European biofuels market



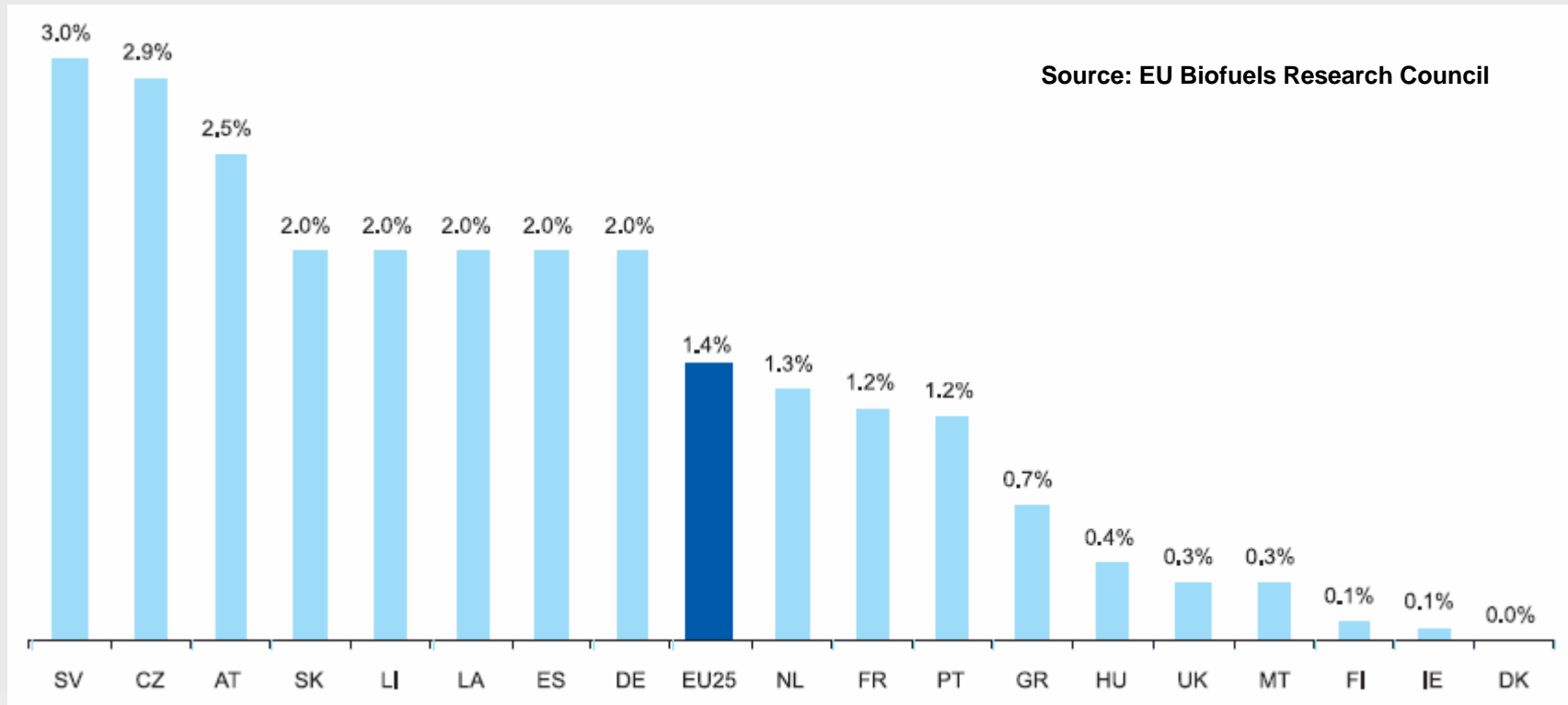
EU-25 Biodiesel Market



- Biofuels market driven by EU indicative target for each country to achieve 2% biofuels by energy content by 2005
- Second stage EU indicative target for each country to achieve 5.75% biofuels by energy content by 2010



