



Towards criteria for the sustainable use of biobased materials:

Lessons learnt from biofuels

Dr rer nat Guido Reinhardt

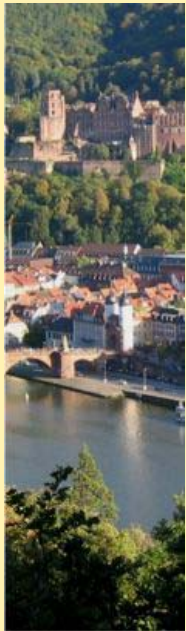
OECD Workshop

“Best Practices in Assessing the Environmental and Economic
Sustainability of Bio-based Products”

July 23 – 24, 2009, Montreal, Canada

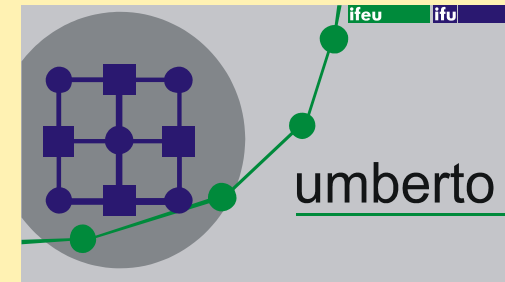
IFEU - Institute for Energy and Environmental Research Heidelberg, since 1978

- **Independent scientific research institute**
- **organised as a private non profit company with currently about 40 employees**
- **Research / consulting on environmental aspects of**
 - **Energy (including Renewable Energy)**
 - **Transport**
 - **Waste Management**
 - **Life Cycle Analyses**
 - **Environmental Impact Assessment**
 - **Renewable Resources**
 - **Environmental Education**



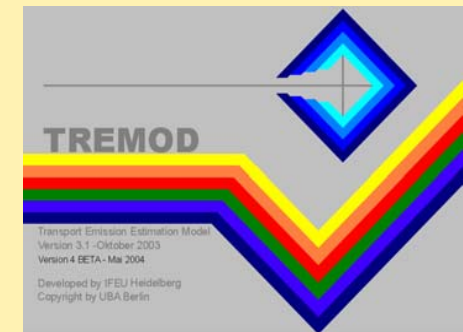
Life cycle analyses (LCA) and technology impact assessments since 1990:

- Biofuels (all biofuels, all applications)
- Food, feed, biobased materials
- Alternative transportation modes
- Renewable Energy
- etc.



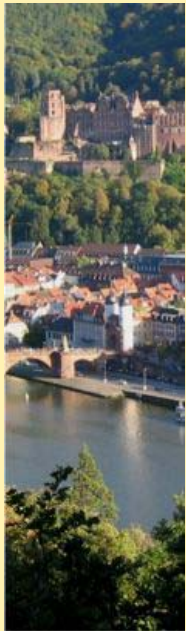
TREMOD: Transport Emission Model

- Modelling emissions of road vehicles, trains, ships and airplanes
- Official database of the German Ministries for emission reporting



IFEU - Institute for Energy and Environmental Research Heidelberg, since 1978

- **Our clients (on biomass studies)**
 - World Bank
 - UNEP, GTZ, FAO, UNFCCC etc.
 - European Commission
 - National and regional Ministries
 - Associations (national and international)
 - Local authorities
 - WWF, Greenpeace, Friends of the Earth etc.
 - Companies (Daimler, Shell, German Telekom, etc.)
 - Foundations (German Foundation on Environment, British Foundation on Transport etc.)





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Existing sustainability schemes



Biomass for energy	RSPO ^{a)}	Roundtable on Sustainable Palm Oil
	RTRS ^{a)}	Roundtable on Responsible Soy
	GGL	Green Gold Label (Eugene)
Forestry	FSC	Forest Stewardship Council
	PEFC	Program for Endorsement of Forest Certification
	CERTFOR	CERTFORCHILE Sistema Chileno de Certificación de Manejo Forestal Sustentable
	MTCC	Malaysian Timber Certification Council
Agriculture and agricultural production	IFOAM	International Federation of Organic Agriculture Movements
	SAN	Sustainable Agriculture Network
	EUREP-GAP	Euro-Retailer Produce Working Group - Good agricultural practice
	SQF	Safe Quality Food
	Bioland	
	BIO	Organic Farming – EC control system
Social standards	CCCC	Common Code for the Coffee Community
	ETI Base Code	Ethical Trading Initiative Code of Conduct
	FLO	Fair-trade Labelling Organisations International
Labels for Electricity	FLP	Flower-Label Program
	GSL	Grüner Strom Label
	OK Power green-e	

Most promising existing schemes



Positive examples with prove of practice:

Forest Stewardship Council, FSC:

Forestry or wood label; since 2003 also with plantation standard:

Positive aspects include in particular the organization and decision-making structure (three-chamber principle), the independent monitoring (third-party auditing), the comprehensive standards (criteria) and the strict traceability system (chain of custody), in which the principle of mass balance (mixed resources) is also applied in addition to the “classical” track-and-trace. The FSC Label enjoys great credibility.

Sustainable Agriculture Network, SAN:

Agricultural label directed specially at tropical cultivation regions:

This label is subject to a very extensive catalogue of ecological and socio-economic criteria. The confirmation system and the participation of vested interest groups are assessed very positively in comparison to the FSC. The label enjoys very high credibility, although it is only little known.

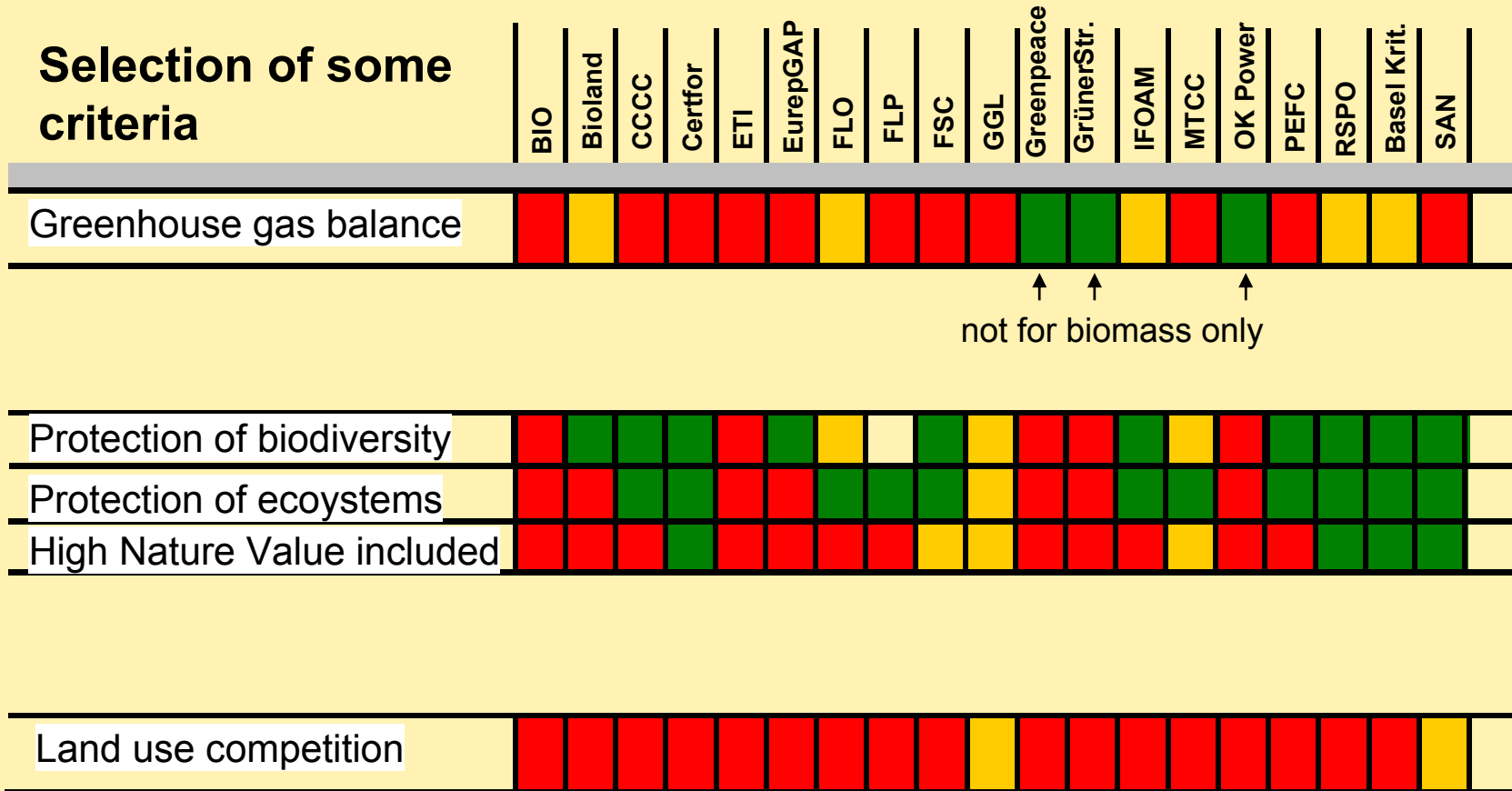
Euro-Retailer-Produce-Working Group - Good Agriculture Practice (EurepGAP):

