

Quality management and quality aspects in LCA projects & software

How making a peer review efficient

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Nature of uncertainties

- **Uncertainty** Level of decision
There is no „exact or true“ value
- **Vagueness** Level of systems, models, data
Perhaps there is an “exact or true” value, but it is not to determine because of the complexity or the dynamics of the system.
- **Inaccuracy** Level of data (systems, models)
There exists a “exact or true” value. It is “only” a question of expenditure to determine the value.
- **Uncertainty about uncertainties**
Is it possible to determine the uncertainty?

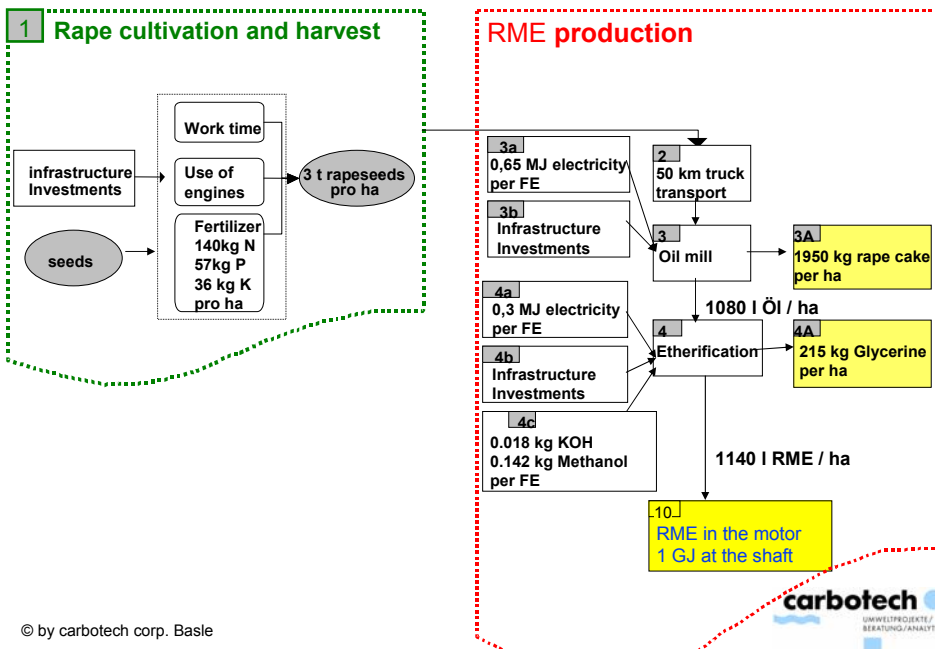
Sources of uncertainty in LCA

Step		Nature of uncertainty	How to deal with
Goal definition and system boundaries	Functional unit, allocation System boundaries: geographic, life cycle, time, chosen aspects	Uncertainty, vagueness	Reviewing
Inventory	System boundaries Variability: space, time, process specific lack of data Errors of measure	vagueness inaccuracy	Reviewing, documentation of errors
Impact assessment	System boundaries, selection of impacts, vagueness of impact factors	uncertainty, vagueness, inaccuracy	Reviewing, documentation of errors
Valuation	socio-politic decision	uncertainty	Reviewing

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Example rape methyl ester



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The energetic balance of rapeseed methyl ester RME in two different studies

