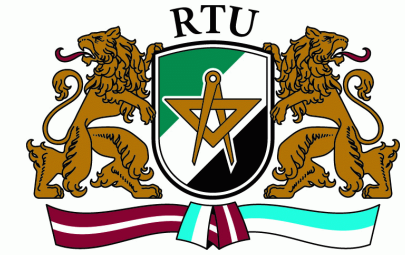




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SIMAPRO modelis biodīzeļdegvielas ražošanai Latvijā: inventarizācijas analīze

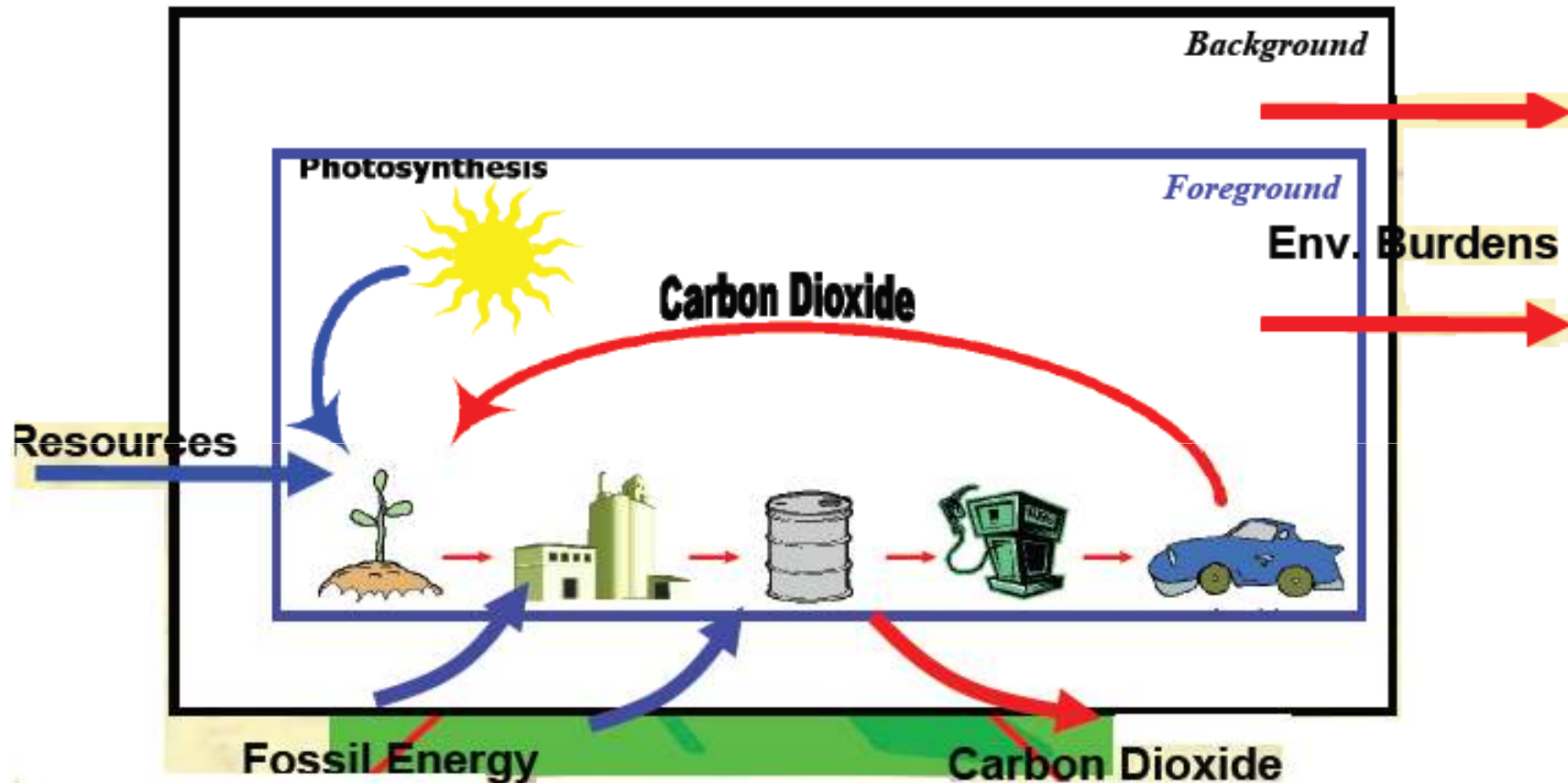
Francesco Romagnoli, M.Sc., pētnieks, doktorants

Konference “Dzīves cikla novērtējums biodīzeļdegvielas ražošanai Latvijā”
24.11.2010.