This internal retail certification system for agricultural products is also subject to a very strict chain of custody, whose control effect is based on the strong self-interest of the retail trade. Here again, there is high credibility, although the label is little known in consumer circles.

Examples for criteria considered



Selection of some criteria



↑ ↑ ↑
not for biomass only

- Not addressed
- Addressed but unclear practice
- Addressed and clear practice
- No evaluation possible

Criteria addressed in existing schemes

	BIOMASS			AGRICULTURE				FORESTRY				SOCIAL			ENERGY					
	GGL	RSPO	Basel Crit.	BIO	Bioland	CCCC	EurepGAP	IFOAM	SAN	Certfor	FSC	MTCC	PEFC	ETI	FLO	FLP	Greenpeace	Grüner Strom	OK Power	
FRAMEWORK	Governance																			
	Governance structure																			
	Basis for participation (e.g. voluntary)																			
	Representation / members																			
	Standard setting																			
	Standard setting process																			
	Stakeholder participation																			
	Verification																			
	Reviewer																			
	Evaluation Process																			
Local stakeholder involvement																				
Publication of results																				
Qualification of verification bodies																				
Accreditation bodies																				
Accreditation process																				
Monitoring																				
Claims and Product Tracking																				
Claim																				
Material tracking																				
Validity of claims																				
Labelling																				

- Not addressed
- Addressed but unclear practice
- Addressed and clear practice
- No evaluation possible

	BIOMASS			AGRICULTURE				FORESTRY				SOCIAL			ENERGY				
	GGL	RSPO	Basel Crit.	BIO	Bioland	CCCC	EurepGAP	IFOAM	SAN	Certfor	FSC	MTCC	PEFC	ETI	FLO	FLP	Greenpeace	Grüner Strom	OK Power
Land-use competition																			
Land-use competition (energy vs. competing land uses)																			
Socio-economic issues																			
Social aspects by stakeholder consultation																			
Land rights (Indigenous peoples, local communities...)																			
Freedom of association, collective bargaining																			
Labour conditions, basic treatment																			
Not permanent employed																			
Child labour; forced labour																			
Wages and compensation																			
Health and safety																			
Discrimination (sex, age, handicap, religion, nationality)																			
Training – capacity building, development of skills																			
Change of way of life, economy and culture, (important, indigenous people)																			
Struggle against poverty (Equitable distribution of returns)																			
Fair trade conditions																			
Complain mechanism																			
Others																			
Environmental land-use issues																			
Conservation of Biodiversity																			
Protection species/ecosystems																			
Soil – erosion																			
Water resources – depletion/loss																			
Chemicals – nutrients/pesticides (how addressed, what is affected)																			
GMOs (genetically modified organisms)																			
National land use regulations																			
High nature values addressed																			
Others																			
Life-cycle aspects																			
Social-issues in life-cycle addressed																			
Energy balance (whole the production chain)																			
Removed resources balance addressed (nutrients, organic matter)																			
Water resources – contamination																			
Soil – contamination																			
Safeguard subject climate addressed																			
GHG balance: (only CO2 emission / more complex approach)																			
Air pollution (NOx, SO2, POP, others...)																			
Waste management addressed																			
Others																			

CRITERIA

Sustainability standards for biofuels



Government Initiatives:

- **Netherlands**: “Cramer Commission”/Ministry of Environment. Involved organisations: Senternovem (lead-manager), CE, Ecofys, University of Utrecht
- **United Kingdom**: Low Carbon Vehicle Partnership/Department of Transport. Involved organisations: E4Tech, Ecofys
- **Brazil**: National Institute of Meteorology, Standardization and Industrial Quality (INMETRO) develops sustainability standard with focus on sugar cane ethanol. „Social Fuel Label“ with focus on biodiesel.
- **EU**: Proposal for EU-Directive

International Initiatives:

- **ISO** → **CEN** → **FAO**

Multistakeholder Initiatives:

- **GBEP** Global Bioenergy Partnership
- **RSB** Roundtable on Sustainable Biofuels
- **RSPO** Roundtable on Sustainable Palm Oil (Pilot phase)
- **RTRS** Roundtable on Responsible Soy

→ **No standard fully implemented yet (running activities)**

Principles and criteria in biofuel related schemes



Principles and criteria	GER BSR	EU Dir RES	NL	UK	WWF	RSB
Carbon performance:						
GHG emission saving	X	X	X	X	X	X
Carbon conservation:						
Preservation of ... above ground carbon stocks	(X)	X	X	X	(X)	(X)
... below ground carbon stocks	(X)	X	X	X	(X)	(X)
Explanation:						
X: addressed and consolidated by a detailed number of indicators or elaborate methodology						
X: directly addressed but low level of specification						
(X): indirectly addressed						
GER BSR: German Biomass Sustainability Regulation (Draft)						
EU Dir RES: EC Directive 2008/0016 (COD): proposal for Directive on the promotion of the use of energy from renewable sources						
NL: Cramer et al. [2007]						
UK: Department for Transport [2008]						
WWF: WWF/Öko-Institut [2006]						
RSB: RSB [2007]						

Principles and criteria in biofuel related schemes



Principles and criteria	GER BSR	EU Dir RES	NL	UK	WWF	RSB
Food competition:						
No competition with food, local energy supply, medicines and building			X		X	X
Biodiversity conservation:						
Biomass production will not lead to the destruction or damaging of high biodiversity areas	X	X	X	X	X	X
Soil conservation:						
Biomass production does not lead to soil degradation	X		X	X	X	X
Sustainable water use:						
Biomass production does not lead to the contamination or depletion of water sources	X		X	X		X
Air quality:						
Biomass production does not lead to air pollution	X		X	X	X	X

Principles and criteria in biofuel related schemes



Principles and criteria (taken from NL/UK)	NL	UK	WWF	RSB
Prosperity: Biomass production contributes to local and national prosperity Positive contribution of production activities to local economy and local industries	X		X	X
Social Well-Being Production of biomass contributes to the well-being of workers and local population No negative effects on working conditions of workers No violation of human rights No violation of prosperity rights and rights of use Positive contribution to social conditions of local population No violation of integrity	X		X	X

Principles and criteria in biofuel related schemes



Principles and criteria (taken from NL/UK)	NL	UK	WWF	RSB
Labour standards		X		
Compliance with law on national working condition				
Legal contracts with transparency about employees' rights				
Freedom of association and right to collective bargaining (ILO)				
Regulation of workings hours (ILO, SASA)				
Child labour restricted				
Health and safety			X	
Wages/compensation at least at the level of legal national minimum				
No discrimination (ILO, SASA)				
No forced labour				
Land use rights and participation		X	X	X
Land right issues and consultation of local stakeholders				

Biofuels: Most relevant schemes



- **EU Res Dir** **Renewable Energy Sources Directive**
- **GBEP** **Global Bioenergy Partnership**
- **ISO/PC** **Sustainability criteria for bioenergy**
- **CEN TC 383** **Sustainability criteria for biomass**
- **BIAS** **Bioenergy Environmental Impact Analysis**



Scope concerning biomass sustainability issues developed during 2008, reflecting the previously discussion in several MS (NL, UK, DE etc.)