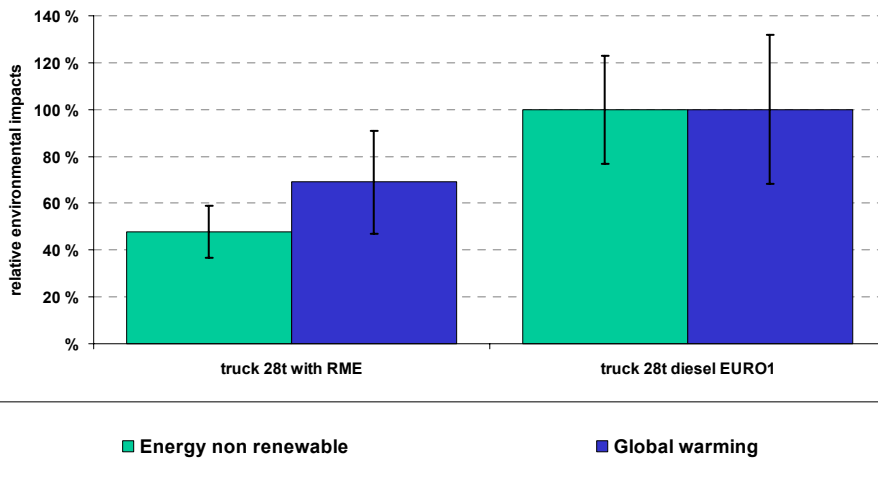
	Study 1	Study 2	remarks
Cultivation Input	19.74 GJ/ha	16 GJ / ha	
Oil mill	5.5 GJ/ha	4.2 GJ electricity = 15.83 GJ pr. Energy	Used energy – primary energy
Allocation: oil - cake	no	70 : 30	economic allocation: 81 : 19 Energetic allocation: 70 : 30
Etherification methanol process energy	2.05 GJ 0.75 GJ	6.8 GJ (175 l methanol) 7.6 GJ (electricity as primary energy)	Taking into account the energy for production used energy – primary energy
Allocation Glycerine	96 : 4	no	No economic value (2)
Output: oil animal feed glycerine	44.85 GJ / ha 26.48 GJ / ha 1.56 GJ / ha 72.89 GJ / ha	35.75 GJ / ha allocated 35.75 GJ / ha	Differences in the yield 1.21 t (1) 0.96 t (2)
Energy input agriculture oil estrication Total	19.74 GJ 5.5 GJ 4.85 GJ 30.3 GJ /ha	11.2 GJ / ha 11.1 GJ / ha 7.6 GJ / ha 29.9 GJ / ha	
Output to input	2.4	1.2	

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The choice of the adequate impact categories:

Rapeseed methyl ester as fuel

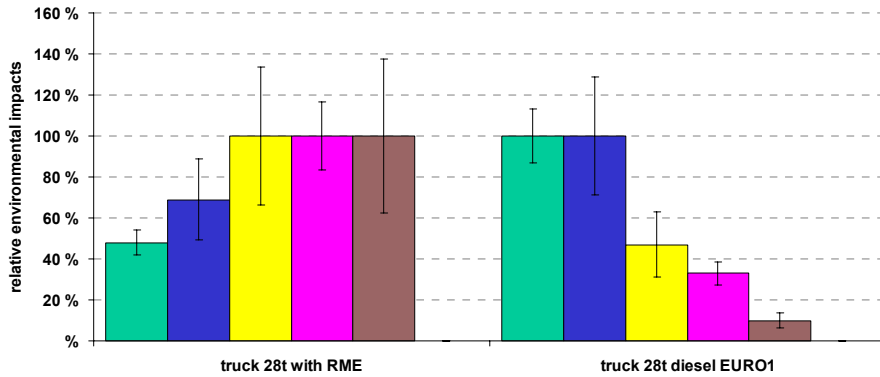


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The picture changes looking at other impact categories

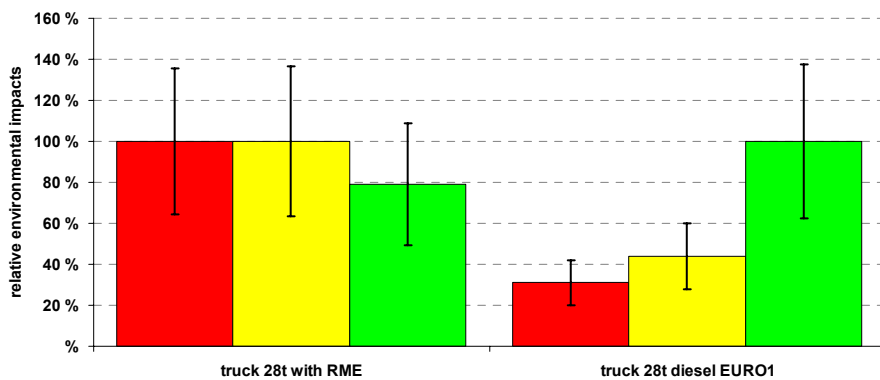
Rape methyl ester



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Valuation



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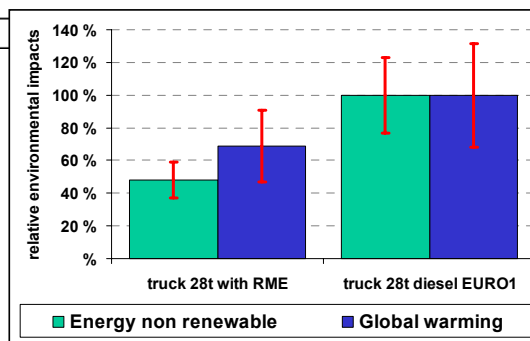
What is needed to deal with uncertainties?

