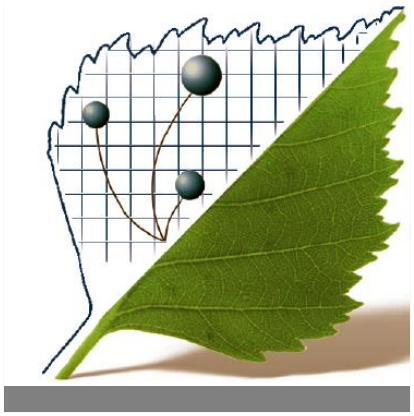
USER HANDBOOK for

Web-based Eco-Efficiency-Analysis

Quantifying Sustainability

Packaging for crop protection materials



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BASF SE

USER HANDBOOK for

Web-based Eco-Efficiency-Analysis

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METHODOLOGY

1.1. BASF's Eco-Efficiency Analysis (EEA)

Eco-Efficiency Analysis is a measure of the environmental and economic aspects of a product or process under consideration of the complete life cycle compared to one or more alternatives that fulfill the defined functional unit or customer benefit.

The Eco-Efficiency Analysis methodology of BASF is described in detail in publications [1] [2]. The BASF method has been certified since 2002 by the TUV Rheinland (TUV ID 5711150561) and since 2009 by the American NSF organization. The method follows the ISO 14040 and 14044 standards for the environmental assessment evaluation and ISO 14045 (2012) for eco-efficiency assessment.

BASF's EEA approach evaluates the environmental impact of the production, use, and disposal of a product or process in the areas of energy and resource consumption, emissions (to air, water and soil), toxicity and risk potential, and land use. The EEA also evaluates the life cycle costs associated with the product or process by calculating the total costs related to materials, labor, manufacturing, waste disposal, and energy.

Products or processes studied have to meet the same defined customer benefit (CB), e.g. tonnes of plastic containers removed from the general environment, so that results of the EEA can be used to compare different products or processes.

In Figure 1, the general procedure for a BASF eco-efficiency analysis is shown.

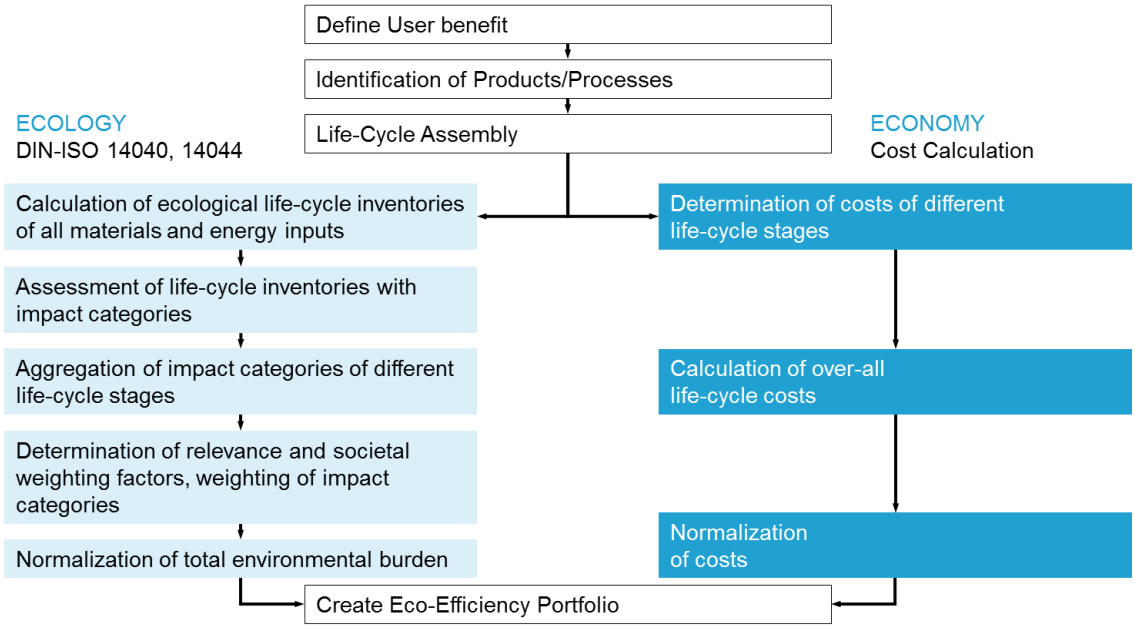

Figure 1: general procedure for a BASF eco-efficiency analysis

1.2. Environmental Impact Metrics

1.2.1. Overview

For BASF EEA, the environmental burden is characterized by using different environmental impact categories including: primary energy consumption, resource consumption, greenhouse gas potential (GHG), ozone depletion potential (ODP), acidification potential (AP), photochemical ozone creation potential (POCP), water emissions, solid waste emissions, toxicity potential, risk potential, and land use. These are shown in Figure 2. There are six main categories of environmental burden that are used to construct the environmental footprint. The emissions category has a substructure where water emissions, wastes and air emissions are displayed. The air emissions have another substructure showing different additional categories (Global Warming, Ozone depletion, acidification and Photochemical Ozone Creation.

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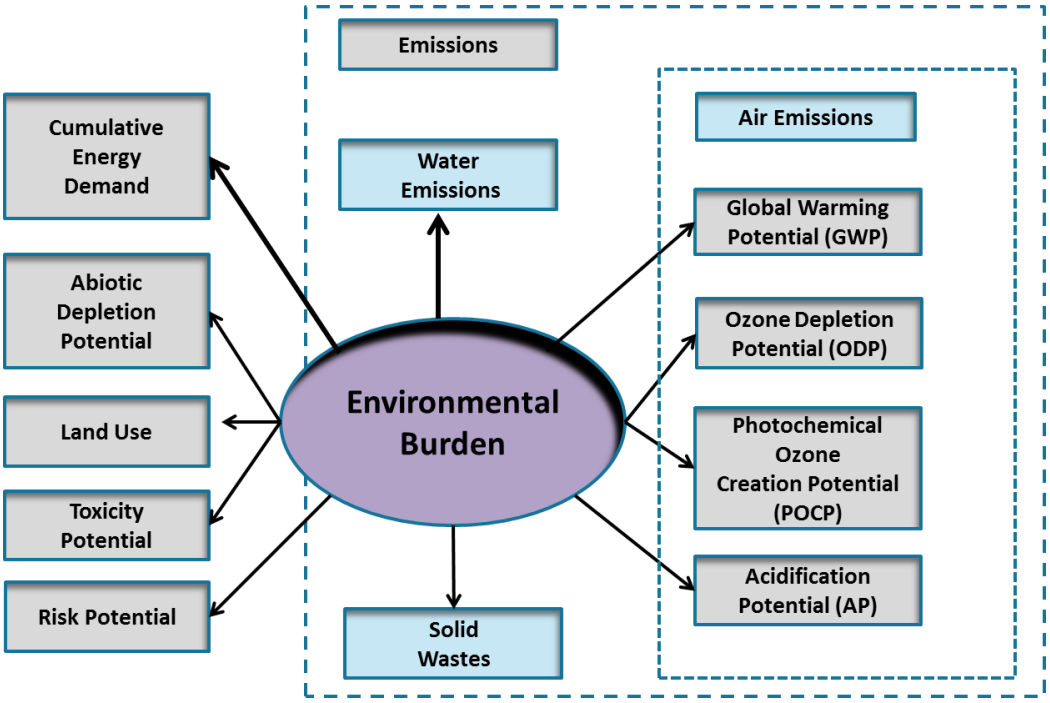


Figure 2: Environmental Burden Metrics for BASF EEA

1.2.2. Cumulative Energy Demand

This category includes the cumulative life cycle energy utilized during production, use, and disposal (i.e. embodied energy). All forms of energy are converted back to their primary energy sources, measured in megajoules/customer benefit (MJ/CB), and include: crude oil, natural gas, anthracite, lignite, uranium ore, water power, biomass and others. Conversion losses from electricity and steam generation are taken into consideration. The energies from biomass feedstock are included. However, the photosynthetic energy that is needed to produce the biomass is not included. The individual energy values are summed to obtain the total cumulative energy demand that is needed to fulfill the customer benefit.

1.2.3. Abiotic Depletion Potential

Abiotic Depletion Potential, or amount of key raw materials consumed, is calculated in terms of kg silver equivalents per customer benefit. Resources (raw materials) are defined as the basic building blocks needed to create a product (e.g. coal, oil, gas, lignite, uranium, sodium chloride, sulfur, phosphorus, iron, lime, bauxite, sand, copper, and titanium). These materials are selected as the resources to be considered because they are the basic starting blocks for a wide range of polymers and products (i.e. coal as a raw material for electricity generation). Additional resources are included as deemed necessary, with justification provided. Although the total resource consumption is calculated as the sum of the individual weighted raw material consumption values needed to fulfill the customer benefit. The weighting of the individual raw material consumption values is based on available resources and demand for the specific materials. A factor is used that reflects the demand and exploitable reserves of the raw materials, according to the statistical calculations of the U.S. Geological Survey and other sources. The lower the reserves of a raw material and the higher the worldwide rate of consumption, the scarcer that material is and, therefore, the higher the weighting factor it is assigned.

Renewable resources are assumed to be sustainably managed and theoretically unlimited in terms of availability. Therefore, they are assigned a weighting factor equal to zero. Thus, renewable resources are considered in the other environmental burden metrics but not in that of resource consumption. In cases when renewable resources are not sustainably managed (e.g. rainforest clear-cutting), an appropriate resource factor is applied.

1.2.4. Air Emissions

Air emissions are calculated in terms of mass of emissions generated per CB (kg/CB) over the entire life cycle. BASF EEA considers the following air emissions: CO_2, SO_X, NO_X, CH_4, non-methane volatile organic compounds (NM-VOC), halogenated hydrocarbons (hal. HC), NH_3, N_2O, and HCl. These emissions are grouped and the environmental burden is reported under the following air emission categories:

- Global warming potential (GWP) - CO_2, CH_4, hal. HC, N_2O (reported as CO_2-equivalents)
- Photochemical ozone creation potential (POCP) - NM-VOC, CH_4 (reported as ethylene equivalents)
- Ozone depletion potential (ODP) - HC (reported as CFC-equivalents)
- Acidification potential (AP) - SO_x, NO_x, NH_3, HCl (reported as SO_2-equivalents)

The emissions considered are weighted with a factor reflecting their potency regarding the global warming, acidification, smog creation, and ozone depletion potentials.

1.2.5. Water Emissions

Water emissions are assessed through a critical volumes approach, which considers both the total amount of emissions to water, as well as the ecological impact of the chemicals being emitted. The individual critical volumes are then summed for a particular life cycle stage in order to obtain an overall impact (L/CB). BASF EEA will consider the following chemicals and factors for water emissions: Carbon Oxygen Demand (COD), N-total, NH_4 as N, PO_4 as P, absorbable organically bound halogens (AOX), heavy metals, hydrocarbons (to include detergents and oils), sulphate, and chloride.

Critical volumes (CV) are calculated as the ratio of the amount of chemicals emitted to the Maximum Emission Concentration (MEC) threshold limits, which are listed in the annex to the German waste water ordinance.
For example, an emission of 150 mg COD with an MEC threshold value 75 mg/L results in a critical volume of 2 L (CV = 150 mg/75 mg L).

1.2.6. Solid Waste Emissions

In BASF EEA the solid waste emissions account for all materials disposed of in a landfill. Therefore, materials that are recycled or reused are not counted as solid waste. Wastes are categorized as municipal, hazardous, construction and mining with a weighting factor applied to each type to account for potential impact.

For example:

- Municipal: household trash
- Hazardous: RCRA definition of hazardous waste
- Construction: non-hazardous waste materials generated during building or demolition activities
- Mining: non-hazardous earth or overburden generated during raw material extraction activities
- Radioactive waste

The impacts are then summed to obtain an overall impact amount in kg/CB. The weighting factors are 1, 5, 0.2, zero and 300,000 for each waste category, respectively, and are subjective values based on deposal costs intended to reflect the degree of potential environmental impact.

1.2.7. Land Use

This indicator is an assessment of generalized impacts on biodiversity through land use and land transformation and is quantified as m^2 a / CB (square meter years per customer benefit), according to the scheme developed by Koellner and Scholz [3, 4]).

The method uses generic characterization factors for quantifying damages to ecosystems as a result of land occupation and land transformation, termed the Ecosystem Damage Potential (EDP). Based on an extensive meta-analysis of biologists' field research, the EDP factors were derived from data on the diversity of plant species, threatened plant species, moss and molluscs. Another feature of this method is that land occupation and transformation are assessed, using an actual or calculated restoration time period. This means that the land use damage is the most significant for land use types that are difficult to restore and need extremely long time periods to recover (e.g., over one thousand years for primary forest and peat bog).

The land use results are calculated based on the total amount of land used (m^2a/CB) in each of a total of 13 categories with corresponding EDP weighting factors to reflect the potential impact for these land uses.

1.2.8. Toxicity Potential

For BASF EEA the toxicity potential is assessed not only for the final products, but also for the entire pre-chain of chemicals used to manufacture the products. In addition, the toxicity potential is also quantified for the use and disposal stages of the life cycle. The general framework for performing the analysis of toxicity potential is described by Landsiedel and Saling [5] and was based upon the Hazardous Materials Regulations (R-phrases) outlined in the European Union Directive 67/546/EEC. This has now changed due to new EU Regulation (EC) No 1272/2008 to the H-phrases of Globally Harmonized System of Classification and Labelling of Chemicals (GHS). This method is chosen because in order to score the toxicity of a substance, all possible effects need to be considered. The H-phrase system is widely used in Europe and the world for the classification of a substance's various toxic effects. The hazard factors of these substances are linked with exposure and safety factors. At the end, there is a simplified risk assessment used for the evaluation of toxic effects of substances used along the whole life cycle.

1.2.9. Risk Potential / Occupational Illnesses and Accidents

The risk potential covers the physical hazards during the production, use, and disposal phases and also considers the risk of explosion, flammability, storage accidents, worker illness and injury rates, malfunctions in product filling/packaging, transportation accidents, and any other risk deemed relevant to the study.

NOTE: Materials or processes can be excluded from consideration in the six key environmental burden metrics if they are viewed as being below minimum levels. The cut-off criterion for resource and energy consumption is < 1.0% while the cut-off criterion for toxicity potential is consistent with the OSHA (Occupational Safety and Health Administration) Hazard Communication Standard requirements for development of Material Safety Data Sheets (MSDSs), i.e. the insignificant level for OSHA-defined carcinogens is 0.1 %.

