BIOFUELS and SUSTAINABILITY:

Conformity assessment biofuels practices

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Biofuels


PROMOÇÃO
GAS. COMUM
2,91
GAS. ADITIVADA
2,94
ÁLCOOL
1,88
DIESEL
2,05
Star Capital
Star Capital
Conveniência
2007/03/28 18:04

Barriers to trade

- 1. *Tariff barriers* to access markets.
- 2. *Internal subsidies.* These subsidies depress international prices of the mentioned products and generate unfair competition in the markets.

- 3) *Sanitary barriers*

- 4) *Deficient access to technology,* whether it is for productive activities,
- transformation and trading or to comply with the standards demanded
- by trade partners.

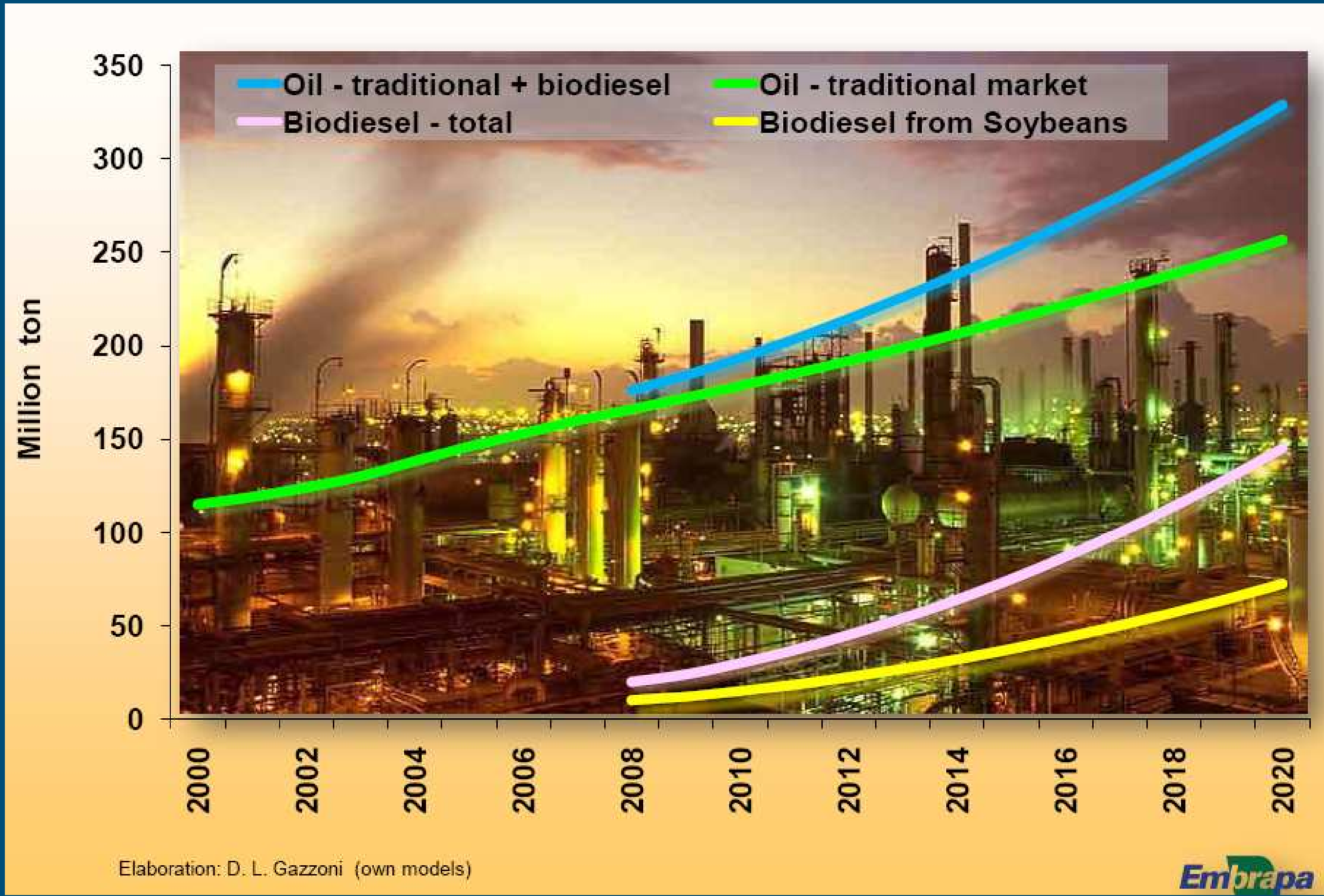
- 5) *Compliance with quality standards,* makes it more difficult for countries to access some more dynamic and/or better paid markets.

- *6) The increasing concentration of agricultural markets:* several studies
- have shown the increasing concentration that is occurring in international agricultural markets, in particular in the trade and processing phases of raw materials (agricultural industry), and the negative material effects caused thereby.

Our basic question: conformity assessment and the the biofuels practices

- Does Brazilian biodiesel currently comply to EU standards, and if not, why not?
- How can Brazilian biodiesel comply to current and future EU standards?

Forecast biodiesel demand



Demand for biodiesel EU

		FEDIOL[1]		MVO	
	(x 1 million tons)	**2006**	**2010**	**2006**	**2010**
A.	Rapeseed production EU-25	16.0	21.0	15.9	23.0[2]
B.	Rapeseed oil production EU-25	6.7	9.0	6.7	9.9
C.	EU diesel consumption	160.0	177.8	163.3[4]	177.8[4]
D.	EU target	2.6%	5.8	2.25%[5]	5.75%
E.	Biodiesel demand[3]	4.2	11.5	4.0[4]	11.1[4,6]
F.	Food demand	2.6	2.0	2.6	2.6
G.	**Total (E+F)**	**6.8**	**13.5**	**6.6**	**13.7**
H.	*Gap (G-B)*	*-0.1*	*-4.5*	*+0.1*	*-3.8*[6]

Where to import 4 million tons of biodiesel from?

