umberto®
know the flow.

The software solution Umberto

ifu Hamburg GmbH

ifu Hamburg GmbH

- Software development
  - Standard products, customizing, special solutions
- Consulting
  - LCA, efficiency in production, trainings
- Founded in 1992
- 50 countries, 2500 clients, 5000 licences
- Leadership in innovation for 20 years

Software made in Germany

SAP® Certified
Integration with SAP Applications

- **Umberto – *know the flow.***
  Process modeling and LCA Software

Integrator umberto® know the flow.

- **Umberto for carbon footprint**
  Model, calculate and analyze carbon footprints easily

umberto® for Carbon Footprint

- **e!Sankey – *show the flow.***
  Visualizing flows as Sankey Diagrams

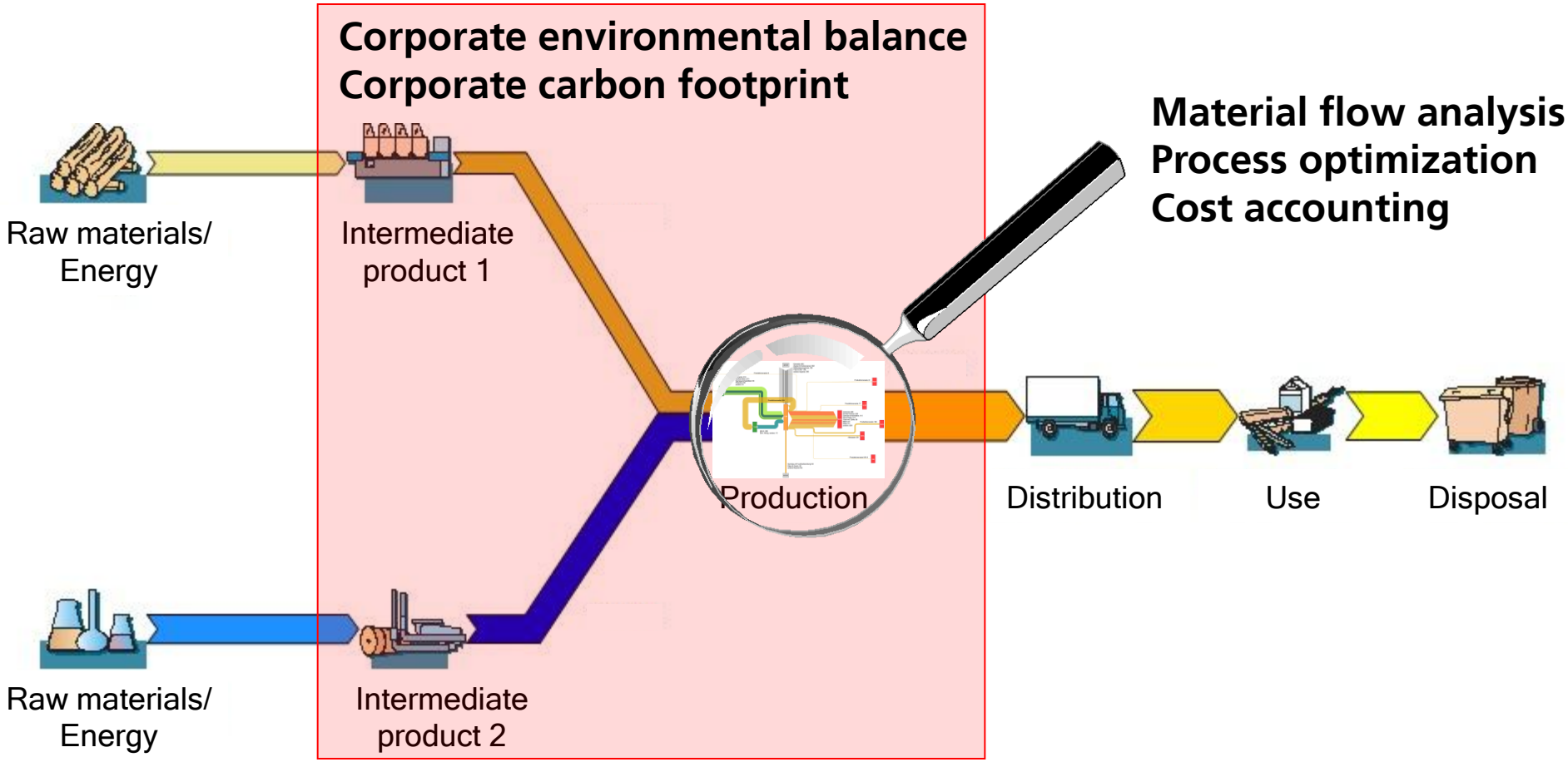
e!sankey® show the flow.

- **ecoinvent**
  Technology partner for the ecoinvent LCI data base

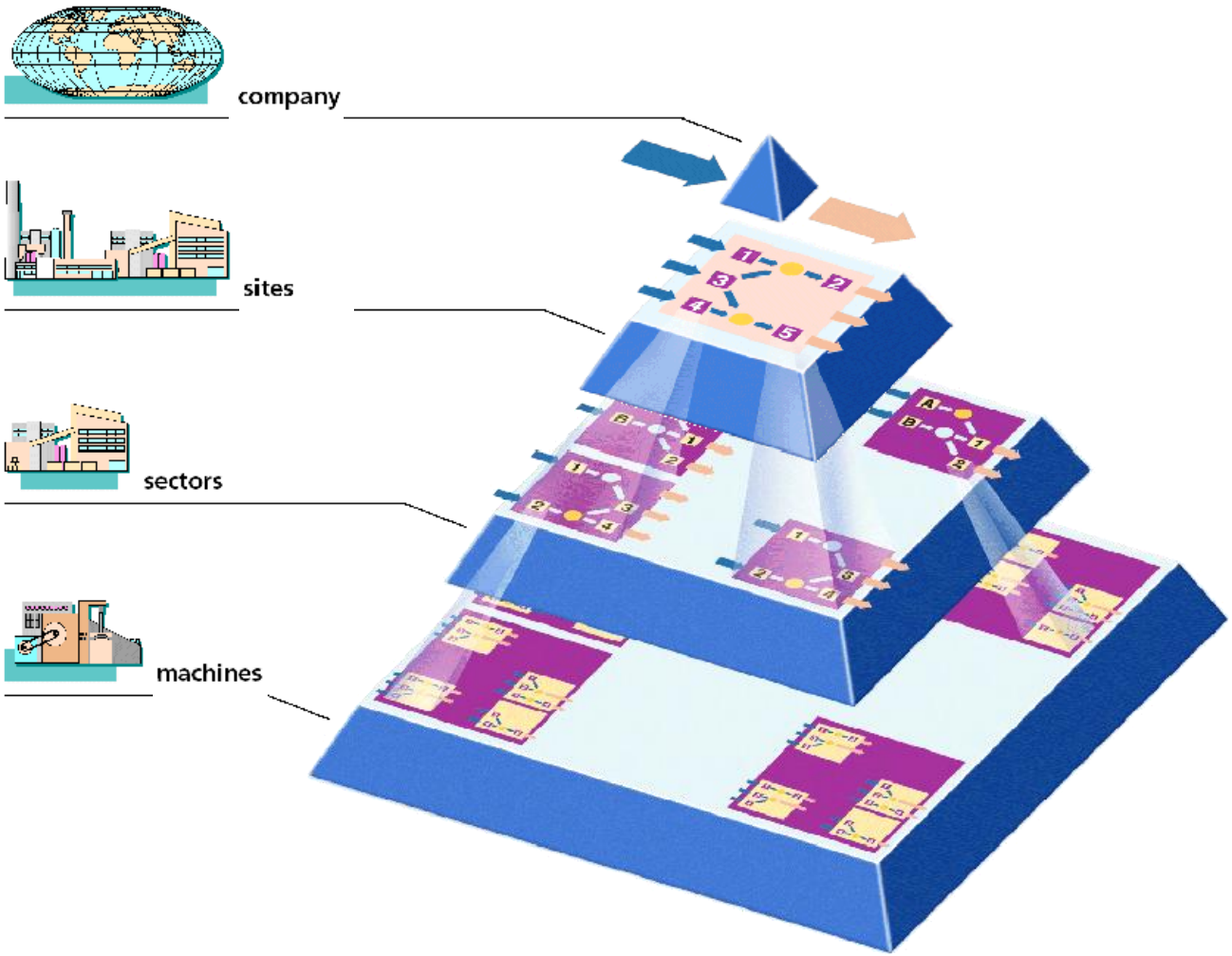
ecoinvent Centre

Some of our reference customers

Umberto Introduction – What can you do with Umberto?



Transparency at all levels



Why our users have chosen Umberto

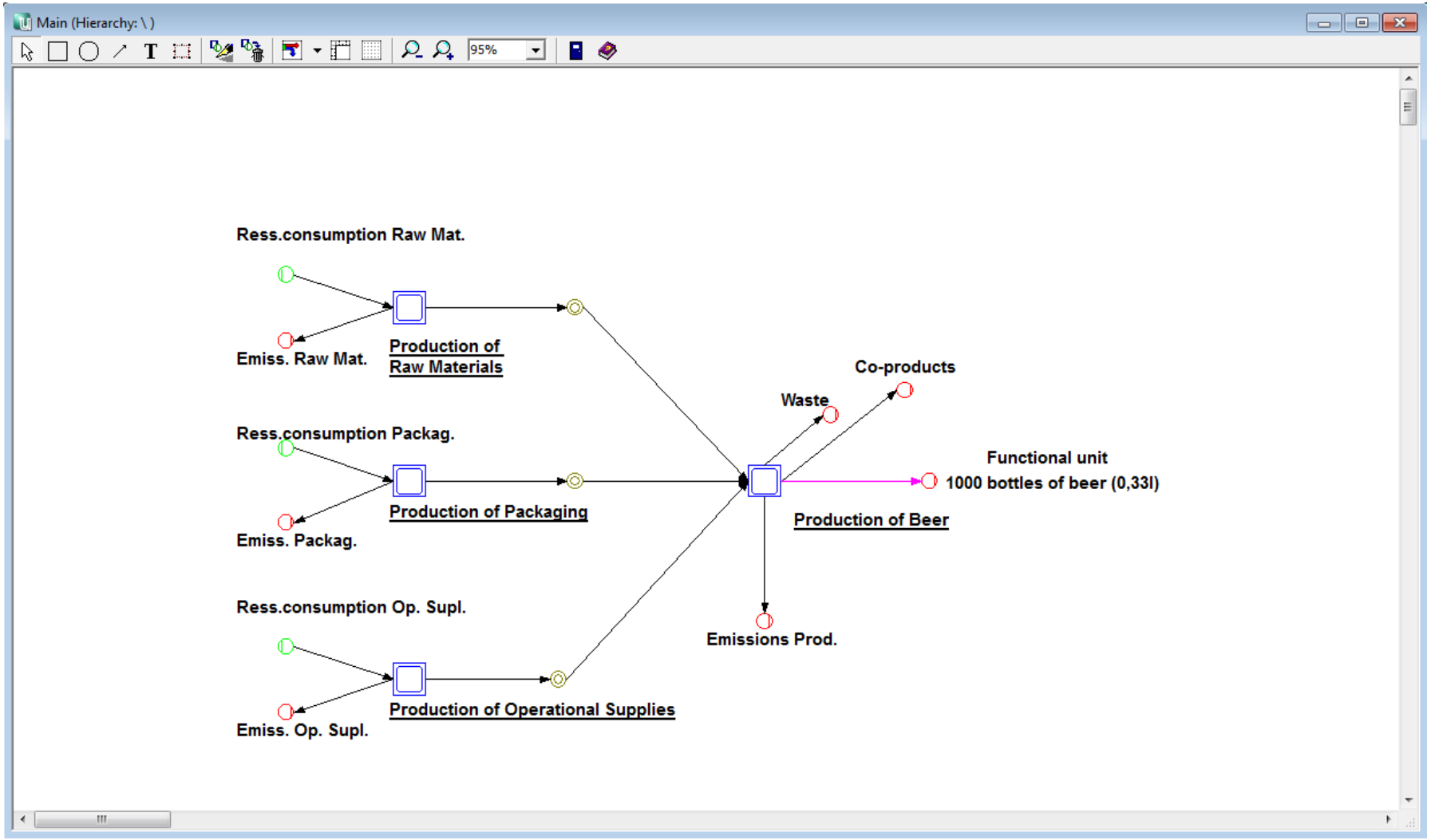
"By using Umberto, we not only succeeded in representing the company as a whole, but through the white-box approach we have the possibility to identify the weak spots. This means right down to the level of an individual machine, and to improve them in a direct way . This advantage already has had positive effects, both in environmental as well as in economical aspects."