1.3. Economic Metrics

It is the intent of the BASF EEA methodology to assess the economics of products or processes over their life cycle and to determine an overall total cost of ownership for the customer benefit ($ or €/CB). The approaches for calculating costs vary from study to study. When chemical products are being compared, the sales price paid by the customer is used. When different production methods are compared, the relevant costs include the purchase and installation of equipment, depreciation, and operating costs. The costs incurred are summed and combined in appropriate units (e.g. dollar or EURO) without additional weighting of individual financial amounts. Regardless of the method used, the BASF EEA methodology will incorporate:

- real costs that occur in the process of creating and delivering the product to consumer
- subsequent costs which may occur in the future (e.g. due to tax policy changes)
- costs associated with ecological aspects, e.g. costs involved to treat wastewater generated during the manufacturing process.

All relevant costs and revenues are considered (e.g. raw material; labour; energy; capital investment; maintenance; EH&S programmes and regulatory costs; illness & injury costs (medical, legal, lost time); property protection & warehousing costs; waste costs (hazardous, non-hazardous); transportation; training costs; taxes, etc.).

1.4. Combining Environmental and Cost Assessment

BASF's EEA methodology assesses environmental burdens and economic costs independently. In order to merge these two elements, they first need to be normalized.
Costs are reduced to relative costs (see Fig. 3):

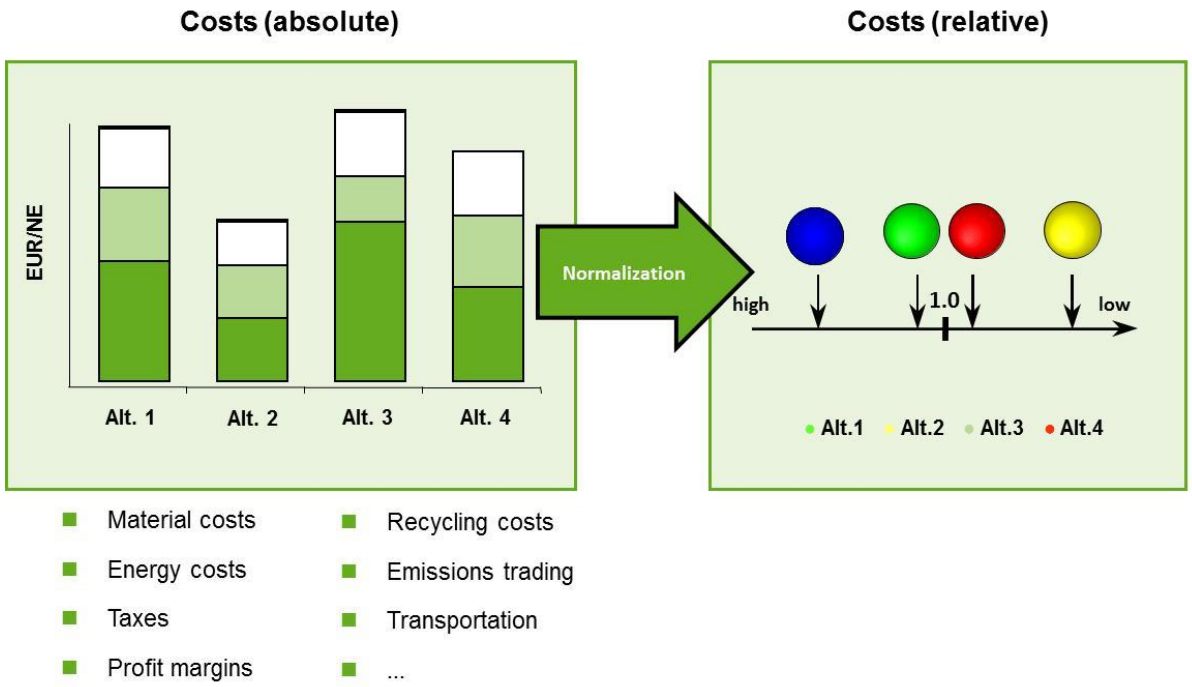


Figure 3: Normalization of costs

Similarly, all impact categories are normalized to build the Ecological Fingerprint (see Fig. 4):

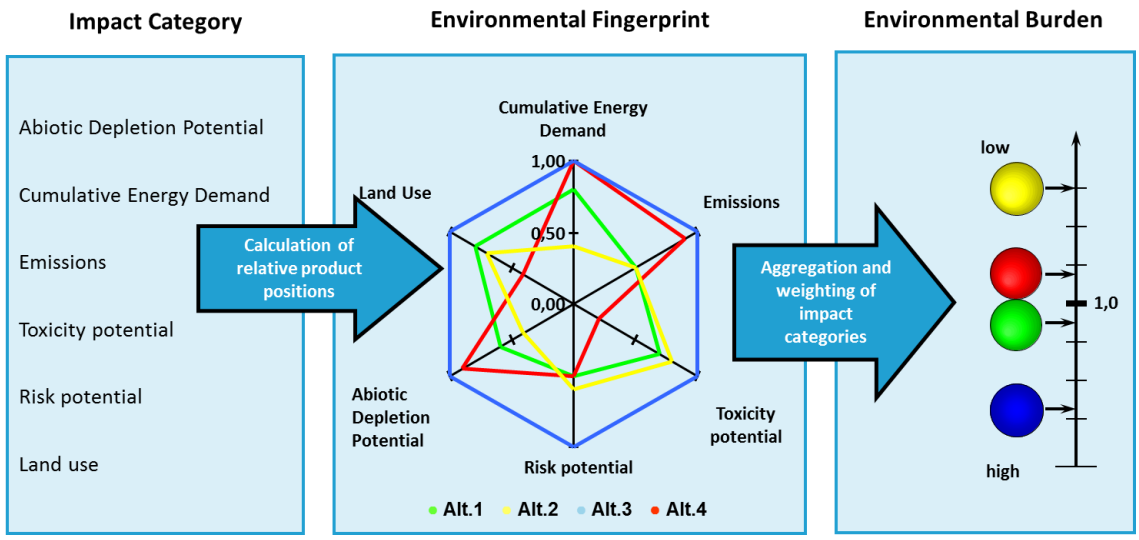


Figure 4: Normalization of environmental impact categories; aggregation into relative environmental burden

The results for the impact categories considered in the Ecological Fingerprint (for more detailed description see §1.5.2) are then aggregated by means of weighting factors into relative environmental burden results. These weighting factors comprise two components:

- Study-specific relevance factors, which are calculated for each analysis. Relevance factors ensure that relatively high environmental burdens are more heavily weighted than relatively low ones; a high relevance factor identifies critical environmental burdens.
- Societal factors obtained through surveys and interviews with experts; through these factors changes in society's attitude can be incorporated

The relative costs and relative environmental burden can then be combined into a two-dimensional diagram or a so-called Eco-Efficiency Portfolio (see §1.5.2). The cost dimension and environmental dimension are weighted equally.

1.5. Presentation of EEA Results

Results of an EEA are depicted in graphs and diagrams (see Fig. 5).

1.5.1. Eco-Efficiency Portfolio

The BASF Eco-Efficiency Portfolio depicts both economic and environmental results on a single 2x2 matrix (see Fig. 5).

Alternatives closest to the upper right hand corner are most eco-efficient. Note that the diagram is a relative diagram and not an absolute one. The distance from the diagonal is a measure of the eco-efficiency. Therefore, two alternatives that are equally distant from the diagonal will have the same eco-efficiency even though their environmental and economic impact may differ significantly.
The additional dotted line is linked with the position of the most eco-efficient alternative. In this example, it is he yellow alternative. Starting from this position, a significant distance which was basically defined by BASF with a number of 10 %, is calculated and displayed. All alternatives, which are above this line are not significantly separated. In this example it is the red alternative. All other alternatives are below this line and consequently differentiated from the most eco-efficient alternative significantly. This line helps independently from the scale of the axis of the portfolio to distinguish between significant and not significant separation of alternatives.

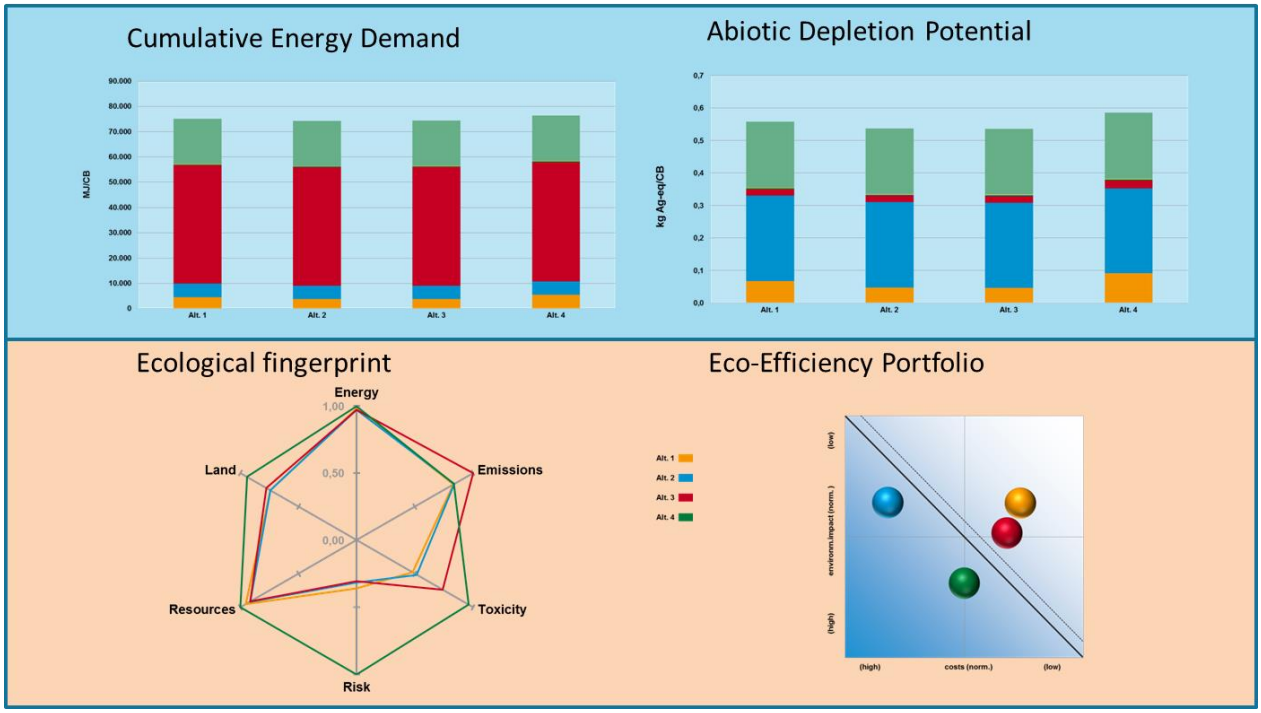


Figure 5: example of presentation of EEA results

1.5.2.Ecological Fingerprint

This diagram shows the relative performance of all alternatives in all of the environmental impact categories in normalized form. The alternative that lies furthest out and has the value of 1 is the least favorable alternative in the category in question. The closer to the origin (0) an alternative lies, the more favorable it is. The axes are mutually independent, so that an alternative that, for example, performs well on energy consumption can perform less well with regard to emissions. The environmental footprint makes it possible to identify environmental impact drivers and give clues to the areas in which improvements should be achieved in order that the overall system may be optimized.

This diagram doesn't give information on the relative weight of the different environmental impact categories; for this information please refers to figure 5 "Eco-Efficiency Portfolio".

1.5.3.Total Environmental Burden and weighting of environmental impact categories

The environmental impact of considered products (or processes) is shown in "Total Environmental Burden"; the bars indicate the contribution of the main environmental impact categories. Results are not absolute, but normalized and therefore can be used only for comparison purposes. In a separate diagram the relative weight of all considered environmental impact categories, i.e. also of single air emissions, is shown. This can help to better evaluate the relative importance of the single categories reported in the other diagrams.

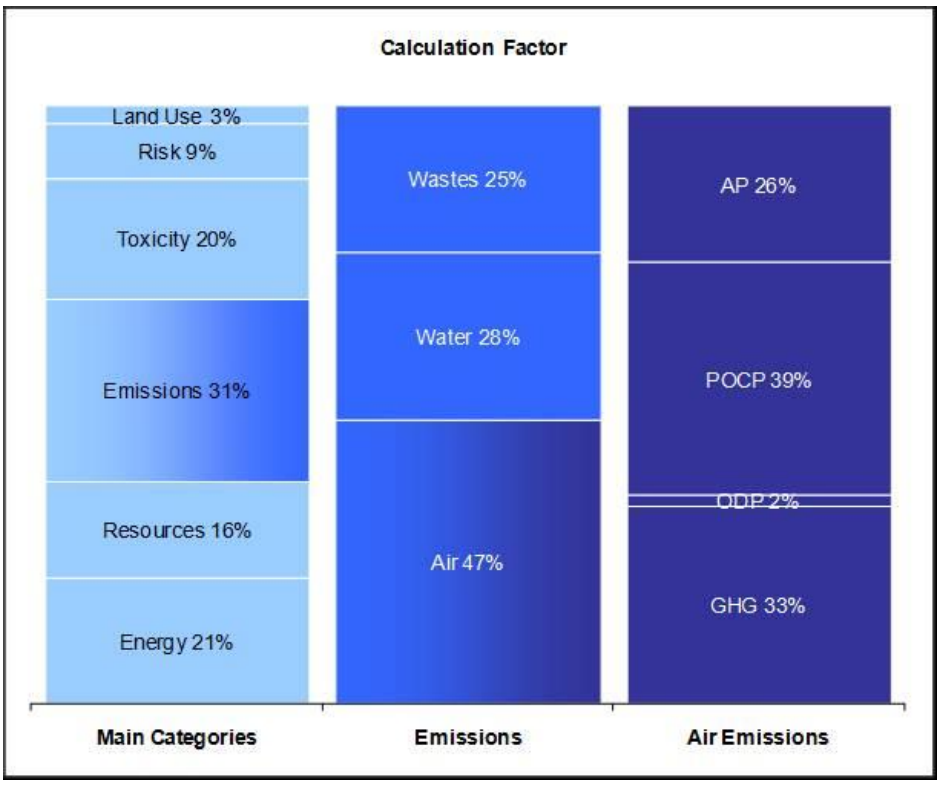


Figure 6: example of calculation factors for aggregation in the Eco-Efficiency Analysis

1.5.4. Other diagrams

All other diagrams are bar diagrams which show the absolute performance of all product (or process) alternatives in the assessed environmental impact categories and costs as shown with examples in figure 5..

1.6. Architecture EEA internet manager

The EEA internet manager is based on a three tier architecture (see Fig. 6).