Summary

- Introduction
- LCA Goal and scope
- Identification of the LCA model
- Assumptions
- Data sources
- Inventory
- Conclusions

Introduction: biofuel life cycle



CO₂ NEUTRAL FUEL CYCLE !!!

Source: João Malça, Fausto Freire, "A comparative assessment of rapeseed oil and biodiesel (RME) to replace petroleum diesel use in transportation", From Concept to Commercial Processes March 5-10, 2006, Tomar, Portugal



Introduction: eco-certification for biofuel

DIRECTIVE 2009/28/EC: promotion of the use of energy from renewable sources

*“The greenhouse **gas emission saving** from the use of **biofuels and bioliquids** taken into account for the purposes referred shall be **at least 35 %**”.*

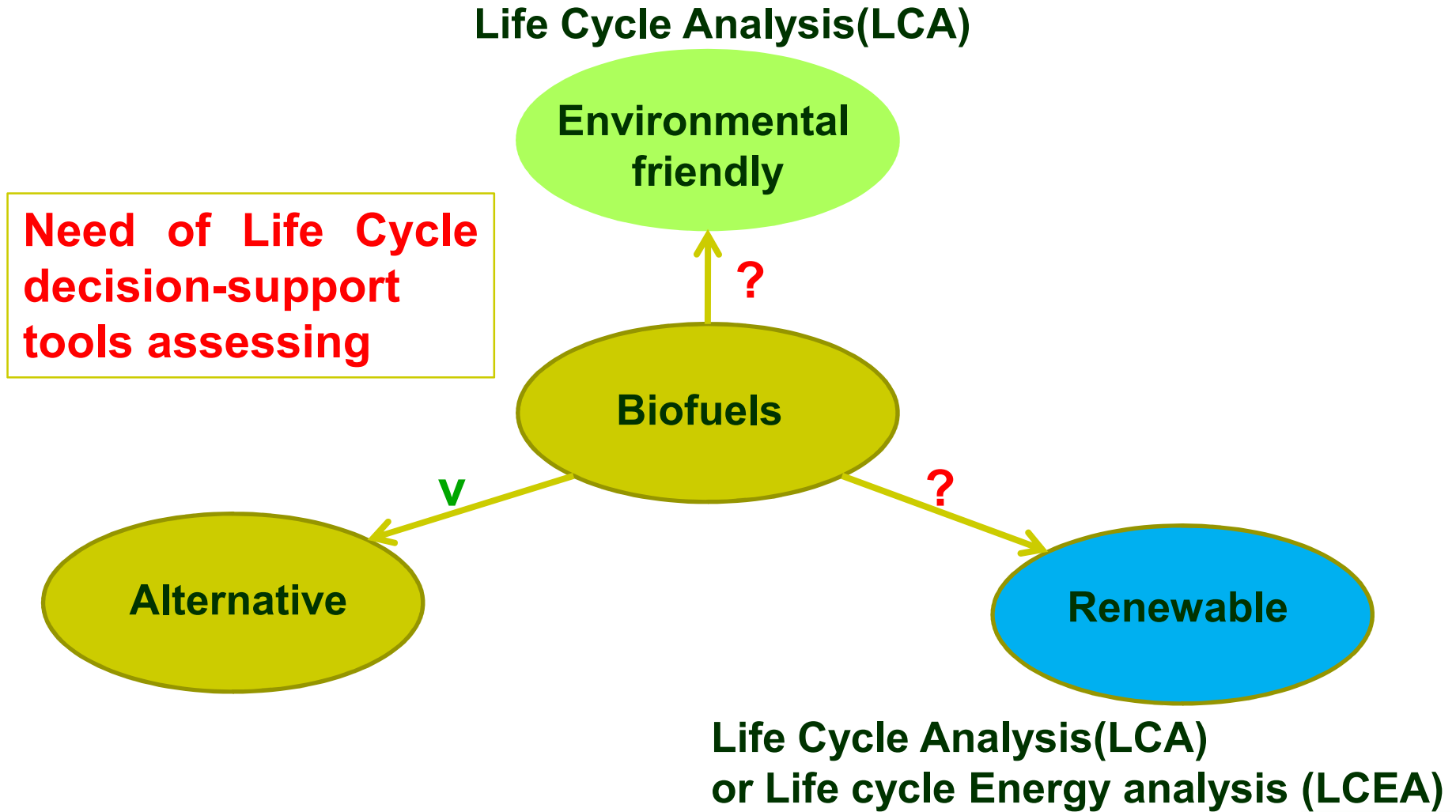


Promotion of those biofuels **which offer the greatest greenhouse gas savings.**

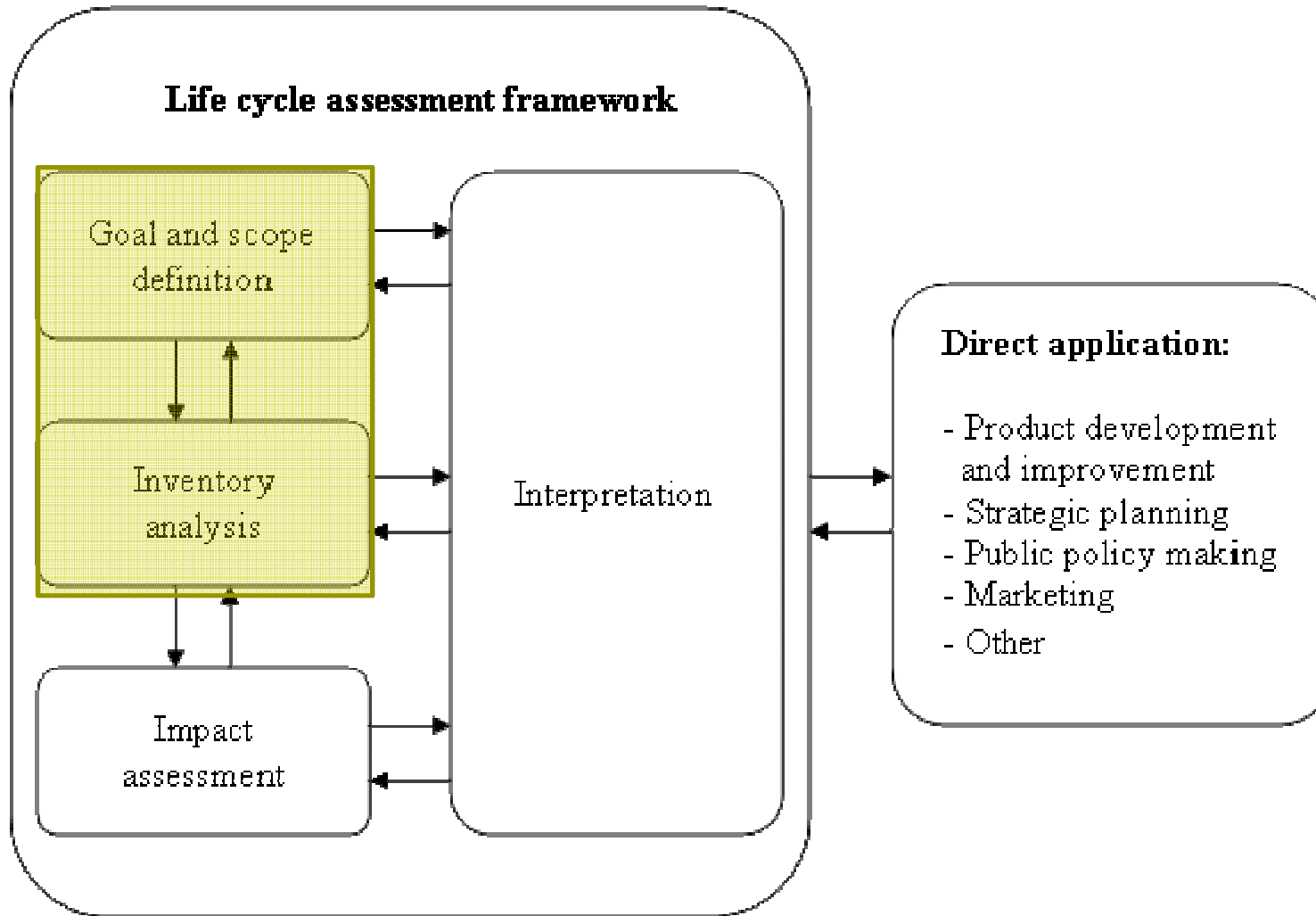


Life-cycle assessment: way of quantifying the total environmental impact.