Andreas Henrichs, Mohn media Environmental Manager

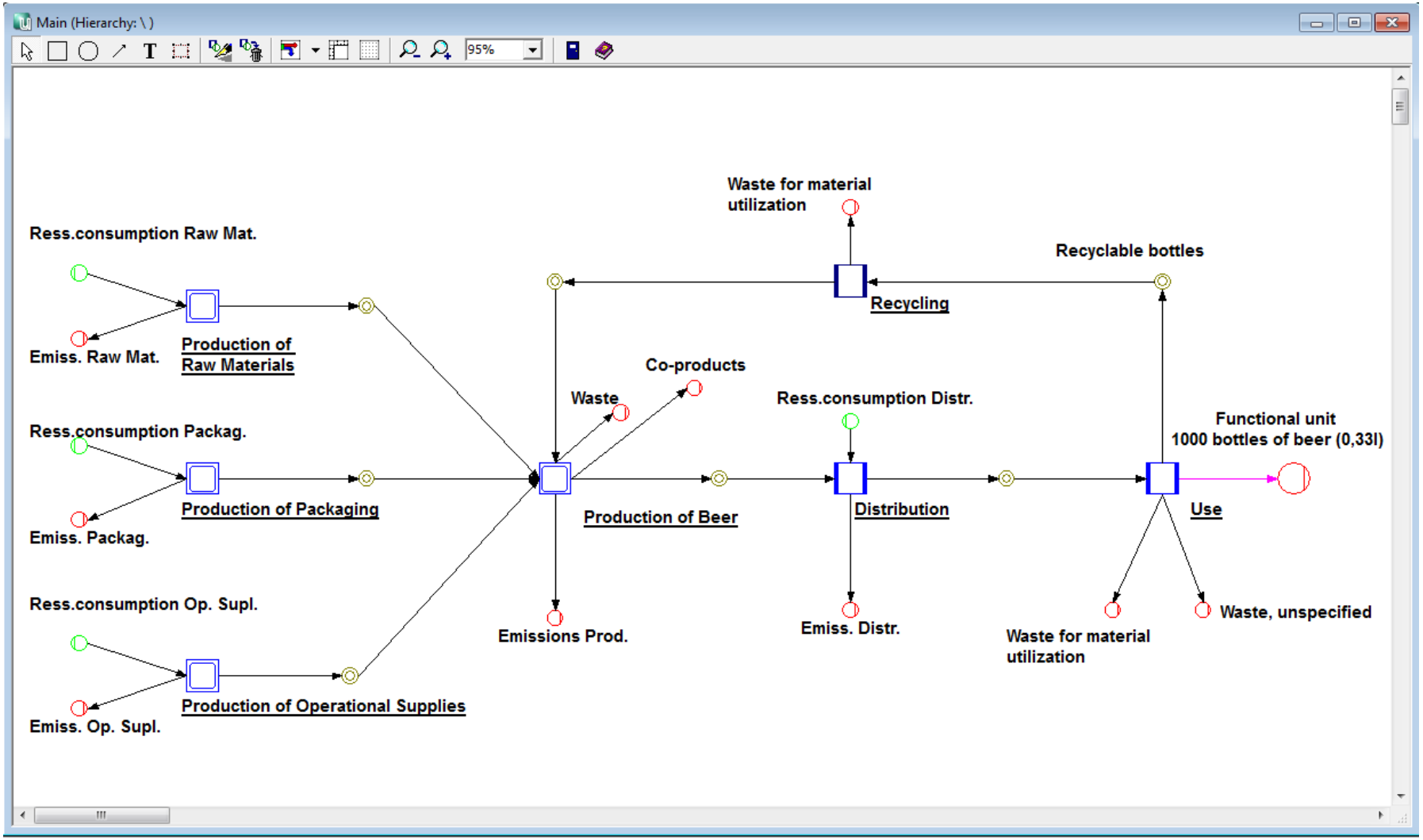
Possibilities you are offered in Umberto

- Scope definition through graphical modelling and visualization

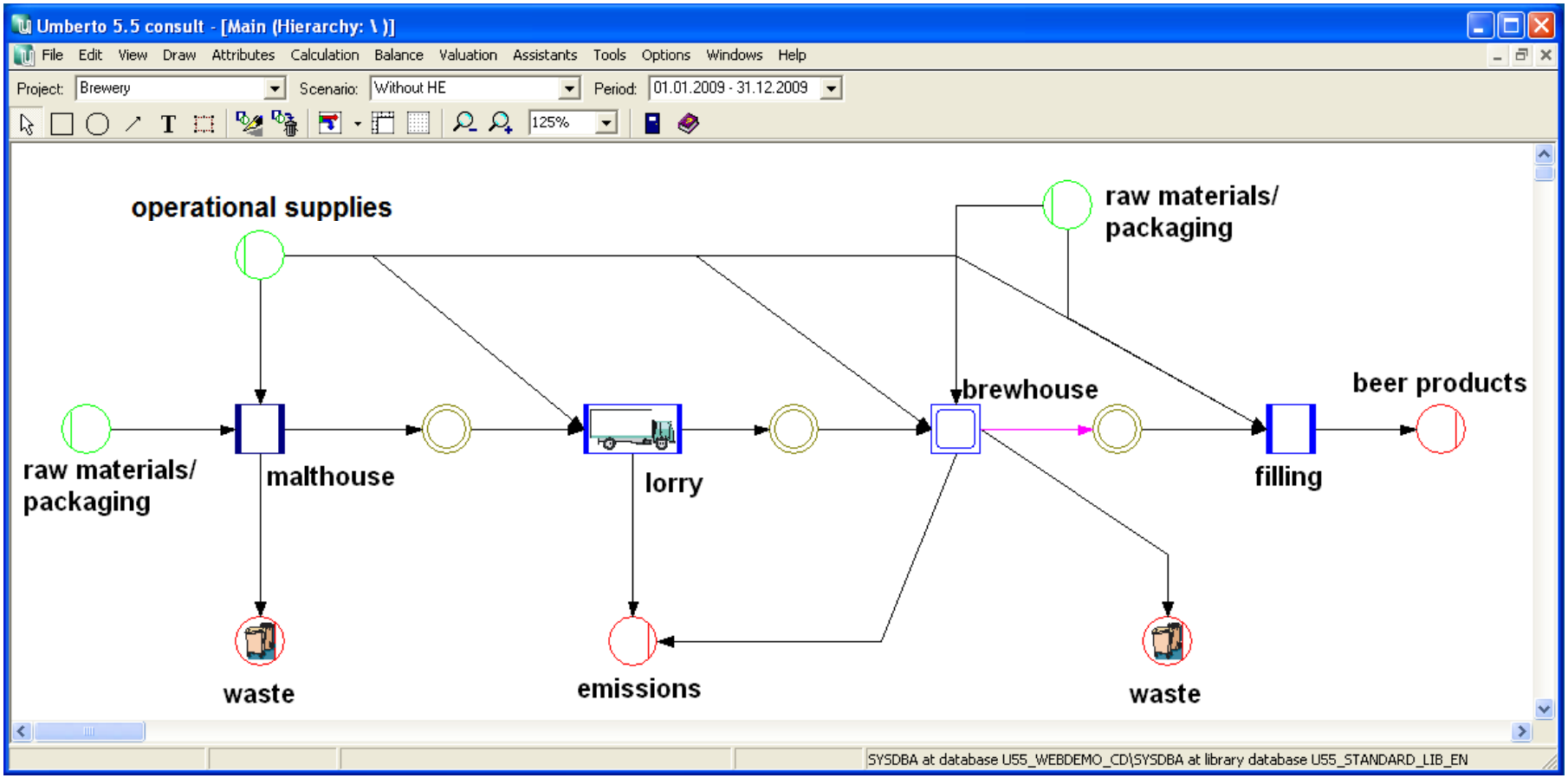
Cradle-to-gate or..