- **A critical peer review to discuss vague and uncertain decisions**
- **Taking into account the errors**
- **A software enable to calculate**
 - **Errors**
 - **Scenarios**

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Declaration and calculation of errors in the software

Inputs of the process: Laundry towels (average) E									
Art	S	C	Input		amount	error	min.	max.	F c
7	✓	✓	Abwasser (häussliches) in ARA	RER	0.0400 m3	30.0	0.40	1.60	✓
7	✓	✓	electricity, medium voltage, at grid CH		0.5000 kWh	30.0	0.40	1.60	✓
7	✓	✓	natural gas, burned in industrial fu	RER	10.8000 MJ	30.0	0.40	1.60	✓
7	✓	✓	oil el. in heating 100 kW	RER	9.0000 MJ	30.0	0.40	1.60	✓
7	✓	✓	transport truck 16t CH EURO2 Pkm	RER	0.2000 tkm	20.0	0.60	1.40	✓



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Peer Review as Carbotech does it in their projects

It is an on going process:

- **Starting when the order is given to perform an LCA**
- **When the first rough results are calculated**
- **When the results are calculated**
- **On the report and documentation**

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Review process in LCA projects by Carbotech

1. preliminary discussion

Reviewer:	
Date :	
Time used Reviewer:	

Checklist	remarks:
System boundaries:	<input type="checkbox"/> OK →
Functional unit:	<input type="checkbox"/> OK →
Allocation:	<input type="checkbox"/> OK. →
General conditions:	<input type="checkbox"/> OK. →
Procedure data acquisition:	<input type="checkbox"/> OK →
Selection of processes:	<input type="checkbox"/> OK →
Discussion of the quick LCA:	<input type="checkbox"/> OK →

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2. Review Calculations

Reviewer:	
Date review-discussion:	

Documents for the LCA-review given to the reviewer:

- Input data and calculations
- Printout analysis
- Printout graphs
- Printout main processes
- Printout current LCA quality test

The review can be done together with the performer of the study.

	estimated time use Reviewer	Time used	Short review und remarks:
Re-check check list preliminary discussion:			<input type="checkbox"/> OK →
Understanding of the calculations:			<input type="checkbox"/> OK →
Check the plausibility of the input data:			<input type="checkbox"/> OK →
Plausibility check, results:			<input type="checkbox"/> OK →
Current print out of the test LCA:			<input type="checkbox"/> OK →
Expenditure total:			

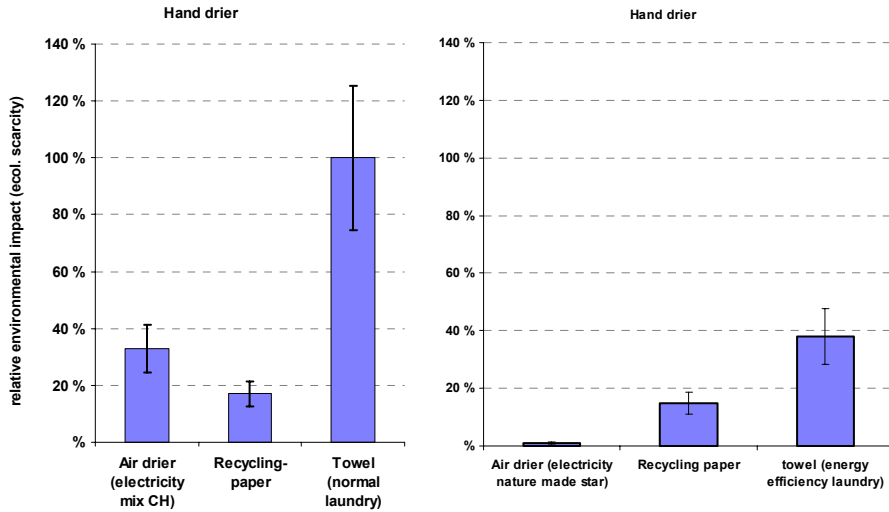
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Some typical questions of the reviewer

- **What is the relevance of your decisions?**
- **Will the results be opposite, choosing other allocation factors or methods?**
- **In a comparative LCA:
Would you choose the same assumptions, making the study for a competitor?**
- **Are the chosen processes appropriate?**
- **Are the relevant impacts taken into account?**