Passed in June 09 → has to be implemented by member states until 5th December 2010

Biomass sustainability concerns 3 articles:

Art. 17: Sustainability criteria for biofuels and bioliquids

Art. 18: Verification of compliance

Art. 19: Calculation of greenhouse gas impact



Article 17:

Sustainability **criteria** for biofuels and bioliquids

Compliance for national biofuel targets, obligations and eligibility for financial support.

- (1) **GHG saving shall be at least 35%** (enhanced after 2016)
- (2) **Not from land with high biodiversity** (status after 01/2008)
- (3) **Not from lands with high carbon stocks**
- (4) **Not from peatland**
- (5) **Within EU biomass prod. requires Cross Compliance**
- (6) **Bi/multilateral agreements**
→ report on soil/water/air, ILO, Cartagena/CITES

Sustainability issues and principles



Issues	Principle
Mitigation of greenhouse gas emission	1. There has to be a significant contribution to greenhouse gas mitigation.
Land use practices and land use changes	2. Minimizing indirect land use change and keeping balance in terms of land use competition. 3. The loss of habitats of high nature value (HNV) shall be prevented. 4. The loss of biodiversity shall be prevented. 5. Negative impacts on soil, water and air shall be minimized.
Impact on social-economic aspects	6 Local population shall not suffer drawbacks but participate in opportunities. 7 international agreed labour conditions has to be respected

Issue: land use practices and land use changes

Principle	Criteria
2 Minimize negative effects of indirect land use change and keeping balance in terms of land use competition	2.1 Binding goals regarding land use and conservation of quality of nature in the producing country 2.2 Land use policy promotes use of degraded land, that does not compete with other protection objectives 2.3 If there are no objectives nor a national land use policy, biomass producer must prove that in his case no competition between land uses occurs.

Issue: land use practices and land use changes

Principle	Criteria
3 The loss of habitats of high nature value (HNV) shall be prevented	3.1 Analyses if HNV are present and affected on the claimed area must be available. 3.2 Primary vegetation and area with HNV are not converted into farmland; satellite picture proof with 2005 reference 3.3 No drainage of wetlands. 3.4 Adequate protection distance between cultivated area and HNV

Issue: land use practices and land use changes

Principle	Criteria
4 No loss of biodiversity	4.1 Preservation and/or improvement of biodiversity on-farms. 4.2 A fixed portion of set aside area shall be allocated. 4.3 The requirements of the Convention on Biological Diversity (CBD) have to be adopted and put into action (if the country has signed) 4.3 Genetic modified organisms (GMO) have to be avoided

Issue: land use practices and land use changes

Principle	Criteria
5 Negative impacts on soil, water and air shall be minimized	5.1 Minimisation of soil erosion. 5.2 Water consumption adapted to regional resources. 5.3 Minimise inputs into water bodies. 5.4 Proof of fertilisation adapted to the needs. 5.5 Minimise pesticide application to the necessary degree 5.6 Minimise emission of air pollutants

Sustainability principles and criteria



Issue: socio-economic aspects

Principle	Criteria
6 local population shall not suffer drawbacks but participate in opportunities from biomass	6.1 Stakeholders with socio-economic interests are integrated in all procedures 6.2 Struggle against poverty 6.3 Fair trade conditions are given 6.4 Land rights are respected 6.5 Complaints mechanism are given
7 Labour conditions	7.1 The right to organize, freedom of association and collective bargaining. 7.2 Child labour must be prevented. 7.3 Forced labour must be prevented. 7.4 Wages and compensation are regulated 7.5 Regulations about health and safety 7.6 There is no type of discrimination 7.7 Training and capacity building is given

Most relevant schemes



- **EU Dir** **Renewable Energy Sources Directive**
- **GBEP** **Global Bioenergy Partnership**
- **ISO/PC** **Sustainability criteria for bioenergy**
- **CEN TC 383** **Sustainability criteria for biomass**
- **BIAS** **Bioenergy Environmental Impact Analysis**

Global Bioenergy Partnership



- **Launched at the G8 Summit 2005 in Gleneagles to initiate an international discussion on the issues related to bioenergy**
- **Objective: support "bioenergy deployment, particularly in developing countries" and „to work on biofuel best practices and take forward ... sustainable development of bioenergy“.**
- **Members G8 + 5 (originally), meanwhile: 18 countries, 10 organizations + 20 observers.**
- **In 10/07 the Task Force GHG methodology started**
- **In 06/08 the Task Force Sustainability started work**

Global Bioenergy Partnership



Task Force GHG sustainability:



- **Develops a set of global science-based criteria and indicators regarding the sustainability of bioenergy → useful platform.**
- **Provisional criteria:**
GHG emissions, natural resource utilisation and impacts, indirect effects, resource availability and use efficiency, economic development, economic viability and competitiveness, rural and social development, food security, issues of access to energy and natural resources, labour and human health issues and energy security
- **Next step: developing science-based indicators reviewing the criteria**



Scope:

- a.) Detailing of the given European regulatory sustainability themes in the area of renewable energy, laying down indicators, methodologies and guidance for the legally given criteria.
- b.) **Elaborate on and define possible additions to the given criteria and methodologies** related to the European regulatory sustainability themes in the area of renewable energy.

Conflict with DG TREN:

→ re-definition of the work: only offering supporting contribution useful in the context of practical implementation of the requirements of the RES Directive

EU criteria for organic farming



Criteria:

- Land related crop cultivation and livestock production
- Restriction of the use of external inputs
- High animal welfare standards
- Recycling of wastes and by-products of plant and animal origin as input in plant and livestock production
- Use of genetically modified organisms (GMO) is excluded
- Mineral nitrogen fertiliser shall not be used
- Natural and mechanical pest, disease, and weed control



German national label for organic production according to the Council regulation (EC) No 834/2007

Findings



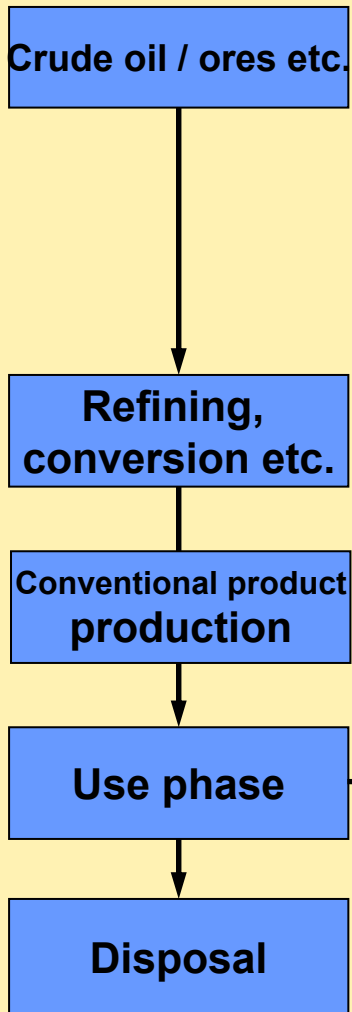
The provision of biomass is well addressed in existing initiatives for the sustainable production of biomass and biofuel related initiatives (**except for marine and freshwater resources**)

→ **No need to reinvent the wheel: no need to implement a new institution to develop criteria concerning the sustainable provision of biomass**

