



## Economics and Sustainability of Biodiesel and other Biofuels



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- Current research on certification and assurance standards
- Biofuels market
- Supply chains
- Stakeholders
- Socio-economic issues and considerations
- Examples of biofuels socio-economic impacts (sugar cane, palm oil and soya)
- Conclusions

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## First umbrella for EU

- Sustainable transport agenda
- Climate strategy
- Directives EU
  - **The Biofuels Directive** (Directive 2003/30/EC) indicative targets (non compulsory) of 2% by 2005 to 5.75% by 2010 (by energy content).
  - **The Fuel Quality Directive** (98/70/EC), amended 2003, currently limits biofuels to a maximum of 5% by volume (less than the Biofuels Directive target of 5.75% by energy).
  - **Biofuels Strategy** (COM 2006:34) aims to further promote biofuels in the EU and developing countries, and prepare the EU for the large-scale use of biofuels in an environmentally sustainable manner,.
  - **Biomass Action Plan** (COM 2005:628), revision of the Biofuels Directive. i) give favourable treatment to second generation biofuels in biofuels obligations; and ii) bring forward a legislative proposal promoting public procurement of clean and efficient vehicles, including high blends of biofuels.

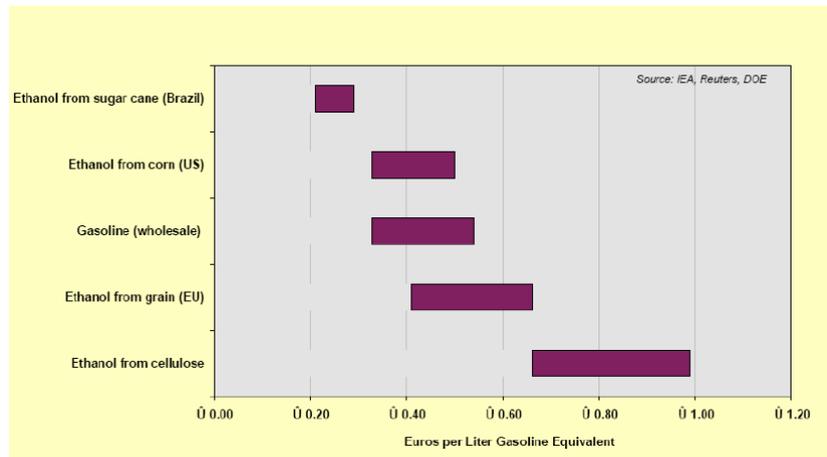
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## Expected biofuels in the market in 2010

Fuel	Feedstock (s) and feedstock type (wet / solid biomass, sugar rich crop, oil crop)	Conversion technology	Cost of production <sup>a</sup> (euros per energy-equivalent litre)	Key characteristics, pros / cons
Biodiesel	Oil crops, and waste: rapeseed, sunflower, soybean, palm oil, jatropha, waste vegetable oil, waste animal fats	Extraction & esterification	US, soy – 0.50 EU, rapeseed – 0.56 Brazil, soy – 0.52	-energy density about 0.9 that of petroleum diesel -conventional diesel engines can operate on up to 100% biodiesel -minor modifications required on blends above 20% -sensitive to cold conditions
Bioethanol	Starch and sugar crops: wheat grain, sugar beet, sugar cane, sorghum, corn	Fermentation, gasification, pyrolysis	US, corn – 0.36 EU, wheat – 0.70 Brazil, sugar cane – 0.27	- energy density about two-thirds that of petrol -easily blended into petrol at low blend levels - high octane
Biogas	Organic waste, wet energy crops	Anaerobic conversion	-----	Advantage: It can be integrated within the infrastructure designed for natural gas, LPG and LNG; good performance on GHG emissions. Disadvantage: Limited market (buses)