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Scenario analysis



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Scenario calculation in EMIS

szenario

Standard

- Expo Recycling reduziert
- Expo Standard
- Homan Borat, BIKO 2 (3500..)
- Homan Borat, BIKO 3 (5500..)
- Homann
- Homann 2003
- Homann Borat, BIKO 3 verschiedene
- Homann Standard alt
- Igora 1990
- Igora 2000 - 1
- Igora 2000 - 2
- Igora 2000 - 3
- Igora 2000 - 4
- Igora 2000 Gewichtsreduktion 7.5%
- Igora 2000 Grundszenario
- Igora 2000 mit Schwerverkehrsabgabe
- Igora 2000 nicht bereinigt
- Igora TINA Grundszenario
- Igora TINA-LETU
- Isofloc nicht bereinigt
- Kästle 1999
- Kästle 2000 (neue Bitumenanlage)
- Kästle ohne Recyclingmaterial
- Standard**
- WB-IP - Jute Mill

process

Number of steps: 0

Calculation method:

- linear
- Random
- Optimum

Excel-Version 95 or older
 Excel-Version 97

order by:

- influx
- characteristic valk

only cockpit data

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Standard									
characteristic value	unit		unit	influx	error	S	Abs/minimum	maximum	
co-products	1	Nm3	=	0.0000000000000000	kg	oil gas natural	0.00	1.000000	1.000000
co-products	1	kg	=	0.0000000000000000	kg	Oil, crude, in ground	0.00	1.000000	1.000000
co-products	1	g	=	0.0000000000000000	kg	Uranium, in ground	0.00	1.000000	1.000000
co-products	1	kg	=	0.0000000000000000	kg	Wood, unspecified, standing	0.00	1.000000	1.000000
costs disposal	1	kg	=	2.0000000000000000	CHF	waste hazardous waste landfill	0.00	1.000000	1.000000
costs disposal	1	kg	=	0.1200000000000000	CHF	waste incineration	0.00	1.000000	1.000000
costs disposal	1	kg	=	1.0000000000000000	CHF	waste industry	0.00	1.000000	1.000000
costs disposal	1	kg	=	0.5000000000000000	CHF	waste inert material landfill	0.00	1.000000	1.000000
costs disposal	1	kg	=	0.1000000000000000	CHF	waste radioactive material landfill	0.00	1.000000	1.000000
costs disposal	1	kg	=	0.1000000000000000	CHF	waste rest material landfill	0.00	1.000000	1.000000
costs interest	1	CHF	=	0.0000000000000000	CHF	Fremdkapital (kurzfristig) (bewertet)	0.00	1.000000	1.000000
costs interest	1	CHF	=	0.0000000000000000	CHF	Fremdkapital (langfristig) (bewertet)	0.00	1.000000	1.000000
costs interest	1	CHF	=	0.0000000000000000	CHF	leasing (vehicel)	0.00	1.000000	1.000000
costs material, goods - services	1	CHF	=	1.0000000000000000	CHF	Aufwand Material	0.00	0.000000	0.000000

process									
characteristic value	unit		unit	influx	error	S	Abs/minimum	maximum	
Schwerverkehr sabgabe CH	1	Fzkml	=	1.0000000000	CHF	operation truck 16t CH	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	1.0000000000	CHF	operation truck 16t CH EURO1	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	1.0000000000	CHF	operation truck 16t CH EURO2	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	1.0000000000	CHF	operation truck 16t CH EURO3	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	2.0000000000	CHF	operation truck 20t CH	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	2.0000000000	CHF	operation truck 20t CH EURO1	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	2.0000000000	CHF	operation truck 20t CH EURO2	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	2.0000000000	CHF	operation truck 20t CH EURO3	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	2.0000000000	CHF	operation truck average CH	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	2.0000000000	CHF	operation truck average CH EURO1	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	2.0000000000	CHF	operation truck average CH EURO2	0.00	0.000000	0.000000
Schwerverkehr sabgabe CH	1	Fzkml	=	2.0000000000	CHF	operation truck average CH EURO3	0.00	0.000000	0.000000