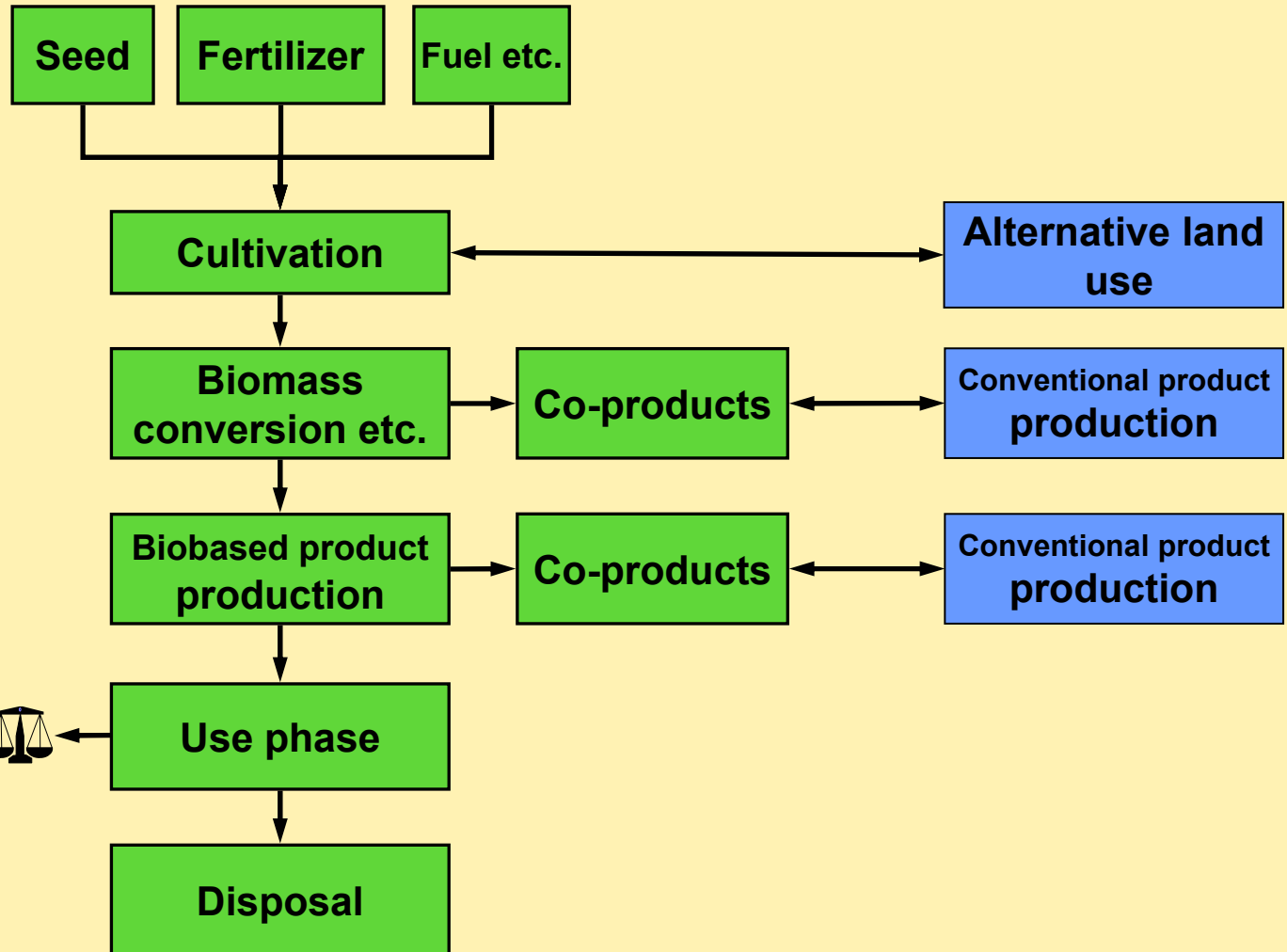
→ **Nevertheless, there are some issues to tackle:**

Biobased products: life cycle

Conventional product



Biobased product



credits

Biobased products: life cycle



Conventional product

Biobased product

credits

Crude oil / ores etc.



Refining, conversion etc.

Conventional product production

Use phase

Disposal

Seed

Fertilizer

Fuel etc.



Cultivation

Biomass conversion etc.

Biobased product production

Use phase

Disposal

→ Addressed in biofuel related initiatives (except marine and freshwater resources)