- Back-end:
  - Excel-based Eco-Efficiency Analysis
  - Windows Server
- Data calculation:
  - PHP web application on a web server
  - Application logic and user management
- Presentation tier:
  - No client installation required; can be run with different web browsers on a PC/laptop

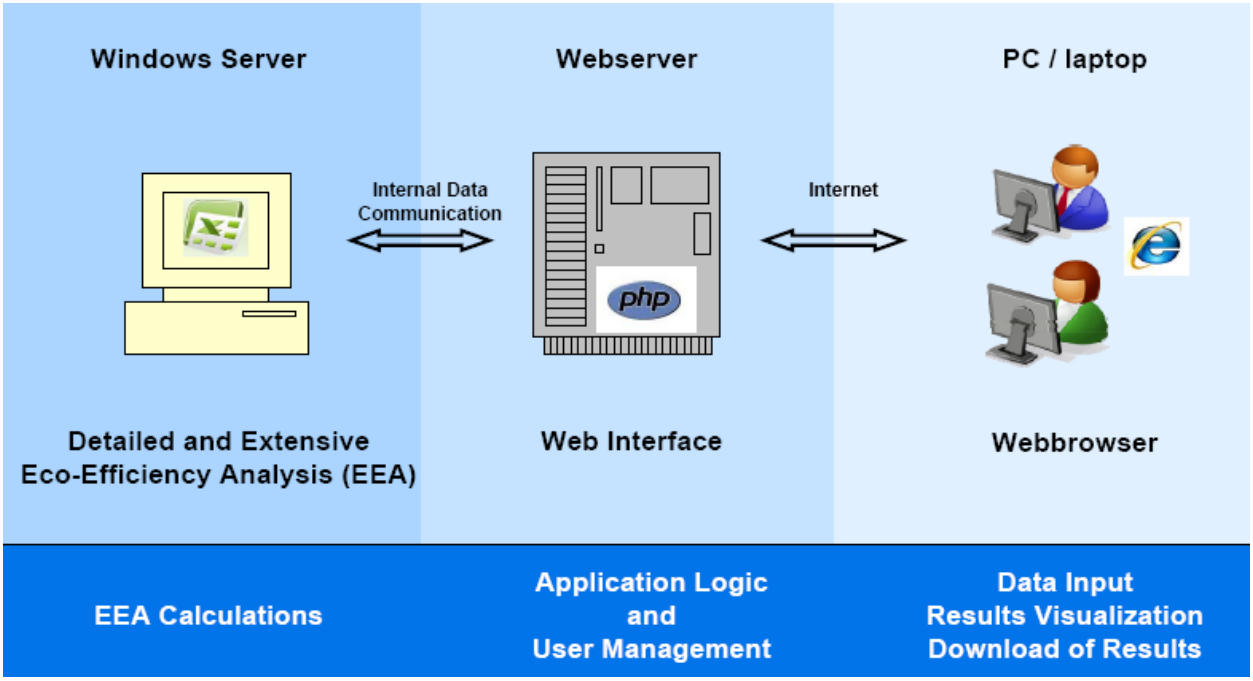


Figure 6: Technical architecture (EEA internet manager)

The EEA internet manager tool is a secure software:

- PHP application accessible from internet; however, it does not contain critical data
- Windows Server isolated and not accessible from internet
- Different user groups with different access rights:
  - Password protected areas
  - Internal users: new business development, marketing and sales
  - External users: downstream cooperation, e.g. common product development, common strategies, …

1.7. User Administration

Each user has a unique login name and password. Passwords cannot be modified. Two sets of users exist: application users and specialist users. Application users have access to a restricted set of data and information. Input data as well as results generated (and/or saved) within a working session are restricted to the specific user; other users cannot access these data. A login name and password are specific for a given user and cannot be shared by several users. Specialist users have a separate access. They have the option to set default values and to make specific modifications.

2. Definitions and abbreviations

AOX:	absorbable organically bound halogens
AP:	acidification Potential
BOD:	biochemical oxygen demand
CB:	customer benefit
COD:	chemical oxygen demand
CV:	critical volumes
EEA:	Eco-Efficiency Analysis
GWP:	global warming potential
MJ:	mega joules
MSDSs:	material safety data sheets
NM-VOC:	non-methane volatile organic compounds
ODP:	ozone depletion potential
OSHA:	Occupational Safety and Health Administration
POCP:	photochemical ozone creation potential (summer smog)
CO_2:	Carbon Dioxide

3. References

[1] Saling et al (2002) Int. J. Life Cycle Assess, 7 (4), 203-218.
[2] Saling et al (2002) Int. J. Life Cycle Assess, 7 (4), 261-268.
[3] Köllner T & Scholtz R (2007) Assessment of Land Use Impacts on the Natural Environment, Part 1: An Analytical Framework for Pure Land Occupation and Land Use Change. Int. J. Life Cycle Assess. 12:16-23
4 ; Köllner T, & Scholz R (2008) Assessment of Land Use Impacts on the Natural Environment, Part 2: Generic Characterization Factors for Local Species Diversity in Central Europe. Int. J. Life Cycle Assess. 13:32-48.).
5 Landsiedel, R.; Saling, P. (2002) Assessment of Toxicological Risks for Life Cycle Assessment and Eco-Efficiency Analysis. Int. J. Life Cycle Assess, 7 (5), 261-268.

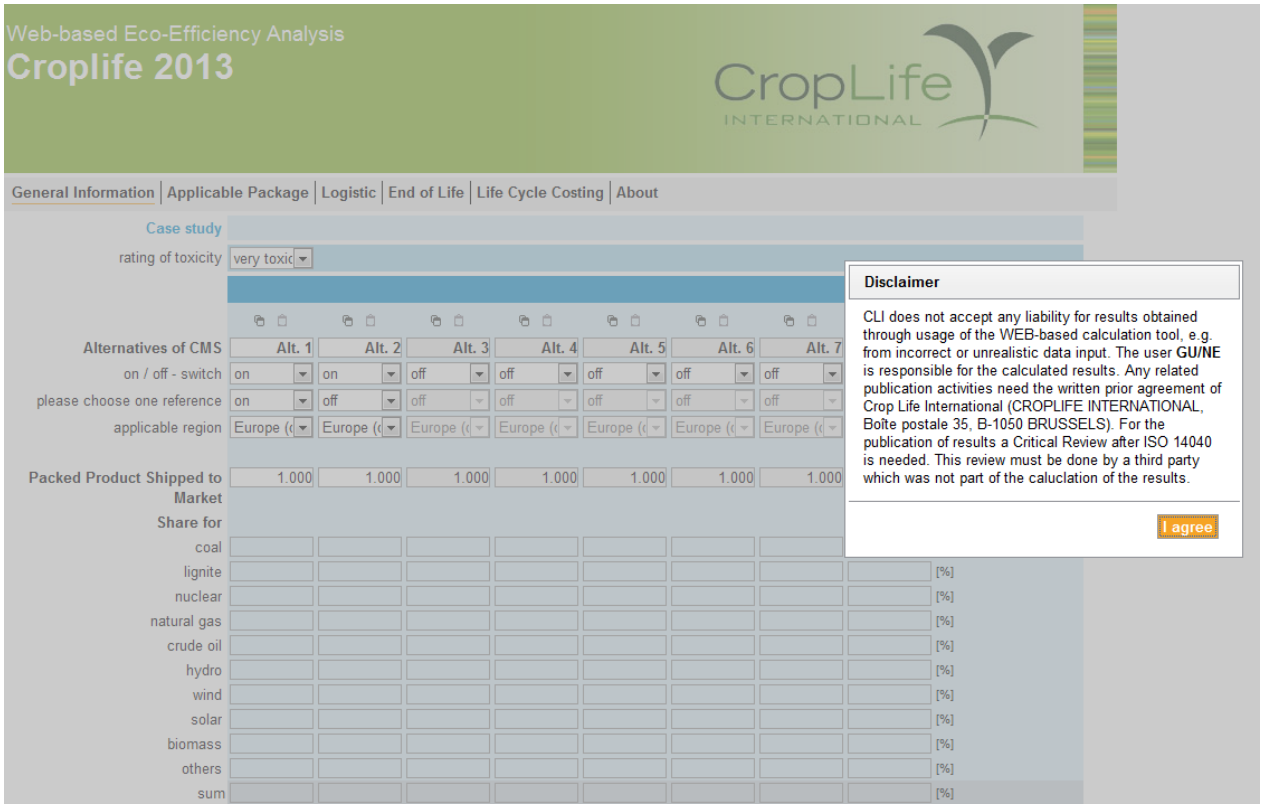
4. Using the Tool: Instructions

4.1. Start

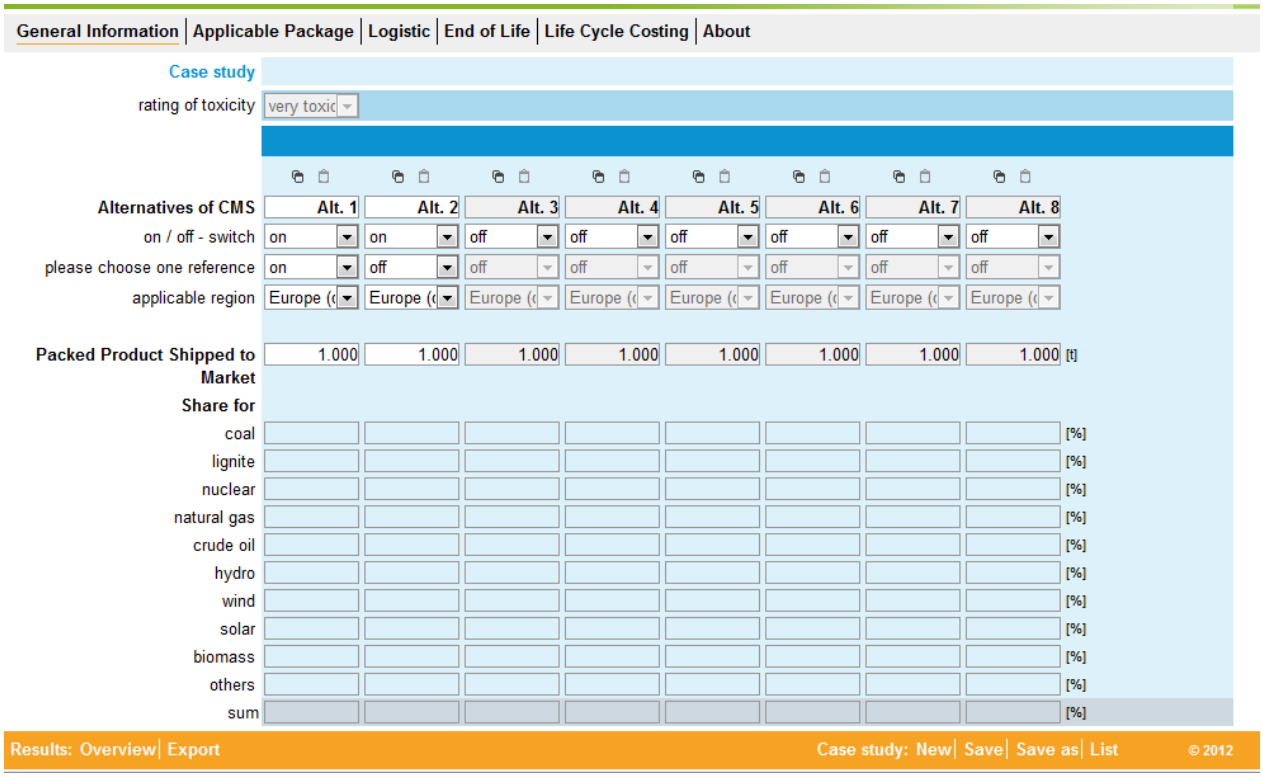
Select the Webpage: http://www.v2.eeaman.com/

Each user has a unique login name and password. Passwords cannot be modified. Type your user ID and Password, the program starts. A login name and password can be obtained, on request, from the Director of Stewardship at CropLife International (email admin@croplife.org, for the attention of the Director of Stewardship).

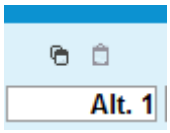
Accept the disclaimer, after accepting, the grey color disappears and you can start working with the WEB-based tool:



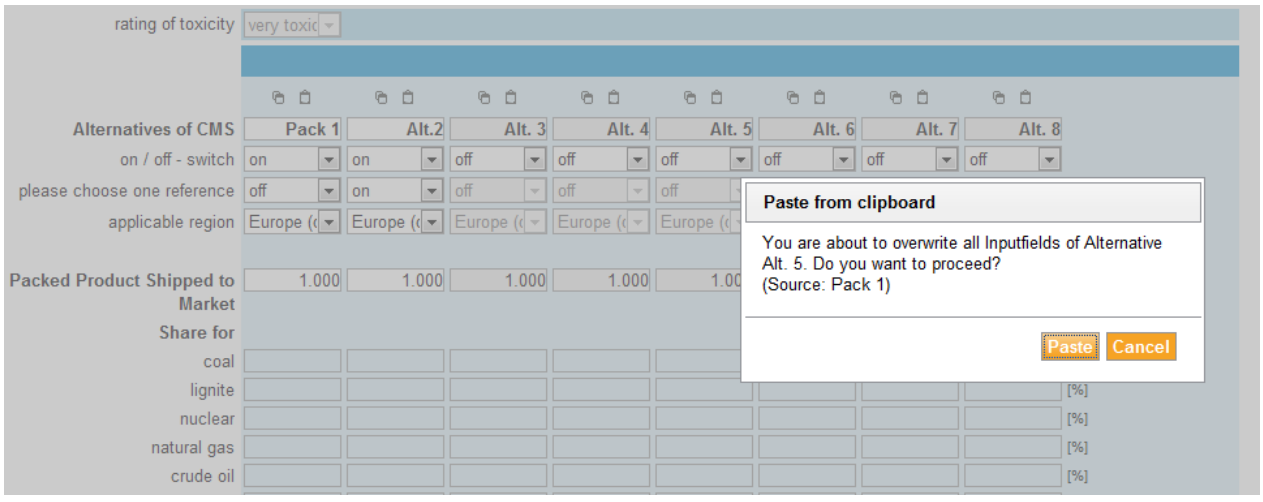
The first page ‘General data’ is displayed. The orange underlined folder is the page where inputs can be made.



In the field “Alternatives” you can type the names of the alternatives. You are completely free to use names, please make them not too long because it can be difficult to display them in the graphs. Start with one alternative and fill in data. The advantage is, that alternatives you like to fill in data for, can be copied. If they are very similar, you can avoid filling in many data several times.