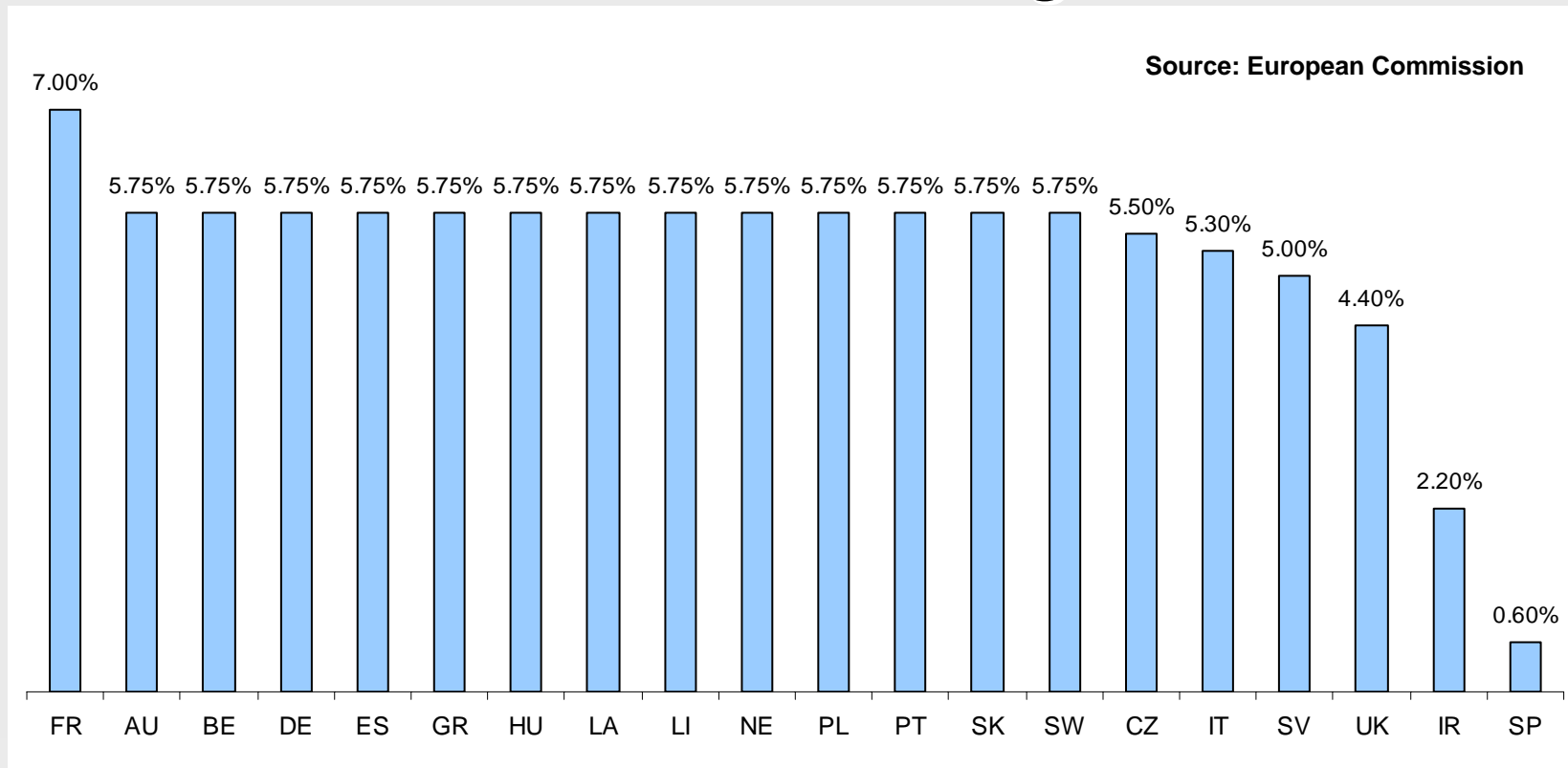
National Biodiesel Targets - 2005



- For 2005, each country set own non binding biofuels target
- Based around EU reference value of 2% and known production capacity
- Includes both bioethanol and biodiesel



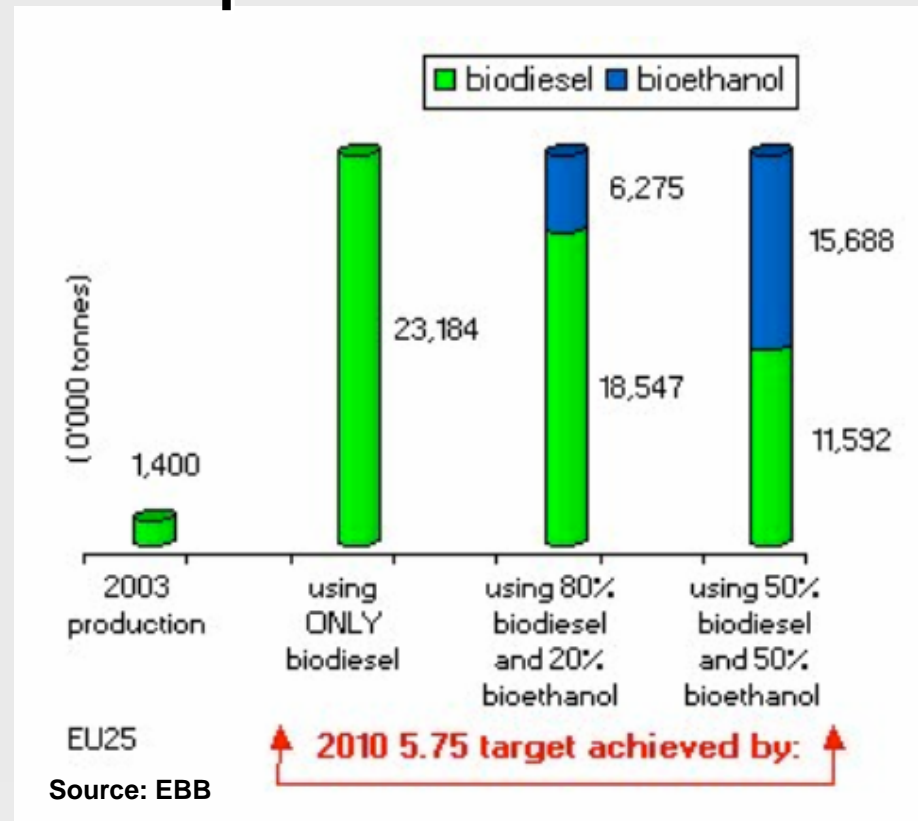
National Biodiesel Targets - 2010



- For 2010, each country again set own biofuels target, but countries not achieving 5.75% target must explain why
- Methods chosen to achieve targets are either mandatory biofuel obligations, tax reductions/exemptions or both