Co-products

Conventional product production

Co-products

Conventional product production



Co-products

Use phase

Co-products

Open loop recycling

Co-products

Biodegradability

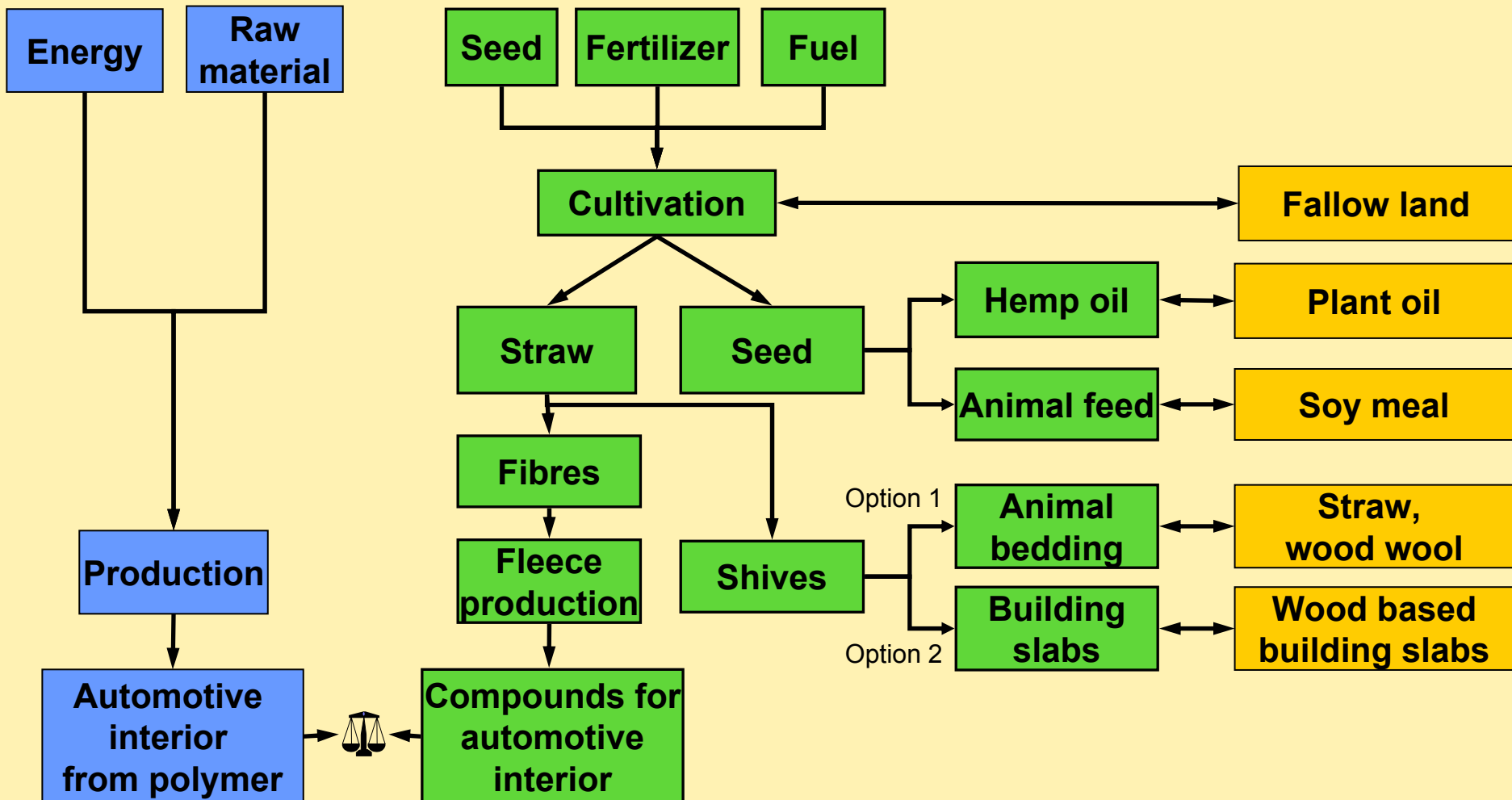
Biobased products: co-product handling

Automotive interior

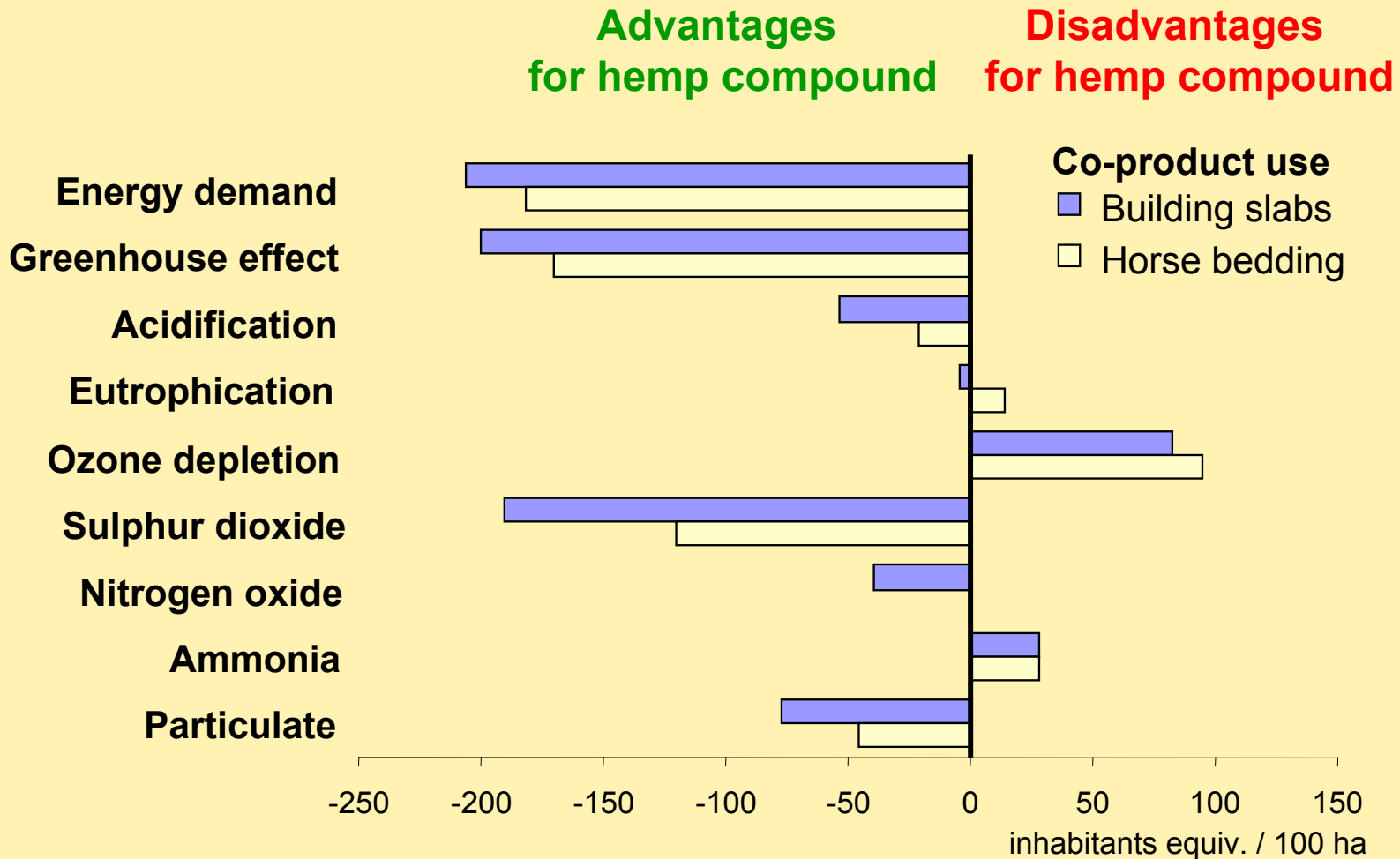
conventional

from hemp

credits



Life cycle results for an automotive interior



Life cycle results for an automotive interior

Advantages
for hemp compound

Disadvantages
for hemp compound



- Results can differ a lot (significantly)
- Need for proper co-product handling in sustainability criteria schemes for biobased products
- Today, co-product handling is not yet addressed sufficiently in sustainability criteria schemes for biobased products

Biobased products: life cycle



Conventional product

Biobased product

credits

Crude oil / ores etc.



Refining, conversion etc.

Conventional product production

Use phase

Disposal

Seed

Fertilizer

Fuel etc.



Cultivation

Biomass conversion etc.

Biobased product production

Use phase

Disposal

→ Addressed in biofuel related initiatives (except marine and freshwater resources)