MVO, 2006

The EU biofuels targets:

1. 5,75 % in 2010: Equal to 20 MTOE.
   10% in 2020 > 40 MTOE

2. Imports of biofuels will be required in order to meet these targets. The development of biofuels as a commodity market is therefore necessary

3.The Netherlands could be an important importer of biofuels.

4.Brazil could be an important exporter of biodiesel (or vegetable oils)

In order for a real biofuels market to develop exporter and importer have to agree on **technical standards and sustainability standards**

Sustainability criteria (NL): 9 principles

GHG balance of the production chain and application must be positive

Not be at the expense of important carbon sinks in the vegetation and in the soil

Biomass for energy must not endanger the food supply and local biomass applications (energy supply, medicines, building materials).

Biomass production must not affect protected or vulnerable biodiversity

In the production and processing of biomass the soil and soil quality are retained or improved.

In the production and processing of biomass ground and surface water must not be depleted and the water quality must be maintained or improved.

In the production and processing of biomass the air quality must be maintained or improved.

The production of biomass must contribute towards local prosperity.

The production of biomass must contribute to the social well being of the employees and the local population.

Roundtable on Sustainable Biofuels, 2007

11 principles:

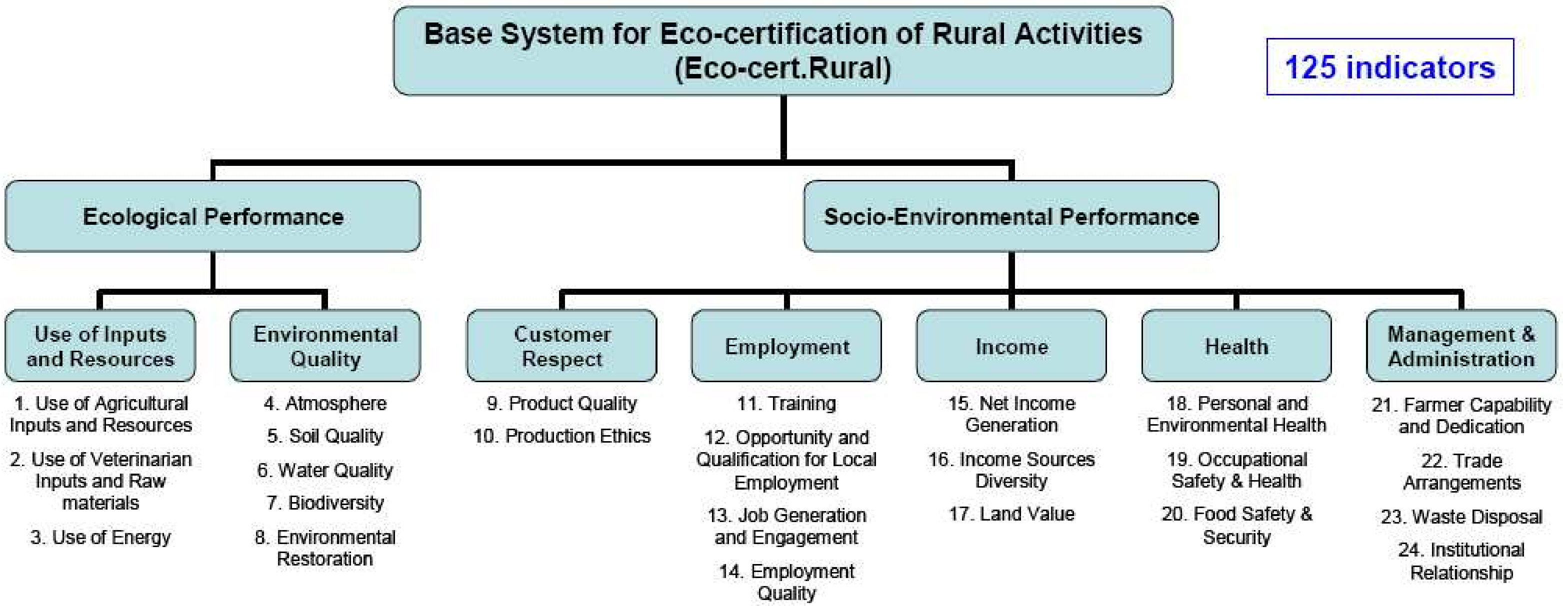
1. Legality Respect all applicable laws of the country
2. Consultation: Transparent, consultative and participatory processes that involve all relevant stakeholders
3. Climate Change and Greenhouse Gases ; Biofuels shall contribute to reducing GHG emissions as compared to fossil fuels. Including direct and indirect GHG emissions It shall also include GHG emissions resulting from land use changes as land is converted to biofuel crop production, or as other production is displaced
4. Human and labor rights Not violate human rights or labor rights, and ensure decent work and the well6being of workers
5. Socioeconomic development Not violate land or water rights, contribute to the social and economic development of local, rural and indigenous peoples and communities.
6. Food security Biofuel production shall not impair food security

7. Conservation: No direct or indirect endangerment of wildlife species or areas of high conservation value.
8. Soil Biofuel production shall not directly or indirectly degrade or damage soils.
9. Water Biofuel production shall not directly or indirectly contaminate or deplete water resources.
10. Air Biofuel production shall not directly or indirectly lead to air pollution.
11. Biotechnology If biotechnologies are used in biofuels production, they shall improve the social and/or environmental performance of biofuels, and always be consistent with national and international biosafety and transparency protocols

- RTRS principles on
  - Impact of Infrastructure
  - Compliance with labor laws and requirements
  - Respect for land rights
  - Small scale and traditional land use
  - Rural communities and migration
  - Water as a key resource
  - Soil as a key resource
  - Protection of biological diversity
  - Responsible use of agrochemicals

Embrapa project on sustainability

Integrated indicators impact assessment system: EcoCert.Rural (Principles and Criteria)



MONTEIRO, R.C. & RODRIGUES, G.S. A system of integrated indicators for socio-environmental assessment and eco-certification in agriculture. **Journal of Technology Management and Innovation**. v. 1, n. 3. 2006. pp. 47-59.

