

Potential for liquid biofuels

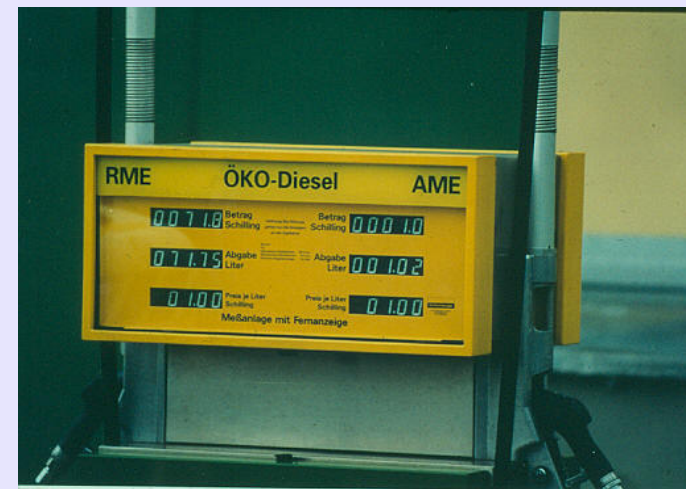


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Content



- Why consider liquid biofuels?
- Technical and utilisation potential
- Potential for environmental benefits
- Economic opportunity potential
- Conclusions



Drivers for liquid biofuels

- Environment and associated legislation
 - Transport accounts for a significant share of energy demand, in the UK - 25%
 - EU Targets
 - biofuels should achieve 2% of transport fuels by 2005 and 5.75% by 2010 (UK currently at 0.3%)
 - UK Renewable Transport Fuel Obligation
 - proposed start 2008, rising to 5% by 2010 (2.5% in 08/09, 3.75% in 09/10)
- Cost and availability of mineral fuel

Liquid biofuel types

- Renewable energy sources for transport are limited
- Bioethanol - *petrol substitute / additive*
 - from starch/sugar crops, eg cereals, potatoes, sugar beet
- Biodiesel - *diesel substitute / additive*
 - from oil crops, used cooking oil, tallow



Bioethanol - most widely used liquid biofuel worldwide



- **Brazil** - production since 1975 using sugar cane
 - now 30% of gasoline demand (production peak - 15 billion L in 1997)
 - blends up to E26, also dedicated use requiring engine modification
- **USA** - production since early 1980s using maize
 - 10 billion L bioethanol/year (2% transport fuel)
 - mostly blends up to E10
- **Europe - Spain** biggest producer at 144 million L (cereals)