Introduction: Motivation for LCA approach



Introduction



Source: ISO standards 14044

Goal and scope

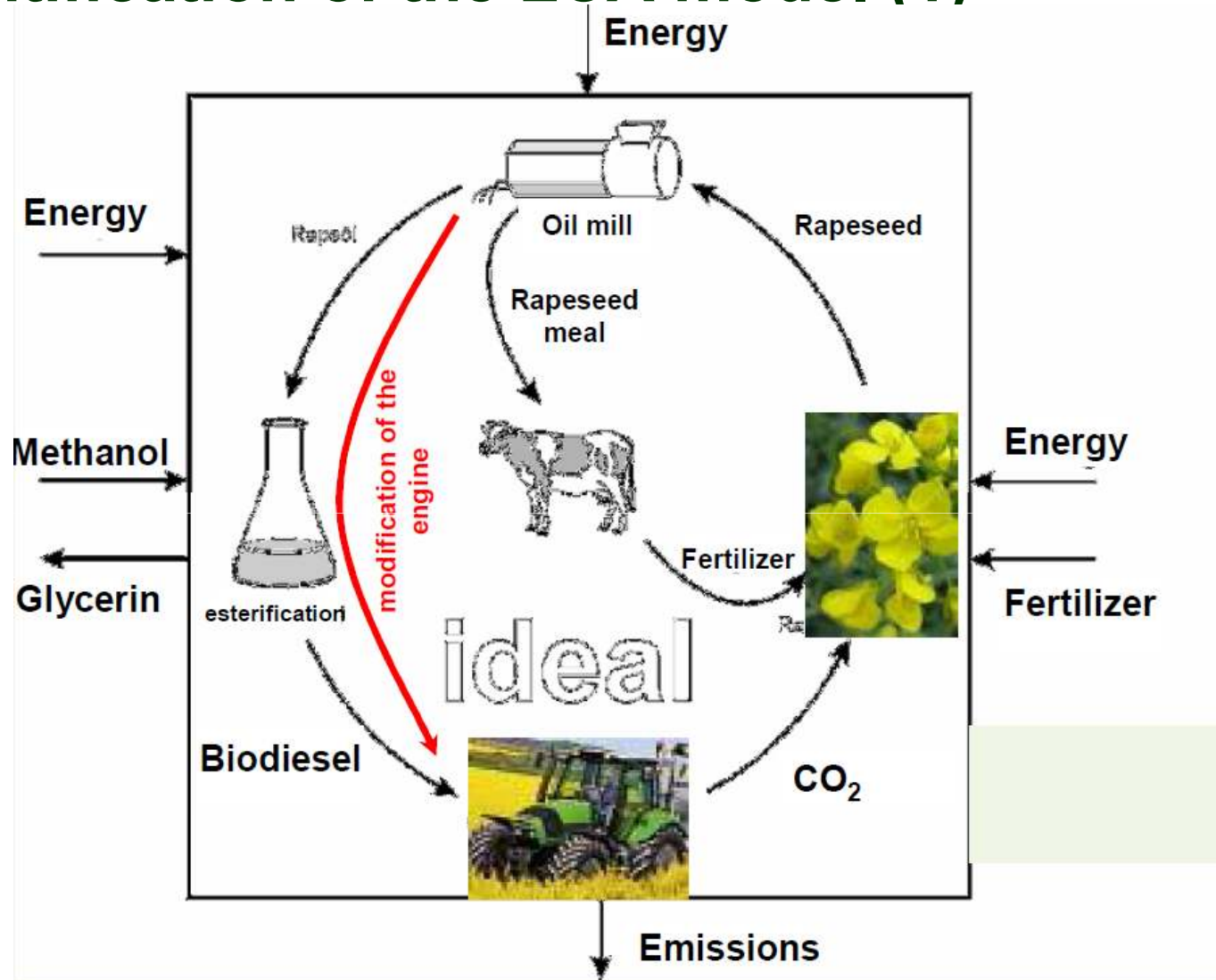
Goal

1. Demonstrate that biofuel has a positive energy balance, saves GHG emissions and to quantify how much biodiesel is renewable.
2. Use of LCA to evaluate the life cycle environmental burdens of a biodiesel (BD) system use (B100) from rapeseed oil.
3. Identify the hot spots of the system and suggest improvement opportunity