APOIA-NovoRural

Indicators' sustainability dimensions

Landscape Ecology

Environmental Quality

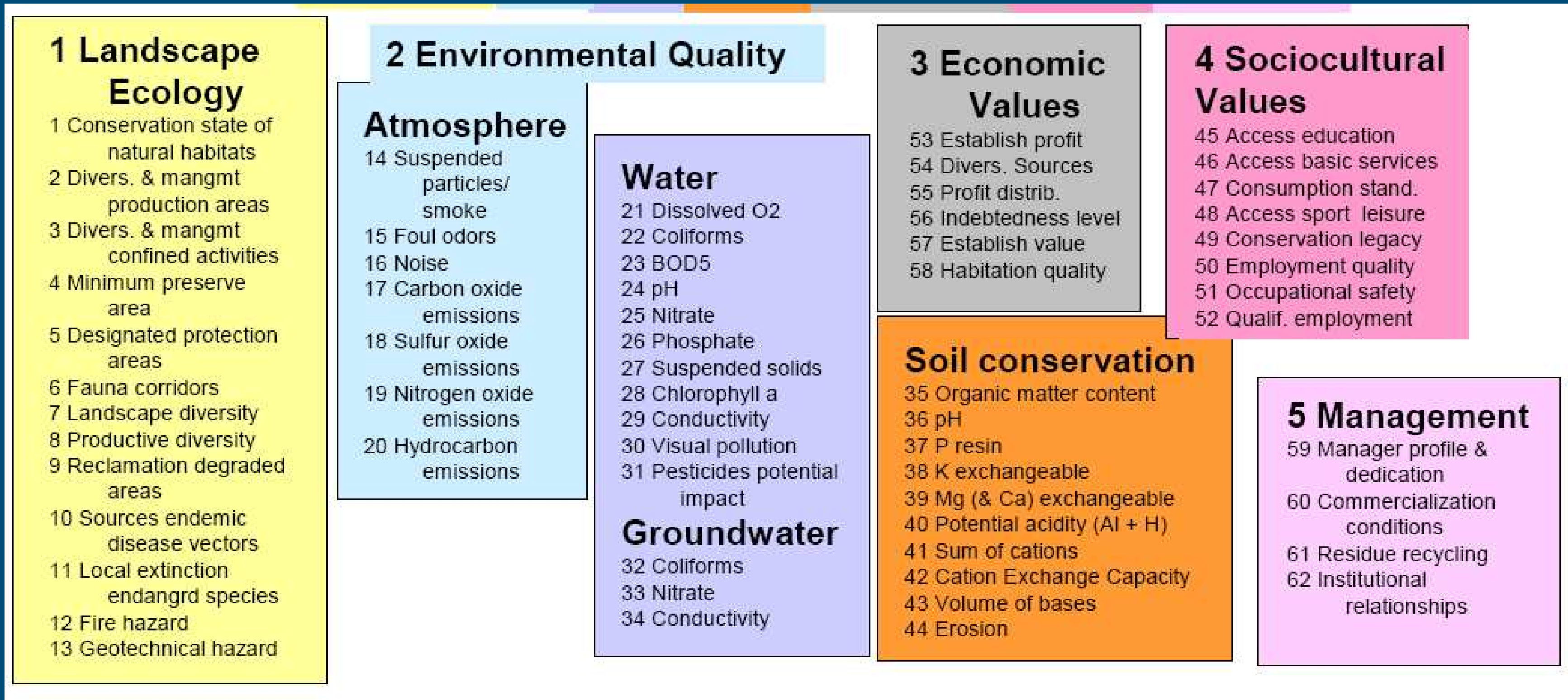
(atmosphere, water, and soil)