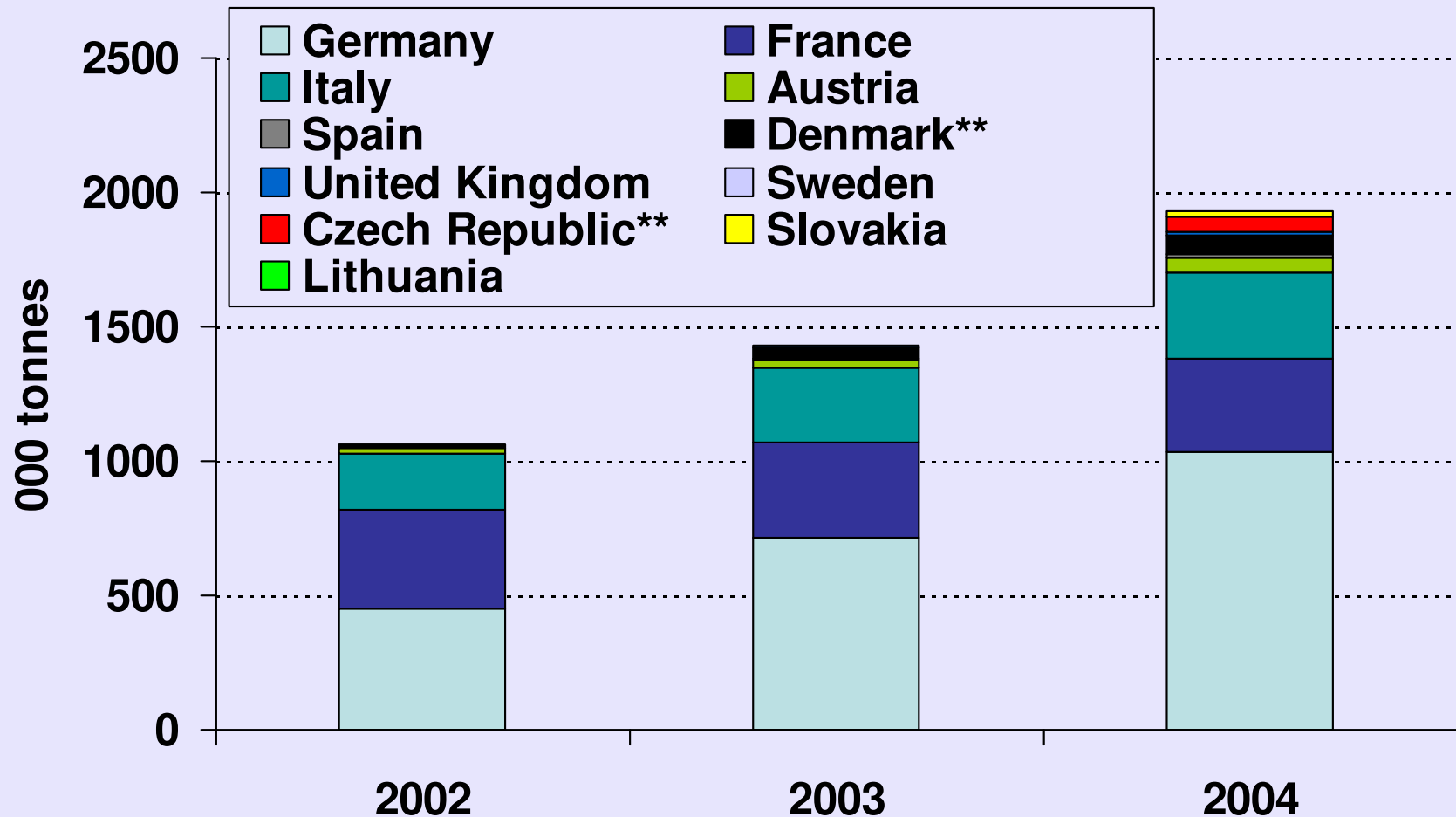
Biodiesel



- Widespread use in Europe, eg Germany, Austria
 - removal of glycerol from vegetable oil prevents engine ‘coking’, used as a diesel substitute or blend in **unmodified** diesel engines
 - frequently included as 5% blend to fit with engine warranties
- Pure plant oil can be used, but requires engine modification



EU-25 Biodiesel Production



Source: UFOP & VBD

Liquid biofuels; potential for environmental benefits



- Energy balance
 - Bioethanol from cereals
 - poor - barely 1 energy unit out : 1 unit in
 - Biodiesel from oilseed rape
 - positive - between 2 and 3 units out : 1 unit in
- Greenhouse gas emissions
 - Reduction in GHG emissions, compared to fossil fuels
 - Bioethanol 64%
 - Biodiesel 53%