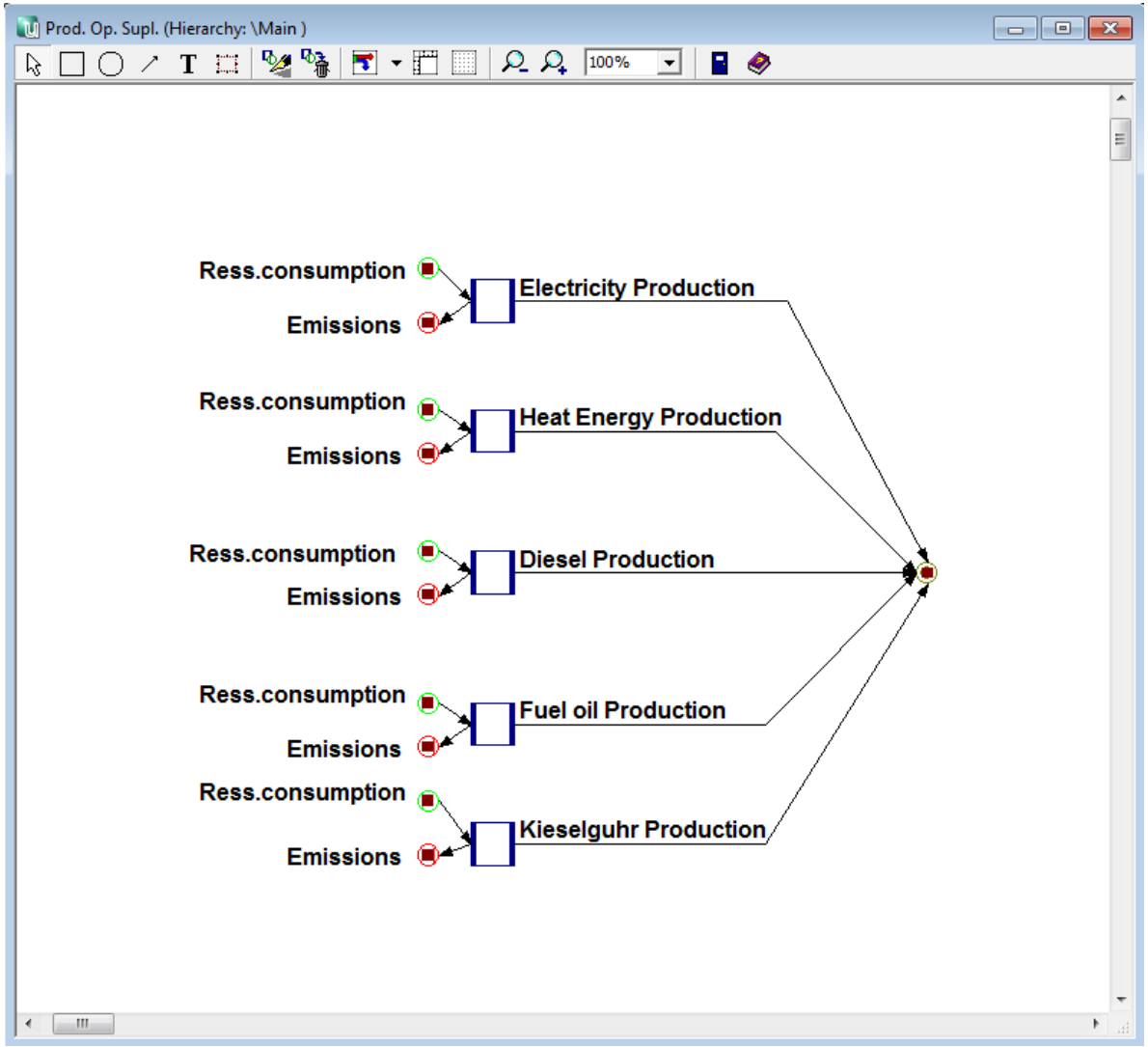


…Cradle-to-cradle



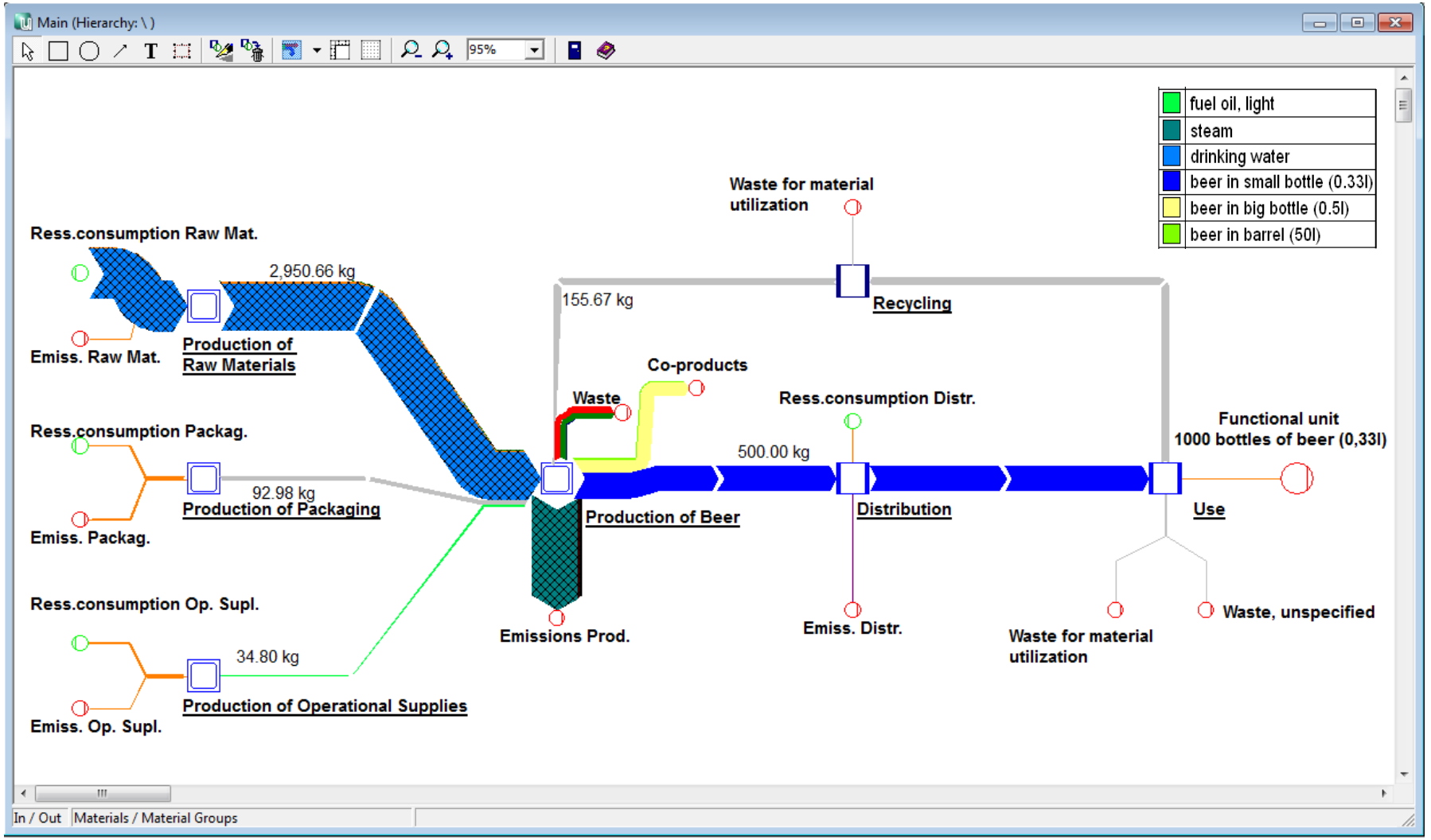
Hierarchical Modelling of Life Cycle Phases (e.g. Production)



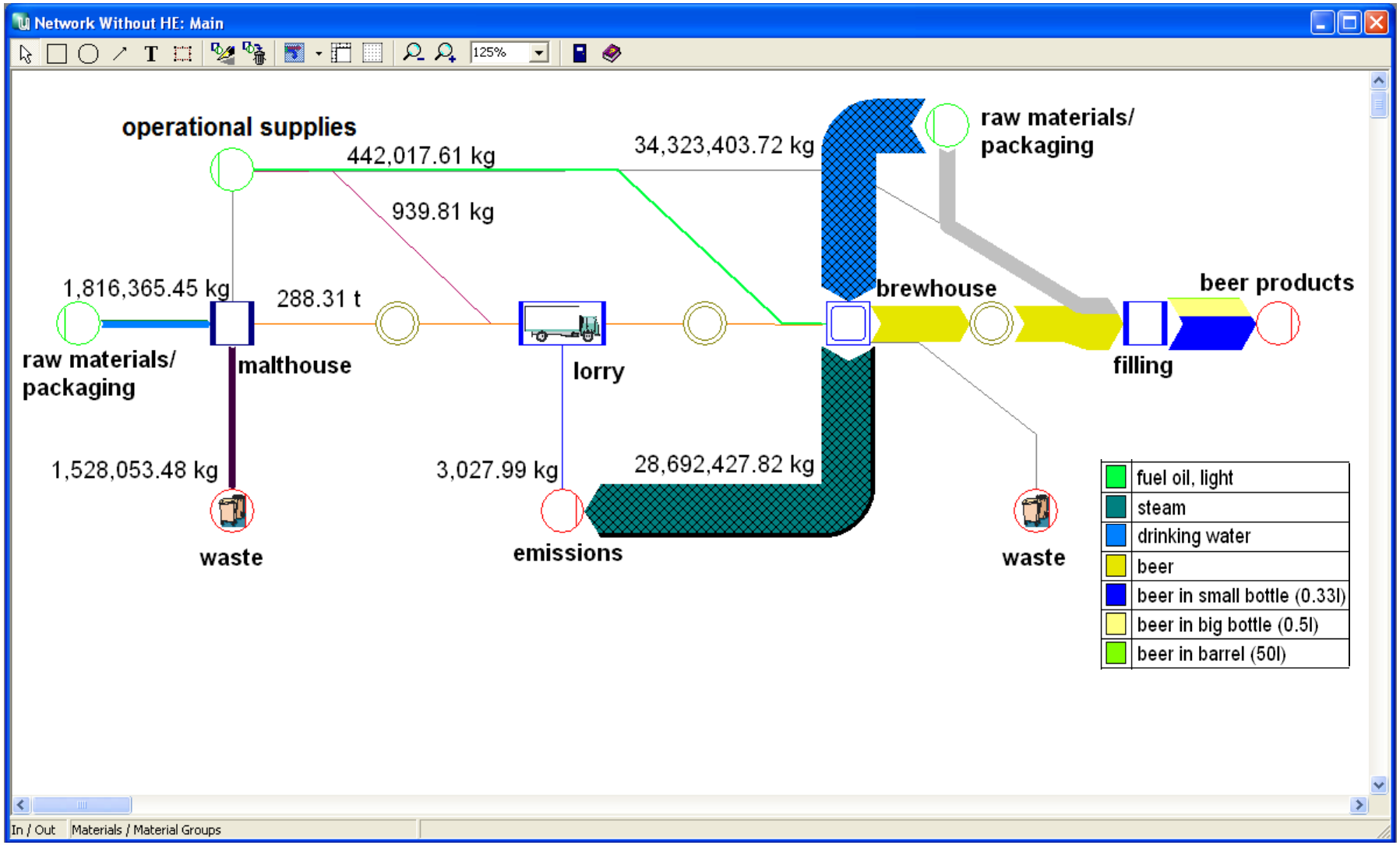


Incorporation of Pre-Chains Processes (available in DB like Ecoinvent)

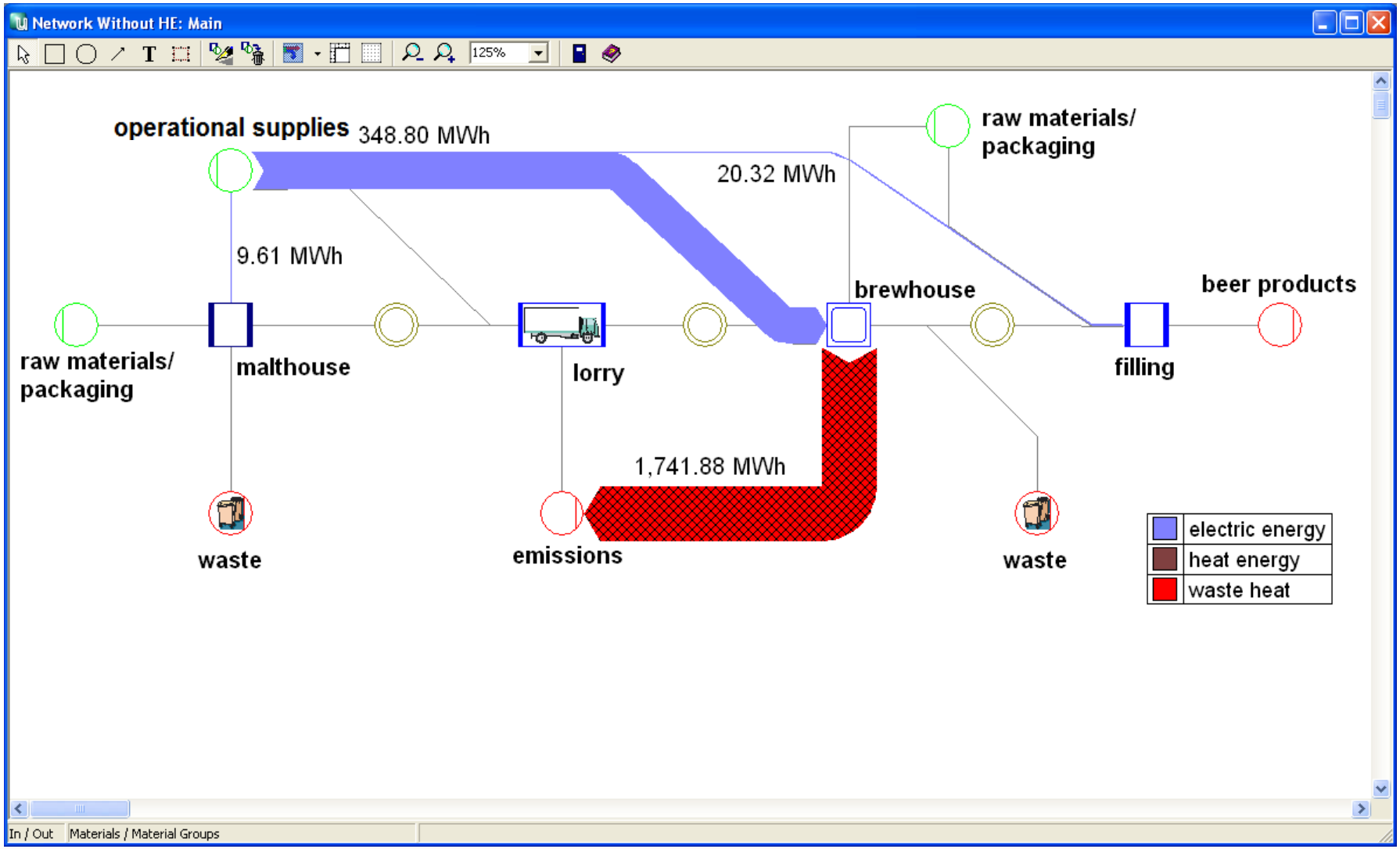
Visualized Calculation



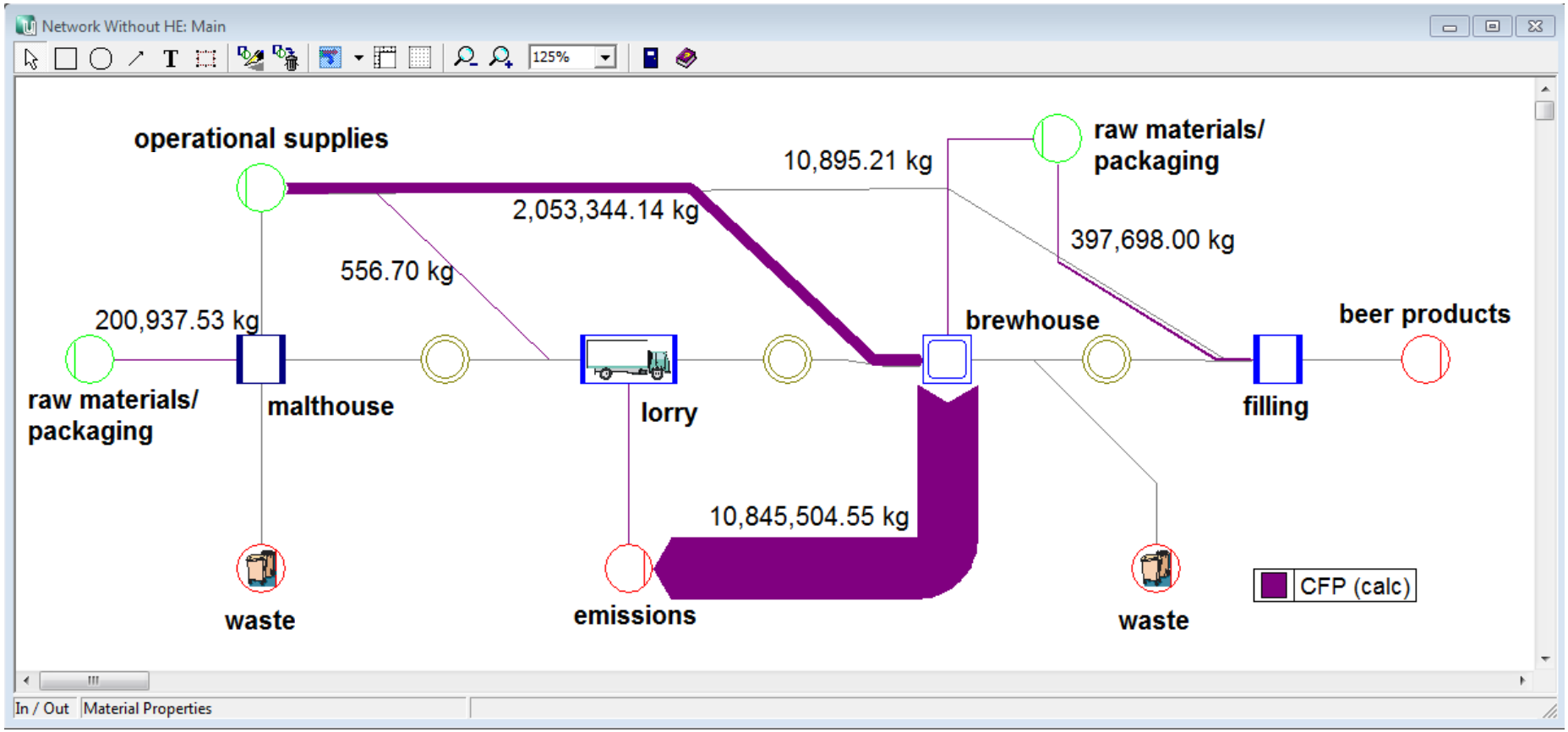
Material flow visualization



Energy flow visualization



Visualization of material properties (e.g. kg CO2 equivalents)