Socio-cultural Values

Economic Values

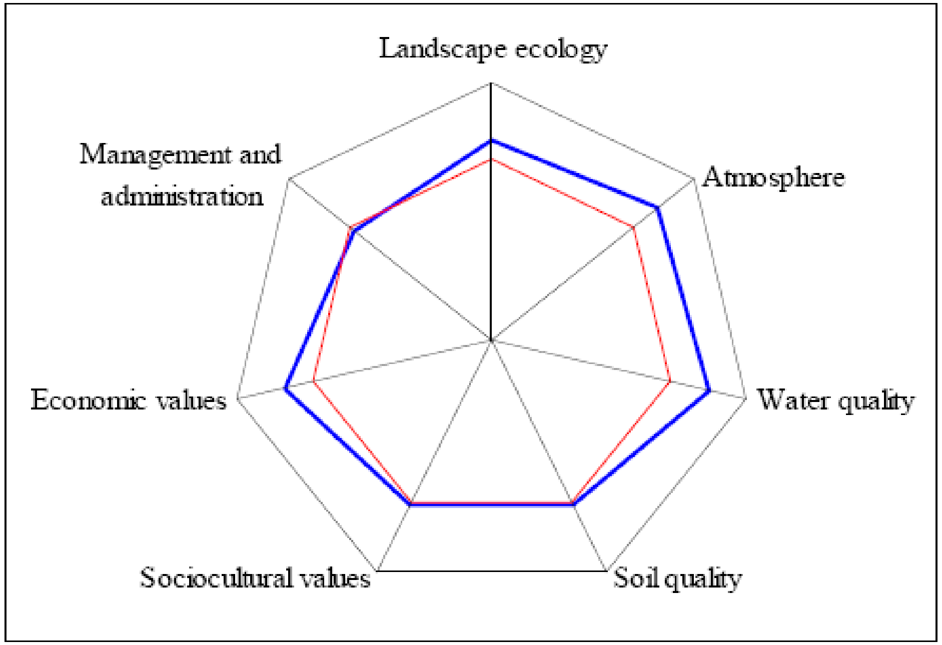
Management and Administration

Indicators



1 Landscape Ecology
1 Conservation state of natural habitats
2 Divers. & mangmt production areas
3 Divers. & mangmt confined activities
4 Minimum preserve area
5 Designated protection areas
6 Fauna corridors
7 Landscape diversity
8 Productive diversity
9 Reclamation degraded areas
10 Sources endemic disease vectors
11 Local extinction endangrd species
12 Fire hazard
13 Geotechnical hazard
2 Environmental Quality
Atmosphere
14 Suspended particles/ smoke
15 Foul odors
16 Noise
17 Carbon oxide emissions
18 Sulfur oxide emissions
19 Nitrogen oxide emissions
20 Hydrocarbon emissions
Water
21 Dissolved O2
22 Coliforms
23 BOD5
24 pH
25 Nitrate
26 Phosphate
27 Suspended solids
28 Chlorophyll a
29 Conductivity
30 Visual pollution
31 Pesticides potential impact
Groundwater
32 Coliforms
33 Nitrate
34 Conductivity
3 Economic Values
53 Establish profit
54 Divers. Sources
55 Profit distrib.
56 Indebtedness level
57 Establish value
58 Habitation quality
Soil conservation
35 Organic matter content
36 pH
37 P resin
38 K exchangeable
39 Mg (& Ca) exchangeable
40 Potential acidity (Al + H)
41 Sum of cations
42 Cation Exchange Capacity
43 Volume of bases
44 Erosion
4 Sociocultural Values
45 Access education
46 Access basic services
47 Consumption stand.
48 Access sport leisure
49 Conservation legacy
50 Employment quality
51 Occupational safety
52 Qualif. employment
5 Management
59 Manager profile & dedication
60 Commercialization conditions
61 Residue recycling
62 Institutional relationships

Reporting



Establishment B, Cássia (MG)

Mean sustainability index = 0.77

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Implementation of sustainability criteria and WTO?

How do the criteria fit WTO/EU regulation?
- GHG demands for biofuels appear to be in accordance with WTO en EU trade regulations as long as criteria are implemented in a non6discriminatory way

For other demands it may be more difficult to make
- regulation and it may be left to society to deal with that…. (RSPO, etc)

Therefore it appears that GHG balance will be a “hard” demand
- while the other criteria will be “soft” ones

Direct GHG efficiency (in chain) will have to be calculated

(CO_2 calculators developed now)

Minimal GHG efficiency will be required: 30% for transport fuel 70% for heat and electricity OR reward for higher efficiency

Discussion on indirect GHG effects 6> caused by indirect land use change

How to measure and how to implement?

For now the other criteria will “have to be reported on”

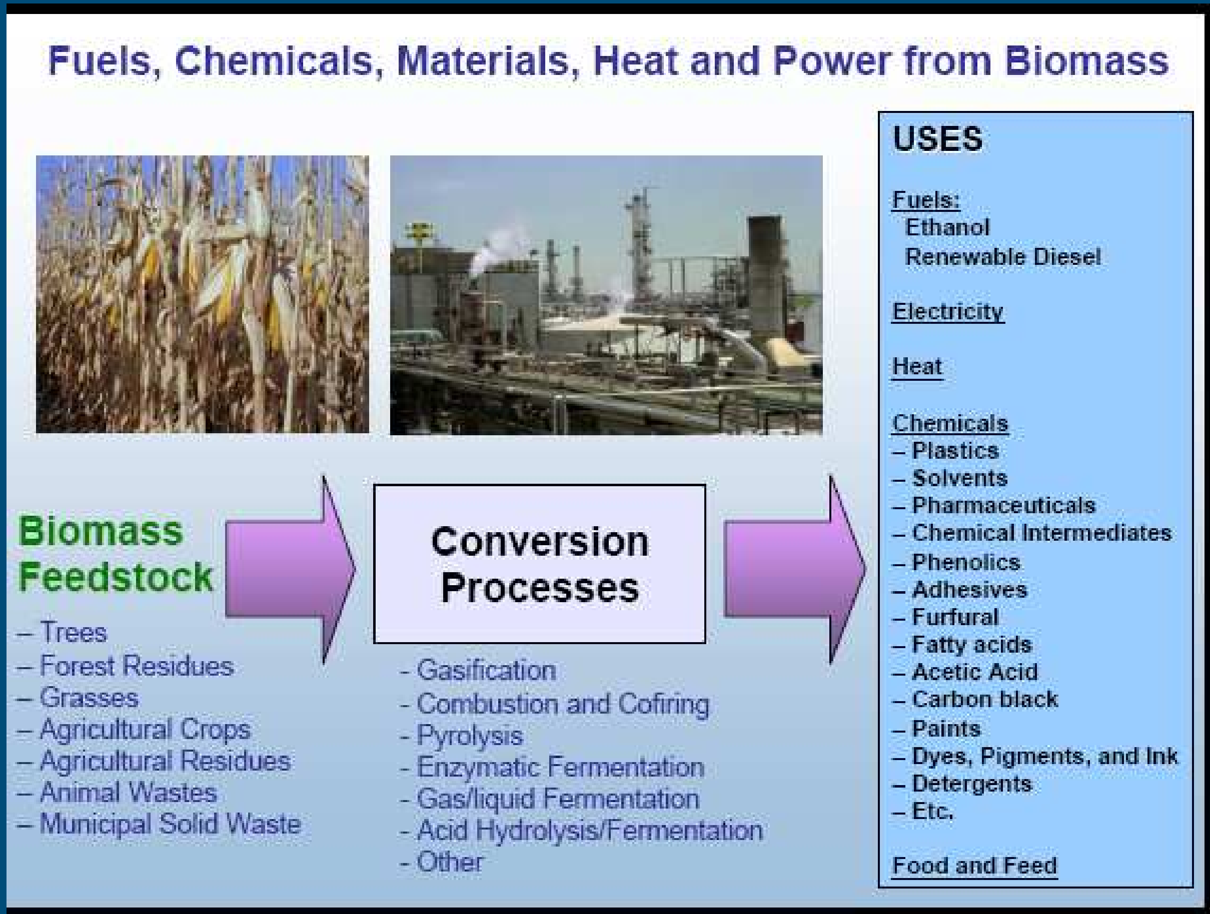
Brazil: Objectives Agro-energy plan

To support the change in the energy matrix in order to guarantee its sustainability.
To create the conditions necessary for increasing the agroenergy sources' share in the energy matrix.
To create the conditions necessary for the development of the country‘ hinterlands and regions through an expansion of energy agriculture and by adding value to the production chain.
To create opportunities for increasing the number of jobs within the scope of action of agribusiness.
To enable the broadening of income opportunities and its equitable distribution among stakeholders.
To contribute to reducing greenhouse gas emissions.
To help reduce petroleum imports.
To increase biofuel exports.