Economic potential for UK liquid biofuel production



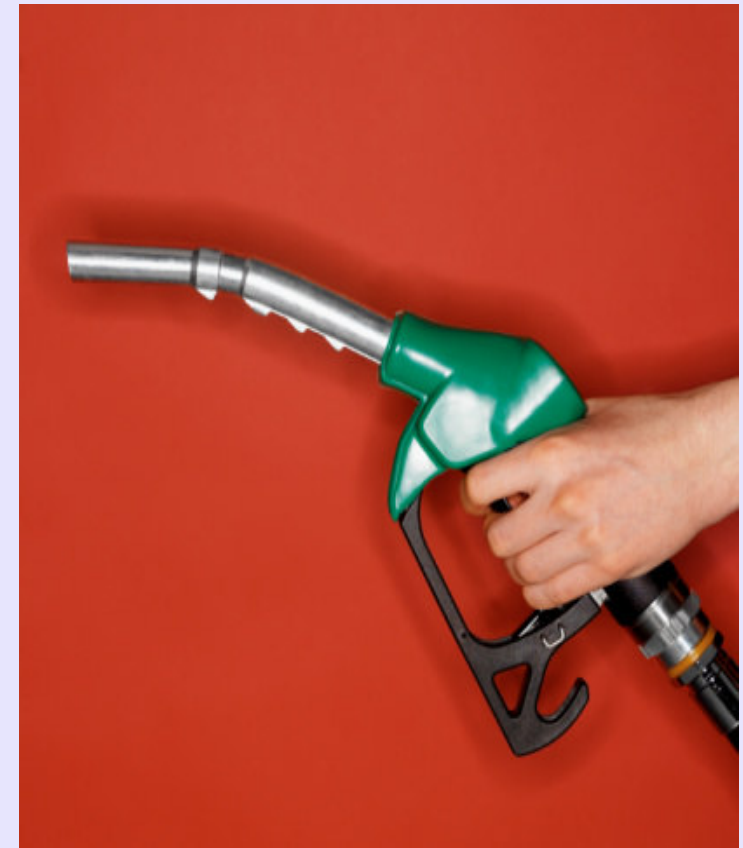
Budget 2006 update

- Fuel duty rebate of 20p/l (fuel duty of 27.1p for biofuels) extended
- In addition, RTFO buy out price (price paid by fuel suppliers who fail to meet obligation) will be 15p/l in 08/09
- Combination of duty incentive and buy-out price at 35p/l guaranteed for 09/10, but will reduce to 30p/l in 10/11

Fuel Duty on main UK Transport Fuels



Product	Duty Rate (p/l)
Petrol (ULS)	47.10
Diesel (ULS)	47.10
Biodiesel / Bioethanol	27.10
Red Diesel	5.22



Source: HM Revenue & Customs

UK Liquid Biofuel Plants Proposed



	Location	Size	Feedstock	Stage
Argent - biodiesel	Motherwell	50 ML	UCO Tallow	In operation
Biofuels Corp - biodiesel	Teeside	284 ML	Palm soya OSR	Being built
Greenergy - biodiesel	Immingham	113 ML	Palm, soya OSR	Advanced plans
Wessex Grain - bioethanol	SW England	100 ML	Wheat	Advanced plans
British Sugar - bioethanol	Norfolk	70 ML	Sugar Beet	Advanced plans

Processing options considered - Scottish context



OSR (tonnes)	Option	Scale	Product	Capital cost
190	1A	Farm	Crude Oil	£7.3K
355	1B	Farm	Biodiesel	£30.4K
1,030	2	Small Group	Crude oil	£81.2K
15,000	3	Group	Biodiesel	£3.86M
60,000	4	Medium	Biodiesel	£10.2M
250,000+	5	International	Biodiesel	£25M

** - not eligible for fuel duty rebate

On-the-road price for 5 biodiesel options (p/litre)



Option	Production cost	Retail margin	Duty	Sub-total	VAT 17.5%	Total cost
1A	57.9	2	47.1	107.0	0	107.0
1B	61.3	2	27.1	90.4	0	90.40
2	39.6	5	47.1	91.7	16.05	107.75
3	55.2	10	27.1	92.3	16.15	108.45
4	41.3	10	27.1	78.4	13.72	92.12
5	38.0	10	27.1	75.1	13.14	88.24

Appropriate scale for Scotland



- Large scale - lower cost/litre, but need to balance with availability of feedstock
- Medium scale plant (60,000t OSR crushed) (+ 10,000t oil) + esterified - produces 33ML of biodiesel
- 14% return with pay-back by year 6
- Considerable inherent risks involved
- Best mitigated through formation of a joint-venture company

Bioethanol - economic assessment



- Scotland could justify a larger scale plant than for biodiesel, allowing economies of scale
 - potentially lower cost/litre
 - but higher capital requirement
- surplus barley in Scotland gives a feedstock opportunity, but gives a poorer and less certain conversion rate than wheat feedstock
- threat of cheap bioethanol imports (eg from Brazil) could disrupt markets

Conclusions



- Biodiesel and bioethanol offer technical potential to provide a portion of transport fuels
- Energy balance shows that biodiesel from oilseed rape is positive - environmentally sustainable. Bioethanol has a poor energy balance. Both fuels give GHG reductions.
- Biodiesel and bioethanol are more expensive to produce than fossil fuels, however with 20p/l fuel duty rebate can compete
- RTFO and the introduction of a buy-out price stimulates the demand for biofuels

Conclusions (2)



- Biodiesel has the advantage of different scale of production
- Medium scale biodiesel plant of 60,000t OSR is viable - joint venture needed to reduce risks
- Small scale biodiesel plants are expensive - so need to look at costs carefully, but may allow establishment of the industry in Scotland