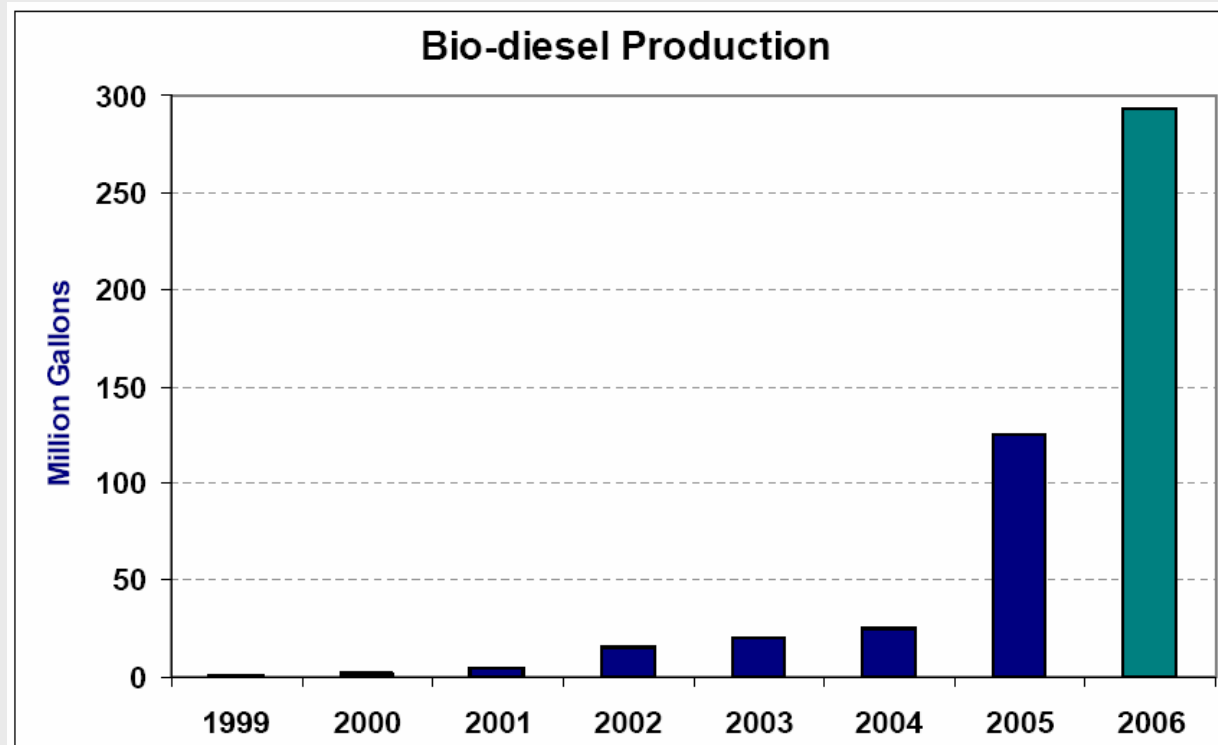
EU-25 Split between Biofuels



- If 5.75% target met just with biodiesel, 23MT capacity reqd
- Currently in EU, 80% biofuels on sale is biodiesel
- However, more bioethanol plants coming on stream and more interest in importing from Brazil to meet targets



US Biodiesel Market



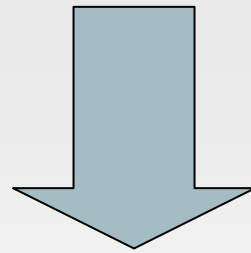
Source: FC Stone

- Currently, ~ 56 biodiesel plants with 80+ more planned
- From 1/1/05, demand stimulated by biodiesel tax credit
- Renewable fuel standard introduced to increase quantity of biofuel from 4 billion gals in 2006 to 7.5 billion gals in 2012



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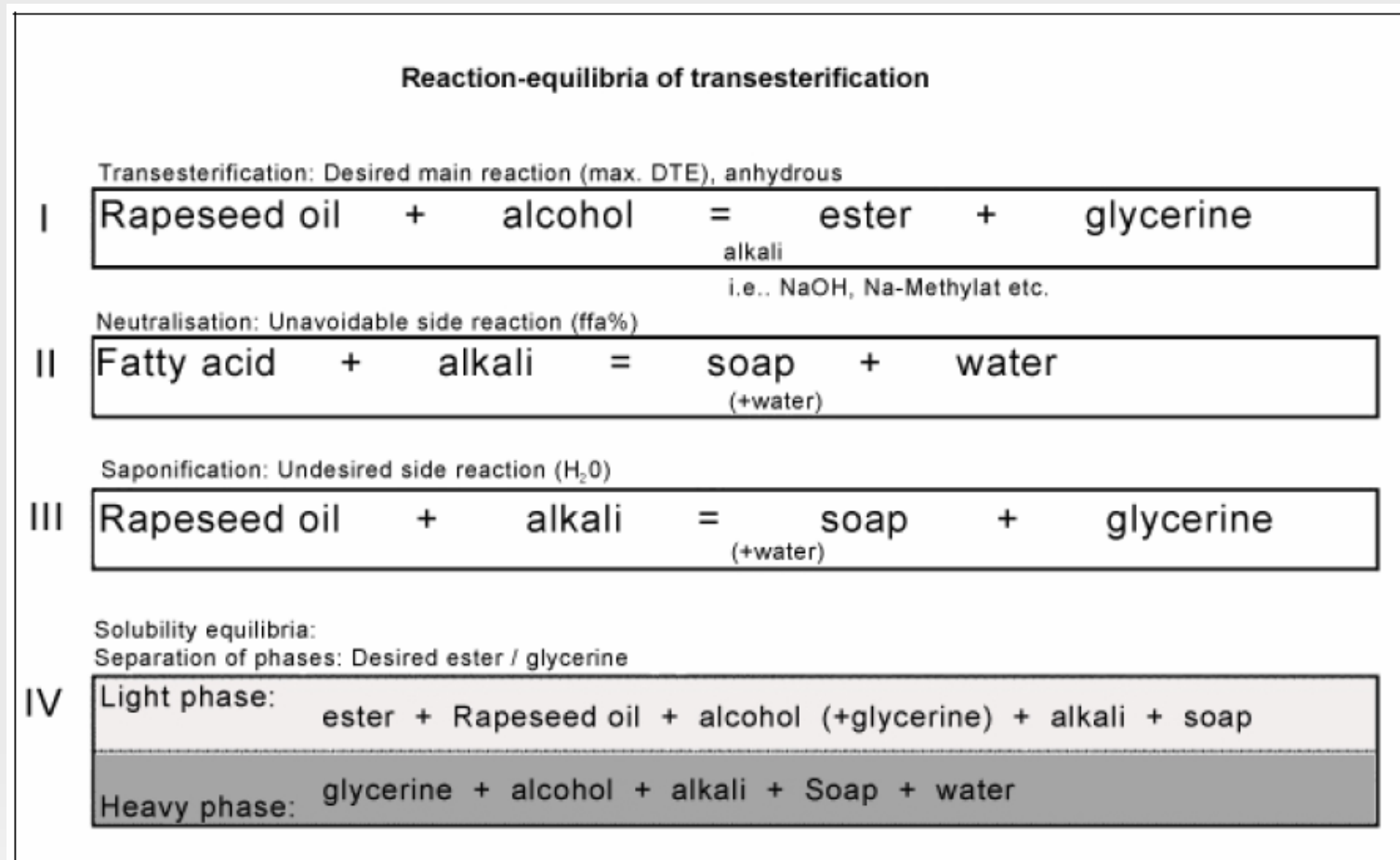