Scope

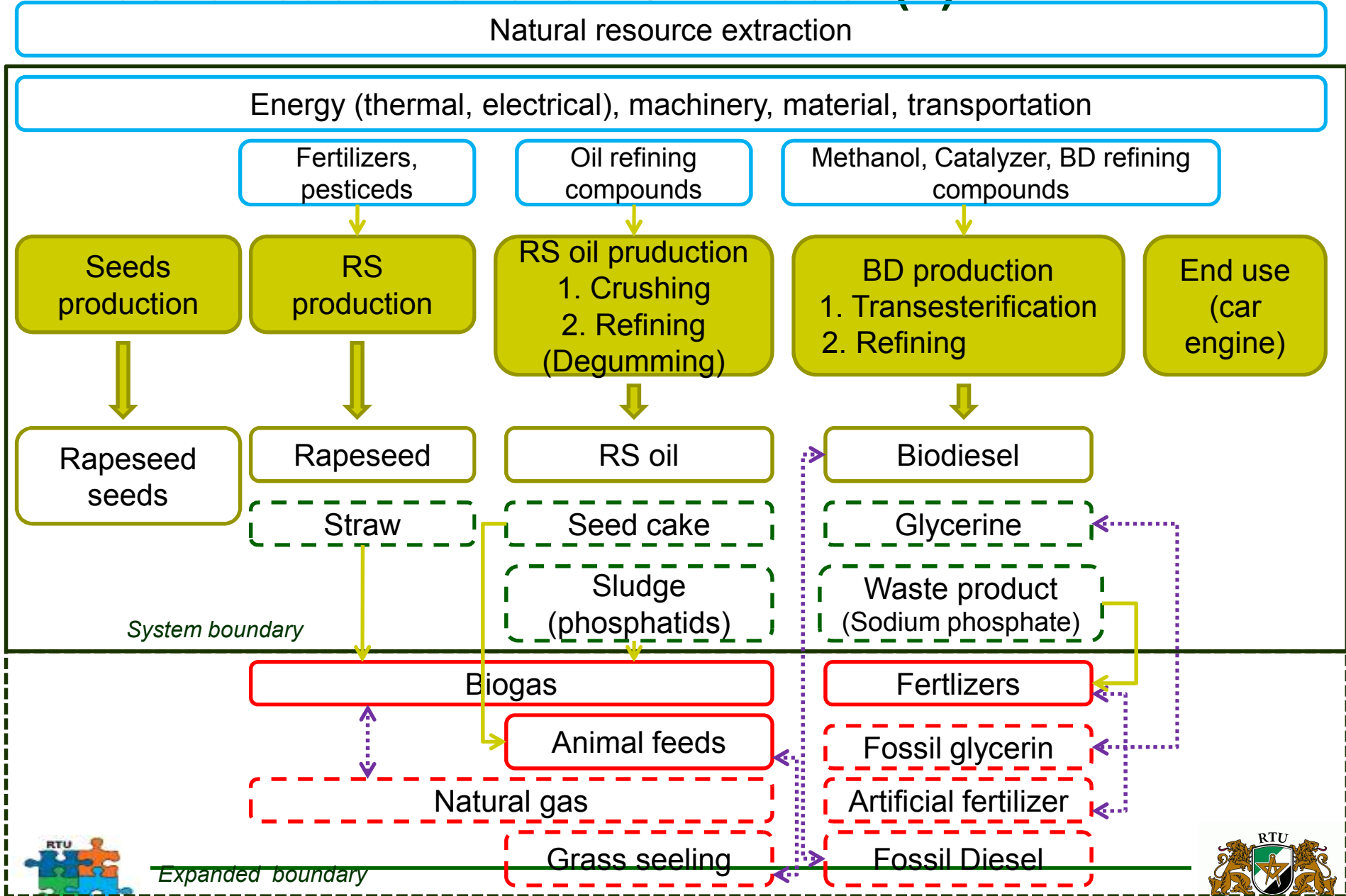
1. **Type of analysis:** well-to-wheel.
2. **Evaluated parameters:** materials inputs, energy input and output, water emission, ground emissions, air emissions.
3. **Analyzed system:** biodiesel production from rapeseed (RP) in a Latvian context and final car end use.
4. **System function:** production of BD to be used as fuel for car.
5. **Functional unit:** 100km driven by compact pickup truck on a dust road fuelled by BD.