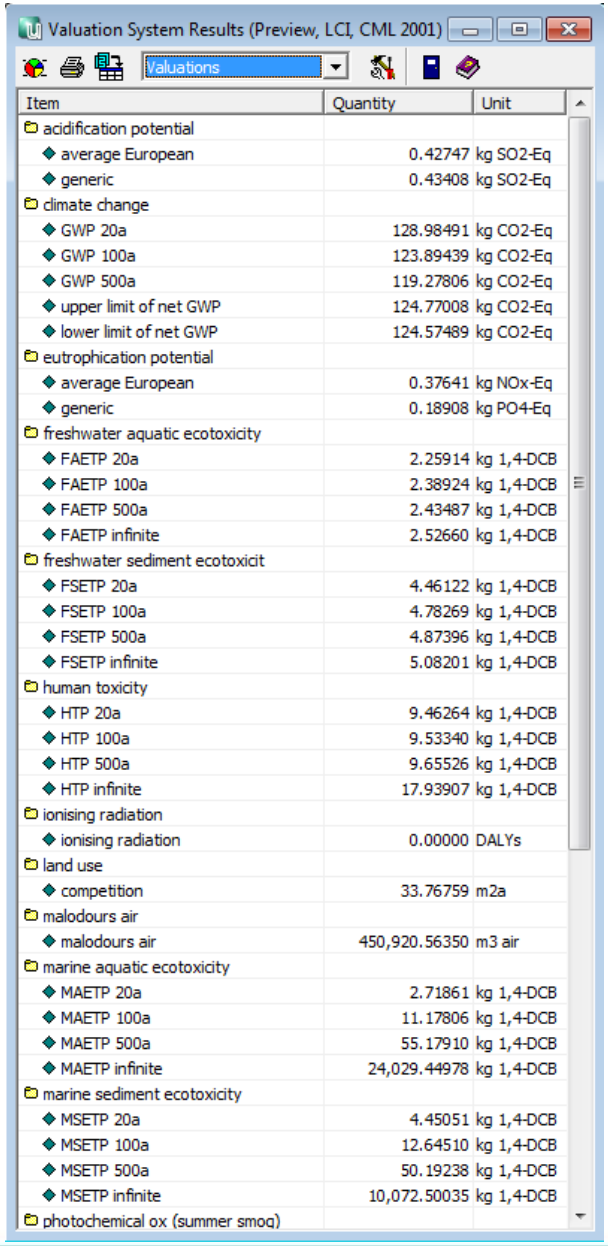


Possibilities you are offered in Umberto

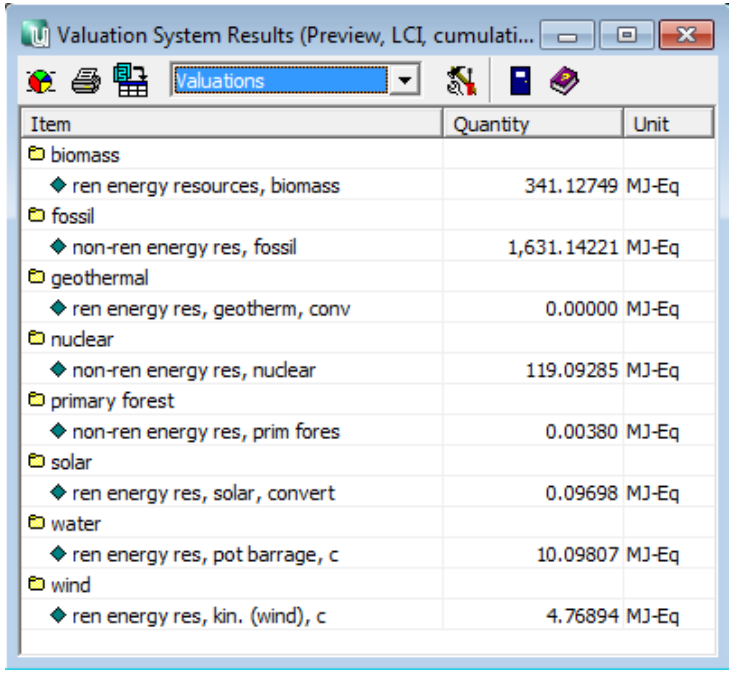
- Scope definition through graphical modelling and visualization
- Life Cycle Inventory Calculation

Possibilities you are offered in Umberto

- Scope definition through graphical modelling and visualization
- Life Cycle Inventory Calculation
- Life Cycle Impact Assessment



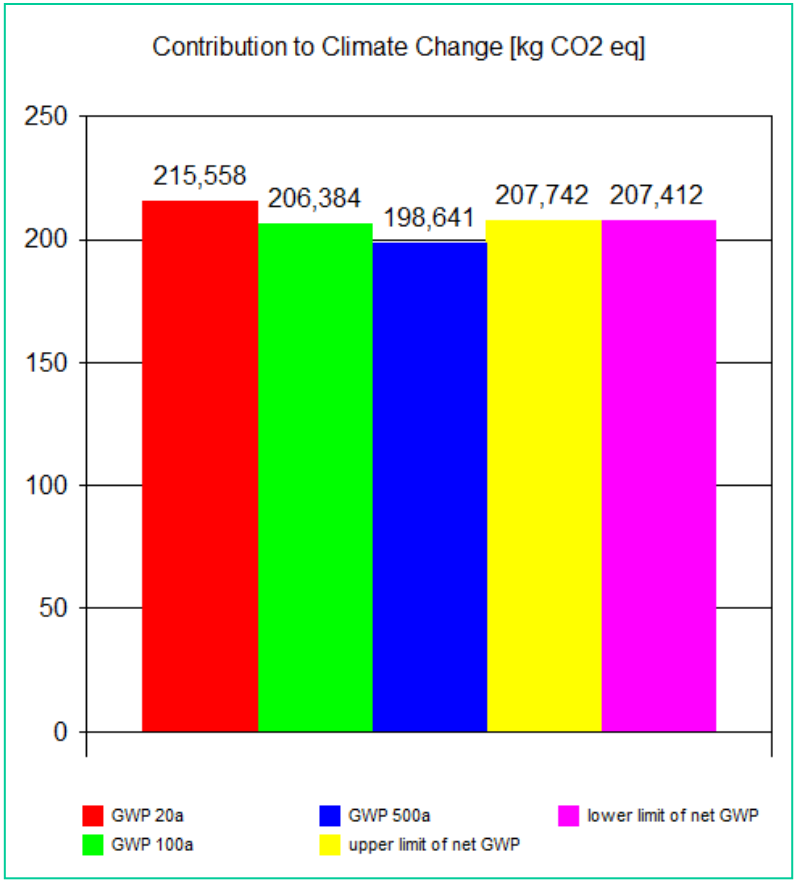
Item	Quantity	Unit
acidification potential		
average European	0.42747	kg SO2-Eq
generic	0.43408	kg SO2-Eq
climate change		
GWP 20a	128.98491	kg CO2-Eq
GWP 100a	123.89439	kg CO2-Eq
GWP 500a	119.27806	kg CO2-Eq
upper limit of net GWP	124.77008	kg CO2-Eq
lower limit of net GWP	124.57489	kg CO2-Eq
eutrophication potential		
average European	0.37641	kg NOx-Eq
generic	0.18908	kg PO4-Eq
freshwater aquatic ecotoxicity		
FAETP 20a	2.25914	kg 1,4-DCB
FAETP 100a	2.38924	kg 1,4-DCB
FAETP 500a	2.43487	kg 1,4-DCB
FAETP infinite	2.52660	kg 1,4-DCB
freshwater sediment ecotoxicit		
FSETP 20a	4.46122	kg 1,4-DCB
FSETP 100a	4.78269	kg 1,4-DCB
FSETP 500a	4.87396	kg 1,4-DCB
FSETP infinite	5.08201	kg 1,4-DCB
human toxicity		
HTP 20a	9.46264	kg 1,4-DCB
HTP 100a	9.53340	kg 1,4-DCB
HTP 500a	9.65526	kg 1,4-DCB
HTP infinite	17.93907	kg 1,4-DCB
ionising radiation		
ionising radiation	0.00000	DALYs
land use		
competition	33.76759	m2a
malodours air		
malodours air	450,920.56350	m3 air
marine aquatic ecotoxicity		
MAETP 20a	2.71861	kg 1,4-DCB
MAETP 100a	11.17806	kg 1,4-DCB
MAETP 500a	55.17910	kg 1,4-DCB
MAETP infinite	24,029.44978	kg 1,4-DCB
marine sediment ecotoxicity		
MSETP 20a	4.45051	kg 1,4-DCB
MSETP 100a	12.64510	kg 1,4-DCB
MSETP 500a	50.19238	kg 1,4-DCB
MSETP infinite	10,072.50035	kg 1,4-DCB
photochemical ox (summer smog)		

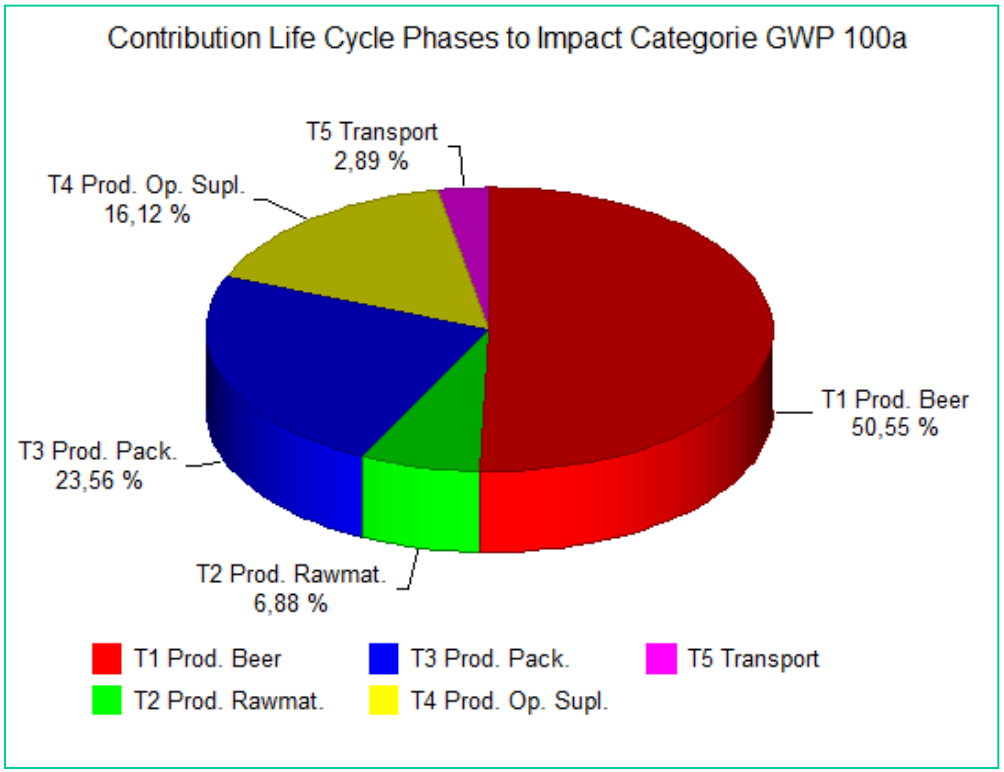


Item	Quantity	Unit
biomass		
ren energy resources, biomass	341.12749	MJ-Eq
fossil		
non-ren energy res, fossil	1,631.14221	MJ-Eq
geothermal		
ren energy res, geotherm, conv	0.00000	MJ-Eq
nuclear		
non-ren energy res, nuclear	119.09285	MJ-Eq
primary forest		
non-ren energy res, prim fores	0.00380	MJ-Eq
solar		
ren energy res, solar, convert	0.09698	MJ-Eq
water		
ren energy res, pot barrage, c	10.09807	MJ-Eq
wind		
ren energy res, kin. (wind), c	4.76894	MJ-Eq