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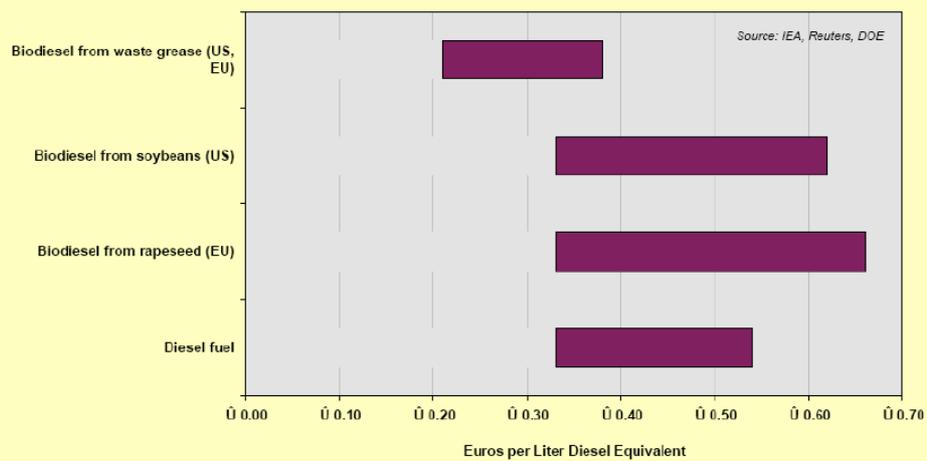
## Cost Ranges for Ethanol Production, 2006



(Worldwatch Institute, 2006)

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## Cost Ranges for Biodiesel Production (at factory gate), 2006



(Worldwatch Institute, 2006)

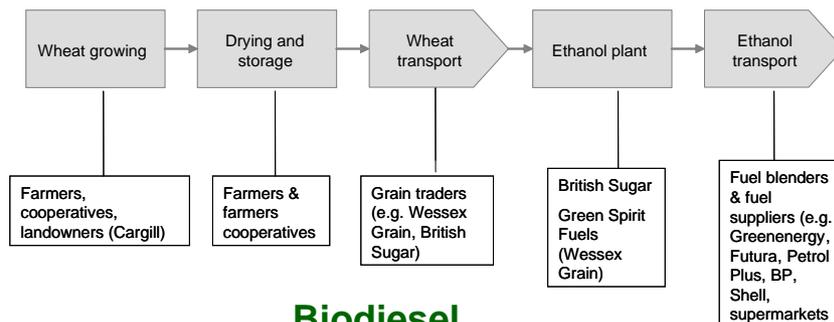
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## Biodiesel

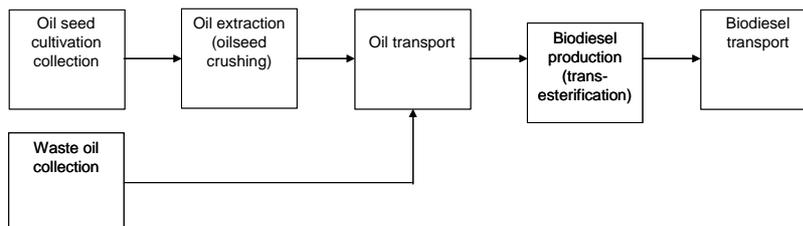
- Globally, biodiesel production is the third fastest growing renewable energy sector, after grid-connected PV and wind.
- However, total biodiesel production remains significantly lower than bioethanol with global production likely to have been around 5BI in 2005 (LowCVP, 2006).
- Europe leads the world in biodiesel production and use. Currently biodiesel production uses about 1.4 Mha in the EU according to the European Biodiesel Board (Rosillo-Calle and Walter, 2006).
- Germany is the key producer and consumer of biodiesel in the world (UFOP, 2005). It's consumption is likely to be about 9% of the German conventional diesel market by the end of 2007

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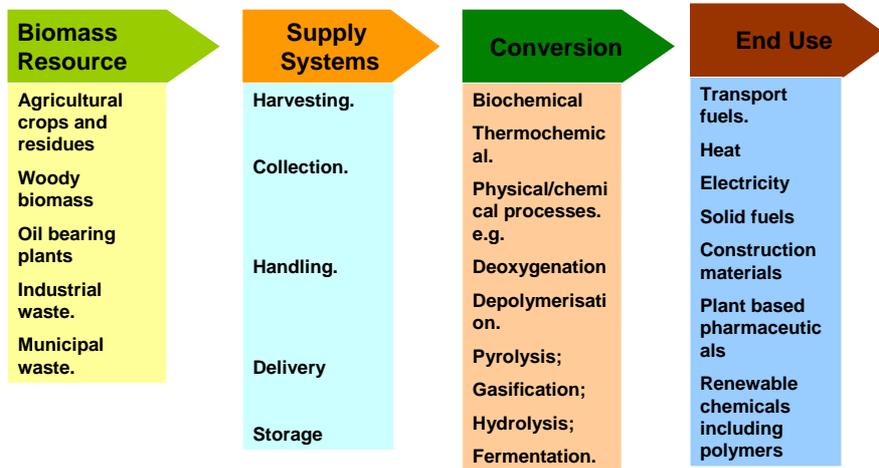
### Production chain Wheat to ethanol