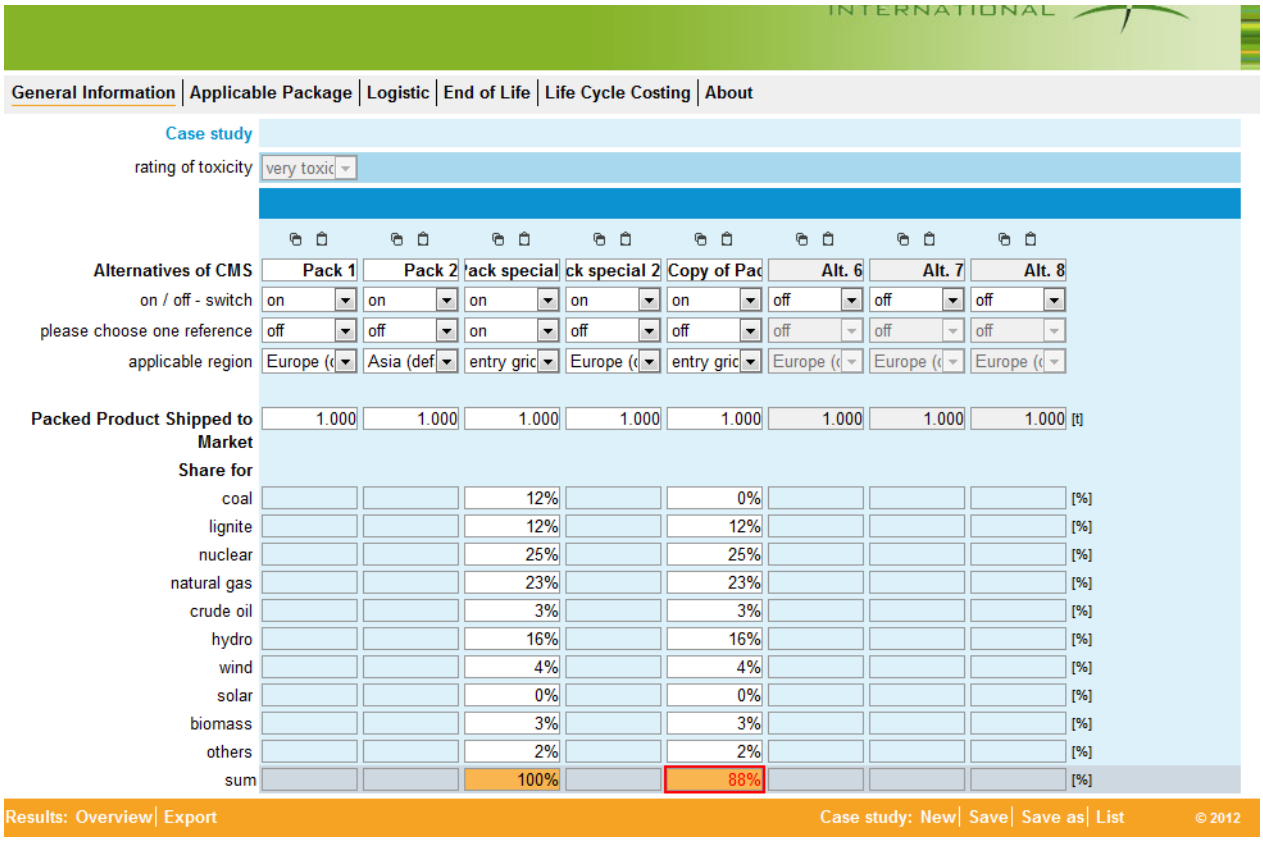


Press the left symbol, this alternative is selceted, with the right symbol, you can paste it into one of the alternatives.



A maximum of 8 alternatives can be calculated in parallel. You can choose the toxicity of the packed goods in three categories.

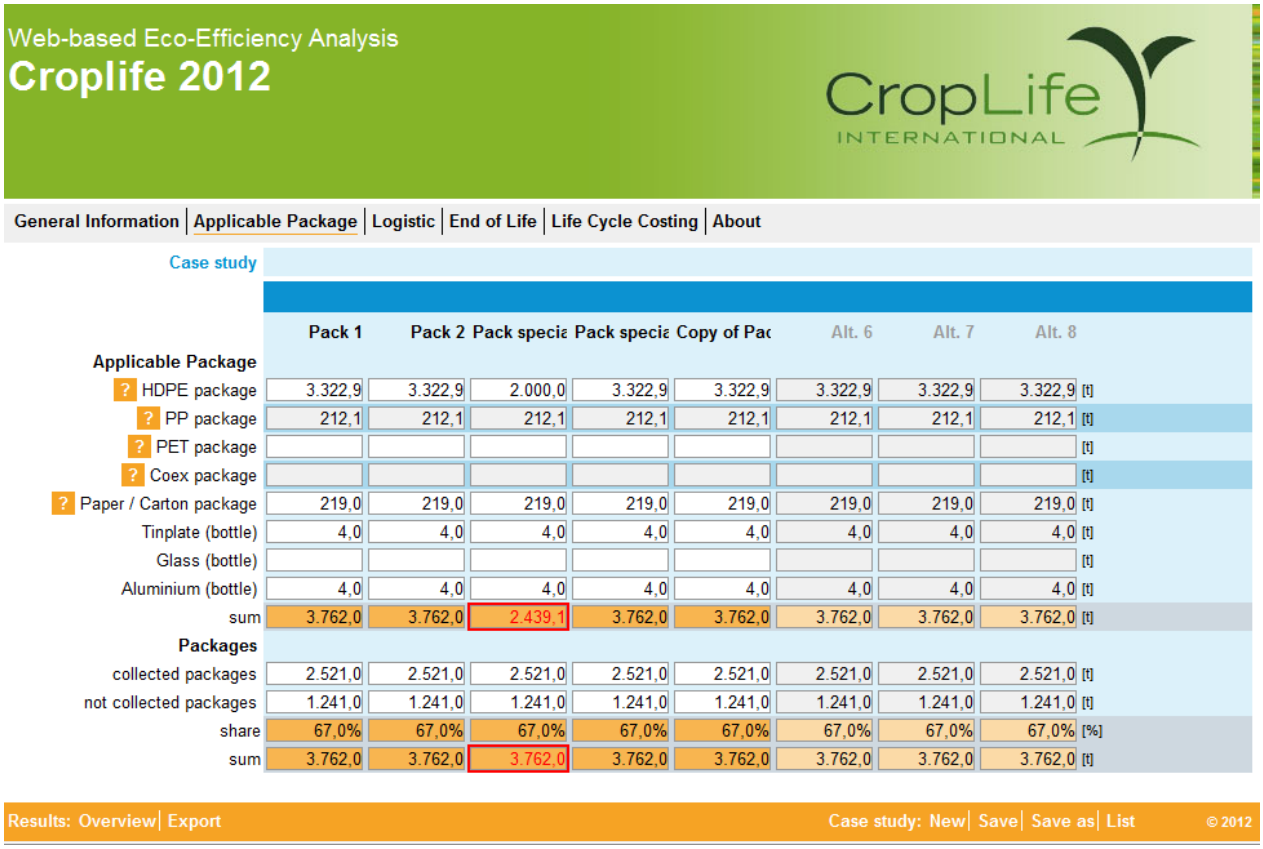
All alternatives that are active in the calculation must be switched on; one alternative must be used as reference. Furthermore an energy mix can be selected. Regions with fixed energy mixes can be selected; furthermore, specific energy mixes can be created with percentage numbers as well. 100 % must be the total, otherwise the calculation cannot be performed.



The total amount of containers (in tonnes) entering the market needs to be introduced in “Packed Product Shipped to Market”.

4.2. Package type (Applicable package)

On this page, packaging materials can be filled in. Behind question marks additional information are available.
The amount of input materials, collected materials and recycled materials must fit together. If not, red marks appear and must be corrected.



Web-based Eco-Efficiency Analysis
Croplife 2012

General Information | Applicable Package | Logistic | End of Life | Life Cycle Costing | About

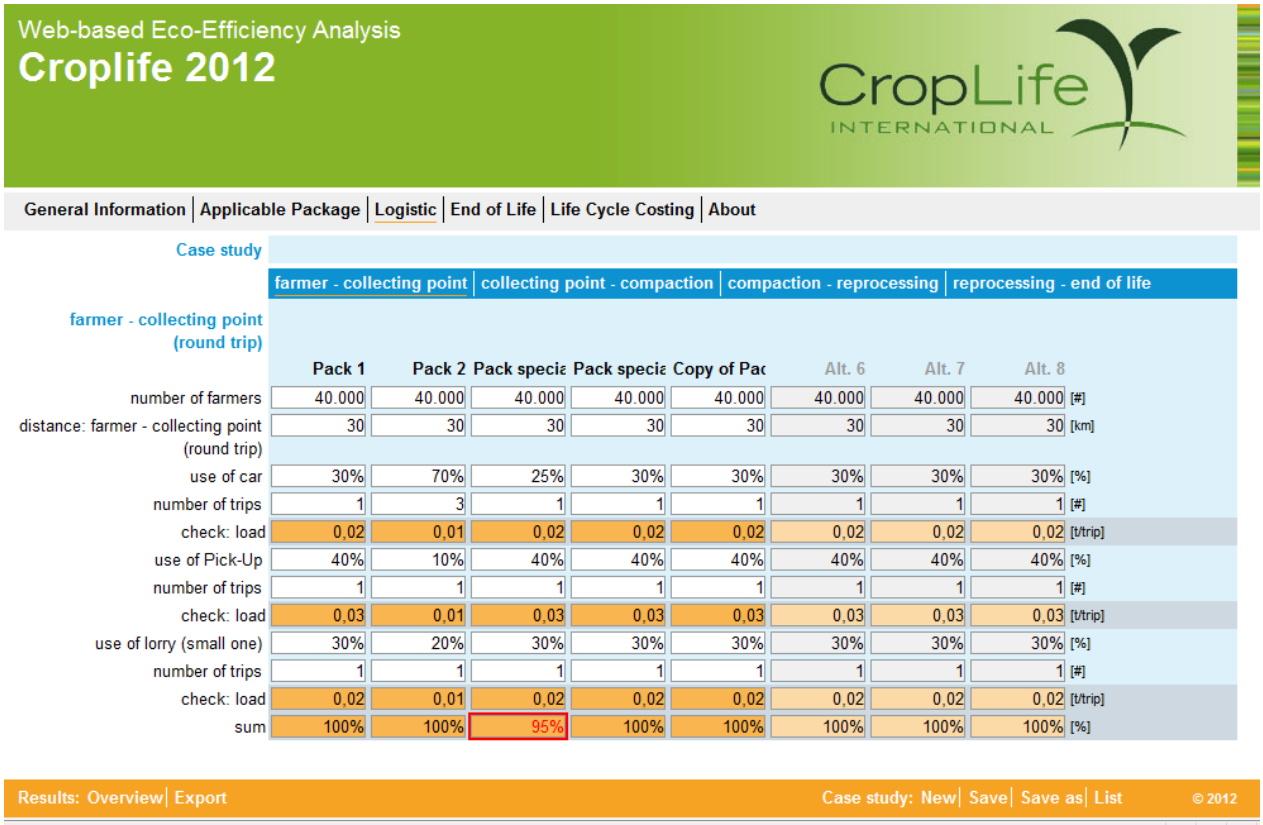
Case study

	Pack 1	Pack 2	Pack specia	Pack specia	Copy of Pac	Alt. 6	Alt. 7	Alt. 8	
Applicable Package									
HDPE package	3.322,9	3.322,9	2.000,0	3.322,9	3.322,9	3.322,9	3.322,9	3.322,9	[t]
PP package	212,1	212,1	212,1	212,1	212,1	212,1	212,1	212,1	[t]
PET package									[t]
Coex package									[t]
Paper / Carton package	219,0	219,0	219,0	219,0	219,0	219,0	219,0	219,0	[t]
Tinplate (bottle)	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	[t]
Glass (bottle)									[t]
Aluminium (bottle)	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	[t]
sum	3.762,0	3.762,0	2.439,1	3.762,0	3.762,0	3.762,0	3.762,0	3.762,0	[t]
Packages									
collected packages	2.521,0	2.521,0	2.521,0	2.521,0	2.521,0	2.521,0	2.521,0	2.521,0	[t]
not collected packages	1.241,0	1.241,0	1.241,0	1.241,0	1.241,0	1.241,0	1.241,0	1.241,0	[t]
share	67,0%	67,0%	67,0%	67,0%	67,0%	67,0%	67,0%	67,0%	[%]
sum	3.762,0	3.762,0	3.762,0	3.762,0	3.762,0	3.762,0	3.762,0	3.762,0	[t]

Results: Overview | Export Case study: New | Save | Save as | List © 2012

4.3. Logistics

On this page, logistic information can be filled in. Different subcategories can be selected like ‘Farmer’, ‘Number of Collecting Points’ etc.. Different parameters can be selected, som basic parameters are fixed and can only be edited by the expert users.