Application of standardized LCA evaluation methods like CML or CED

Result Analysis

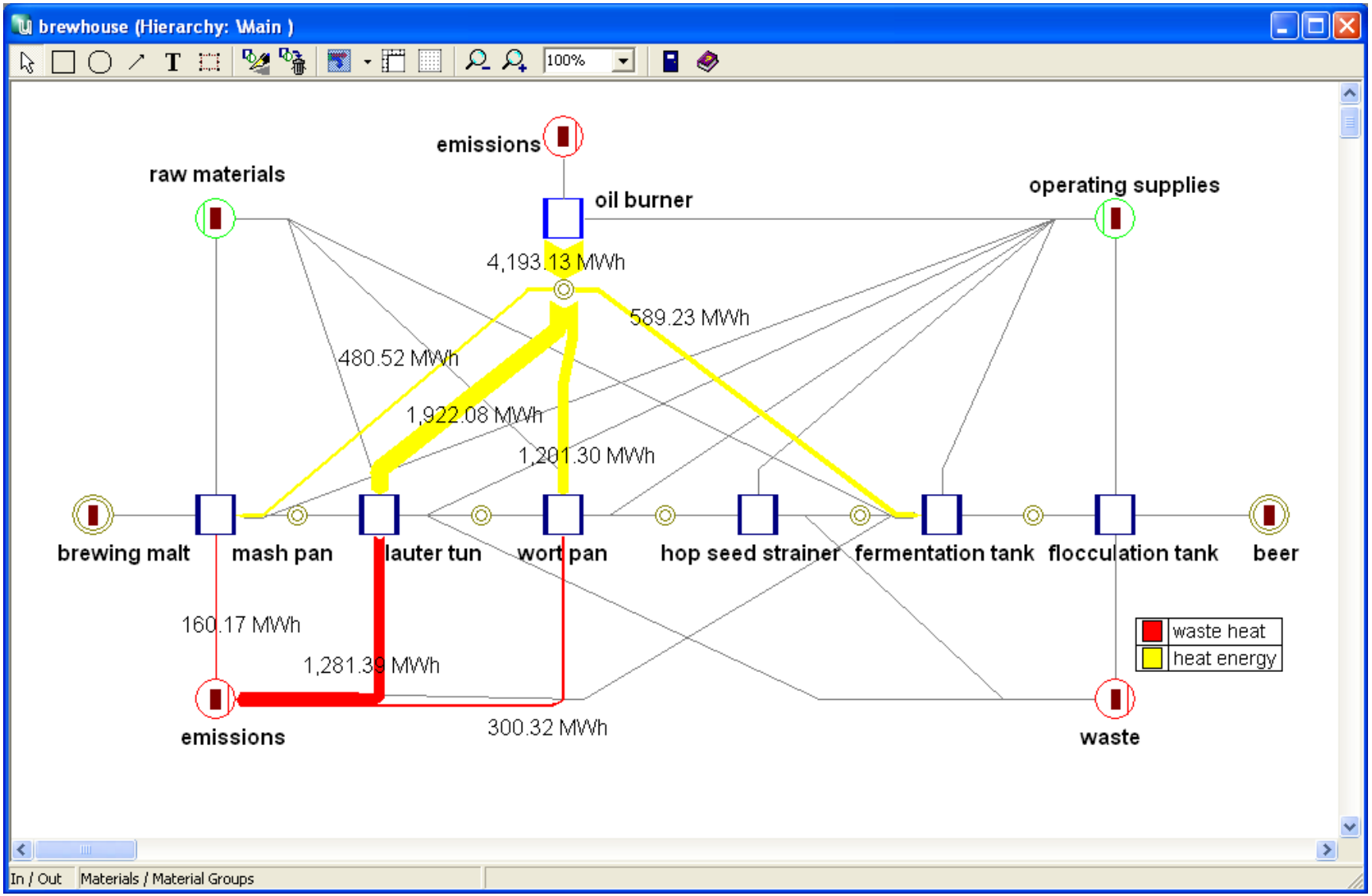




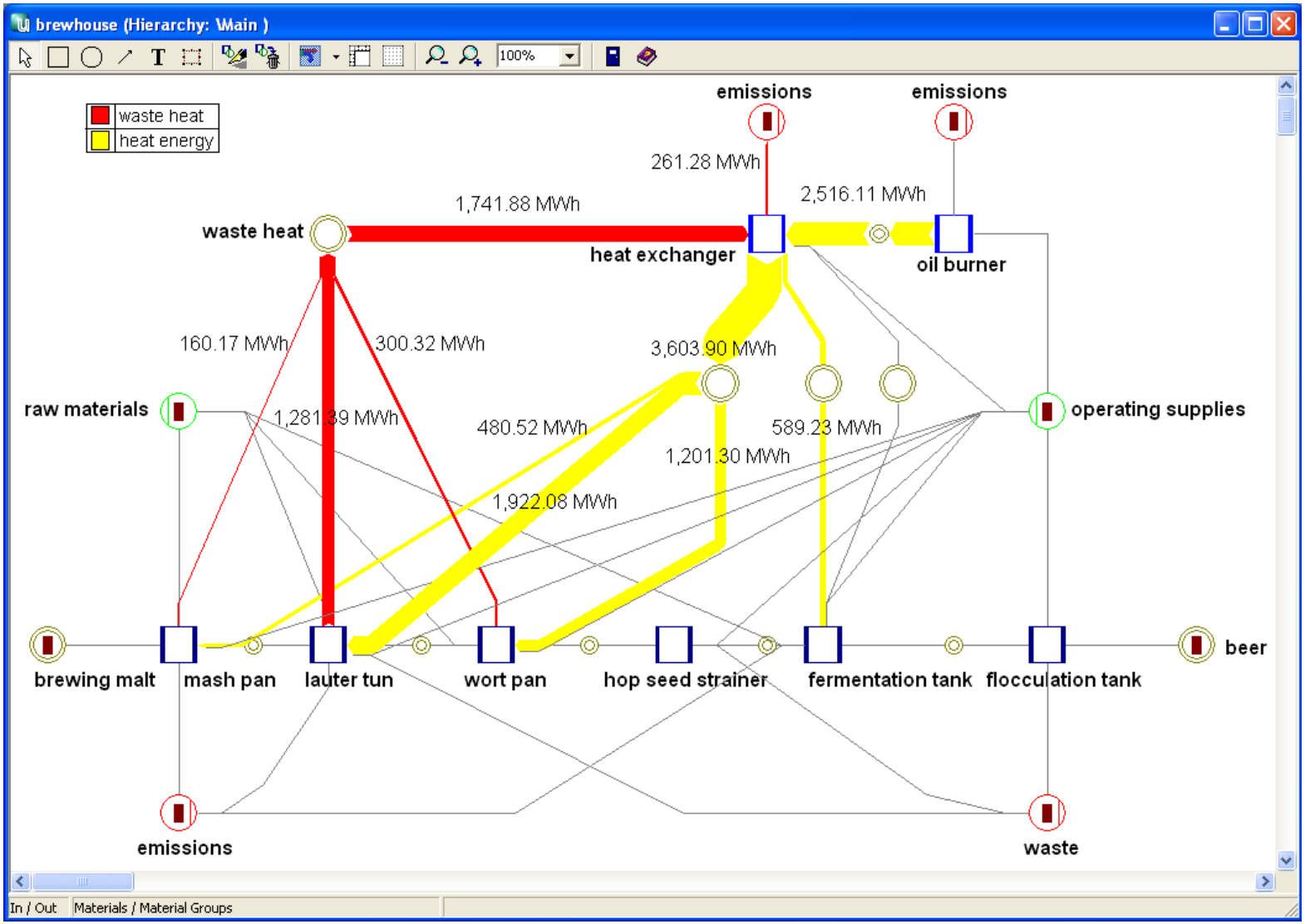
Possibilities you are offered in Umberto

- Scope definition through graphical modelling and visualization
- Life Cycle Inventory Calculation
- Life Cycle Impact Assessment
- Planning tool to optimize process technology / products

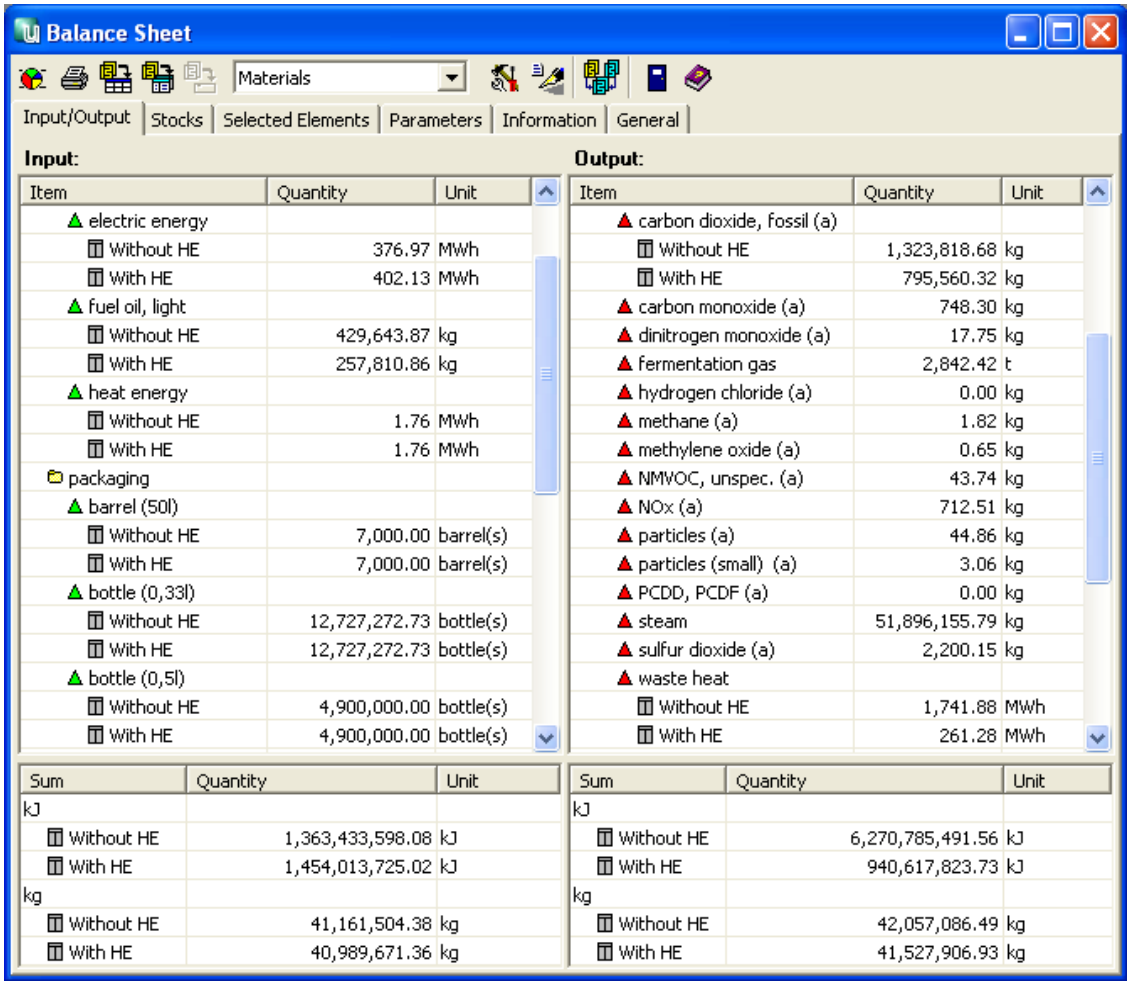
Present Situation (Submodel of the brewhouse process)



Planning of Process Alternatives



Comparison of alternative process routes (e.g. with or without heat exchanger) and their effect: on the LCI..