Biodiesel Production

- Transesterification of triglycerides (vegetable or animal oils) with excess alcohol (esp. methanol) using base catalyst
- Fatty acid methyl ester (biodiesel) and glycerine produced
- 10 kg oil + 1 kg MeOH → 10 kg biodiesel + 1 kg glycerine
- Separation of 0.88 SG biodiesel from 1.26 SG glycerine done in settling tanks or by centrifuges
- Centrifuges more likely on large scale (100+ kT pa) continuous plants as settling tanks get too big
- Trace soaps and water may also require removal
- Most feedstock is veg. oil as biodiesel from animal fats/oils:
 - . more difficult to produce due to free fatty acids present requiring more equipment for pre-treatment
 - . has lower cloud point causing low temp. problems



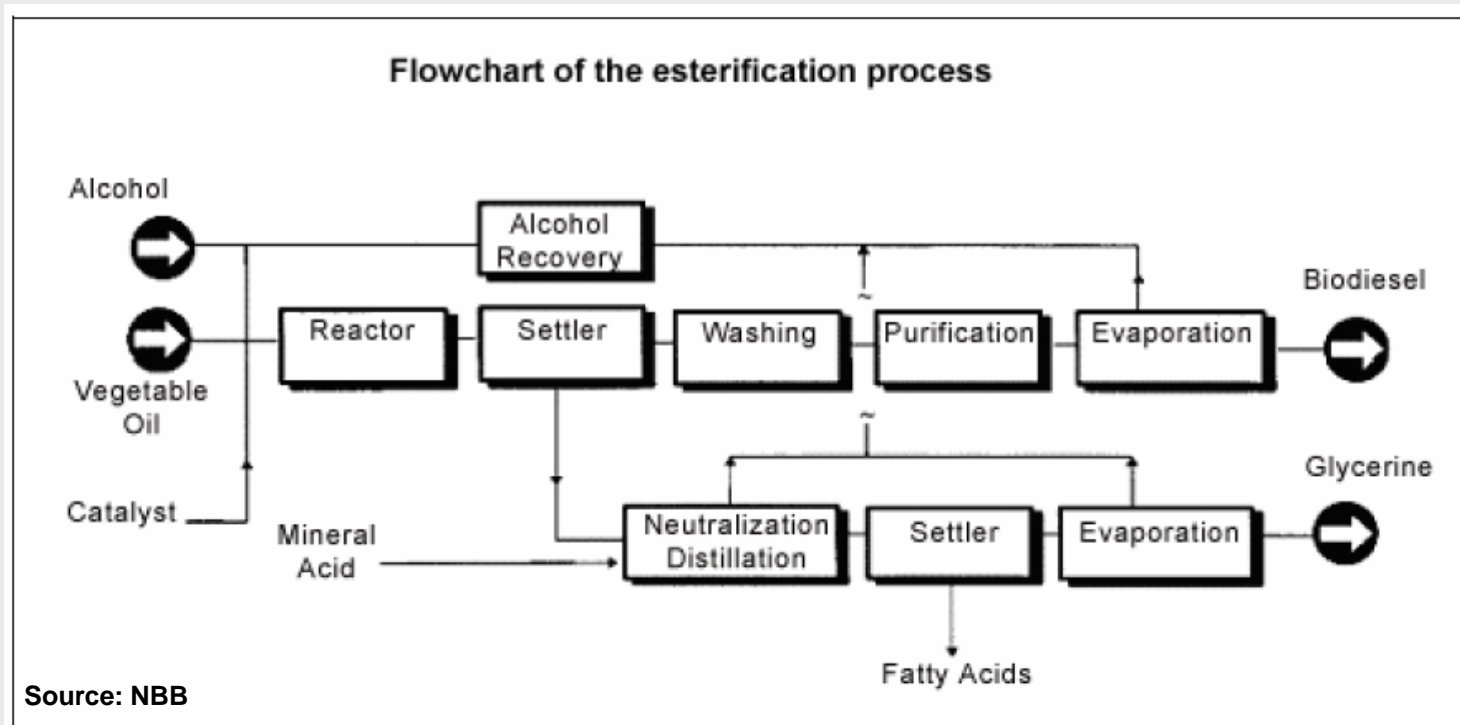
Principal Biodiesel Reactions



- Try to reduce reactions II and III through pre-treatment and chosen technology to maximise yield of ester