First conclusion

- The world players are accepting the importance of sustainability criteria for production of raw materials for biofuels. The chellange is to harmonize standards, criteria and measurements for assessing the practices.

Technical quality criteria



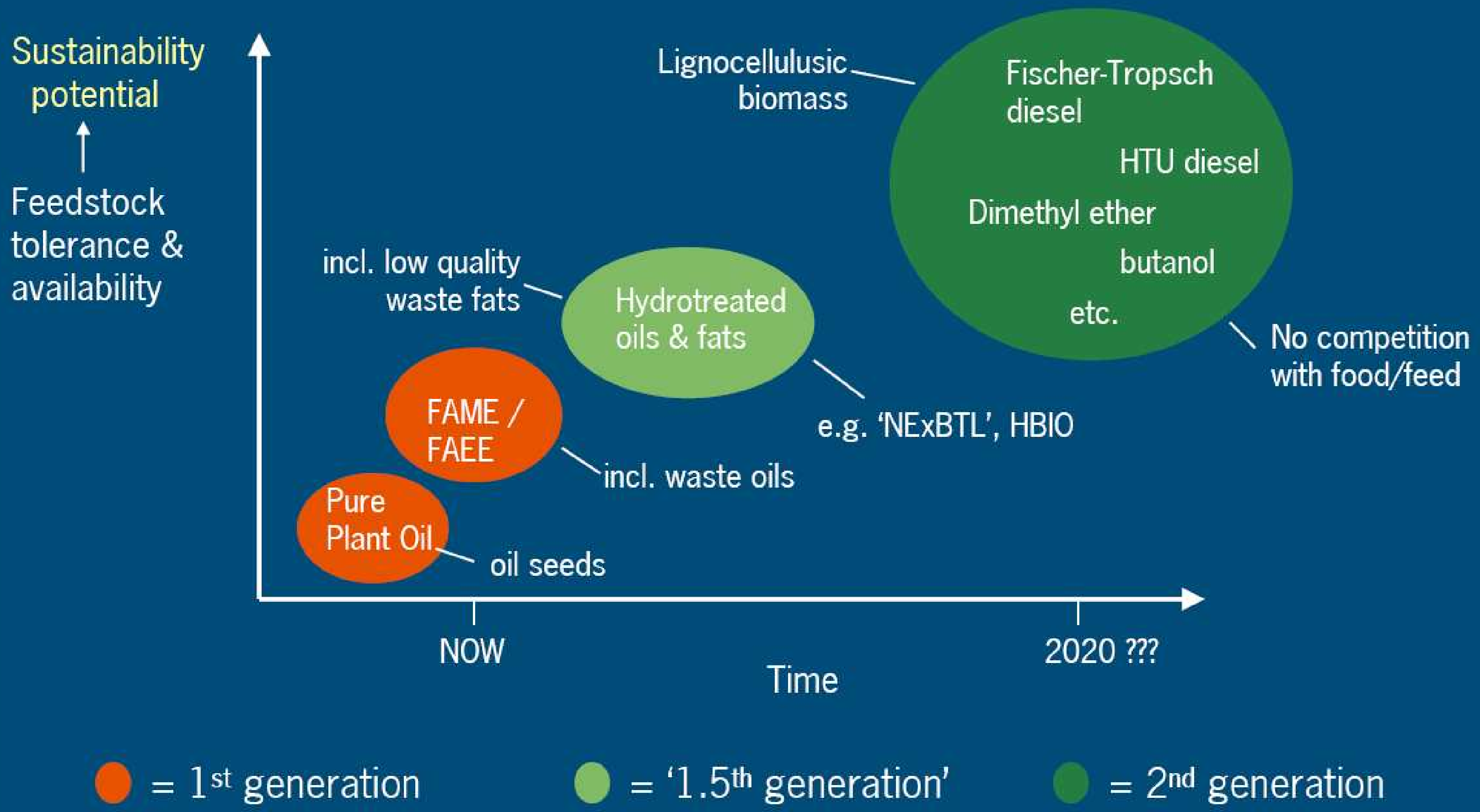
Current biological diesel alternatives

- 1st generation (oils and fats): small part of crop is used
  - PPO (Pure Plant Oil)
  - FAME (Fatty Acid Methyl Ester) and some FAEE (Fatty Acid Ethyl Ester)
- '1.5th'generation (can use lower quality oils and fats): 'renewable diesel'
  - "Hydro-treatment": production of paraffinsby hydrogenolysis
  - 'NExBTL'by NesteOil
  - 'HBio'by Petrobras
  - Very energy intensive: only feasible at large scale

Second generation'diesel alternatives

- Made from cheap, abundant, 'non-food'biomass), e.g.:
  - Fischer-Tropschdiesel (paraffinsfrom CO/H_2)
  - Dimethylether(DME from CO/H_2): CH_3OCH_3(kind of LPG for diesel engines)
  - HTU-diesel (Hydro Thermal Upgrading, 'Bio-oil')
  - Pyrolysis-diesel (hydrocarbons by anaerobic combustion)
- Butanol(by fermentation of carbohydrates)
  - Regarded as being potentially more sustainable
  - High feedstock flexibility
  - Almost whole crop can be used, less land needed
  - However: Fischer-Tropschonly viable on a large scale (i.e. refinery)