Co-products ↔ Conventional product production

Co-products ↔ Conventional product production



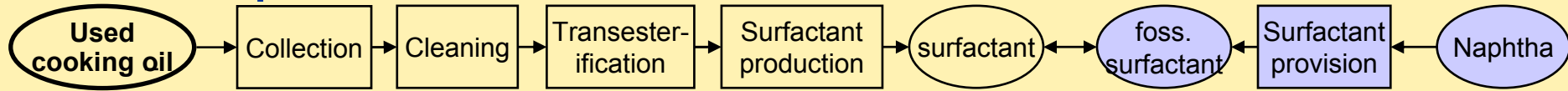
← Co-products
← Use phase

← Open loop recycling

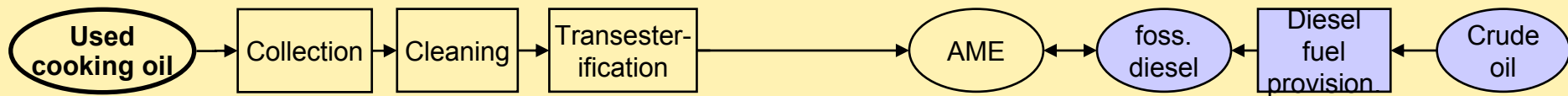
← Biodegradability

Different usage options

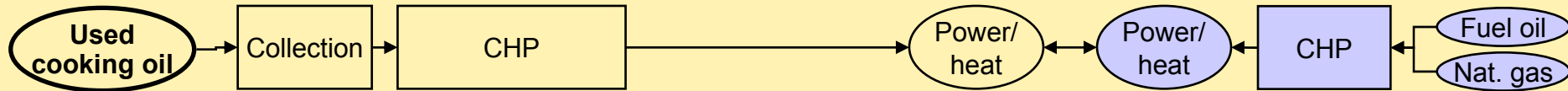
Surfactant production



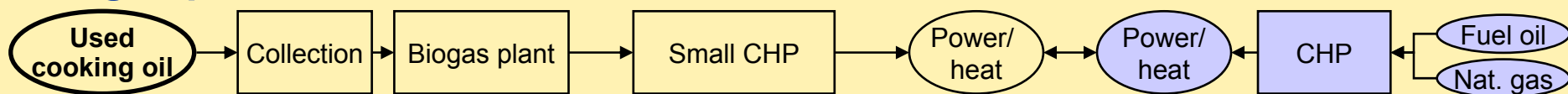
Biodiesel



Small CHP



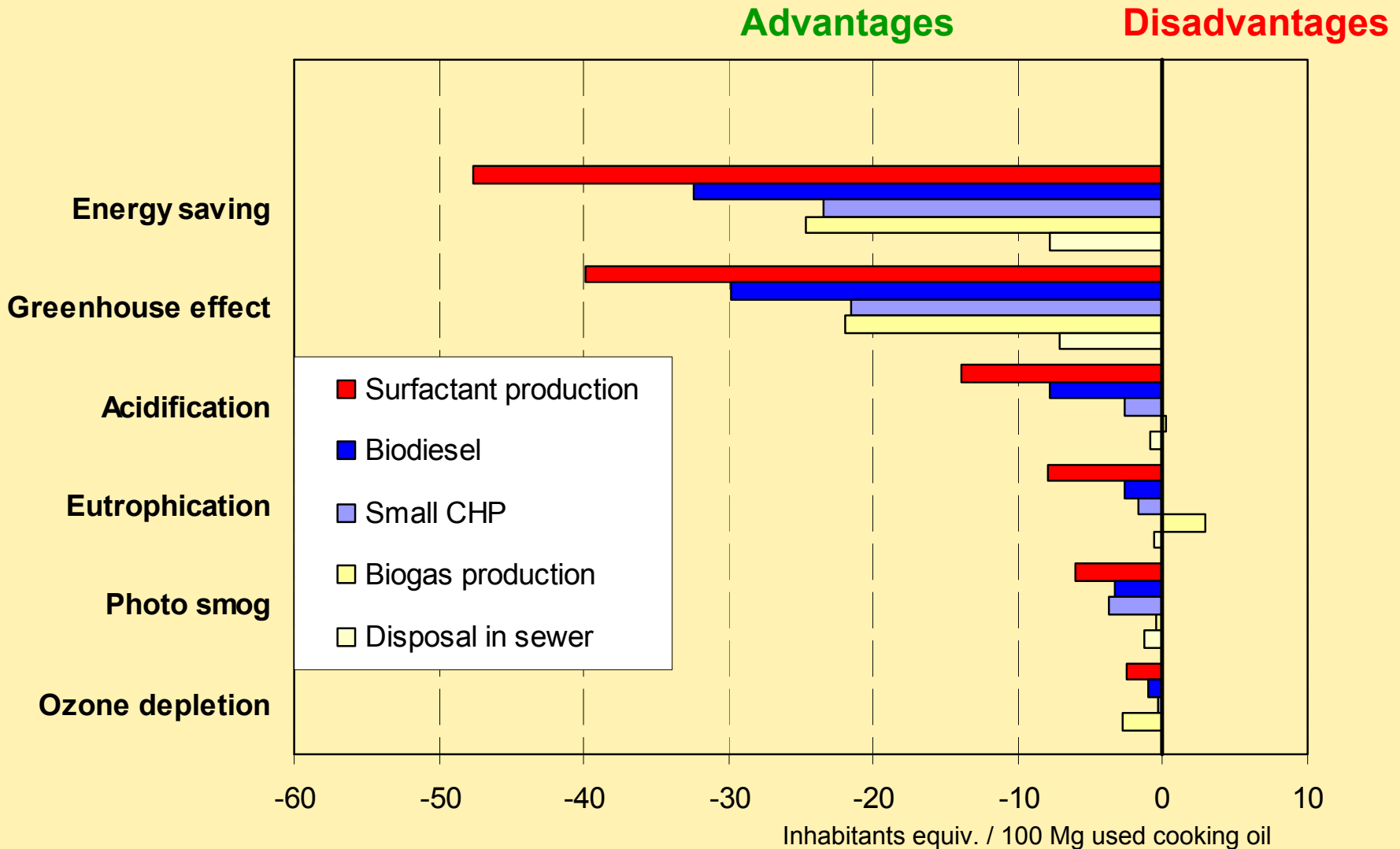
Biogas production



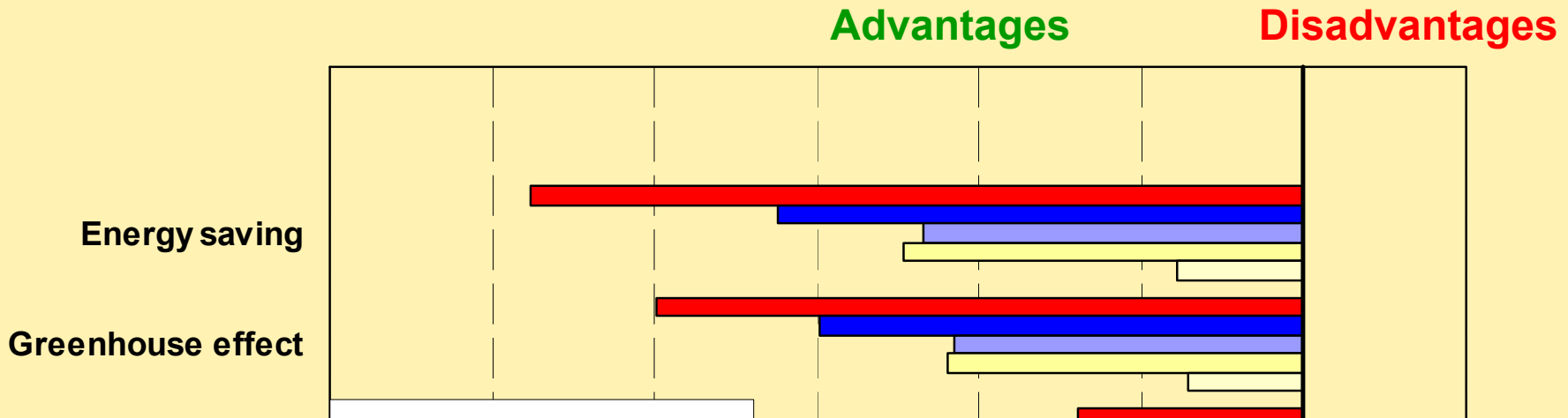
Disposal in sewer



Different usage options



Different usage options



- ➔ **Results can differ a lot (significantly)**
- ➔ **Need for proper use phase handling in sustainability criteria schemes for biobased products**
- ➔ **Today, criteria for usage phase is under discussion for biofuel issues (efficiency factor), but no final conclusion available yet**

Biobased products: life cycle



Conventional product

Crude oil / ores etc.

Refining, conversion etc.

Conventional product production

Use phase

Disposal

Biobased product

Seed Fertilizer Fuel etc.

Cultivation

Biomass conversion etc.

Biobased product production

Use phase

Disposal

credits

→ Addressed in biofuel related initiatives (except marine and freshwater resources)