### Biodiesel



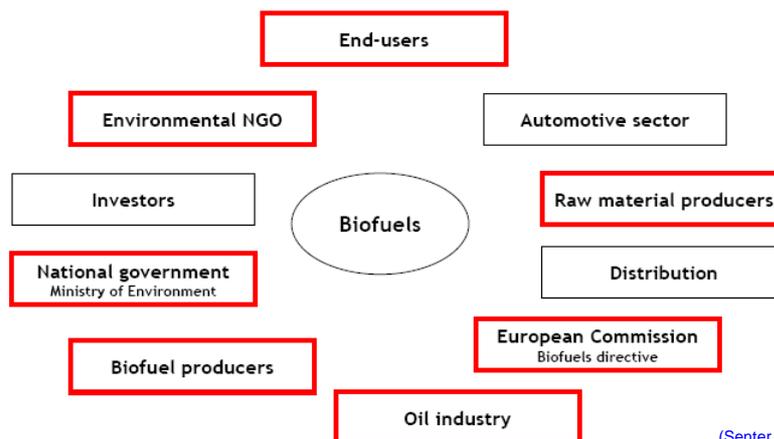
## Biodiesel Production chain



(Leuenberger, 2007)

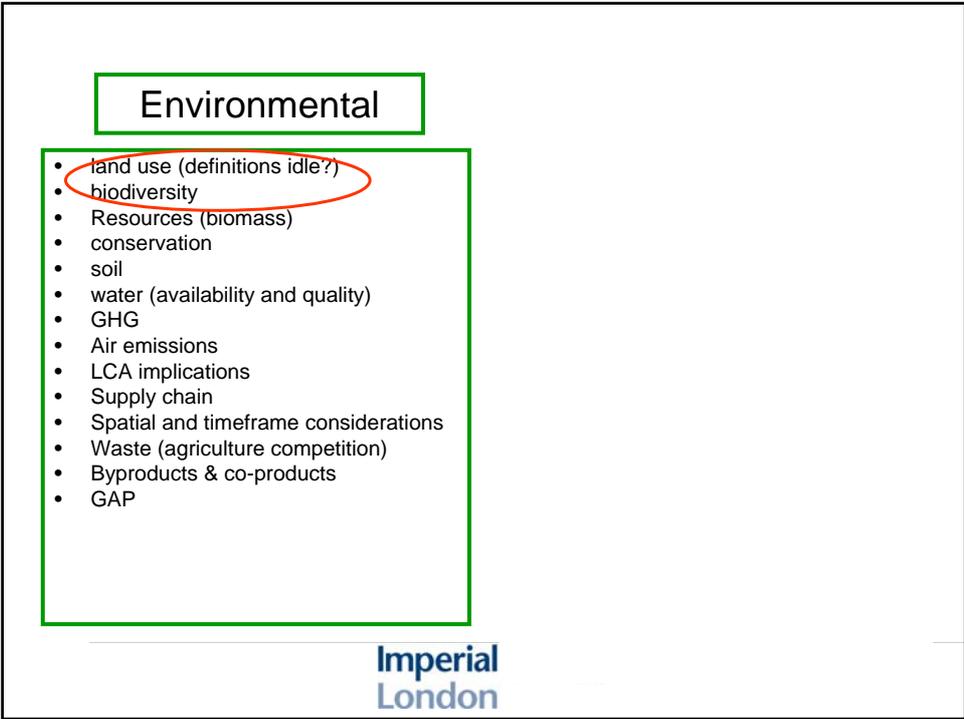
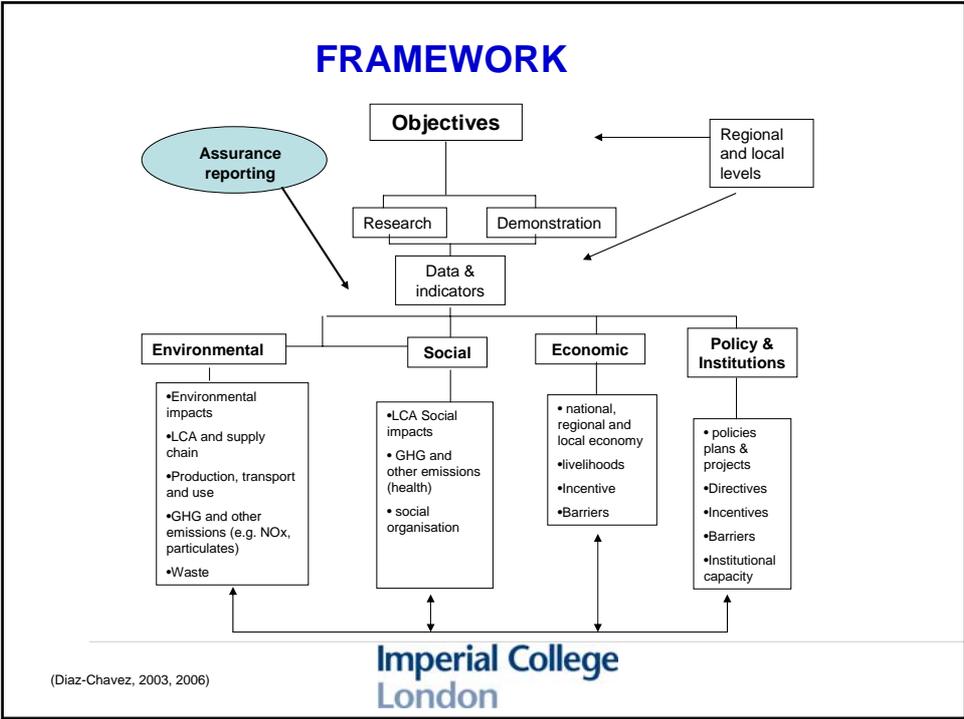
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## Overview of stakeholders in biofuels systems