Web-based Eco-Efficiency Analysis
Croplife 2012

General Information | Applicable Package | Logistic | End of Life | Life Cycle Costing | About

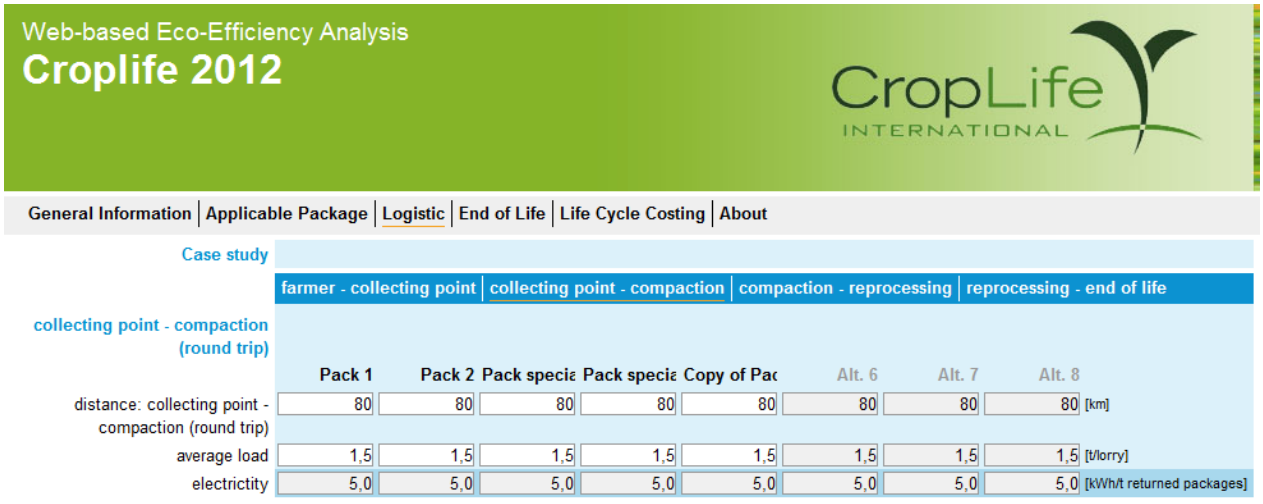
Case study

farmer - collecting point | collecting point - compaction | compaction - reprocessing | reprocessing - end of life

farmer - collecting point (round trip)

	Pack 1	Pack 2	Pack specia	Pack specia	Copy of Pac	Alt. 6	Alt. 7	Alt. 8	
number of farmers	40.000	40.000	40.000	40.000	40.000	40.000	40.000	40.000	[#]
distance: farmer - collecting point (round trip)	30	30	30	30	30	30	30	30	[km]
use of car	30%	70%	25%	30%	30%	30%	30%	30%	[%]
number of trips	1	3	1	1	1	1	1	1	[#]
check: load	0,02	0,01	0,02	0,02	0,02	0,02	0,02	0,02	[t/trip]
use of Pick-Up	40%	10%	40%	40%	40%	40%	40%	40%	[%]
number of trips	1	1	1	1	1	1	1	1	[#]
check: load	0,03	0,01	0,03	0,03	0,03	0,03	0,03	0,03	[t/trip]
use of lorry (small one)	30%	20%	30%	30%	30%	30%	30%	30%	[%]
number of trips	1	1	1	1	1	1	1	1	[#]
check: load	0,02	0,01	0,02	0,02	0,02	0,02	0,02	0,02	[t/trip]
sum	100%	100%	95%	100%	100%	100%	100%	100%	[%]

Results: Overview | Export Case study: New | Save | Save as | List © 2012



Web-based Eco-Efficiency Analysis
Croplife 2012

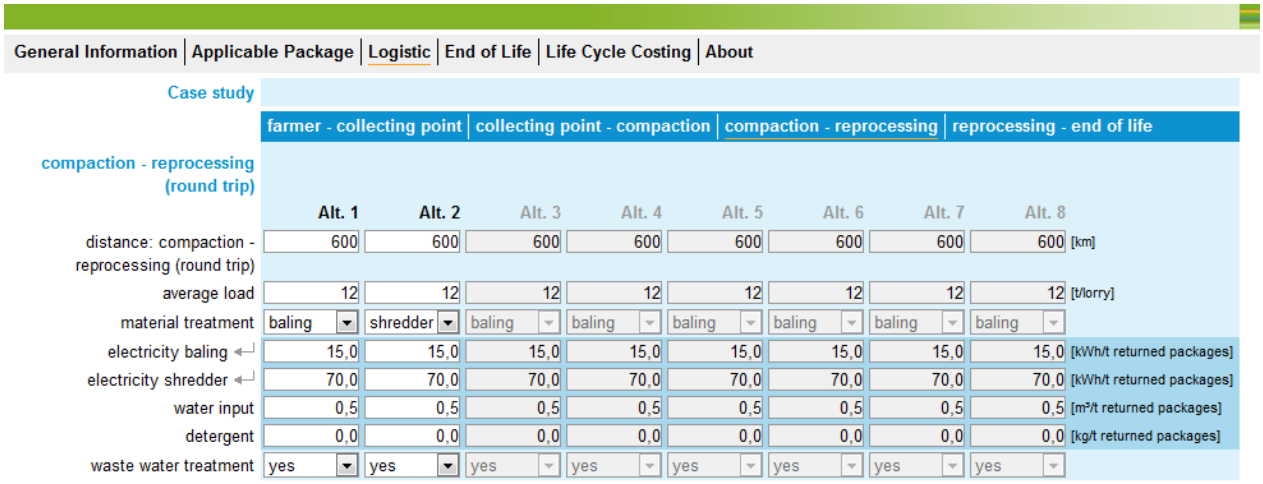
General Information | Applicable Package | Logistic | End of Life | Life Cycle Costing | About

Case study

farmer - collecting point | collecting point - compaction | compaction - reprocessing | reprocessing - end of life

collecting point - compaction (round trip)

	Pack 1	Pack 2	Pack specia	Pack specia	Copy of Pac	Alt. 6	Alt. 7	Alt. 8	
distance: collecting point - compaction (round trip)	80	80	80	80	80	80	80	80	[km]
average load	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	[t/lorry]
electrictity	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	[kWh/t returned packages]



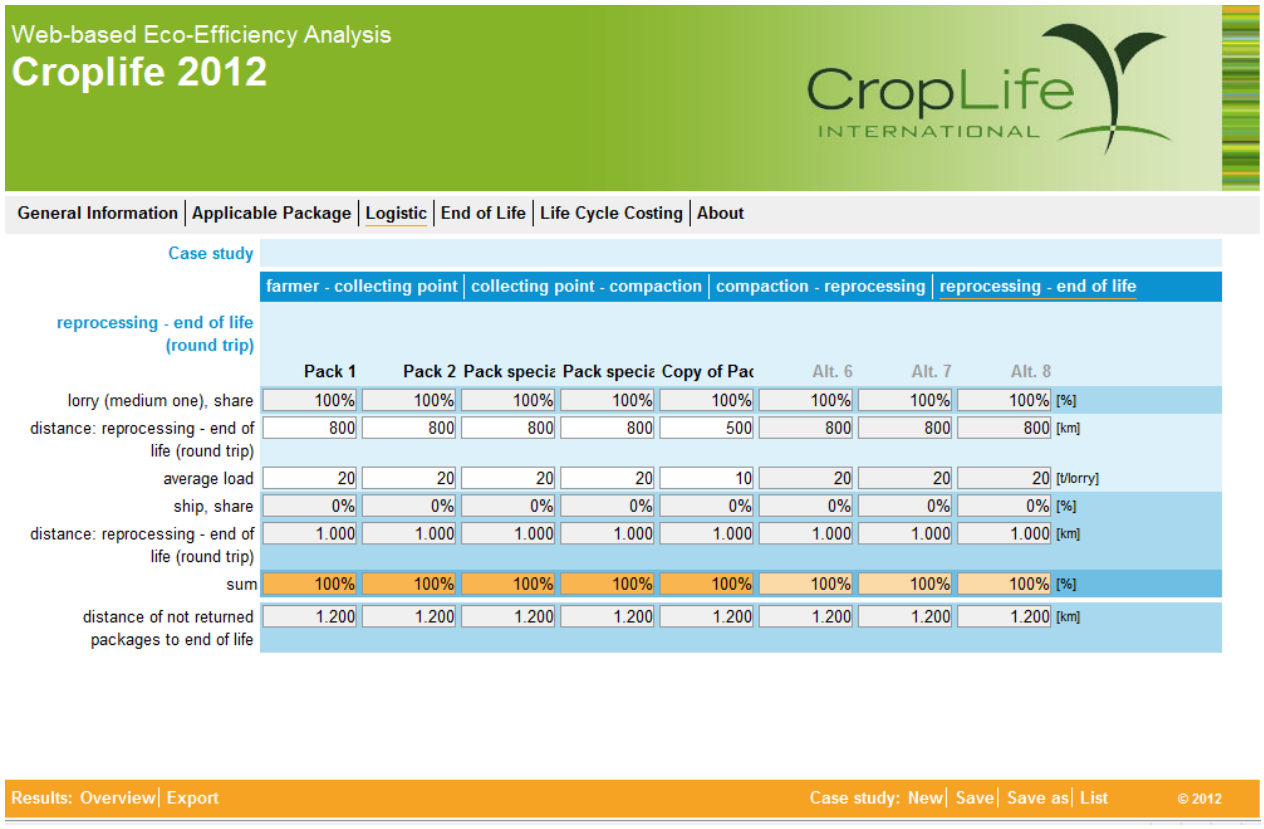
General Information | Applicable Package | Logistic | End of Life | Life Cycle Costing | About

Case study

farmer - collecting point | collecting point - compaction | compaction - reprocessing | reprocessing - end of life

compaction - reprocessing (round trip)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8	
distance: compaction - reprocessing (round trip)	600	600	600	600	600	600	600	600	[km]
average load	12	12	12	12	12	12	12	12	[t/lorry]
material treatment	baling	shredder	baling	baling	baling	baling	baling	baling	
electricity baling	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	[kWh/t returned packages]
electricity shredder	70,0	70,0	70,0	70,0	70,0	70,0	70,0	70,0	[kWh/t returned packages]
water input	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	[m³/t returned packages]
detergent	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	[kg/t returned packages]
waste water treatment	yes	yes	yes	yes	yes	yes	yes	yes	



Web-based Eco-Efficiency Analysis

Croplife 2012

General Information | Applicable Package | Logistic | End of Life | Life Cycle Costing | About

Case study

farmer - collecting point | collecting point - compaction | compaction - reprocessing | reprocessing - end of life

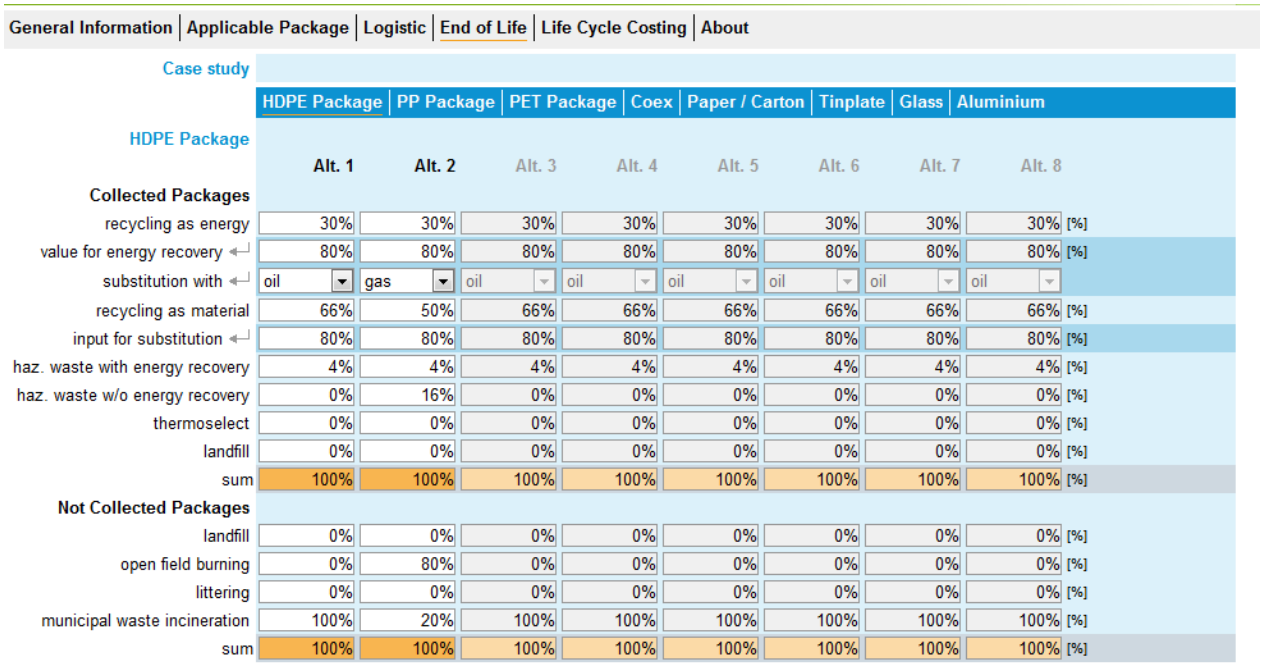
reprocessing - end of life (round trip)

	Pack 1	Pack 2	Pack specia	Pack specia	Copy of Pac	Alt. 6	Alt. 7	Alt. 8	
lorry (medium one), share	100%	100%	100%	100%	100%	100%	100%	100%	[%]
distance: reprocessing - end of life (round trip)	800	800	800	800	500	800	800	800	[km]
average load	20	20	20	20	10	20	20	20	[t/lorry]
ship, share	0%	0%	0%	0%	0%	0%	0%	0%	[%]
distance: reprocessing - end of life (round trip)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	[km]
sum	100%	100%	100%	100%	100%	100%	100%	100%	[%]
distance of not returned packages to end of life	1.200	1.200	1.200	1.200	1.200	1.200	1.200	1.200	[km]

Results: Overview | Export Case study: New | Save | Save as | List © 2012

4.4 End of Life (EoL)

For different types of materials, different EoL options are selected and data filled in. Different options can be selected for collected and not collected packages.



General Information | Applicable Package | Logistic | End of Life | Life Cycle Costing | About

Case study

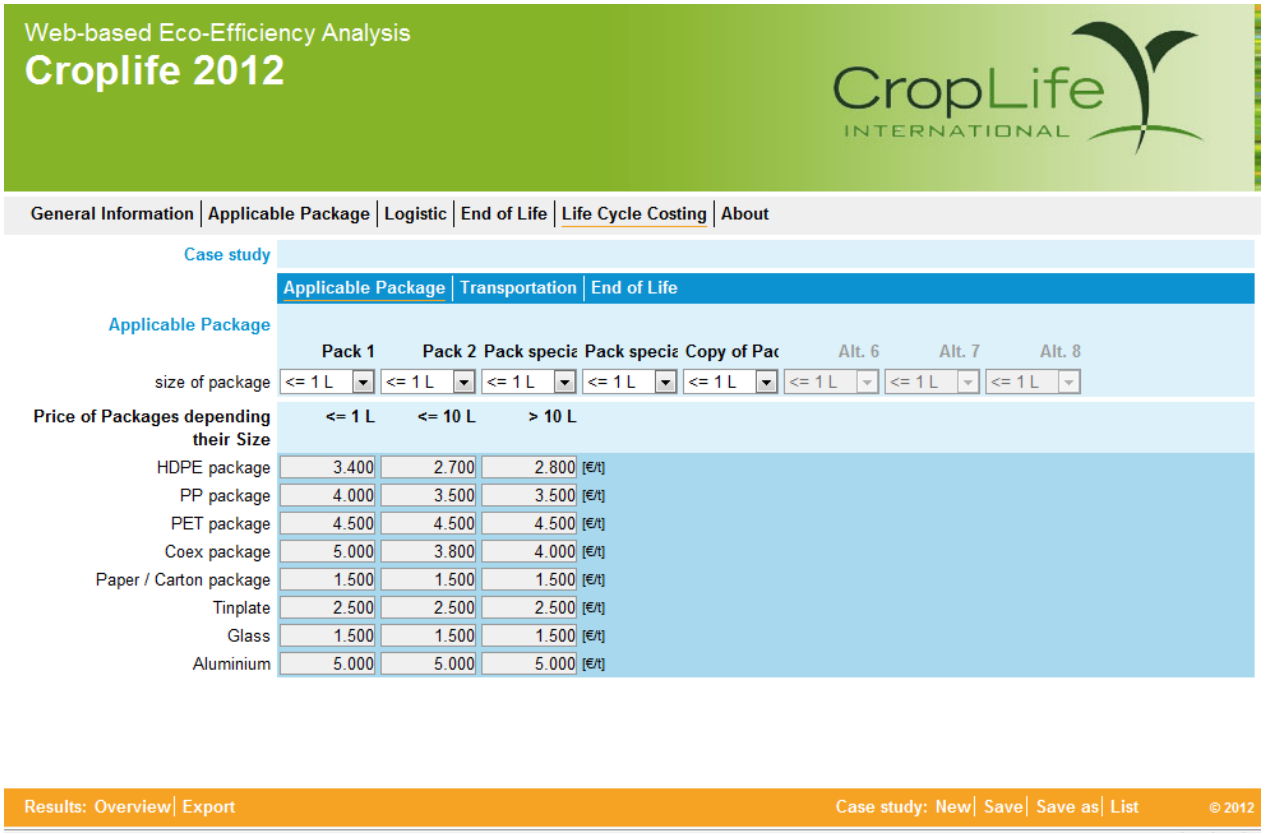
HDPE Package | PP Package | PET Package | Coex | Paper / Carton | Tinplate | Glass | Aluminium