Identification of the LCA model (1)



Biomass: Dr. Karsten Block, "Flexible Energy for Heat, Electricity and Fuels", Center for Renewable Raw Materials - North Rhine-Westphalia, Germany

Identification of the LCA model (2)



Assumptions

1. Transportation infrastructure are not accounted (road, harbors, trucks and boats),
2. Transportations:
 - on road: 40t trucks, 50% load;
 - on sea: medium size cargo boat, 89000 t capacity, 50% load
3. Biodiesel plant technical lifetime: 25years
4. Use of straw for biogas production.
5. Use of average EU electricity mix (EU25).
6. Transportation distances estimation.
7. Material supply point (seeds, tractors, fertilizers, pesticides)



Data sources

1. Latvian rapeseed farmers (interviews, questionnaires),
2. Latvian biodiesel producers (interviews, questionnaires),
3. Technical literature,
4. Ecoinvent 2.1 (data base implemented in Simapro 7.2),
5. GEMIS (Global Emission Model of Integrated Systems – processes and products database).

Distances estimations (1)

Material	Unit process	From	Distance [km]	Way of transport
Seeds	Cultivation	UK (50%) FR (50%)	1270 1750	40 t truck
Fertilizers	Cultivation	GER	1400	40 t truck
Pesticeds	Cultivation	GER	1400	40 t truck
Tractor	Cultivation	SWE	400	Medium size cargo

Distances estimations (2)

Material	Unit process	From	Distance [km]	Way of transport
Rapeseed	RS oil production	LV (35%)	150	40 t truck
		LT (35%)	300	
		BY (15%)	600	
		KZ (15%)	1000	
Oil mix	BD production	RU (60%)	500	40 t truck
		BY (40%)	600	
Methanol	BD production	RU	500	40 t truck
KOH	BD production	RU	500	40 t truck

Main Inventory Results (1)

Biodiesel technical parameter

Rādītāji	Rapša eļļa	Biodīzeļdegviela RME (B100)	Fosilā dīzeļdegviela
Masas siltumspēja, MJ/kg	37,4	37,7	42,1
Tilpuma siltumspēja, MJ/l	34,3	33,2	33,4
Blīvums pie 20 °C, g/cm ³	0,916	0,884	0,835
Cetānskaitlis	31,8	49...52,5	48...51,5
Viskozitāte pie 20 °C, mm ² /s	7,7	7,5	4,2
Zemākā filtrēšanas temp., °C	-15	+20	-18

Main Inventory Results (2)