Balance Sheet

Materials

Input/Output | Stocks | Selected Elements | Parameters | Information | General

Input:

Item	Quantity	Unit
electric energy		
Without HE	376.97	MWh
With HE	402.13	MWh
fuel oil, light		
Without HE	429,643.87	kg
With HE	257,810.86	kg
heat energy		
Without HE	1.76	MWh
With HE	1.76	MWh
packaging		
barrel (50l)		
Without HE	7,000.00	barrel(s)
With HE	7,000.00	barrel(s)
bottle (0,33l)		
Without HE	12,727,272.73	bottle(s)
With HE	12,727,272.73	bottle(s)
bottle (0,5l)		
Without HE	4,900,000.00	bottle(s)
With HE	4,900,000.00	bottle(s)

Output:

Item	Quantity	Unit
carbon dioxide, fossil (a)		
Without HE	1,323,818.68	kg
With HE	795,560.32	kg
carbon monoxide (a)	748.30	kg
dinitrogen monoxide (a)	17.75	kg
fermentation gas	2,842.42	t
hydrogen chloride (a)	0.00	kg
methane (a)	1.82	kg
methylene oxide (a)	0.65	kg
NMVOC, unspec. (a)	43.74	kg
NOx (a)	712.51	kg
particles (a)	44.86	kg
particles (small) (a)	3.06	kg
PCDD, PCDF (a)	0.00	kg
steam	51,896,155.79	kg
sulfur dioxide (a)	2,200.15	kg
waste heat		
Without HE	1,741.88	MWh
With HE	261.28	MWh

Sum	Quantity	Unit
kJ		
Without HE	1,363,433,598.08	kJ
With HE	1,454,013,725.02	kJ
kg		
Without HE	41,161,504.38	kg
With HE	40,989,671.36	kg

Sum	Quantity	Unit
kJ		
Without HE	6,270,785,491.56	kJ
With HE	940,617,823.73	kJ
kg		
Without HE	42,057,086.49	kg
With HE	41,527,906.93	kg

..and on the LC impact assessment

Valuation System Results (Multi, LCI, CML 2001)

Valuations

Item	Quantity	Unit
acidification potential		
average European		
Without HE	0.42747	kg SO2-Eq
With HE	0.28995	kg SO2-Eq
generic		
Without HE	0.43408	kg SO2-Eq
With HE	0.31073	kg SO2-Eq
climate change		
GWP 20a		
Without HE	128.98491	kg CO2-Eq
With HE	60.39780	kg CO2-Eq
GWP 100a		
Without HE	123.89439	kg CO2-Eq
With HE	55.91015	kg CO2-Eq
GWP 500a		
Without HE	119.27806	kg CO2-Eq
With HE	51.59948	kg CO2-Eq
upper limit of net GWP		
Without HE	124.77008	kg CO2-Eq
With HE	56.62851	kg CO2-Eq
lower limit of net GWP		
Without HE	124.57489	kg CO2-Eq
With HE	56.50451	kg CO2-Eq
eutrophication potential		
average European		
Without HE	0.37641	kg NOx-Eq
With HE	0.33938	kg NOx-Eq
generic		
Without HE	0.18908	kg PO4-Eq
With HE	0.18207	kg PO4-Eq
freshwater aquatic ecotoxicity		
FAETP 20a		
Without HE	2.25914	kg 1,4-DCB
With HE	2.11368	kg 1,4-DCB
FAETP 100a		
Without HE	2.38924	kg 1,4-DCB

Valuation System Results (Multi, LCI, cumulative...

Valuations

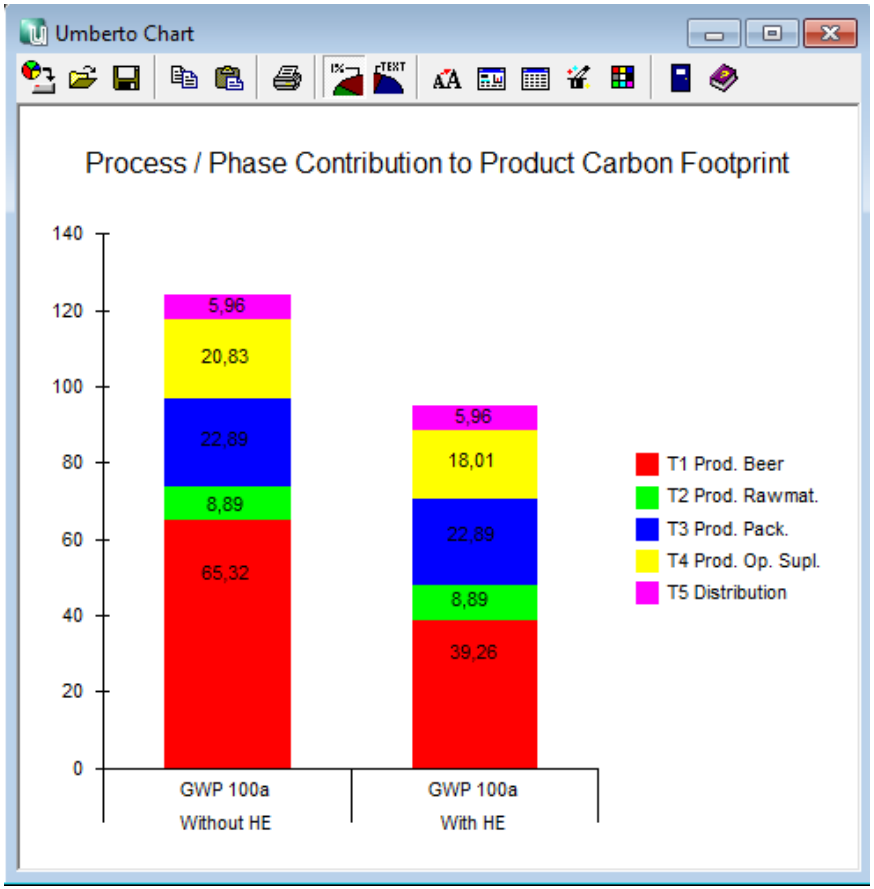
Item	Quantity	Unit
biomass		
ren energy resources, biomass		
Without HE	341.12749	MJ-Eq
With HE	341.19642	MJ-Eq
fossil		
non-ren energy res, fossil		
Without HE	1,631.14221	MJ-Eq
With HE	1,196.91845	MJ-Eq
geothermal		
ren energy res, geotherm, conv		
Without HE	0.00000	MJ-Eq
With HE	0.00000	MJ-Eq
nuclear		
non-ren energy res, nuclear		
Without HE	119.09285	MJ-Eq
With HE	120.01778	MJ-Eq
primary forest		
non-ren energy res, prim fores		
Without HE	0.00380	MJ-Eq
With HE	0.00369	MJ-Eq
solar		
ren energy res, solar, convert		
Without HE	0.09698	MJ-Eq
With HE	0.10045	MJ-Eq
water		
ren energy res, pot barrage, c		
Without HE	10.09807	MJ-Eq
With HE	9.96911	MJ-Eq
wind		
ren energy res, kin. (wind), c		
Without HE	4.76894	MJ-Eq
With HE	4.91587	MJ-Eq

How big is the contribution of the LC phases to the Product Carbon Footprint of different process scenarios?

Valuation System Results (Multi, L...

Valuations-Transitions

Item	Quantity	Unit
climate change		
GWP 20a		
Without HE	128.99	kg CO2-Eq
With HE	99.50	kg CO2-Eq
GWP 100a		
Without HE		
T1 Prod. Beer	65.32	kg CO2-Eq
T2 Prod. Rawmat.	8.89	kg CO2-Eq
T3 Prod. Pack.	22.89	kg CO2-Eq
T4 Prod. Op. Supl.	20.83	kg CO2-Eq
T5 Distribution	5.96	kg CO2-Eq
With HE		
T1 Prod. Beer	39.26	kg CO2-Eq
T2 Prod. Rawmat.	8.89	kg CO2-Eq
T3 Prod. Pack.	22.89	kg CO2-Eq
T4 Prod. Op. Supl.	18.01	kg CO2-Eq
T5 Distribution	5.96	kg CO2-Eq
GWP 500a		
Without HE	119.28	kg CO2-Eq
With HE	90.66	kg CO2-Eq

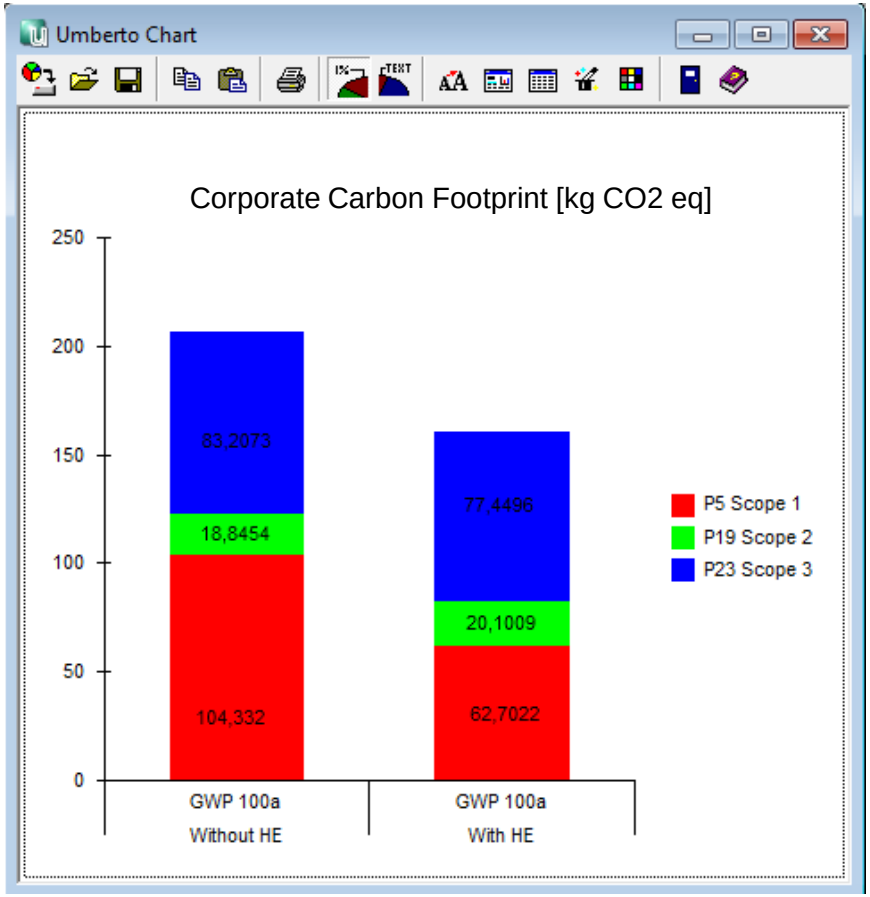


Corporate Carbon Footprint (GHG Protocol)

Valuation System Results (Multi, Inpu...

Valuations-Places

Item	Quantity	Unit
climate change		
GWP 20a		
Without HE		
P5 Scope 1	104.33	kg CO2-Eq
P19 Scope 2	20.61	kg CO2-Eq
P23 Scope 3	90.62	kg CO2-Eq
With HE		
P5 Scope 1	62.70	kg CO2-Eq
P19 Scope 2	21.98	kg CO2-Eq
P23 Scope 3	83.78	kg CO2-Eq
GWP 100a		
Without HE		
P5 Scope 1	104.33	kg CO2-Eq
P19 Scope 2	18.85	kg CO2-Eq
P23 Scope 3	83.21	kg CO2-Eq
With HE		
P5 Scope 1	62.70	kg CO2-Eq
P19 Scope 2	20.10	kg CO2-Eq
P23 Scope 3	77.45	kg CO2-Eq
GWP 500a		
Without HE		
P5 Scope 1	104.20	kg CO2-Eq
P19 Scope 2	18.12	kg CO2-Eq
P23 Scope 3	76.32	kg CO2-Eq
With HE		
P5 Scope 1	62.62	kg CO2-Eq
P19 Scope 2	19.32	kg CO2-Eq
P23 Scope 3	70.98	kg CO2-Eq