(Senter Novem, 2005)

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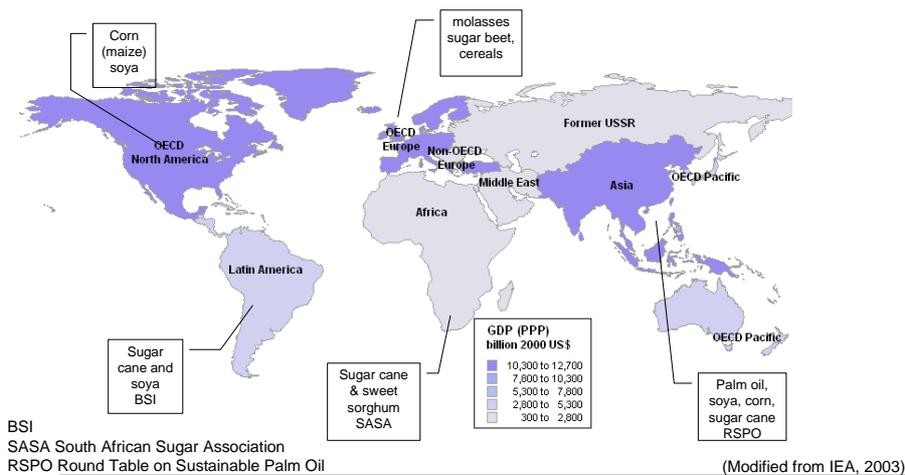


## Economic

- Economic value of resources
- Tax
- Costs of production
- Costs of certification
- Local economy
- Production level (small/large scale, family/small owners)
- Gender
- Investment (funds)
- Trade (incentives and barriers)
- Market
- Supply chain values
- Scale production considerations
- Climate change risks
- Poverty reduction
- Byproducts & co-products
- Rural development

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## Biofuel regions by energy crops and available certification and standard systems.