input process -> process										
characteristic value	unit		unit	input/process	error	Col	S	Abs/minimum	maximum	
electricity Expo (infrastruktur)	1	MJ	=	1.0000000000	MJ	electricity hydro CH (naturemade star) Expo	0.00	<input checked="" type="checkbox"/>	1.000000	0.000000
electricity Expo (infrastruktur)	1	MJ	=	0.0000000000	kWh	electricity mix	0.00	<input checked="" type="checkbox"/>	0.000000	1.000000
Hand drier recycling paper	1	kg	=	1.0000000000	kg	paper, recycling, no drinking, of plant	0.00	<input checked="" type="checkbox"/>	1.000000	0.000000
Hand drier recycling paper	1	kg	=	0.0000000000	kg	paper, nonoffen, uncoated, at integrated mill	0.00	<input checked="" type="checkbox"/>	0.000000	1.000000
laundry towels (average)	1	kg	=	0.5000000000	kWh	electricity, medium voltage, at grid	30.00	<input checked="" type="checkbox"/>	0.000000	1.000000
laundry towels (average)	1	kg	=	10.0000000000	MJ	natural gas, burned in industrial furnace low-NO	30.00	<input checked="" type="checkbox"/>	0.400000	1.000000
laundry towels (average)	1	kg	=	0.0000000000	MJ	oil et. in heating 180 kW	30.00	<input checked="" type="checkbox"/>	0.400000	1.000000
laundry towels (average)	1	kg	=	0.2000000000	tkm	transport truck 16t CH EURO2 Pkm	20.00	<input checked="" type="checkbox"/>	0.500000	1.000000

3. Review report

Reviewer:	
Date review-discussion:	

Documents for the LCA-Review given to the reviewer:

- Copy of the report
- Copy of proposal / order
- Printout analysis
- Printout main processes
- Documentation changes since last review

	Estimated time use reviewer	Time used	Short review und remarks:
Consistency of report and order:			<input type="checkbox"/> OK →
Check the report on consistency and orthography			<input type="checkbox"/> OK →
Re-check previous review remarks especially changes in the LCA			<input type="checkbox"/> OK →
Critical test of conclusions and recommendations			<input type="checkbox"/> OK →
Expenditure Total			

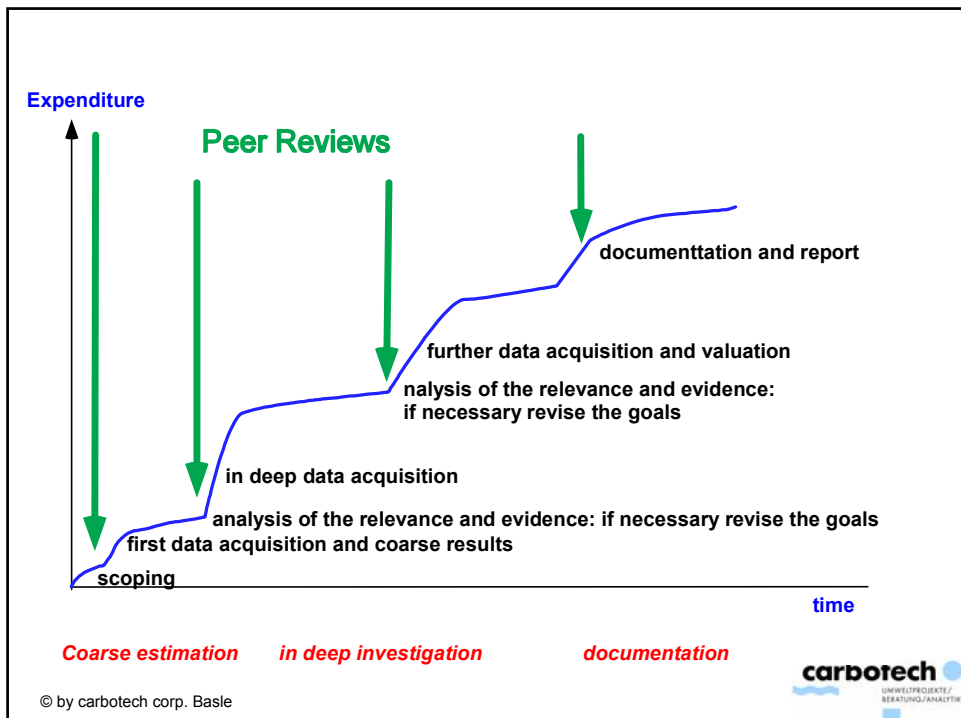
4. Final review

Reviewer:	
Date review-discussion:	

Documents for the LCA-Review given to the Reviewer:

- Copy final document
- Documentation of the changes since last review

Re-check previous review remarks especially changes in the LCA	<input type="checkbox"/> OK →
Review-signature on the original document:	<input type="checkbox"/> OK →



Conclusions

- A **one step peer review** at the end of the study
 - is related to extra costs of about 10%
 - can result in unexpected additional expenditure and costs
 - the improve in quality is normally not very high
- An **on going peer review**
 - has a high improvement of quality of the study
 - is not related to extra costs
 - the overall costs can often be reduced

Thank You for your attention