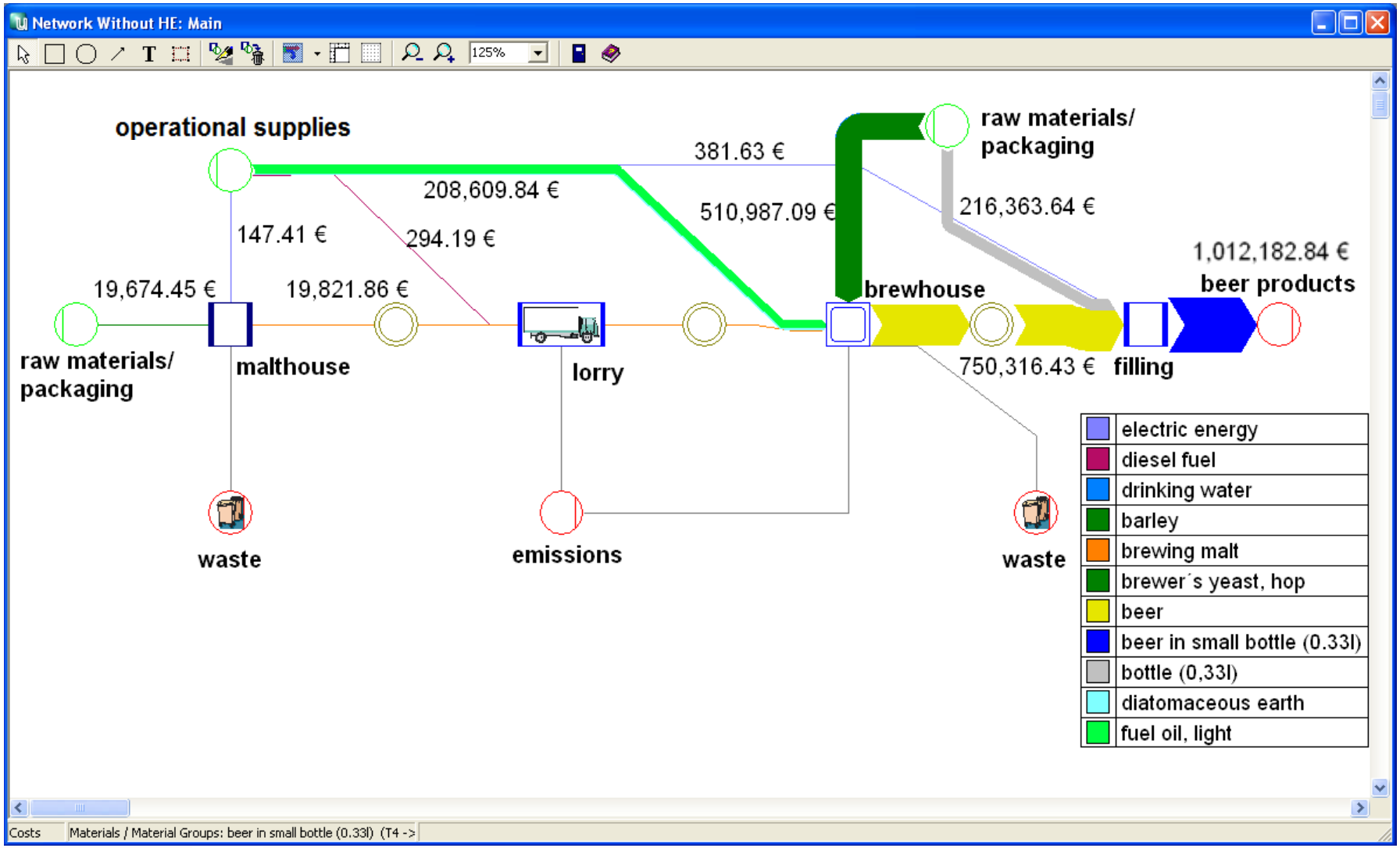


Optional

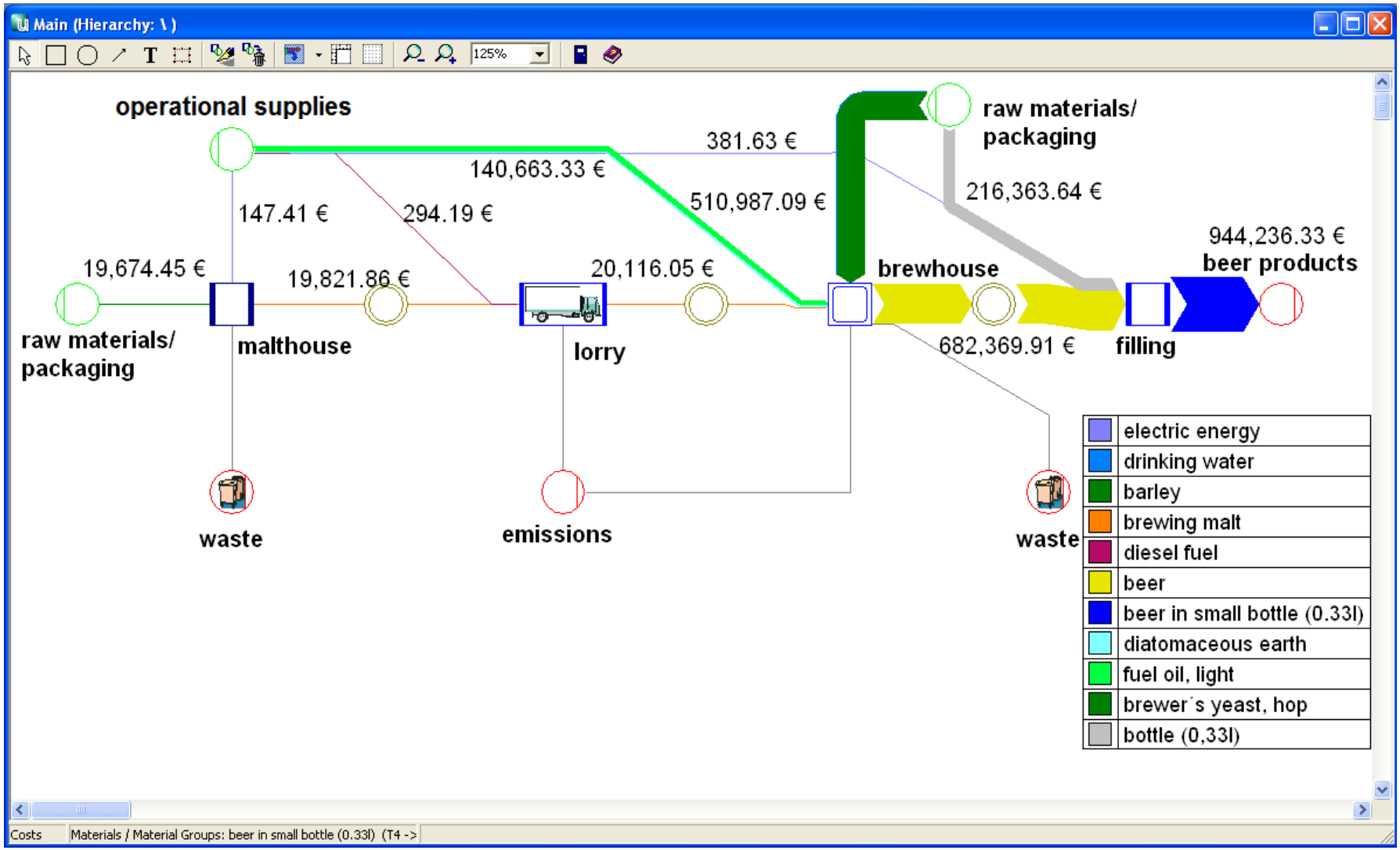
Analysis and Assessment considering Cost Aspects

- Material and process related costs (variable / fixed)

Visualization of Cost Flows: Present Situation



Visualization of Cost Flows: Alternative Planning



Analysis and Assessment considering Cost Aspects

- Material and process related costs (variable / fixed)
- Cost accounting regarding cost types, centres and units
- Calculation of internal prices and marginal income

Balance Sheet - Without HE

Materials

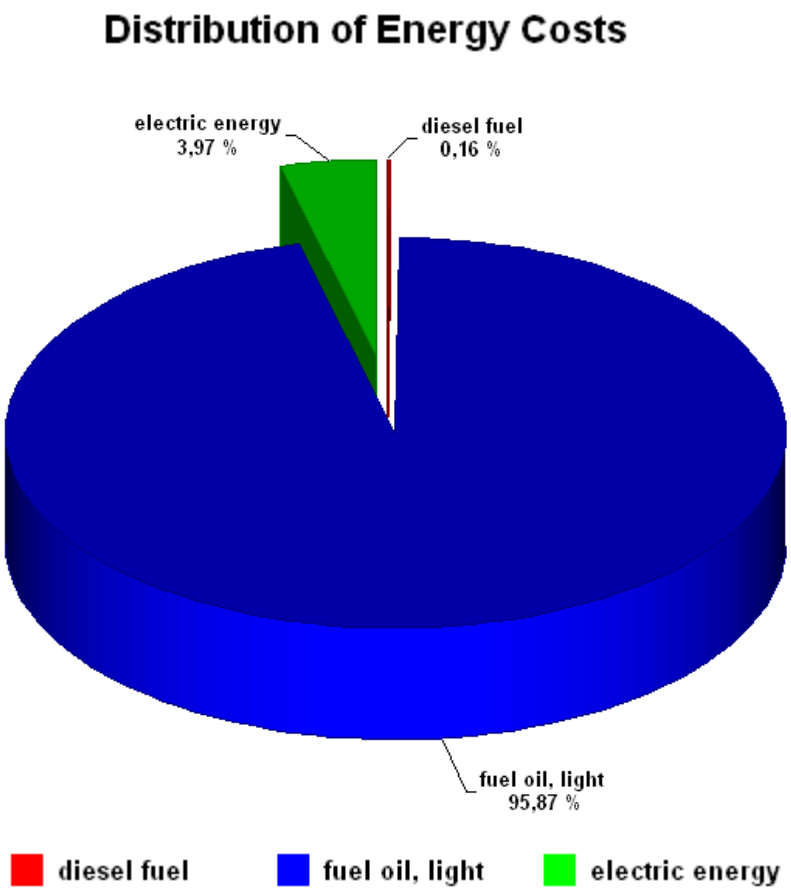
Input/Output | Stocks | LCIs | Variable Costs | Fixed Costs | Selected El

beer in small bottle (0.33l) (Output, A16 — 12,727,272.73 bottle(s)

Variable Costs:

Item	Proportional Costs	Unit
Brewery Ltd.		
energy		
diesel fuel	294.19	€
electric energy	7,080.13	€
fuel oil, light	171,072.12	€
packaging		
bottle (0,33l)	216,363.64	€
raw materials / intermediate products		
barley	18,771.96	€
brewer´s yeast	354,132.95	€
diatomaceous earth	30,986.63	€
drinking water	22,381.95	€
hop	135,374.68	€
waste		
6730 biowaste	9,693.50	€
6730 brewer´s grains	677.55	€
6731 diatomaceous earth left-overs	232.40	€
2 Salaries		
21 Salaries filling	45,121.14	€

Sum	Proportional Costs	Unit
Revenues	5,090,909.09	€
Variable Costs	-1,012,182.84	€
Marginal Income	4,078,726.25	€



Balance Sheet - Without HE

Materials - Transitions

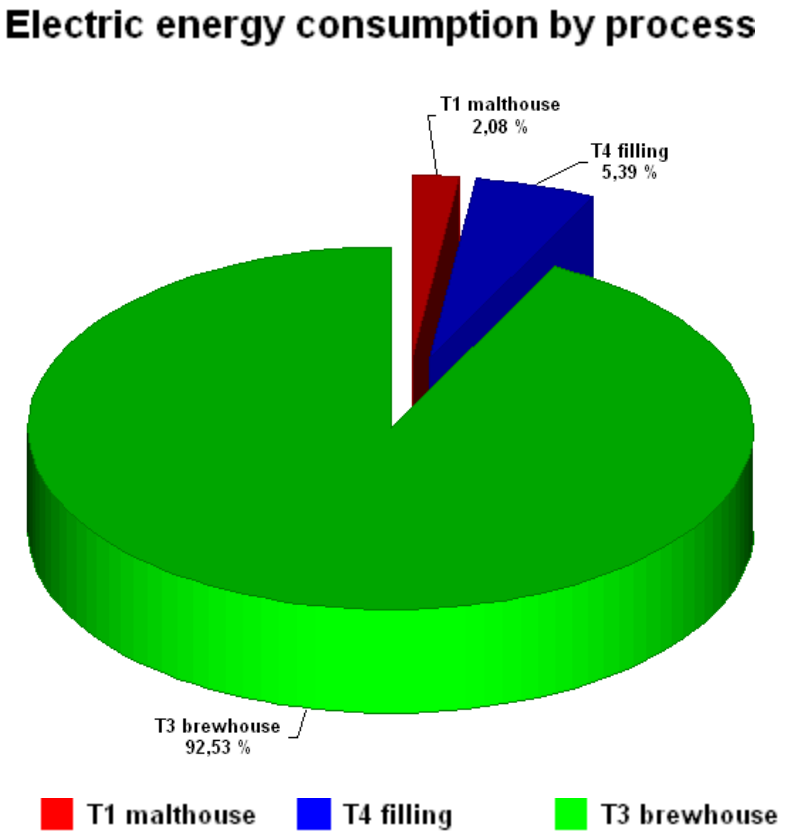
Input/Output | Stocks | LCIs | Variable Costs | Fixed Costs | Selected El

beer in small bottle (0.33l) (Output, A16 | 12,727,272.73 bottle(s)