HDPE Package

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8	
Collected Packages									
recycling as energy	30%	30%	30%	30%	30%	30%	30%	30%	[%]
value for energy recovery	80%	80%	80%	80%	80%	80%	80%	80%	[%]
substitution with	oil	gas	oil	oil	oil	oil	oil	oil	
recycling as material	66%	50%	66%	66%	66%	66%	66%	66%	[%]
input for substitution	80%	80%	80%	80%	80%	80%	80%	80%	[%]
haz. waste with energy recovery	4%	4%	4%	4%	4%	4%	4%	4%	[%]
haz. waste w/o energy recovery	0%	16%	0%	0%	0%	0%	0%	0%	[%]
thermoselect	0%	0%	0%	0%	0%	0%	0%	0%	[%]
landfill	0%	0%	0%	0%	0%	0%	0%	0%	[%]
sum	100%	100%	100%	100%	100%	100%	100%	100%	[%]
Not Collected Packages									
landfill	0%	0%	0%	0%	0%	0%	0%	0%	[%]
open field burning	0%	80%	0%	0%	0%	0%	0%	0%	[%]
littering	0%	0%	0%	0%	0%	0%	0%	0%	[%]
municipal waste incineration	100%	20%	100%	100%	100%	100%	100%	100%	[%]
sum	100%	100%	100%	100%	100%	100%	100%	100%	[%]

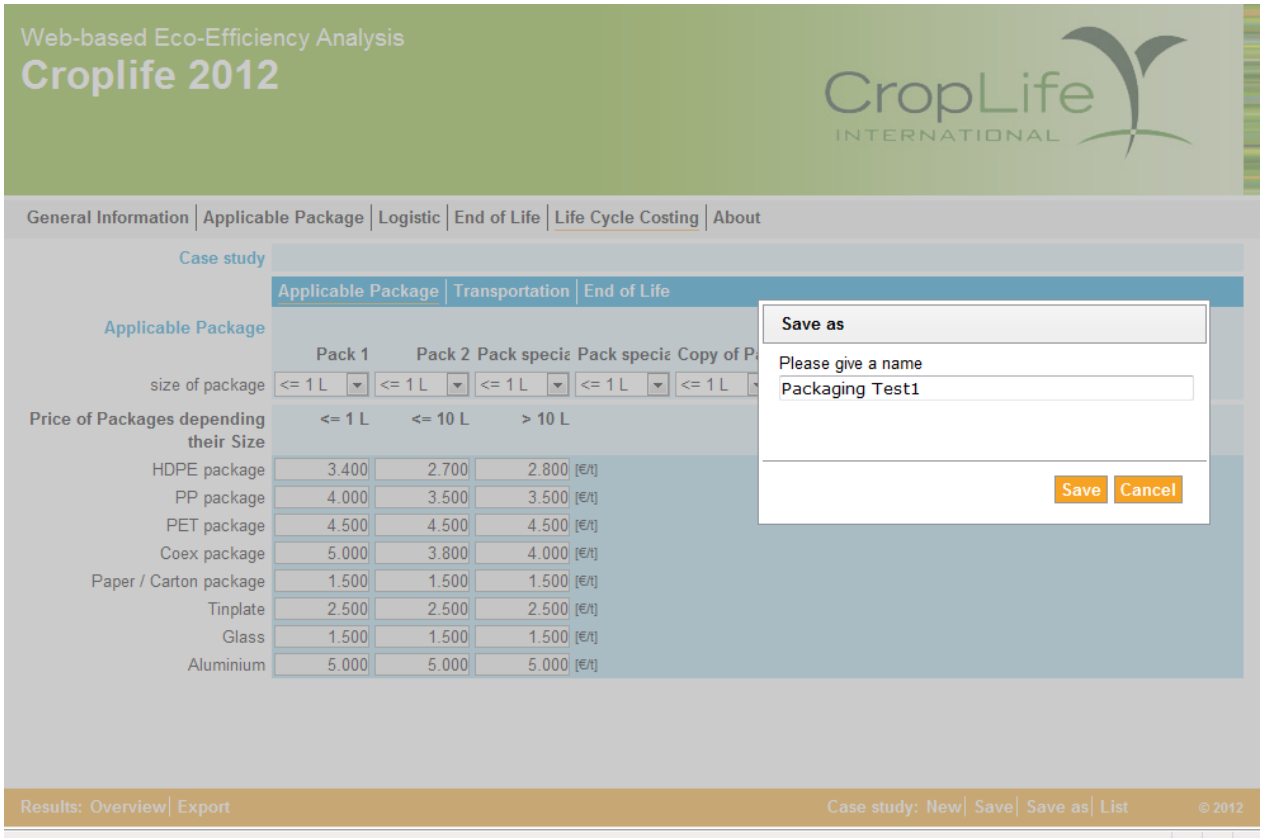
4.5 Life Cycle Costing

Packaging sizes for the alternatives must be selected; different materials are available with the respective costs. Changes can be made here only by the expert users. There are additional fields in different sections which can only be changed by expert users.

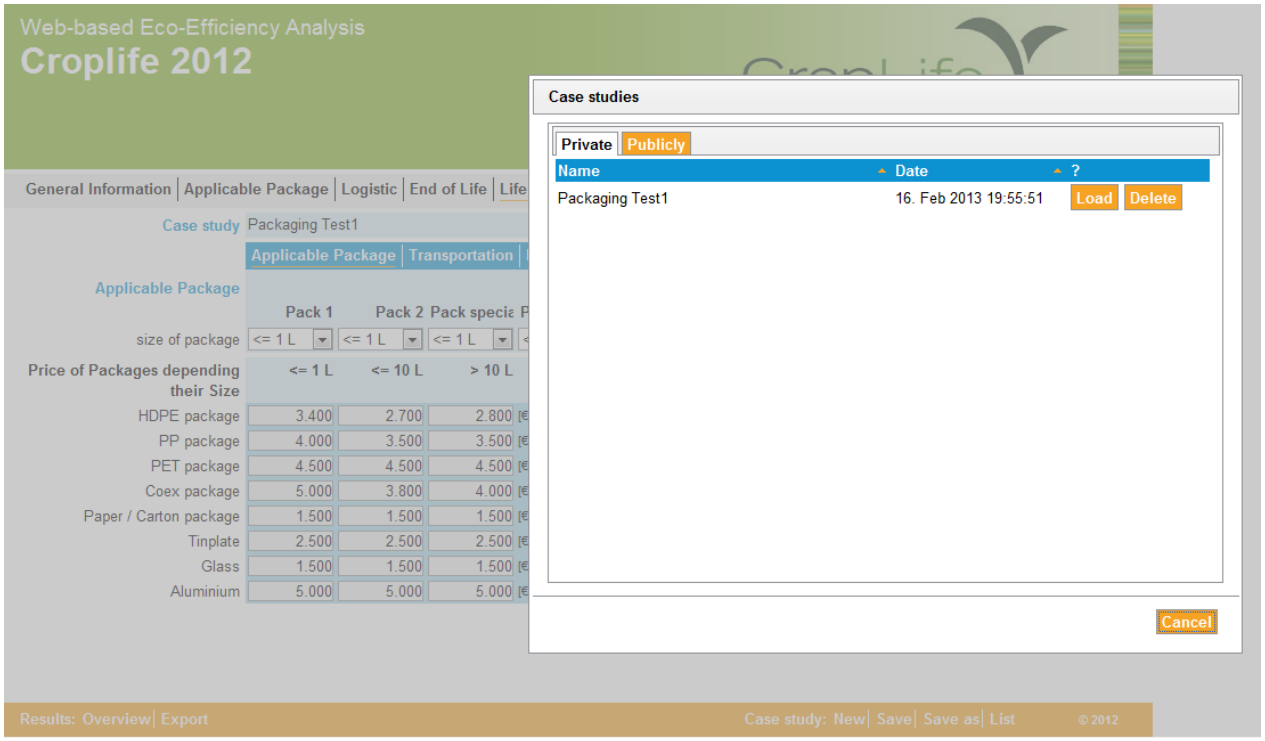


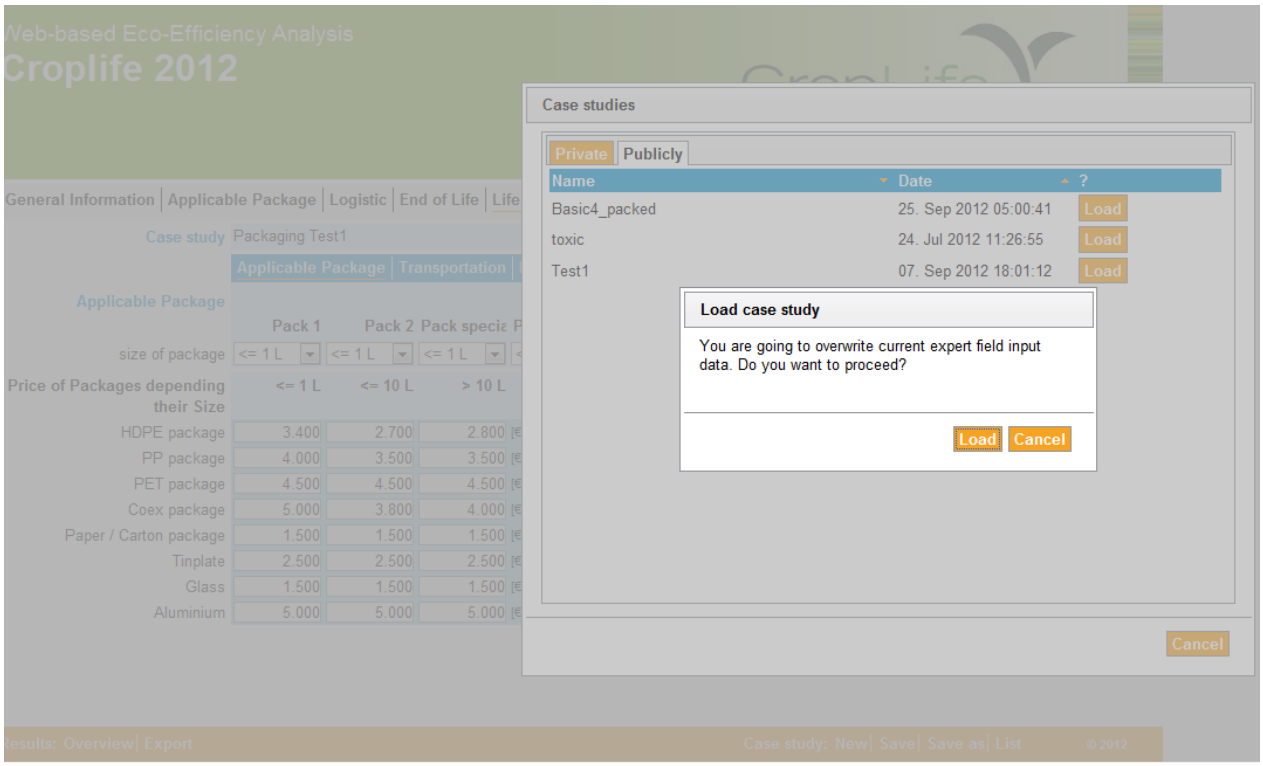
4.6 Saving, uploading

The study can be saved with “Save” or “Save as” in the account of the user. The study can be uploaded out of this sector again.



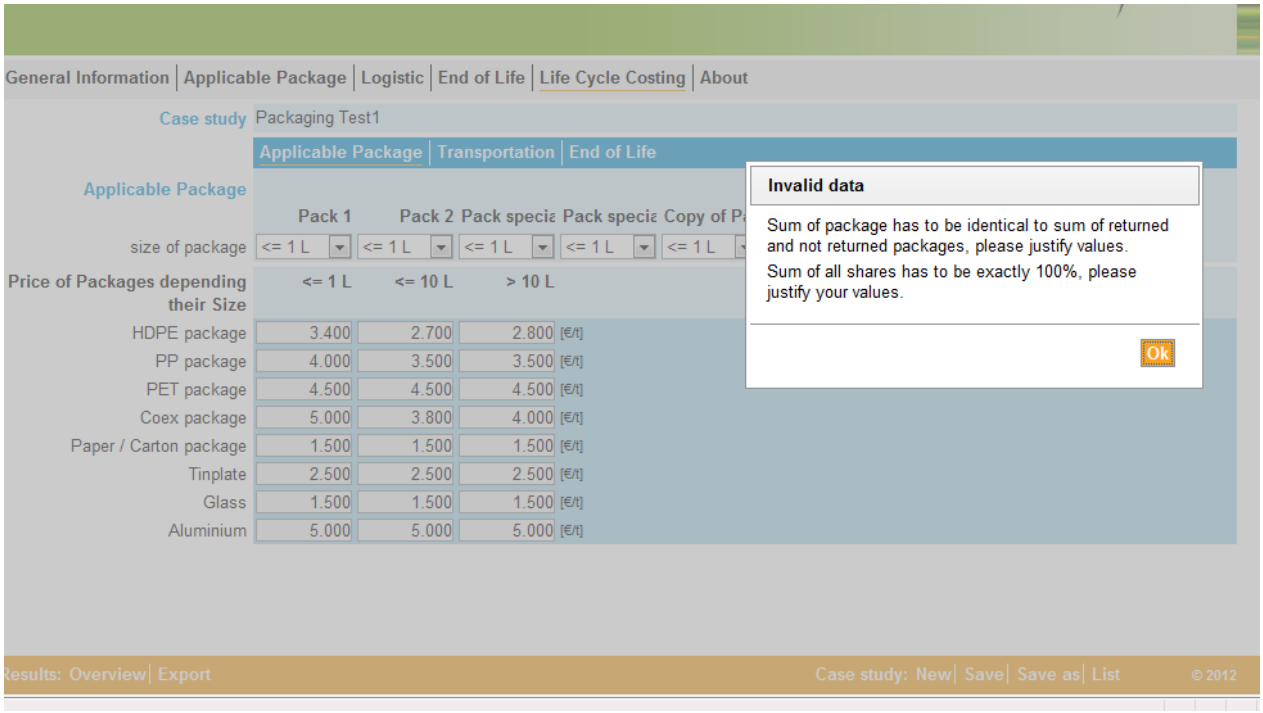
Selection of 'List' will show an overview of your saved case studies. The case studies can be deleted, uploaded or saved as "publicily". Publicily marked case studies can be uploaded by all users. Via this function, case studies can be shared between different users.