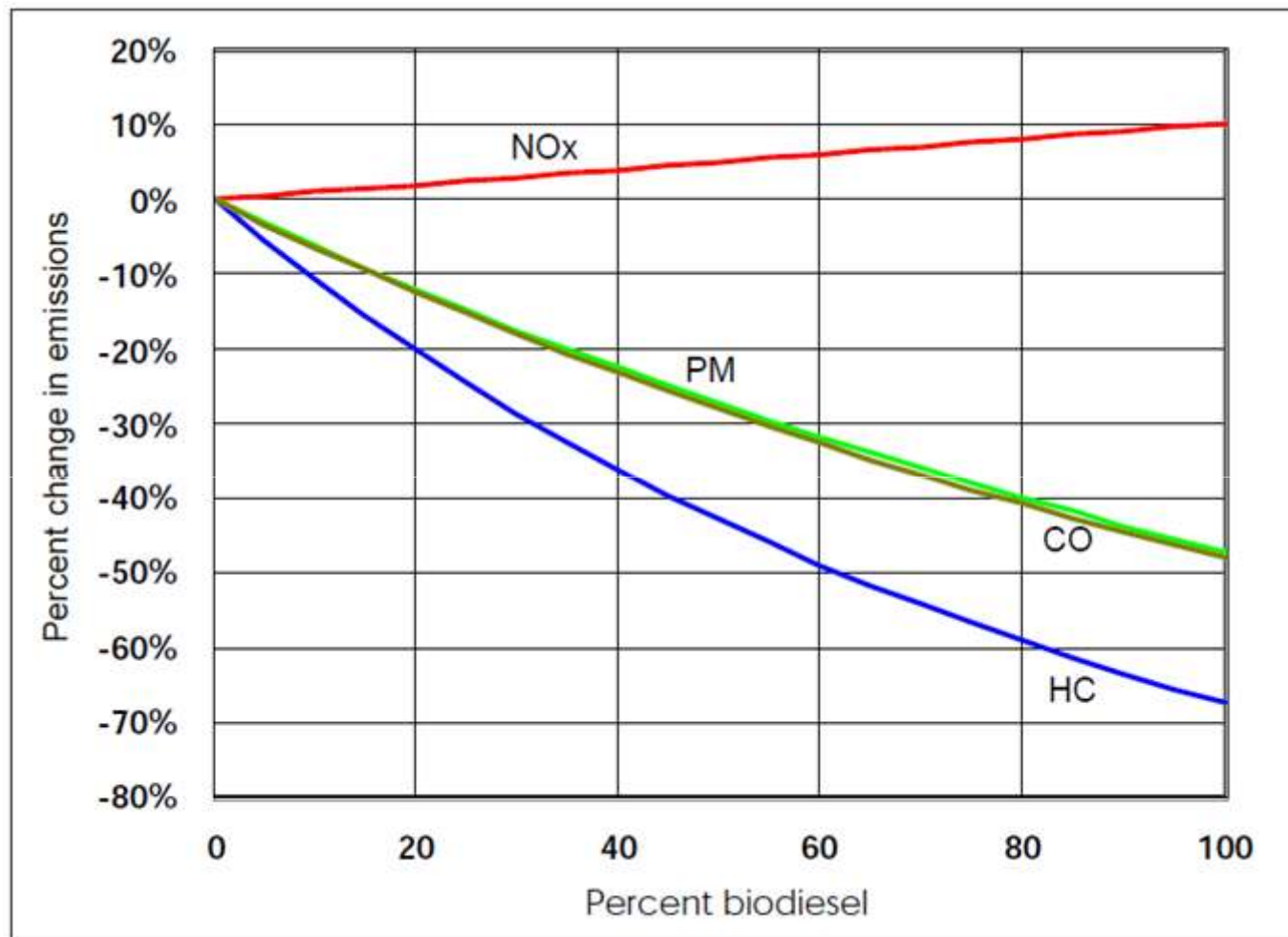
	CULTIVATION	RS oil production	BD production
Land [ha]	-0,97		
Seeds [kg]	-3,39		
N fertilizer [kg]	-49,44		
P fertilizer [kg]	-12,80		
K fertilizer [kg]	-60,35		
S fertilizer [kg]	-84,34		
Leaf fertilizers and Surfactants [kg]	-7,46		
Straw [t]	5,82		
Rapeseeds [t]	3,10	-3,10	
Rapeseed cake [t]		2,01	
H3PO4 (deg.) [t]		0,00	
NaOH (deg.) [t]		-0,02	
Citric acid (deg.) [t]		-0,0003	
Rapeseeds oil [t]		1,05	-1,05
Methanol [t]			-0,11
KOH (for trans.) [t]			-0,01
H2SO4 (for trans.) [t]			-0,01
NaOH (for glicerine prod.) [t]			-0,02
H3PO4 (refin.) [t]			-0,0011
Gliceryn [t]			0,11
Biodiesel (RME) [t]			1,00

Main Inventory Results (3)

Functional unit: 100 km	CULTIVATION RS oil production BD production	
Land [ha]	-0,02	
Seeds [kg]	-0,06	
N fertilizer [kg]	-0,82	
P fertilizer [kg]	-0,21	
K fertilizer [kg]	-1,00	
S fertilizer [kg]	-1,40	
Leaf fertilizers and Surfactants [kg]	-0,12	
Straw [kg]	0,10	
Rapeseeds [kg]	51,32	-51,32
Rapeseed cake [kg]		33,18
H3PO4 (deg.) [kg]		-0,04
NaOH (deg.) [kg]		-0,38
Citric acid (deg.) [kg]		-0,01
Rapeseeds oil [kg]		17,32
		-17,32
Methanol [kg]		-1,75
KOH (for trans.) [kg]		-0,17
H2SO4 (for trans.) [kg]		-0,17
NaOH (for glicerine prod.) [kg]		-0,34
H3PO4 (refin.) [kg]		-0,02
Gliceryn [kg]		1,74
Biodiesel (RME) [kg]		16,54

Main Inventory Results (4)

Average emissions impacts on heavy-duty diesel engines



EPA: A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions – Draft Technical Report, EPA420-P-02-001, October 2002. http://www.biodiesel.org/resources/reportsdatabase/reports/gen/20021001_gen-323.pdf

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