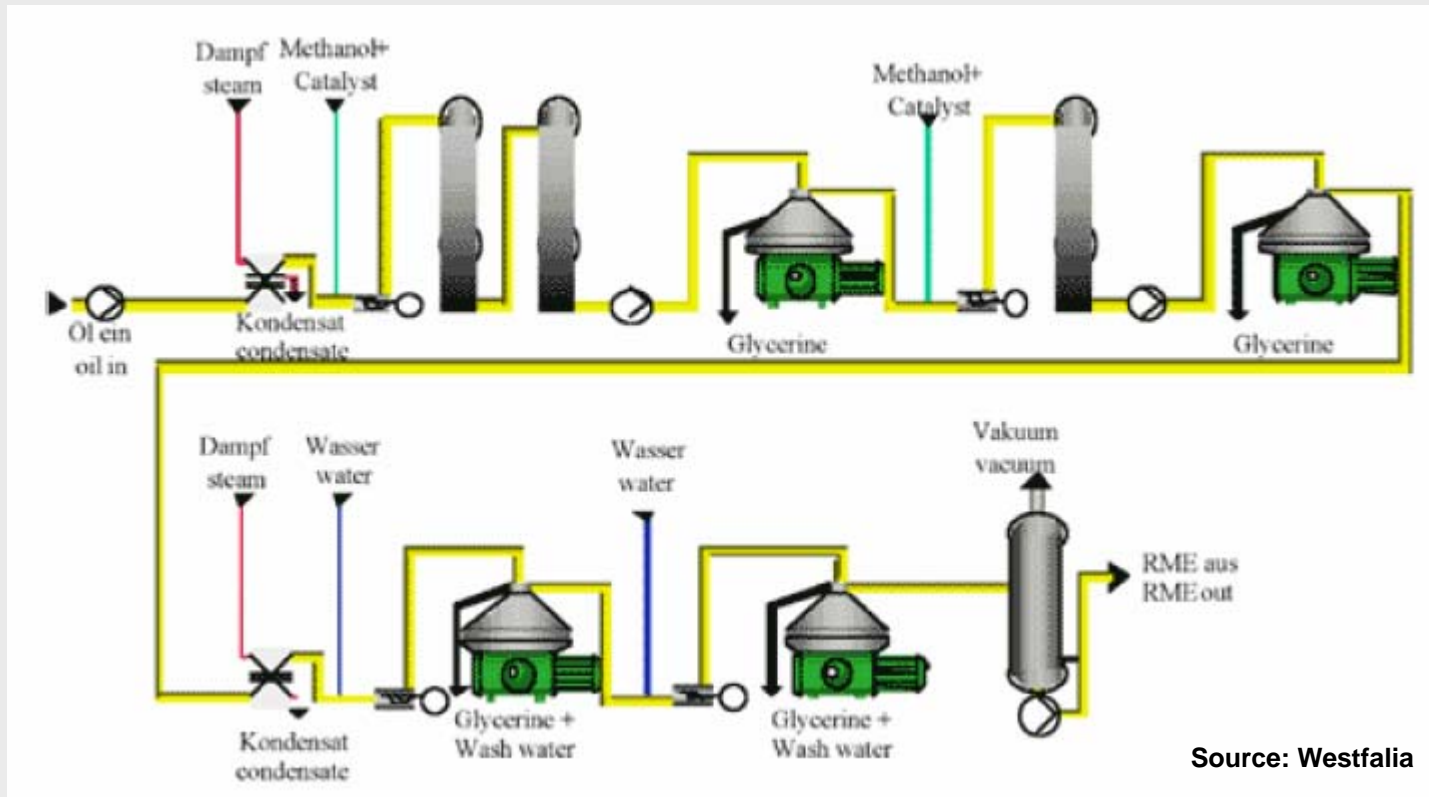
Typical Biodiesel Process



- Centrifuges may also be used for:
 - Feedstock pre-treatment: de-gumming, solids, water
 - Washwater separation from biodiesel
 - Separation of drywash solids if used (eg magnesium silicate)



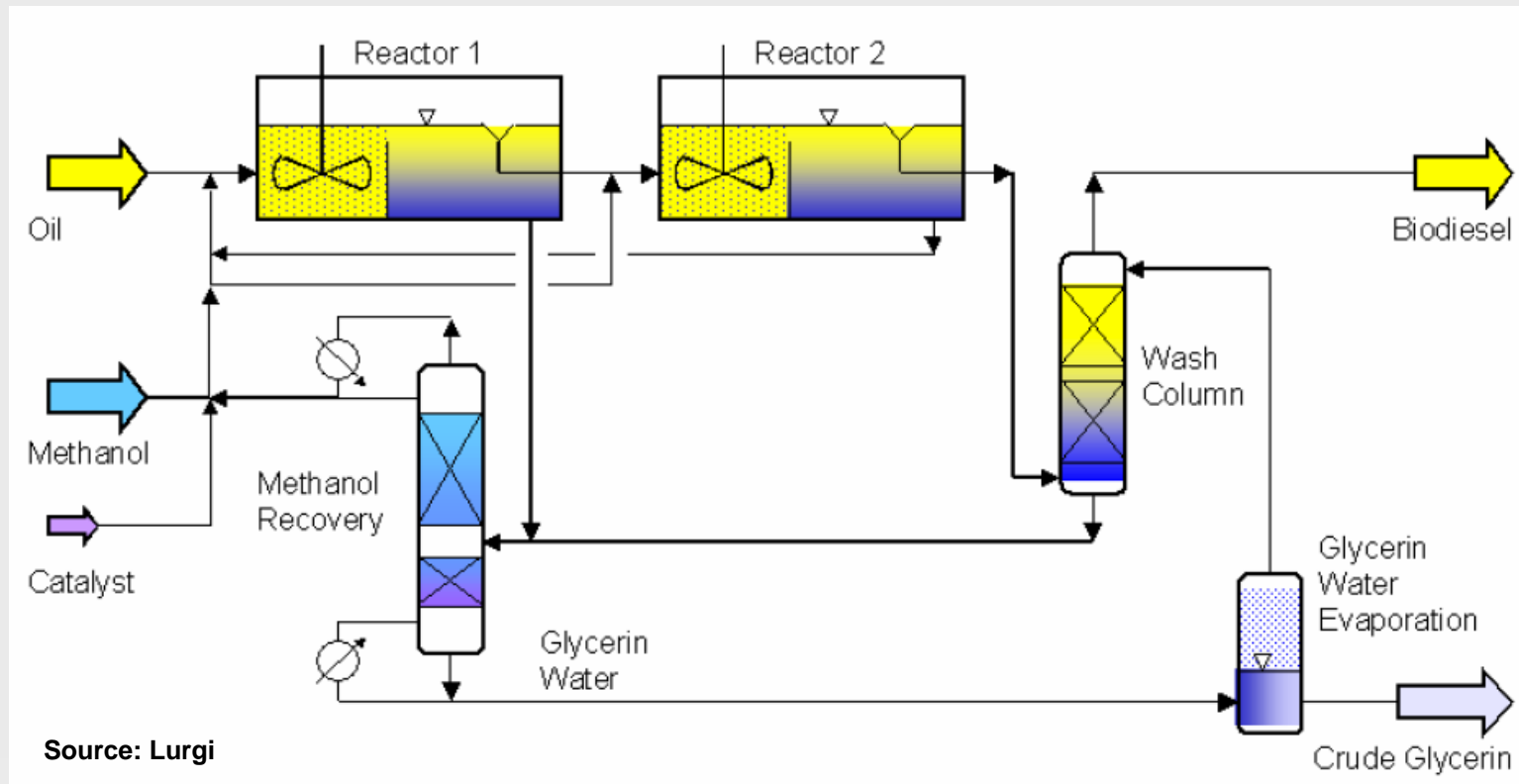
Connemann Biodiesel Process



- Connemann process first to be commercially developed
- Used (amongst others) by ADM who are largest producers
- Process licensed to GEA / Westfalia