Co-products ↔ Conventional product production

Co-products ↔ Conventional product production

← Co-products Use phase

← Open loop recycling

← Biodegradability

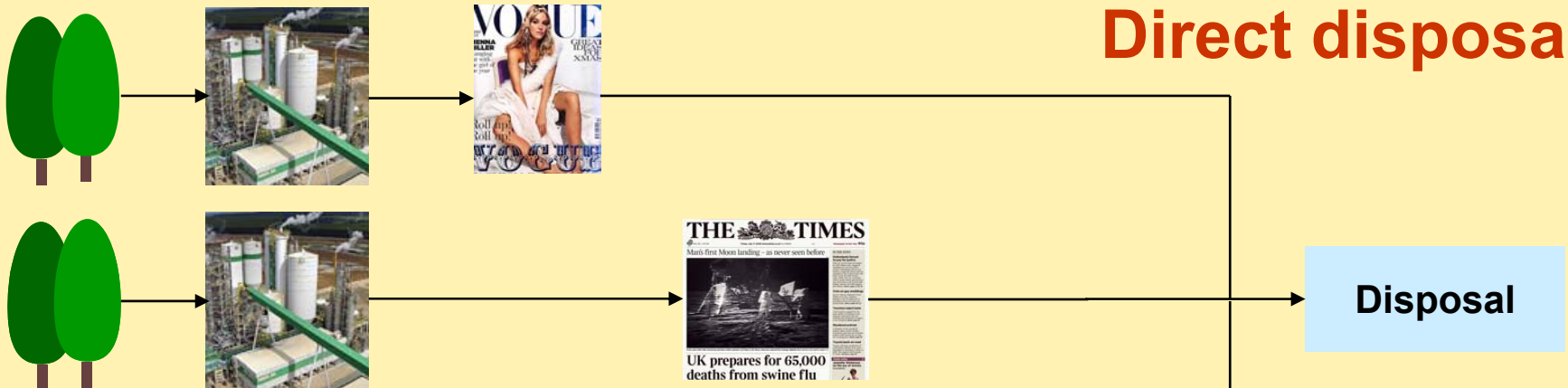


Open loop recycling

Open loop recycling



Direct disposal



Crude oil

Plastic

Plastic box

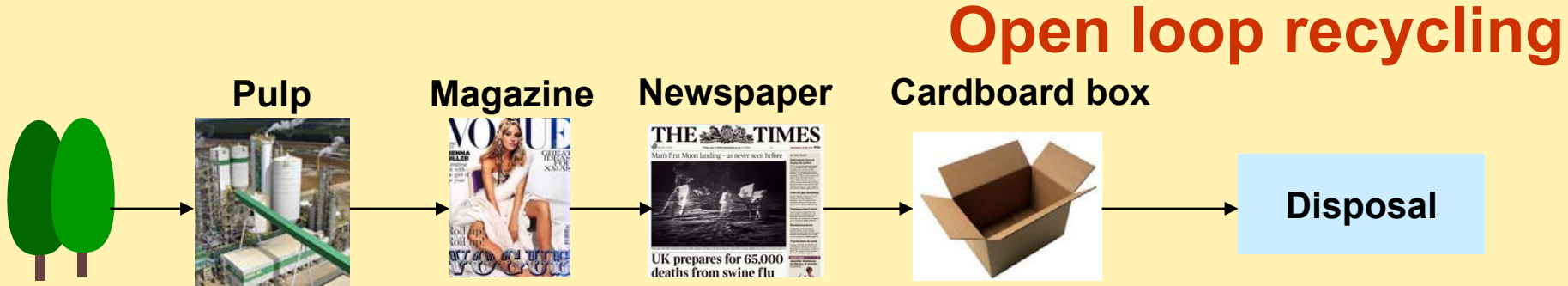
Recycling



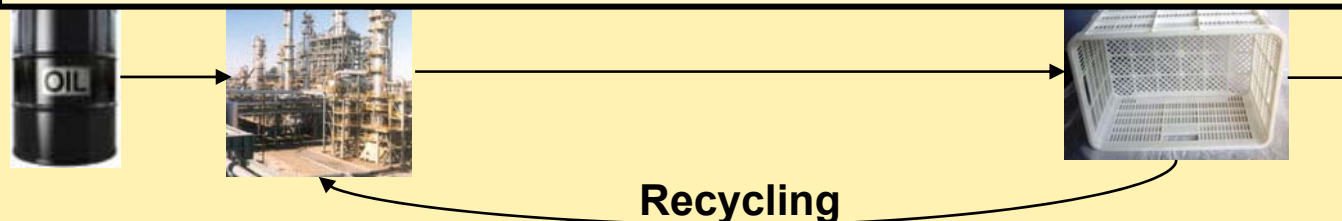
Disposal



Open loop recycling



- ➔ Need to include open loop recycling issues in sustainability criteria schemes for biobased products
- ➔ Today, co-product handling is not yet addressed sufficiently in sustainability criteria schemes for biobased products



Biobased products: life cycle



Conventional product

Biobased product

credits

Crude oil / ores etc.

Seed

Fertilizer

Fuel etc.

→ Addressed in biofuel related initiatives (except marine and freshwater resources)

Cultivation

Refining, conversion etc.

Biomass conversion etc.