Web-based Eco-Efficiency Analysis
Croplife 2012
Case studies
Private
Publicly
Name
Date
?
Packaging Test1
16. Feb 2013 19:55:51
Load
Delete
Cancel
General Information
Applicable Package
Logistic
End of Life
Case study
Packaging Test1
Transportation
Pack 1
Pack 2
size of package
<= 1 L
Price of Packages depending their Size
<= 10 L
> 10 L
HDPE package
3.400
2.700
2.800
PP package
4.000
3.500
PET package
4.500
Coex package
5.000
3.800
4.000
Paper / Carton package
1.500
Tinplate
2.500
Glass
Aluminium
5.000
Results: Overview
Export
Case study: New
Save
Save as
List
© 2012

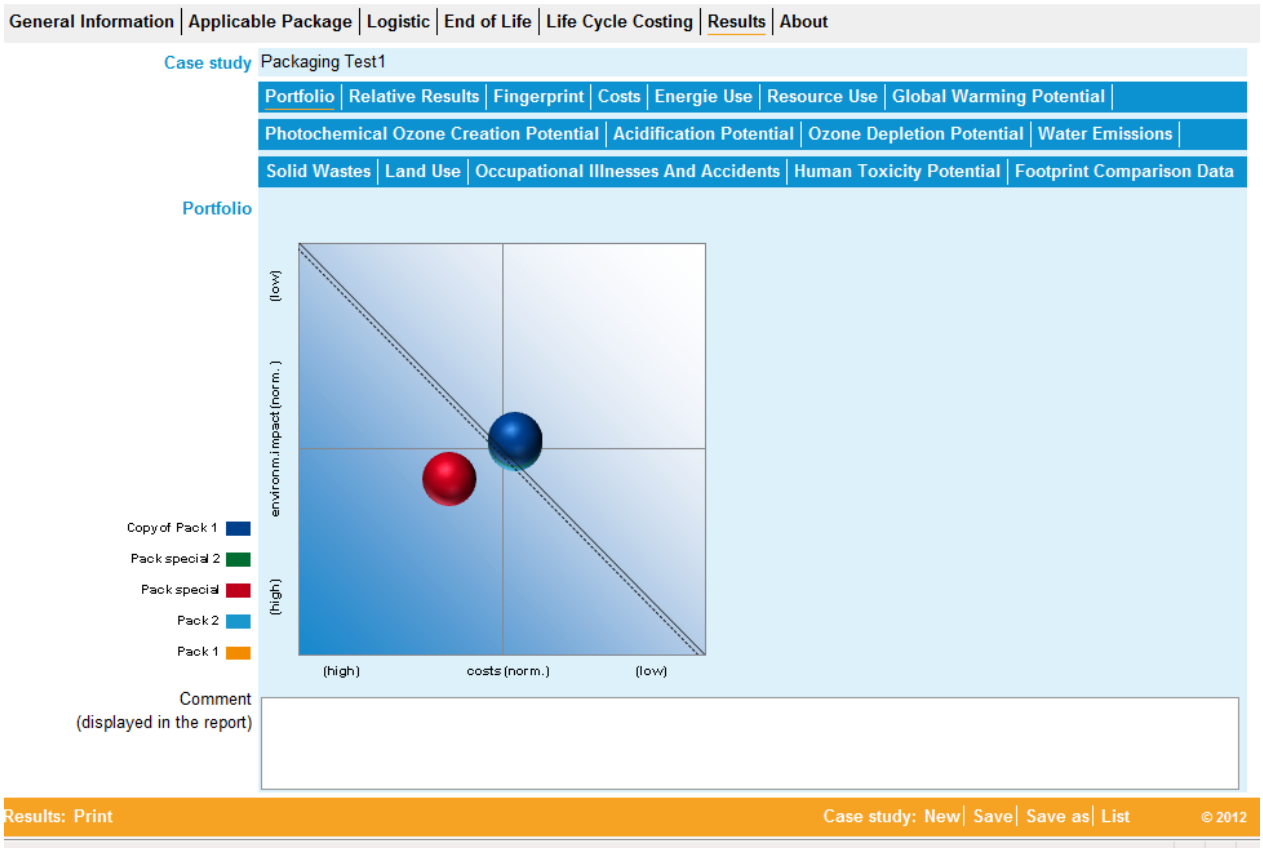

Web-based Eco-Efficiency Analysis
Croplife 2012
Case studies
Private
Publicly
Name
Date
?
Basic4_packed
25. Sep 2012 05:00:41
Load
toxic
24. Jul 2012 11:26:55
Test1
07. Sep 2012 18:01:12
Load case study
You are going to overwrite current expert field input data. Do you want to proceed?
Load
Cancel
General Information
Applicable Package
Logistic
End of Life
Case study
Packaging Test1
Transportation
Pack 1
Pack 2
size of package
<= 1 L
Price of Packages depending their Size
<= 10 L
> 10 L
HDPE package
3.400
2.700
2.800
PP package
4.000
3.500
PET package
4.500
Coex package
5.000
3.800
4.000
Paper / Carton package
1.500
Tinplate
2.500
Glass
Aluminium
5.000
Case study: New
Save
Save as
List
© 2012

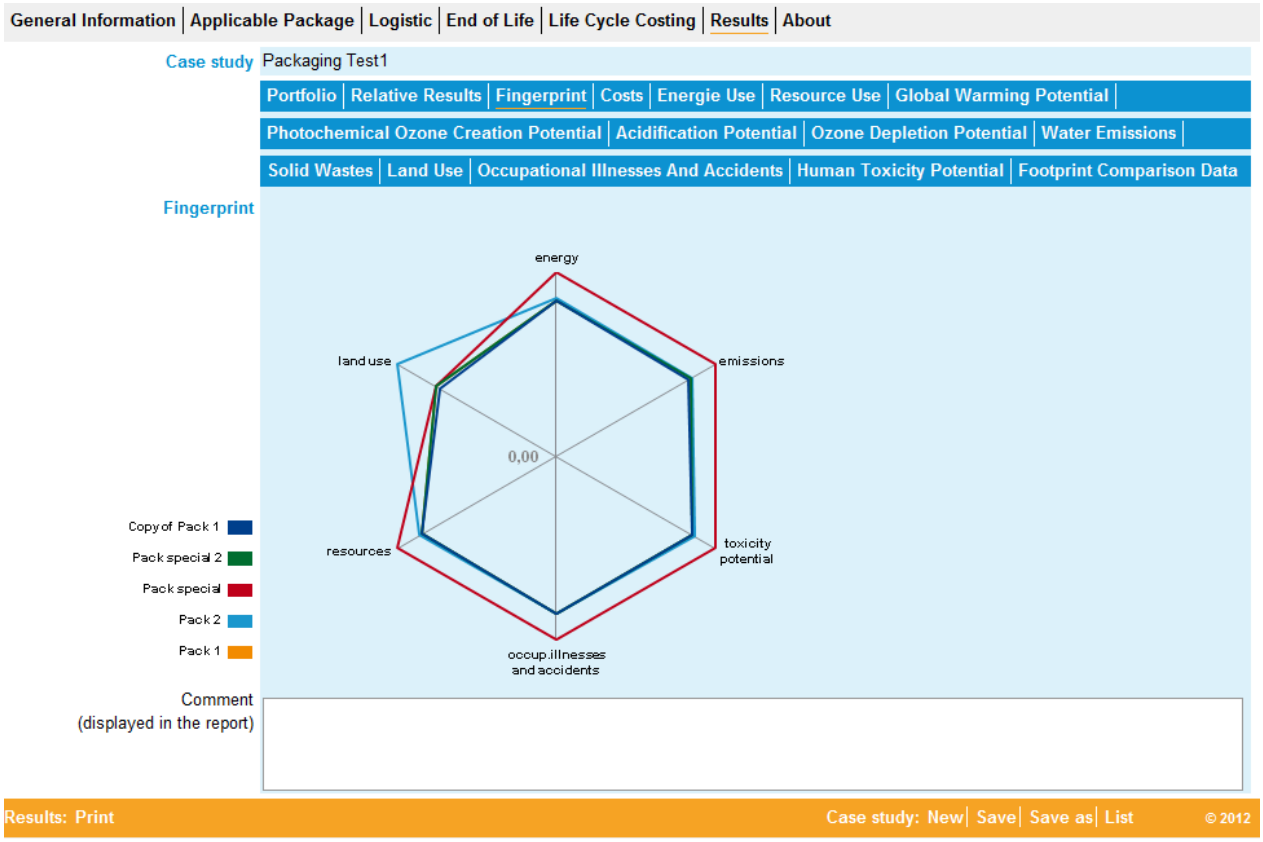
4.7 Calculation, graphs and documentation

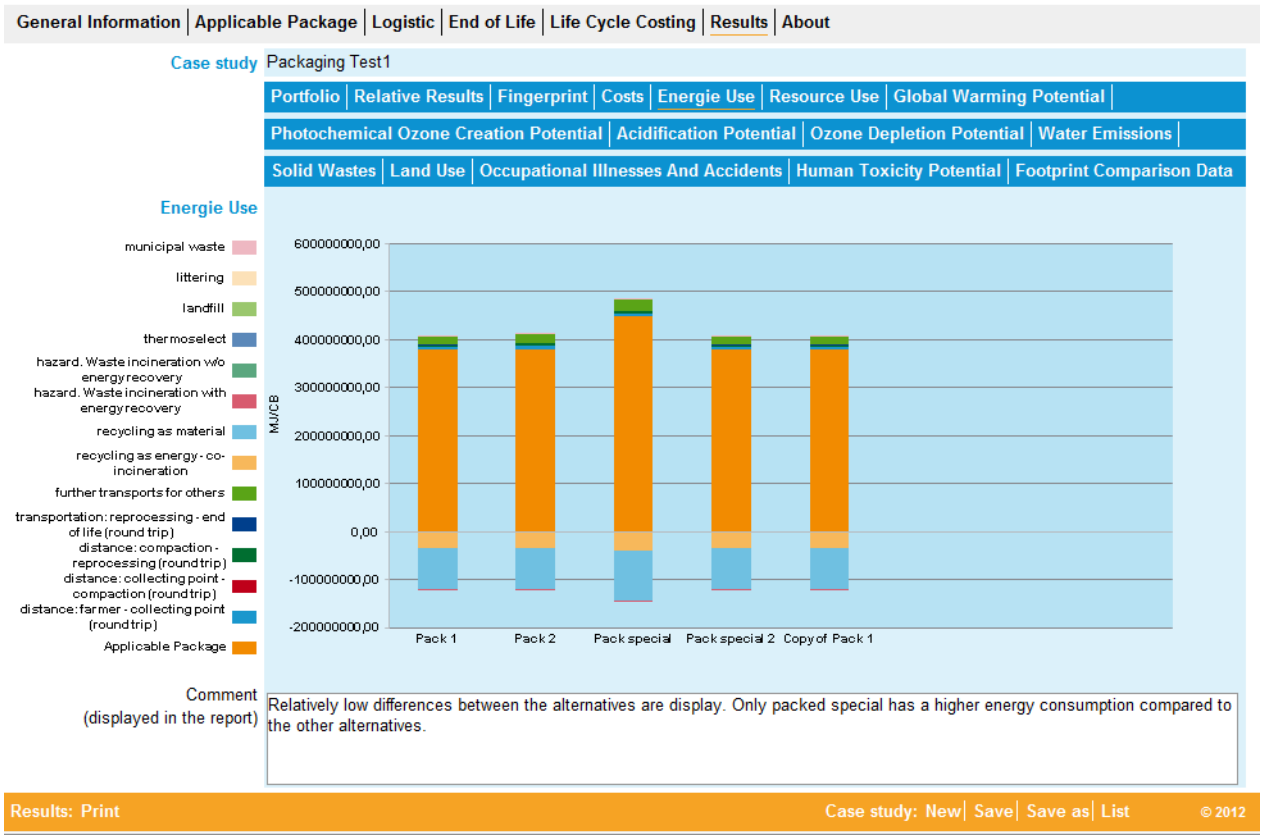
The selection of “Overview” in the bottom line starts the calculation of the data in the Eco-Efficiency Analysis mode. If there are some incorrect or incomplete data inputs, a message will appear. The inputs must be corrected to start the calculation.



A page is displayed, where different result graphs can be selected by clicking on the appropriate box. In the comment field, comments can be introduced. The comments are displayed in the report.