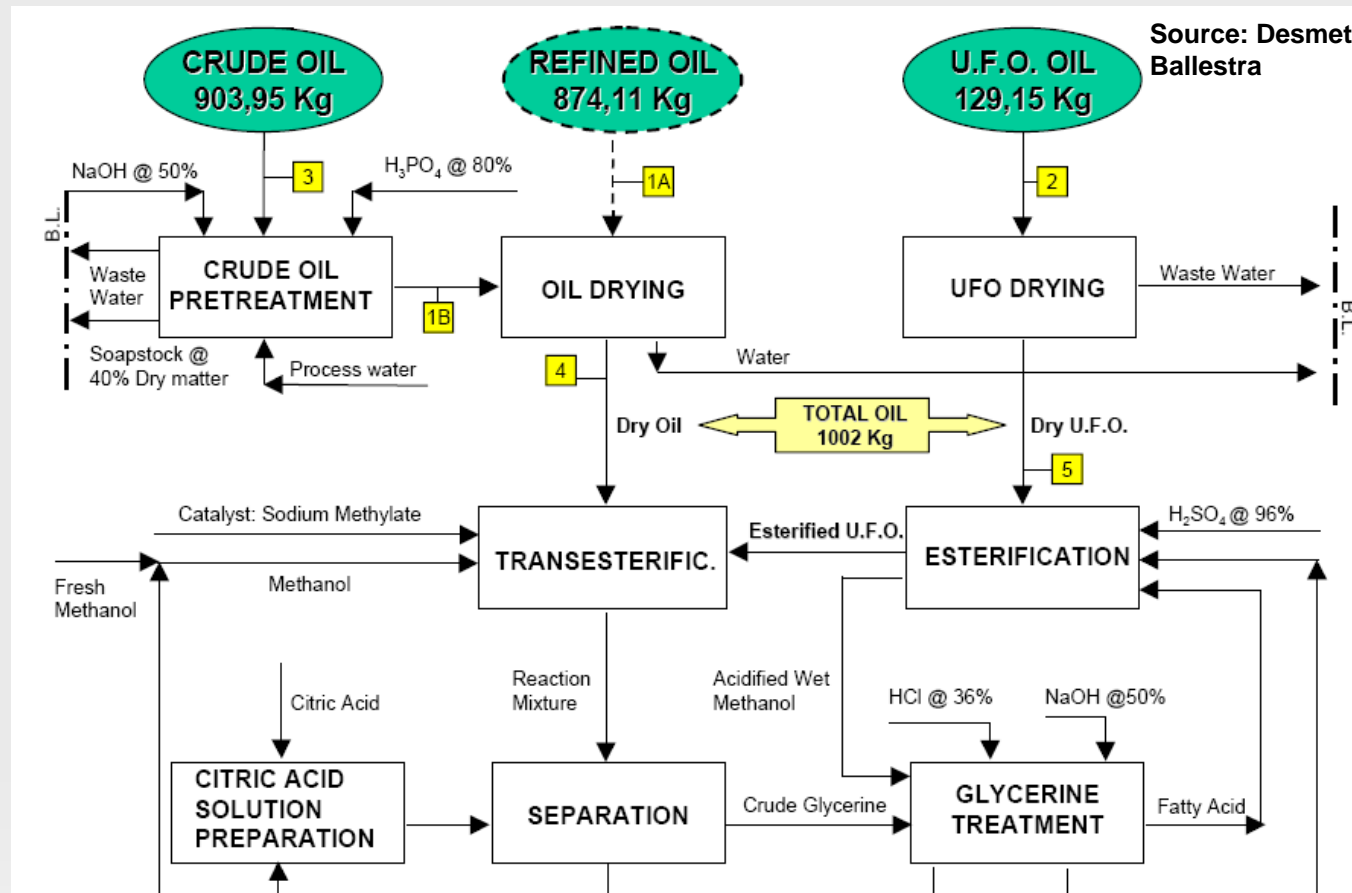
Lurgi Biodiesel Process



- No centrifuges reqd as separation in reactor/settler tanks
- Lurgi claim by end 2007, 60-70% of global biodiesel plants and 70-80% of German plants will be using their technology
- Lurgi/PSI also part of GEA, so competing with Westfalia