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## Main International Standard systems and their characteristics

MAIN THEMES									
		Year	Region	Specific to biomass	Criteria	Certification	Env Impact	Users	Focus
<b>STANDARDS</b>									
1	Assured Combinable Crops	2005-06	UK	N	Standards	N	Y	Farmers/producers	Codes of practice for food chain
2	Climate, Community and Biodiversity	2005	Worldwide	N	Standards	N	Y	Developers, investors, governments	Climate change mitigation projects
3	Forest Stewardship Council	2000	Worldwide	N	Standards	Y	Y	Forest managers	Forest management
4	Green Gold Label Program General Standard	2005	Worldwide	Y	General Standards	Y	N	Producers of agriculture, forest and related industries	Chain of custody
5	Green Gold Label Program (Agriculture)	2005	Worldwide	Y	Standards	Y	Y	Producers of agriculture, forest and related industries	Agriculture producers
6	Green Gold Label Program (Forest)	2005	Worldwide	Y	Forest Management	Y	Y	Seller/producer	Forest management and EI
7	EUREPGAP	2005	Europe	N	Fruits & vegetables	N (verification)	Not clear	Farmers	Food production
8	ISEAL	2006	Europe	N	Code of practice	N	Y	International standards	Code of good practice for setting social and env standards
9	PEFC	2006	Europe	N	Standards	Y	?	Not specified	Forest management
10	Rainforest Alliance Sustainable Agriculture	2002	Worldwide	N	General Standards	N	N	Producers	General Standards for Sustainable Agriculture
11	Rainforest Alliance FSC /Smartwood	2002	Worldwide	N	Standards	Y	Y	Producers	Forest management
12	RSPO	2006	Asia	Y	Standards	Y	?	Producers, traders	Palm Oil producers, traders
13	UK Forestry Standard	2004	UK	N	Standards	Y	Y	Producers	Forest management

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## Renewable Transport Fuels Obligation (RTFO) Criteria (2006)

	SAN/RA	RSPO	Basel	LEAF	ACCS	EurepGAP	FSC	SAI	IP
P1. Conserve Carbon	P	P	P	P	P	N	P	N	
P2. Conserve Biodiversity	P	Y	Y	P	N	N	Y	N	
P3. Soil conservation	Y	Y	Y	Y	Y	Y	Y	N	
P4. Sustainable Water Use	Y	Y	Y	Y	Y	Y	P	N	
P5. Air quality	Y	Y	Y	Y	Y	Y	P	N	
P6. Compliance with applicable law (social issues)	Y	Y	Y	Y	N	Y	Y	Y	
P7. Contracts and subcontractors	Y	N	N	P	P	N	N	P	
P8. Freedom of association and right to collective bargaining	Y	Y	Y	N	N	N	Y	Y	
P9. Working hours	Y	N	N	N	N	N	N	Y	
P10. Child labour	Y	Y	Y	N	N	N	N	Y	
P11. Health and safety	Y	Y	Y	N	P	Y	Y	Y	
P12. Wages/compensation	Y	Y	Y	N	N	N	N	Y	
P13. Discrimination	Y	Y	Y	N	N	N	N	Y	
P14. Forced labour	Y	N	Y	N	N	N	N	Y	
P15. Land right issues	Y	Y	Y	P	N	N	Y	N	

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## Review of other standards

	STANDARDS	CROSS COMPLIANCE GAECS	CROSS COMPLIANCE SMRS	LEAF	ACCS	EurepGAP
	<b>CRITERIA</b>					
P1	Conserve Carbon	Y	N	P	P	N
P2	Conserve Biodiversity	Y	Y	P	N	N
P3	Soil conservation	Y	Y	Y	Y	Y
P4	Sustainable Water Use	Y	Y	Y	Y	Y
P5	Air quality	Y	Y	Y	Y	P
P6	Compliance with Applicable law (social issues)	NA	NA	Y	N	Y
P7	Contracts and subcontractors	NA	NA	P	P	N
P8	Freedom of association and right to collective bargain	NA	NA	N	N	N
P9	Working hours	NA	NA	N	N	N
P10	Child labour	NA	NA	N	N	N
P11	Health and safety	NA	NA	N	P	Y
P12	Wages/compensation	NA	NA	N	N	N
P13	Discrimination	NA	NA	N	N	N
P14	Forced labour	NA	NA	N	N	N
P15	Land right issues	NA	NA	P	N	N