Diesel substitution by biofuels –outlook



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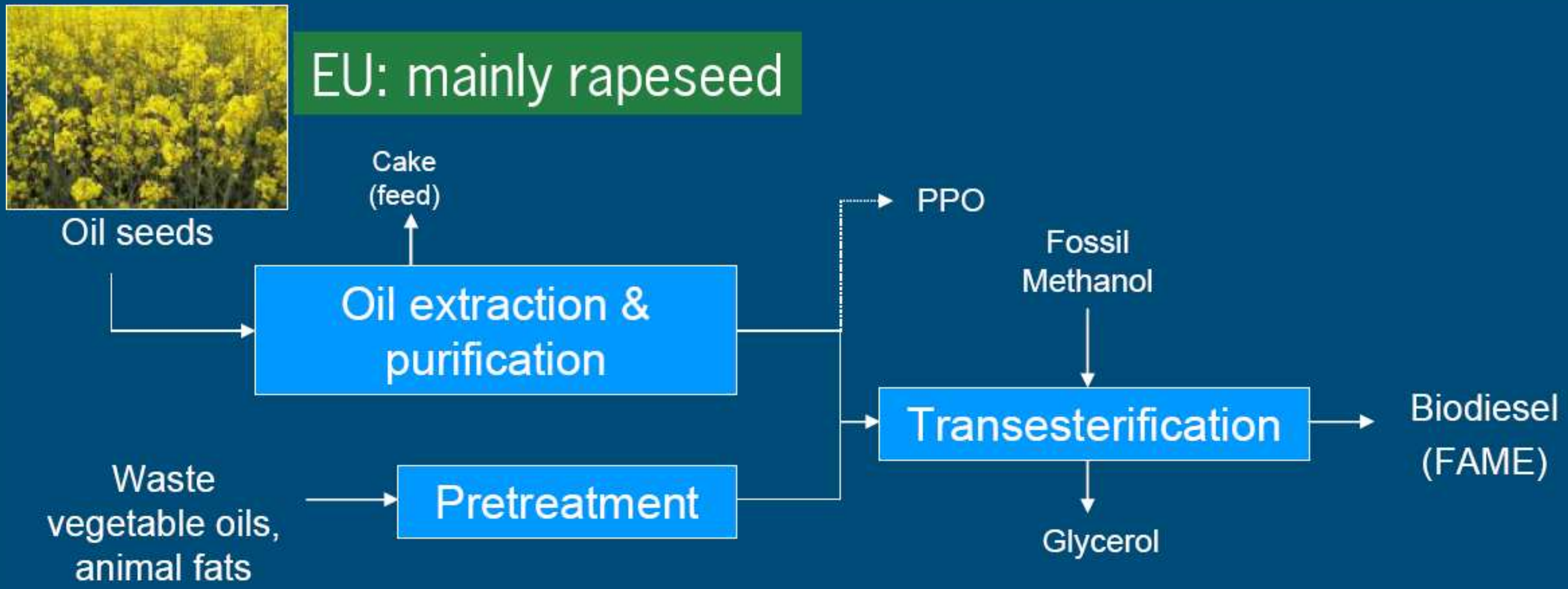
Conventional biodiesel productionEU:



Developments towards 100% ‘green’ biodiesel:

– Biodiesel-derived glycerol → biomethanol → transesterification

– Use of bioethanol instead of methanol

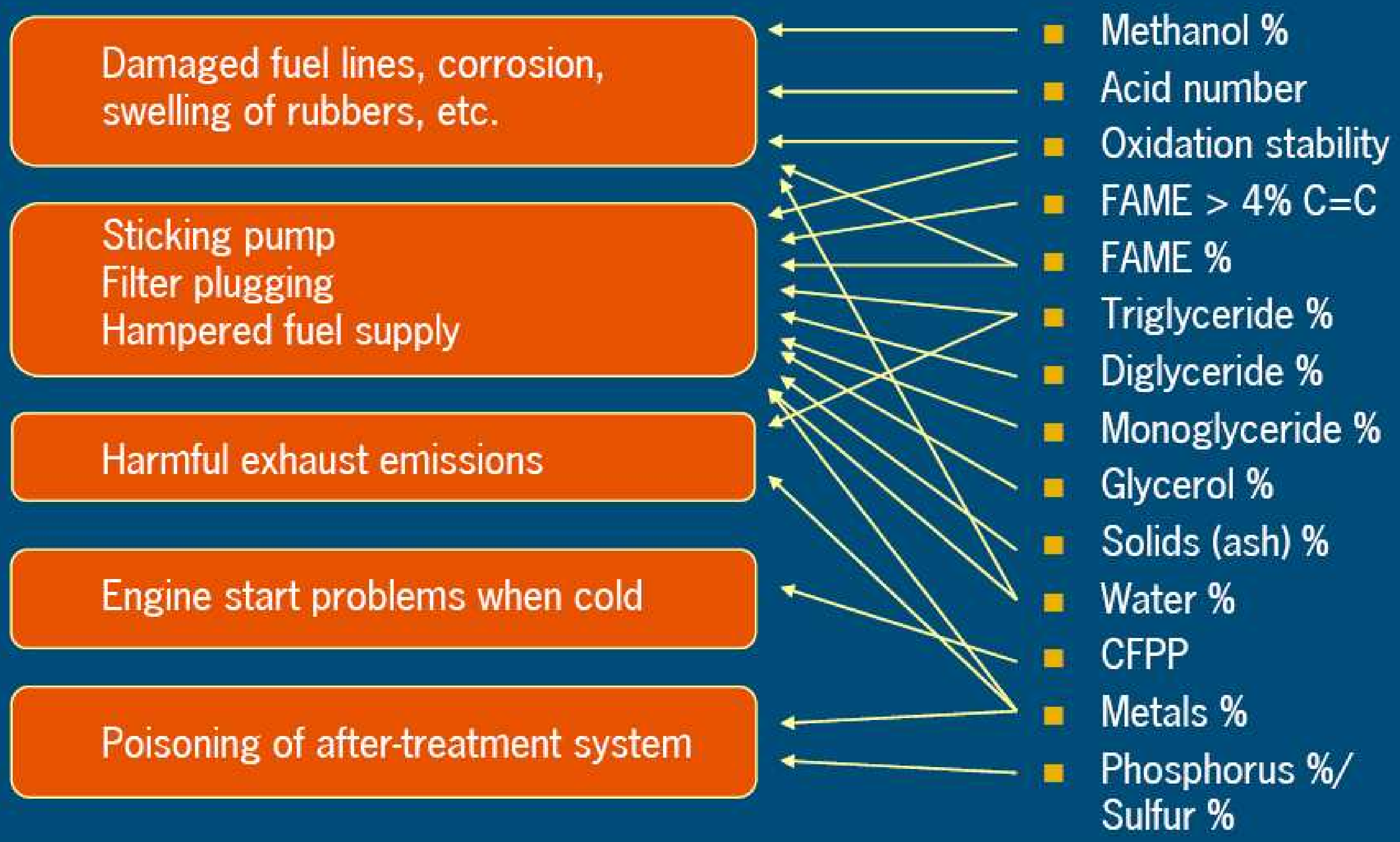
Biodiesel fuel quality

- Emission reduction and better fuel economy only possible with good quality fuels
- Fuel properties and quality determined by
  - Feedstock type, e.g. soybean versus rapeseed oil
  - Alcohol type, e.g. methanol versus ethanol
  - Feedstock purity, e.g. free fatty acid content (FFA%)
  - Production process (degree of conversion, purification)
  - Fuel additives
  - Storing and transportation conditions (air oxidation, hydrolysis)

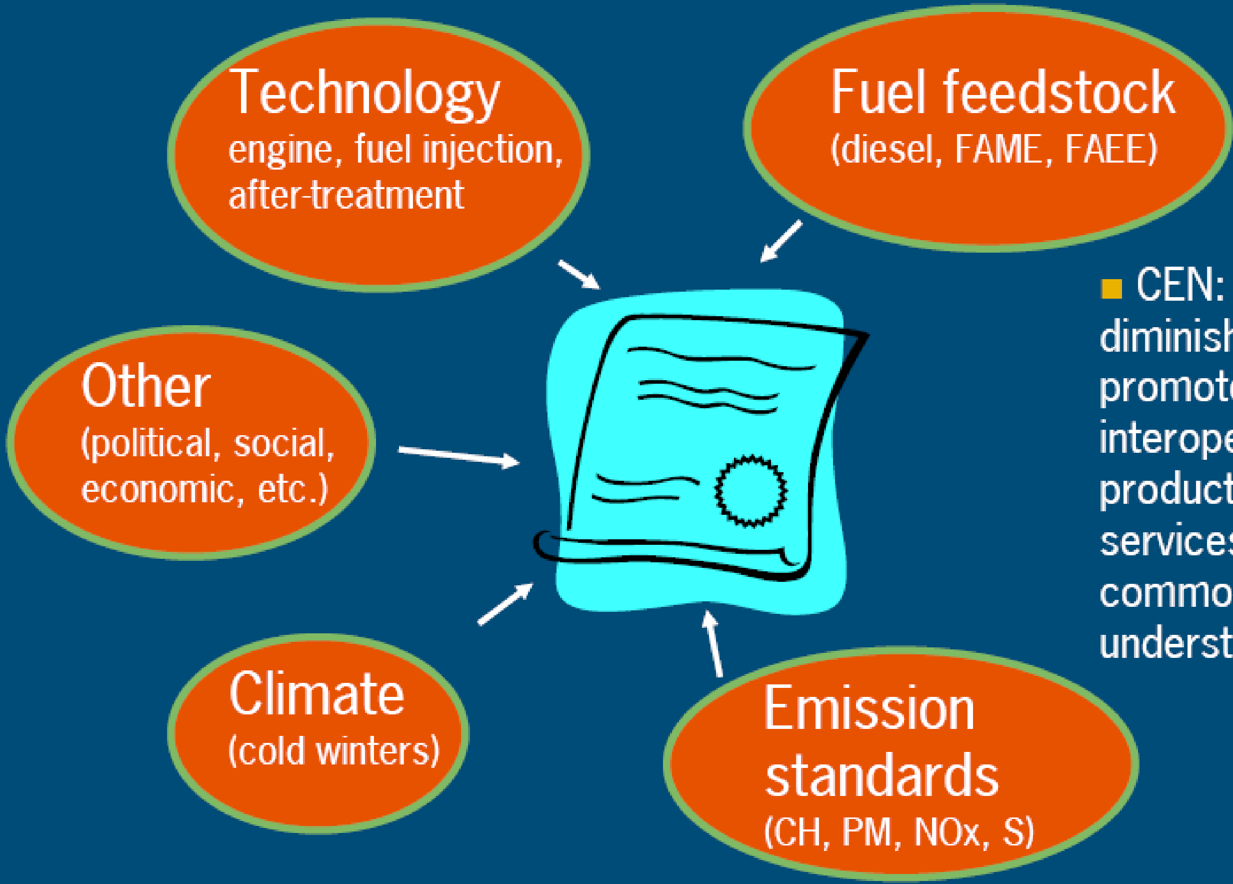
Trend: Multi-feedstock biodiesel factories (also in EU) to reduce cost

Quality control becomes even more important

Poor quality = big problems



The need for fuel quality standards



- CEN: 'Standardization diminishes trade barriers, promotes safety, allows interoperability of products, systems and services, and promotes common technical understanding.'

(Bio)diesel quality standards in EU

- EN 14214 (2003): Biodiesel for transport (*)
  - Based on existing national standards for FAME
  - FAME only (not FAEE)
  - 26 properties, to be measured with standardized test methods
  - Cold flow properties differ per region
- EN 590 (2003): diesel fuel
  - Adapted to allow up to 5% of biodiesel as FAME
  - FAME has to comply to EN 14214
- No standard for PPO, and no standard for 2nd generation fuels

(*) Biodiesel for heating: EN 14213

European feedstocks

- Rapeseed is most important oilseed crop, before sunflower and olive
  - Rapeseed meal is protein-rich animal feed
- EN 14214 is based on rapeseed methyl ester (RME)
  - RME was only fuel tested thoroughly as diesel alternative
  - OEM were reluctant to allow other FAME
    → reflected by inclusion of iodine value (IV)
    → limits options for sustainability
  - RME fatty acid composition happens to be suited for most European climates: good compromise of winter operability and oxidation stability

(Bio)diesel quality standards in Brazil

- National Biodiesel Program
  - Reduce diesel imports
  - Create income for family farmers in poor regions (North, North-East)
    - Tax incentives for biodiesel producers that buy crops from family farmers
  - Law: 2% in blends mandatory in 2008; 5% mandatory in 2013