Co-products

Conventional product production

Conventional product production

Biobased product production

Co-products

Conventional product production

Use phase

Use phase

Co-products

Use phase

Disposal

Disposal

Co-products

Open loop recycling

Biodegradability



Biobased products: Biodegradability

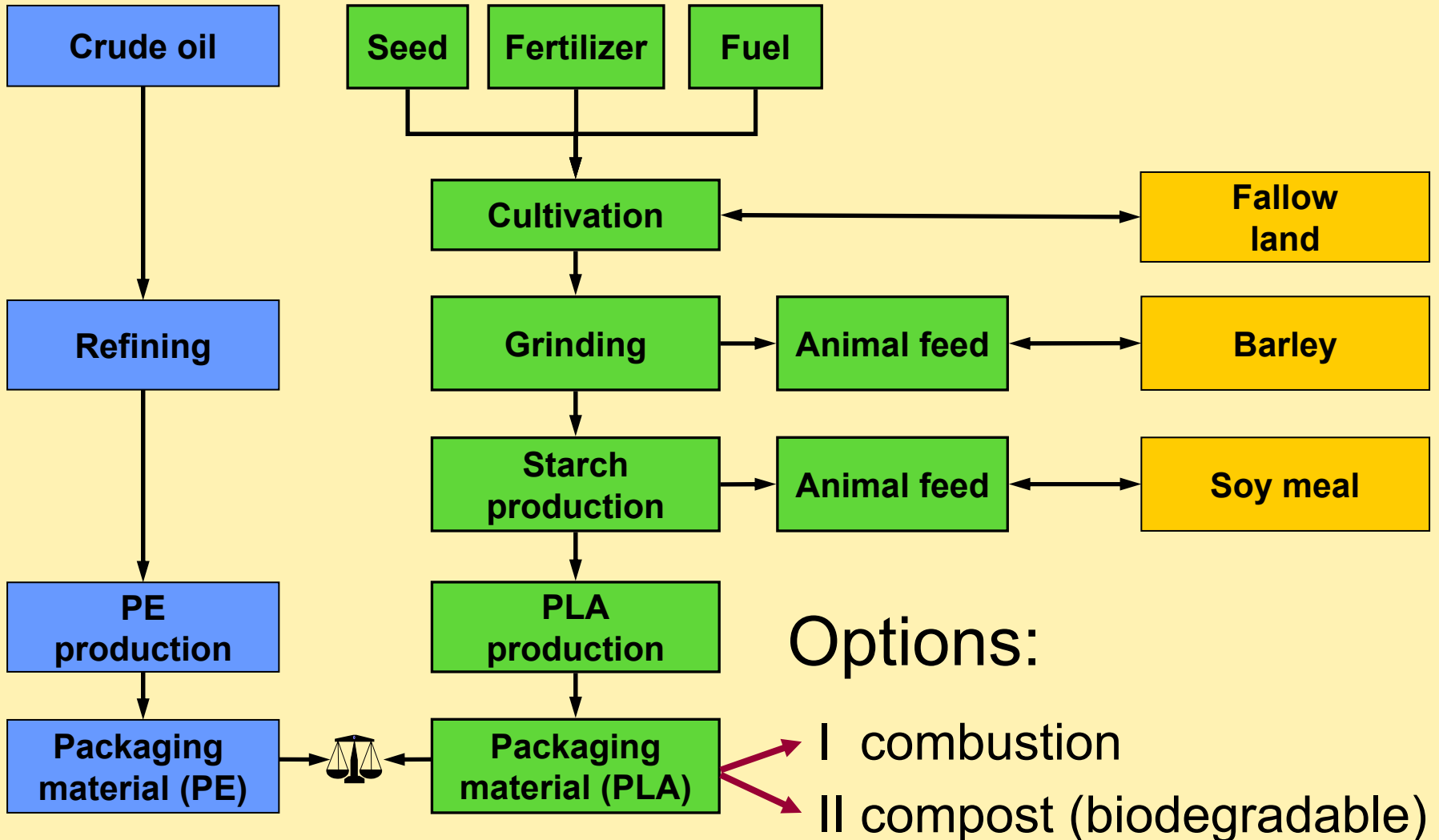


Packaging systems from wheat PLA vs. PE

conventional

from wheat

credits



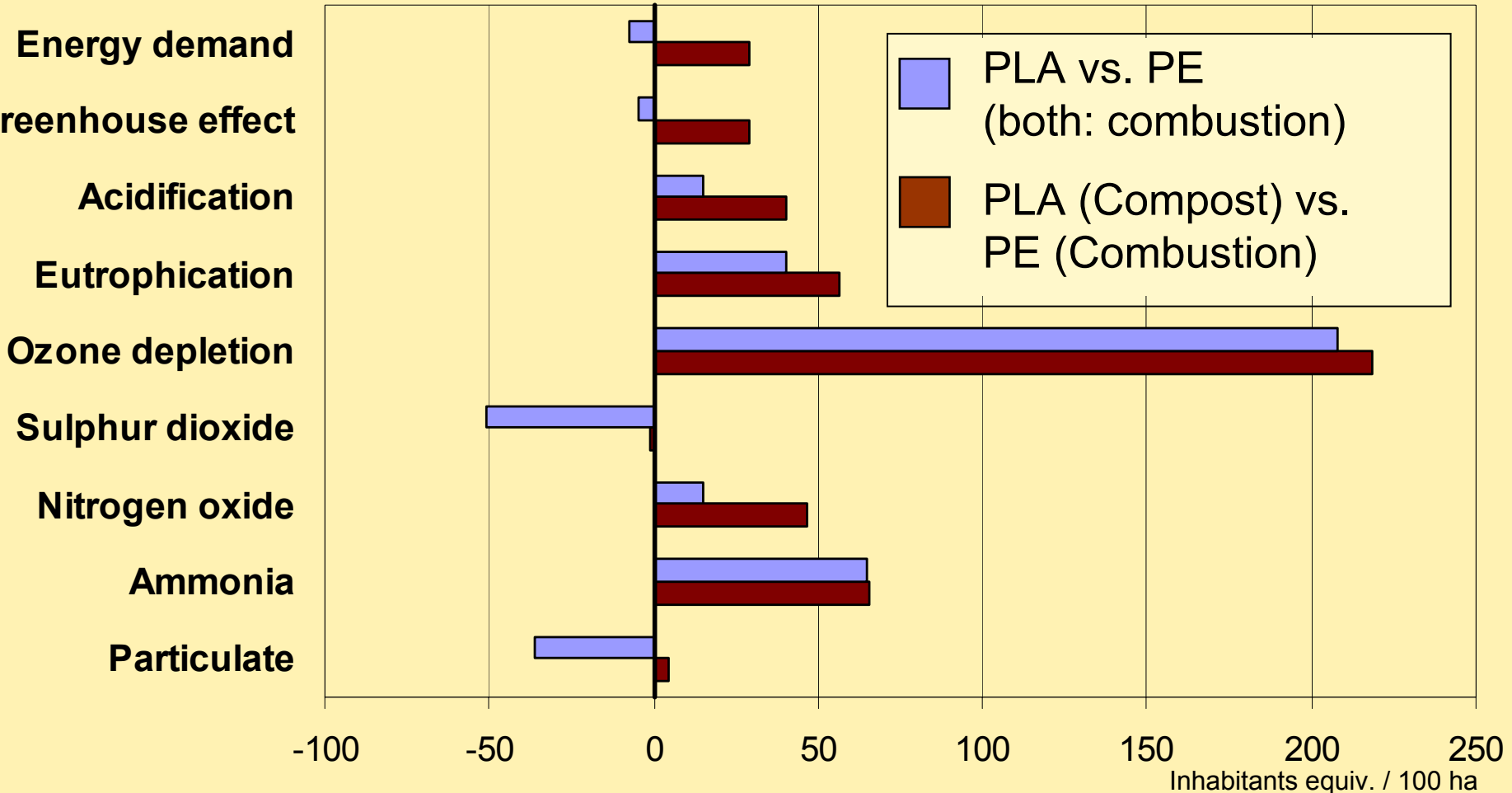
Biobased products: Biodegradability



Packaging systems from wheat PLA vs. PE

Advantages for wheat

Disadvantages for wheat



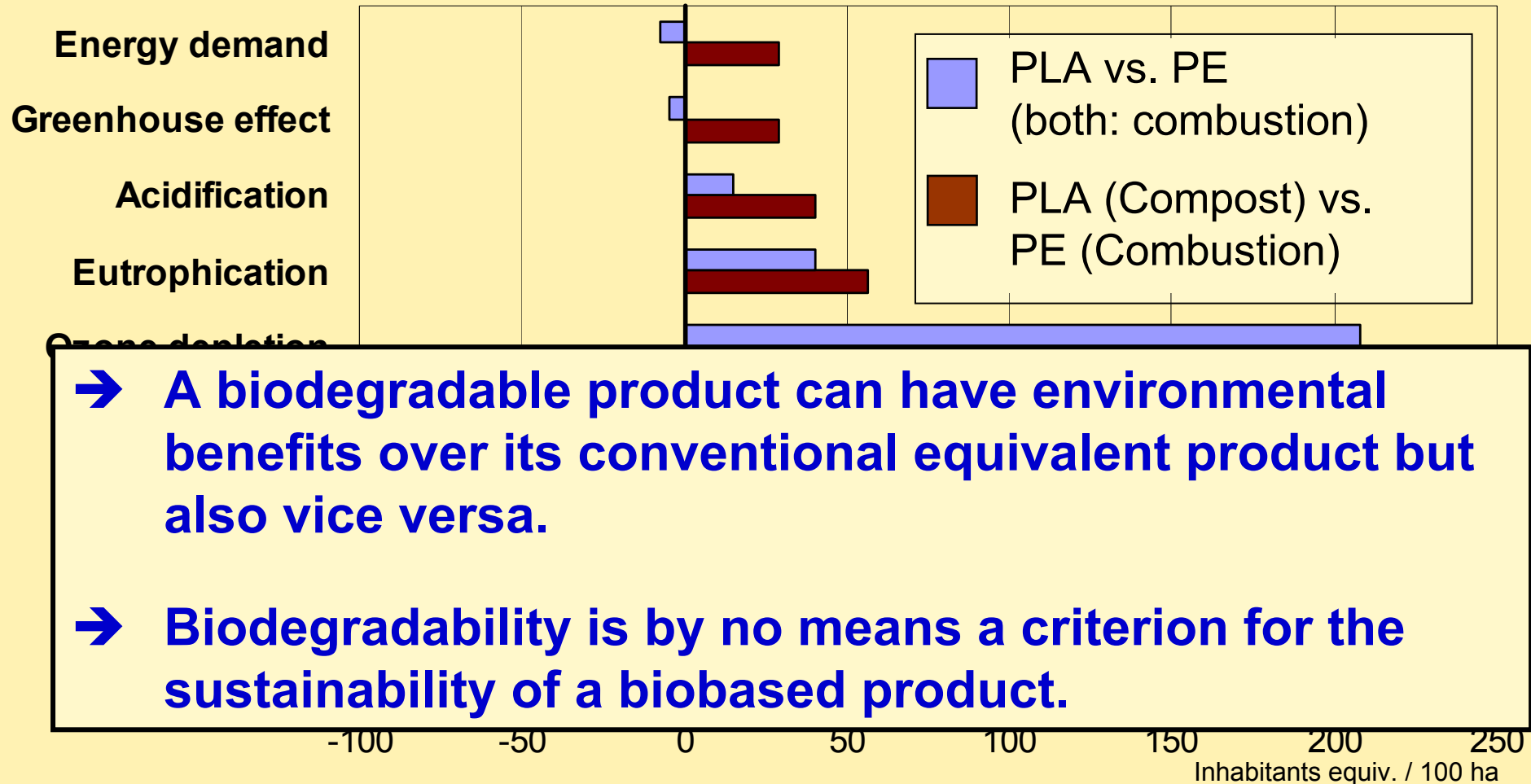
Biobased products: Biodegradability



Packaging systems from wheat PLA vs. PE

Advantages for wheat

Disadvantages for wheat



- A biodegradable product can have environmental benefits over its conventional equivalent product but also vice versa.
- Biodegradability is by no means a criterion for the sustainability of a biobased product.

- **Co-product handling**
→ not yet addressed sufficiently
- **Use phase**
→ under discussion (efficiency factor)
- **Open loop recycling**
→ not yet addressed sufficiently
- **Biodegradability**
→ not a criterion for sustainability

Findings



The provision of biomass is well addressed in existing initiatives for the sustainable production of biomass and biofuel related initiatives (except for marine and freshwater resources)

- No need to reinvent the wheel: no need to implement a new institution to develop criteria concerning the sustainable provision of biomass**
- Strong need for co-operation with existing initiatives to address the needs concerning sustainability criteria associated with biobased products**
- Main topics to be addressed: co-product handling, open loop recycling, use phase**

Thank you for your attention



Any questions ?

..... Don't hesitate to ask.

Contact

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