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## Cramer Report 2006 (The Netherlands)

1. Greenhouse balance
2. Competition with food, local energy supply, medicines and building
3. Biodiversity
4. Economic prosperity
5. Well-being
6. The Environment

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<b>2. Competition with food, local energy supply, medicines and building</b>	
Insight into the availability of biomass for food, local energy supply, building materials or medicines.	• Reporting obligation on the availability of biomass for food, local energy supply, building materials or medicines. Protocol for this will be worked out further.
<b>4. Economic prosperity</b>	
Insight into possible negative effects on the regional and national economy.	• Reporting obligation according to, among other things, the Economic Performance Indicators, as expressed in the Global Reporting Initiative. A protocol for this will be worked out, in which indirect effects on the meso and macro-economy are taken into account.
<b>5. Well-being</b>	
No negative effects on the social well-being of the workers and local population, taking into account:	
5a Working conditions of workers	• Comply with Social Accountability 8000 and with the Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy compiled by the International Labour Organisation.
5b Human rights	• Comply with the Universal Declaration of Human Rights (concerning: non-discrimination; freedom of association; child labor; forced and compulsory labor; disciplinary practices; security practices and indigenous rights).
5c Property rights and rights of use	• Comply with the following requirements: <ul style="list-style-type: none"> <li>• No land use without the consent of sufficiently informed original users.</li> <li>• Land use is carefully described and officially laid down.</li> <li>• Official property and use, and customary law of the indigenous population is recognized and respected.</li> </ul>
5d Insight into the social circumstances of local population	• Reporting obligation about the social effects of biomass cultivation for local population, according to a protocol that will be worked out further.
5e Integrity	• Companies in the supply chain comply with the Business Principles for Countering Bribery.

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## Öko Institute and WWC Sustainability standards for bioenergy” (2006)

### Criteria for bioenergy

- Priority for food supply and food security
- Rights to use land for bioenergy cropping
- Workers rights and shares of proceeds
- Health impacts

## The Lisbon Strategy

- It was adopted for a ten-year period in 2000 in Lisbon, Portugal by the European Council.
- Formulation of various policy initiatives to be taken by all EU member states.
- It broadly aims at making "the EU the world's most dynamic and competitive economy" by the 2010 deadline.

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	<b>Determinant of employment and growth</b>	<b>Lisbon policies</b>
Labour	Labour supply	Employment target, participation
	Matching	Labour mobility
Capital	Market size	Internal market: services, network industries
	Cost of capital	Financial services markets
Innovation	ICT	Information Society
	Research and Development (R&D), knowledge spillovers	R&D Target
	Knowledge infrastructure	Attract top researchers European Research Area Linkages between firms and research institutes (universities)
Human capital	Education	Upper secondary education, literacy, graduates (maths, science and technology)
	Training	Participation in life-long learning
Competition	Market structure	Competition policy, internal market
	Constraints	Administrative costs
		Taxation, regulation

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## Examples of environmental and socio-economic impacts

- Sugar cane
- Palm oil
- Soya
- Others

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## Sugar Cane



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## Palm oil



Outside a palm oil processing factory, workers sort the fruit that was collected that morning from local cutters in surrounding villages, Congo.



Oil palm fruit bunches being loaded into truck. The workers in the pictures are from the local villagers. There are also Indonesian workers working in the plantation, Kampong Stenggang, Malaysia

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Land use rights and land use change, competition for resources from rain forest, Malaysia



Eric Velasco/Environment

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## Soya South America



Deforestation in Argentina



Soya crops are closer to urban areas

Deforestation in Brazil for soya

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## Sunflower and Jatropha



(Sinkala, 2007)

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## Conclusions

- A standard assurance or certification system must be implanted, currently under design at different levels in the EU
- Biofuels production and use must be sustainable (economic, environmental and social issues)
- Promote rural development

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## Cont.

- Biofuels production may be seen as an additional form to help reduce poverty in developing countries
- Problems with certification or standard assurance lay within implementation, additional costs, audit and compliance.

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Thank you



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