- ANP 255 (2003): for blends up to B20
  - For private fleets
  - Properties and test methods based on EU and US standards
  - Both FAME and FAEE

- ANP 42 (2004): current biodiesel standard
  - To allow 2% in blends in 2008
  - Special test methods for fatty acid esters of 'uncommon' oils, e.g. castor oil

- ANP 310 : Diesel fuel

EU 14214 versus Brazilian ANP 42/2004

Property	*Unit*	*ANP 42*	*EN 14214*
Aspect	-	LII	-
Ester content	% (m/m)	Take note	≥ 96.5
Density at 20°C (BR)/15°C (EU)	kg/m^3	ANP 310	860–900
Kinematic viscosity at 40°C	mm^2/s	ANP 310	3.5–5.0
Flash point	°C	≥ 100	≥ 120
Sulfur content	mg/kg	Take note	≤ 10.0
Carbon residue 90% (EU)/100% (BR)	% (m/m)	≤ 0.10	≤ 0.30
Cetane number	–	Take note	≥ 51
Cold Filter Plugging Point	°C	ANP 310	*a*
Sulfated ash	% (m/m)	≤ 0.020	≤ 0.02
Water content	mg/kg	-	≤ 500
Water and sediments	% v/v	≤ 0.050	-
Total contaminants	mg/kg	Take note	≤ 24

Copper strip corrosion (3 hours at 50°C)	–	Class 1	Class 1
Oxidative stability at 110°C	hour	≥ 6	≥ 6.0
Acid number	mg KOH/g	≤ 0.80	≤ 0.50
Iodine number	g I_2/100 g	Take note	≤ 120
Linolenic acid content	% (m/m)	-	≤ 12
FAME with ≥ 4 C=C	% (m/m)	-	≤ 1
Methanol (EU)/ethanol (BR) content	% (m/m)	≤ 0.5	≤ 0.20
Monoglyceride content	% (m/m)	Take note	≤ 0.80
Diglyceride content	% (m/m)	Take note	≤ 0,20
Triglyceride content	% (m/m)	Take note	≤ 0.20
Free glycerol	% (m/m)	≤ 0.02	≤ 0.02
Total glycerol	% (m/m)	≤ 0.38	≤ 0.25
Alkali metals (Na + K)	mg/kg	≤ 10	≤ 5.0
Earth alkali metals (Ca + Mg)	mg/kg	Take note	≤ 5.0
Phosphorus content	mg/kg	Take note	≤ 10.0

Why are EU and Brazilian standards different?

- Brazil:
  - ethanol is almost as cheap as methanol
  - many different oilseed crops (but no rapeseed) in different regions
    - excluding certain crops has social consequences
  - no passenger cars on diesel
  - keep investments in testing equipment low

- EU:
  - Rapeseed is most abundant oilseed crop
  - some EU-countries have cold climates
  - more stringent emission restrictions

Brazilian feedstocks: EN 14214 compliance?

FAME	EN 14214 (B100)	Critical property	Other drawbacks
Rapeseed ME	PASS		
Soybean ME	FAIL	Iodine Value	Oxidation stability
Castor ME	FAIL	Viscosity	Cetane Value
Palm ME	FAIL	CFPP	
Jatropha ME	PASS		CFPP in winter

- Discussion:
  - Ethyl esters not covered by EN 14214
  - EN 14214 allows little room for additives
  - Iodine Value unnecessarily restrictive

Brazilian biodiesel and the EU standard

- In principle, Brazilian biodiesel may comply to EN 14214 by:
  - Using methanol and not ethanol
  - Blending soybean methyl ester (SME) with less unsaturated biodiesel (e.g. palm)
  - Partial hydrogenation of soybean oil or SME to reduce unsaturation → extra costs
  - Using additives such as antioxidants
- European Commission has submitted two new mandates that would allow:
  - FAEE as blend component in diesel and
  - up to 10% of biodiesel in diesel as either FAME or FAEE
- Possibly Iodine Value raised to 130 in EN 14214 (allows soybean ME)

Towards better standards

- A new standard should be focused on fuel *performance*
  - higher feedstock and technology flexibility → sustainability
    - e.g. enzyme catalysis / partial esterification (Fraunhofer/Vital Planet)
    - 2nd generation technology
    - prevent loss of biodiversity
  - more room to use *additives*
  - fatty acid *ethyl* esters (FAEE)
- UN: International Biofuels Forum → ISO standards desired
  - Brazil, US, EU, China, India, South Africa

Global standards harmonization efforts

- Worldwide Fuel Charter: fuel quality recommendations
  - Published by an alliance of automobile and engine manufacturers
  - Four categories of fuel quality, based on emission requirements (Cat. 4 is best, allows e.g. Euro 4 and Euro 5 emission standards)

- ISO Technical Committee 28 ‘Petroleum products and lubricants’, Subcommittee ‘Liquid Biofuels”
  - Global standard hard to accomplish
  - Probable outcome: ‘two-tier approach’:
    - one ‘base fuel’ standard that can be traded
    - several regional ‘fit-for-purpose’ standards

Future quality standards developments

- Recent ‘renewable biodiesel’ (NExBTL, HBio-blends) even better/cleaner than fossil diesel
  - easily comply to EN 590
  - enables better after-treatment technology
  - ready for EURO 5

- Second generation biofuels standards
  - many different feedstocks
  - large availability
  - more sustainable than conventional biofuels

Conclusions

- Wide range of feedstock options contributes to overall sustainability
- Investments in conventional biodiesel technologies (incl. area expansions for oil crops) should be weighed against arrival of 2nd generation technologies and standards
- Current EU standard should be adapted to allow for a larger number of feedstocks
- Currently, many Brazilian one-crop biodiesels do not comply to EN 14214 (does Brazil care?)
- High costs for testing equipment will be a major hurdle for small scale initiatives
- A global quality standard is unlikely to appear, due to large regional differences
- Much is expected from HBio and related 'renewable biodiesel' technologies

- Obrigado