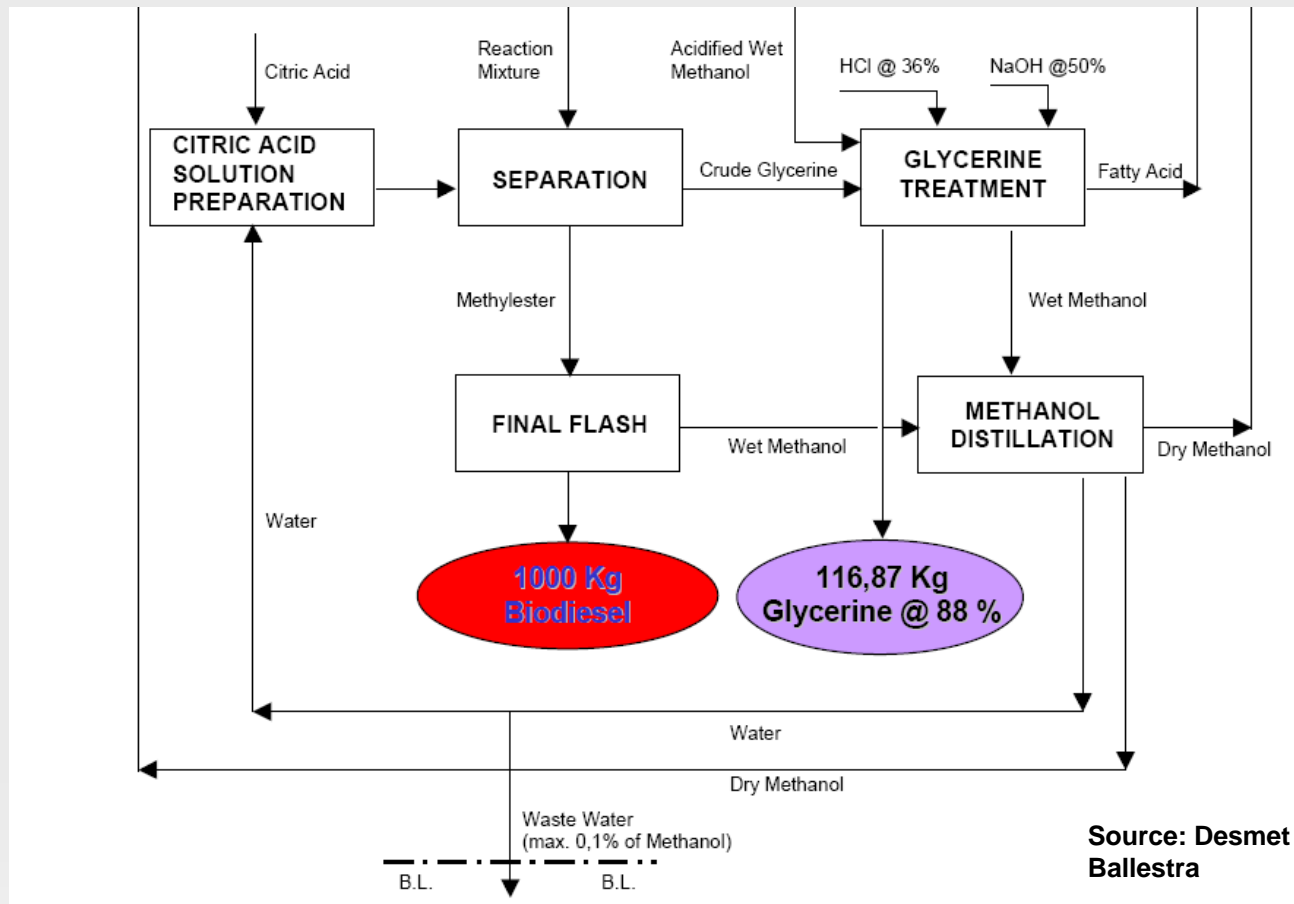
Desmet Ballestra Biodiesel Process - I



- Shows pre-treatment and acid esterification of high FFA feed to reduce soap formation
- Transesterification itself is three stage process



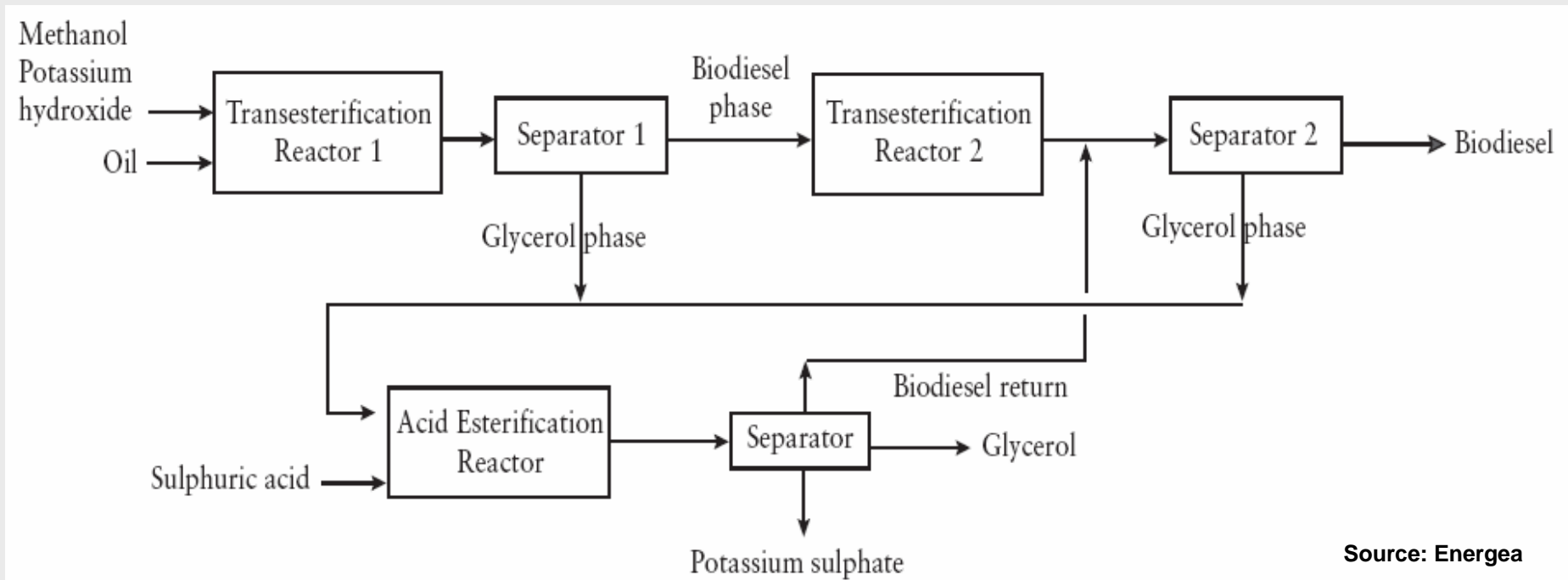
Desmet Ballestra Biodiesel Process - II



- Ballestra (based in Rome) merged with De Smet (based in Brussels) in 2004 ,and MBO with Barclays PE in Jan 2007
- Currently, ~ 50 plants in design, construction or start up



Energiea Biodiesel Process



- Patented CTER process operates at high pressure (ie 60-80 bar cf 1 bar for Lurgi) to get high conversion in minutes
- Ability to handle multiple vegetable and animal feedstocks
- New technology and only 3 medium/large scale plants
- Based in Vienna



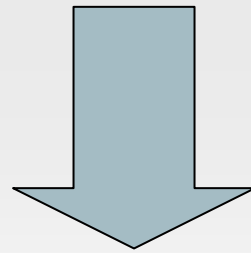
Other Technology Licensors

- BDI – BioDiesel International AG
 - Patented technology from University of Graz, Austria
 - Can use high FFA vegetable or animal feedstock
 - Currently, 12 plants in design, construction or start up
- Axens
 - Subsidiary of Institut Francais du Petrole
 - ESTERFIP process
- Other technology suppliers (many in U.S.) include:
 - Crown Iron Works / Renewable Energies Group
 - Superior Process Technologies
 - Biodiesel Industries
 - Pacific Biodiesel



Conclusion for Technology

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EU-25 Biodiesel Production Capacities