Variable Costs:

Item	Proportional Costs	Unit
Brewery Ltd.		
energy		
diesel fuel		
T2 lorry, round tr	294.19	€
electric energy		
T1 malthouse	147.41	€
T3 brewhouse	6,551.09	€
T4 filling	381.63	€
fuel oil, light		
T3 brewhouse	171,072.12	€
packaging		
bottle (0,33l)	216,363.64	€
raw materials / intermediate products	561,648.17	€
waste	10,603.45	€
2 Salaries		
21 Salaries filling		
T4 21 filling	45,121.14	€

Sum	Proportional Costs	Unit
Revenues	5,090,909.09	€
Variable Costs	-1,012,182.84	€
Marginal Income	4,078,726.25	€



Balance Sheet

Materials - Transitions

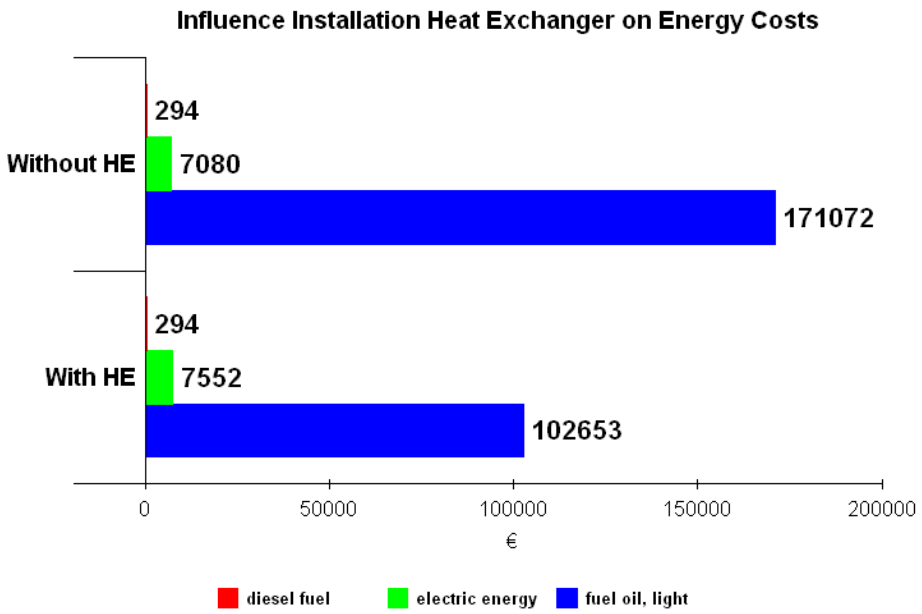
Input/Output | Stocks | LCIs | Variable Costs | Fixed Costs | Selected El

beer in small bottle (0.33l) (Output, A16 | 12,727,272.73 bottle(s)

Variable Costs:

Item	Proportional Costs	Unit
Brewery Ltd.		
energy		
diesel fuel	588.38	€
electric energy		
Without HE		
T1 malthouse	147.41	€
T3 brewhouse	6,551.09	€
T4 filling	381.63	€
With HE		
T1 malthouse	147.41	€
T3 brewhouse	7,023.66	€
T4 filling	381.63	€
fuel oil, light		
Without HE		
T3 brewhouse	171,072.12	€
With HE		
T3 brewhouse	102,653.04	€

Sum	Proportional Costs	Unit
Revenues		
Without HE	5,090,909.09	€
With HE	5,090,909.09	€
Variable Costs		
Without HE	-967,061.70	€
With HE	-899,115.18	€
Marginal Income		
Without HE	4,123,847.40	€
With HE	4,191,793.91	€

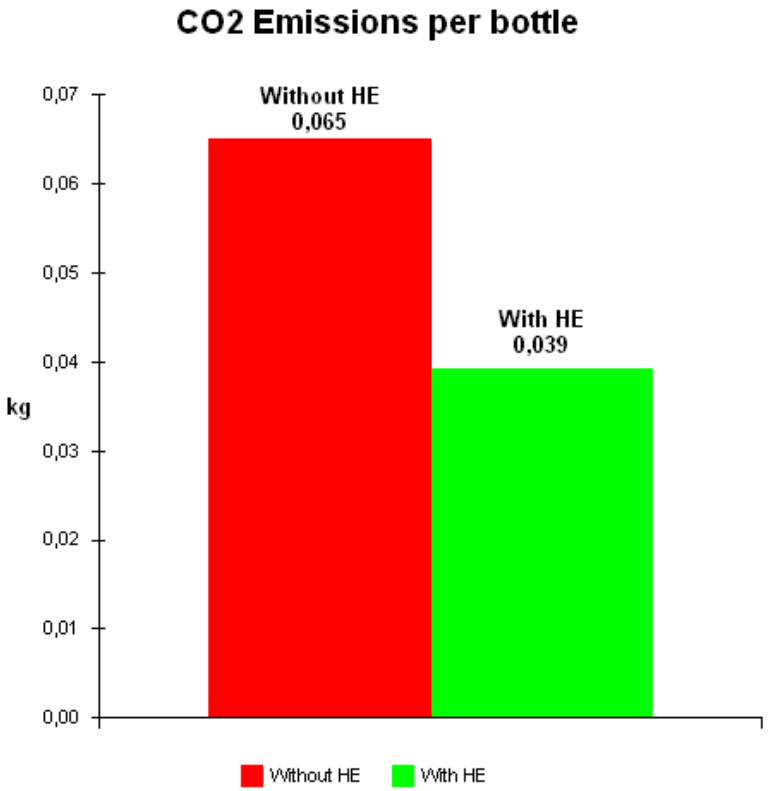


Freely define key performance indicators

Valuation System Results (Multi, Inp...

Valuations

Item	Quantity	Unit
energy consumption per bottle		
Without HE	940.641	kj/bottle
With HE	595.717	kj/bottle
water consumption per bottle		
Without HE	1.759	l/bottle
With HE	1.759	l/bottle
waste per bottle		
Without HE	1.569	kg/bottle
With HE	1.543	kg/bottle
waste heat per bottle		
Without HE	308.461	kj/bottle
With HE	46.269	kj/bottle
CO2 emissions per bottle		
Without HE	0.065	kg/bottle
With HE	0.039	kg/bottle



Analysis and Assessment considering environmental Aspects

- Corporate environmental balance
- Life Cycle Assessment / Carbon Footprint Analysis
  - One model delivers findings for several products
  - Usage of standard databases (e.g. Ecoinvent)
  - Assessment with pre-defined valuation systems (e.g. CML method)

Usual LCA performance indicators (e.g. CML method)

Valuation System Results (Multi, Input/...

Valuations

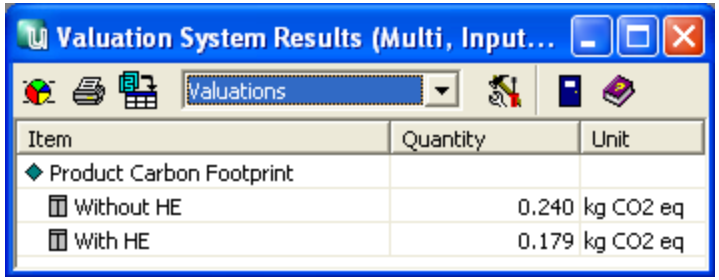
Item	Quantity	Unit
Aggregated Results		
abiotic depletion		
acidification		
Without HE	1,868.732	kg SO2 eq
With HE	1,127.758	kg SO2 eq
eutrophication		
Without HE	56.922	kg PO4 eq
With HE	35.717	kg PO4 eq
freshwater aquatic ecotoxicity	5.373	kg p-DCB
freshwater sedim. ecotoxicity	2.910	kg p-DCB
global warming		
Without HE	1,327,256.498	kg CO2 eq
With HE	797,662.658	kg CO2 eq
human toxicity		
Without HE	802.613	kg p-DCB
With HE	554.126	kg p-DCB
marine aquatic ecotoxicity		
Without HE	0.542	kg p-DCB
With HE	0.542	kg p-DCB
marine sedimental ecotoxicity		
Without HE	0.524	k p-DCB
With HE	0.524	k p-DCB
ozone layer depletion		
odour	1,365,460.638	m3
photochemical oxidation		
Without HE	78.763	kg ethylen
With HE	47.430	kg ethylen
radiation		
terrestrial ecotoxicity	0.611	kg p-DCB

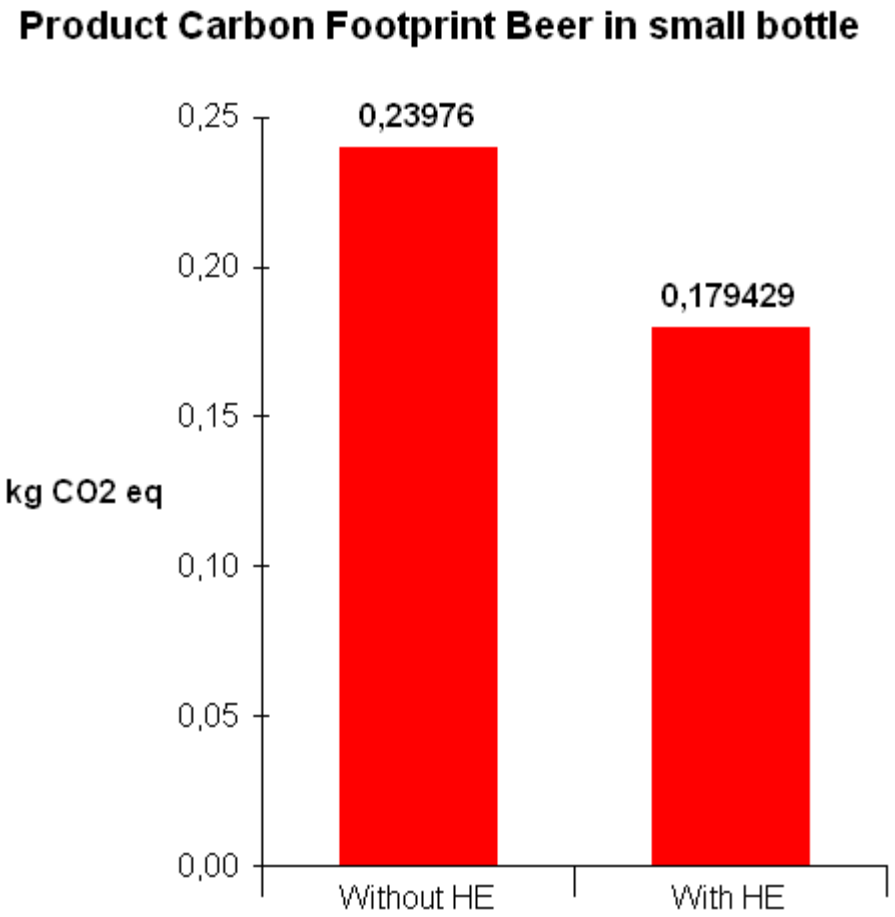
Valuation System Results (Multi, Input/...

Valuations-Transitions

Item	Quantity	Unit
Aggregated Results		
abiotic depletion		
acidification		
Without HE		
T2 lorry, round tr	16.032	kg SO2 eq
T3 brewhouse	1,852.700	kg SO2 eq
With HE		
T2 lorry, round tr	16.032	kg SO2 eq
T3 brewhouse	1,111.726	kg SO2 eq
eutrophication		
Without HE		
T2 lorry, round tr	3.903	kg PO4 eq
T3 brewhouse	53.019	kg PO4 eq
With HE		
T2 lorry, round tr	3.903	kg PO4 eq
T3 brewhouse	31.814	kg PO4 eq
freshwater aquatic ecotoxicity	5.373	kg p-DCB
freshwater sedim. ecotoxicity	2.910	kg p-DCB
global warming		
Without HE		
T2 lorry, round tr	3,082.847	kg CO2 eq
T3 brewhouse	1,324,173.651	kg CO2 eq
With HE		
T2 lorry, round tr	3,082.847	kg CO2 eq
T3 brewhouse	794,579.811	kg CO2 eq
human toxicity	1,356.739	kg p-DCB
marine aquatic ecotoxicity	1.083	kg p-DCB
marine sedimental ecotoxicity	1.048	k p-DCB
ozone layer depletion		

Usual key performance indicators (e.g. Product Carbon Footprint)





Summary

With Umberto

- you get transparency,
- speed up your analyses and
- make decisions on a well-founded basis

to reach

- an increased material and energy efficiency,
- lower production costs and
- an improved environmental performance.