Country	Production			Capacity	
	2004	2004	2005	2006	2007
Germany	1.035	1.205	2.016	3.603	4.033
Italy	320	914	1.038	1.038	1.038
Great Britain	9	31	517	660	910
France	348	434	434	594	894
Spain	13	91	151	322	422
Austria	57	122	127	127	127
Czech Republik	60	112	112	112	112
Latvia	n.a.	3	106	106	286
Denmark	70	70	100	100	100
Portugal	n.a.	100	100	100	100
Greece	n.a.	n.a.	80	80	80
Slovakia	15	35	57	57	57
Lithuania	5	n.a.	10	10	10
Sweden	1	5	5	81	81
Benelux	n.a.	n.a.	3	288	388
Estonia	n.a.	n.a.	n.a.	n.a.	110
Finland	n.a.	n.a.	n.a.	n.a.	170
Ireland, Malta, Slovenia, Hungaria, Cyprus	n.a.	n.a.	n.a.	n.a.	n.a.
Total	1.933	3.122	4.856	7.278	8.918

Source:
UFOP, EBB

- Germany, Italy and France currently leading production capacity due to Gov't incentives and presence of leading technology licensors



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EU-25 Biodiesel Production

- Biodiesel must be produced to standard EN 14214 which was developed around rapeseed oil feedstock
- 80% of feedstock still rapeseed oil, but others include:
 - other pure vegetable oils (palm, soy, jatropha etc)
 - used or waste cooking oil
 - animal fats and tallow
- Choice of feedstock heavily dependent on price, but also influenced by agricultural politics and biodiesel blend sold
- Biodiesel may be sold pure (B100) or blended with mineral diesel (Bx where x = % of biodiesel eg B5)
- Blending with mineral diesel to standard EN 590 allows 5% biodiesel blend within car warranties and without labelling
- All blends above 5% must be labelled as such



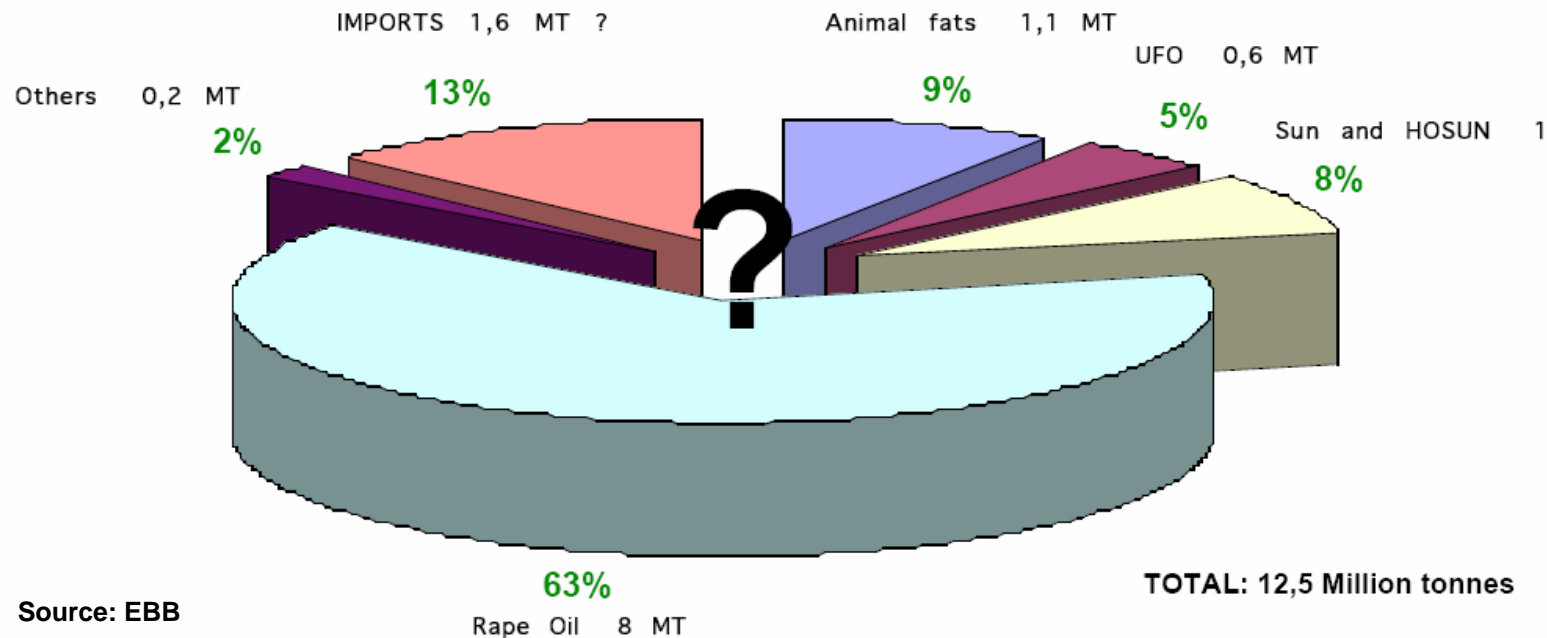
EU Biofuel Issues

- By start of 2007, European Commission to review:
 - EU Biofuels Directive 2003/30/EC
 - EU Fuel Quality Directive 98/70/EC
- Biofuels Directive Review to determine if overall 2010 target likely to be reached and if not, what actions required
- Actions could include:
 - EC set national targets for biofuel market share
 - Mandatory biofuel obligations on fuel suppliers
 - Minimum sustainability standards for domestic and imported biofuels
- Fuel Quality Directive Review to determine if EN 590 should be modified to allow biofuel blending from 5% to 10%
- Biodiesel standard EN 14214 may also be reviewed to allow a wider range of (cheaper) vegetable oils as feedstock



EU-25 Raw Material Market

5,75% biodiesel target a possible raw materials scenario

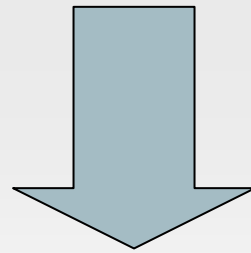


- Concern over sourcing feedstock to achieve 2010 target
- Domestic rapeseed oil dominates but supply limited by land
- Estimated 1.6 MT imported raw material, but world price will determine what type of oil (eg rapeseed, palm, soy etc)



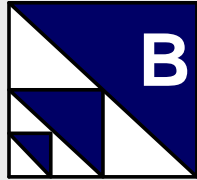
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