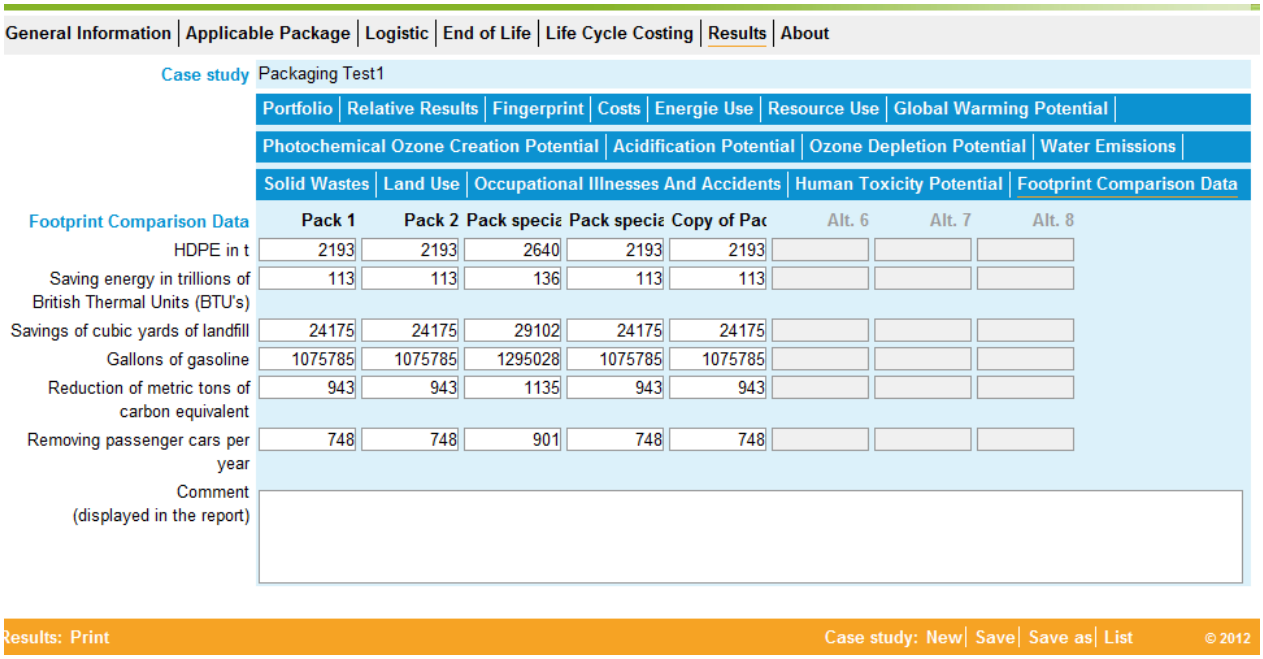

General Information | Applicable Package | Logistic | End of Life | Life Cycle Costing | Results | About
Case study
Packaging Test1
Portfolio | Relative Results | Fingerprint | Costs | Energie Use | Resource Use | Global Warming Potential
Photochemical Ozone Creation Potential | Acidification Potential | Ozone Depletion Potential | Water Emissions
Solid Wastes | Land Use | Occupational Illnesses And Accidents | Human Toxicity Potential | Footprint Comparison Data
Portfolio
(low)
environm.impact (norm.)
(high)
(high)
costs (norm.)
(low)
Copy of Pack 1
Pack special 2
Pack special
Pack 2
Pack 1
Comment
(displayed in the report)
Results: Print
Case study: New | Save | Save as | List
© 2012


General Information | Applicable Package | Logistic | End of Life | Life Cycle Costing | Results | About
Case study
Packaging Test1
Portfolio | Relative Results | Fingerprint | Costs | Energie Use | Resource Use | Global Warming Potential
Photochemical Ozone Creation Potential | Acidification Potential | Ozone Depletion Potential | Water Emissions
Solid Wastes | Land Use | Occupational Illnesses And Accidents | Human Toxicity Potential | Footprint Comparison Data
Fingerprint
energy
emissions
toxicity potential
occup.illnesses and accidents
resources
land use
0,00
Copy of Pack 1
Pack special 2
Pack special
Pack 2
Pack 1
Comment (displayed in the report)
Results: Print
Case study: New | Save | Save as | List
© 2012

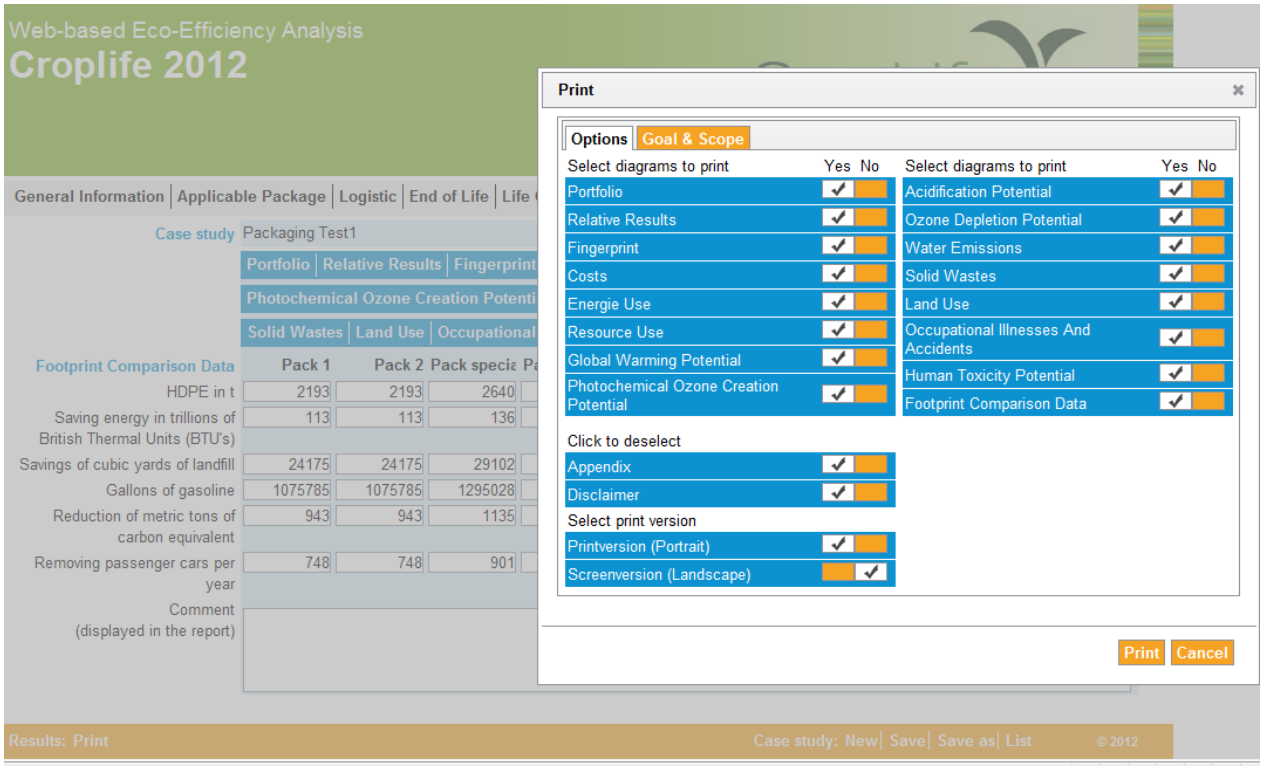


A comment was written in the comment field (350 characters).

An overview sheet shows what the environmental burdens mean translated in easy understandable terms.

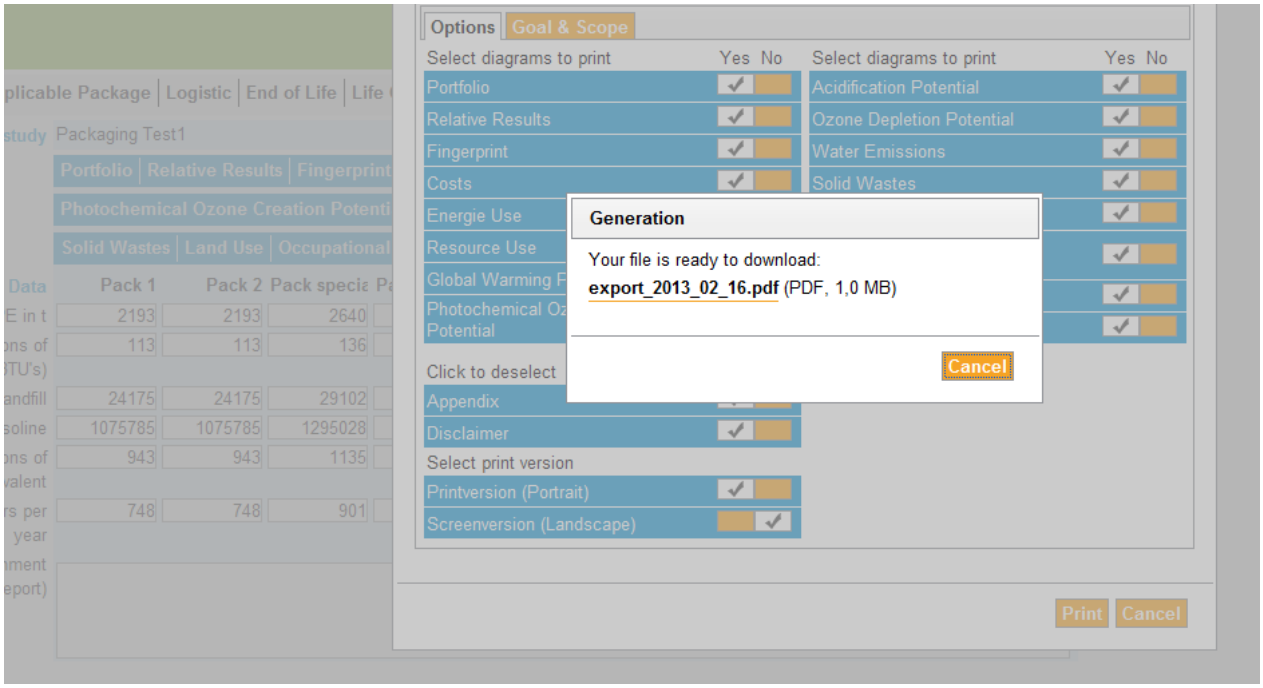


To transfer the results to different types of reports, the button ‘print’ must be clicked.



With ‘Yes’ or ’No’, the categories which will be displayed in the report can be selected. In Goal & Scope additional information for the report can be introduced and will help to understand the case study better.

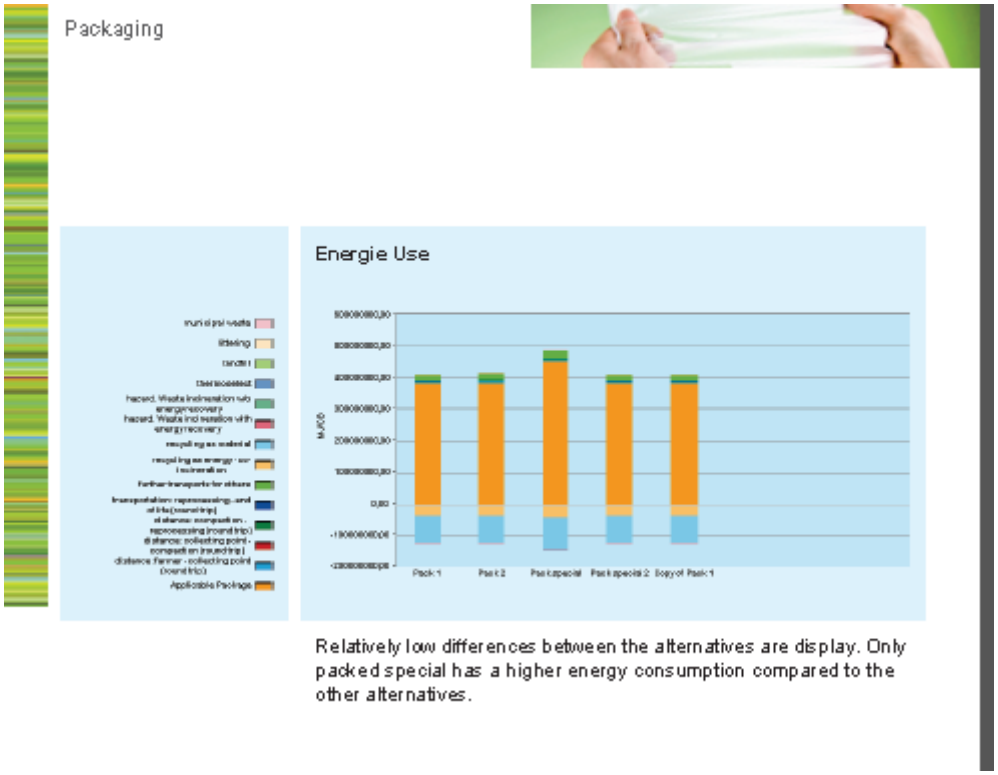
The print version can be selected. There are a print version (Portrait) and a Screenversion (Landscape) available. The latter can be used for presentations as well.



The title of the report looks like:

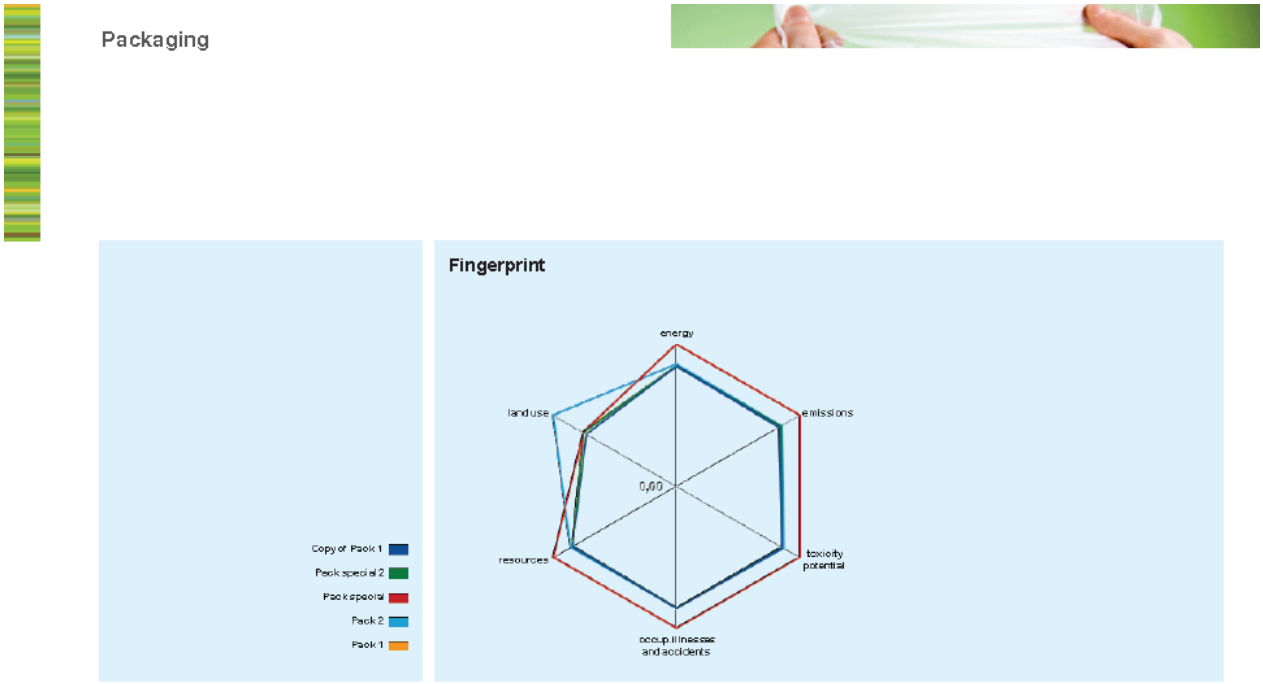
Packaging
CropLife
INTERNATIONAL
Croplife 2012
Web-based Eco-Efficiency Analysis
Author: Crop 1
Date: 16. Feb 2013

Single results from the report version portrait (examples):



Relatively low differences between the alternatives are display. Only packed special has a higher energy consumption compared to the other alternatives.

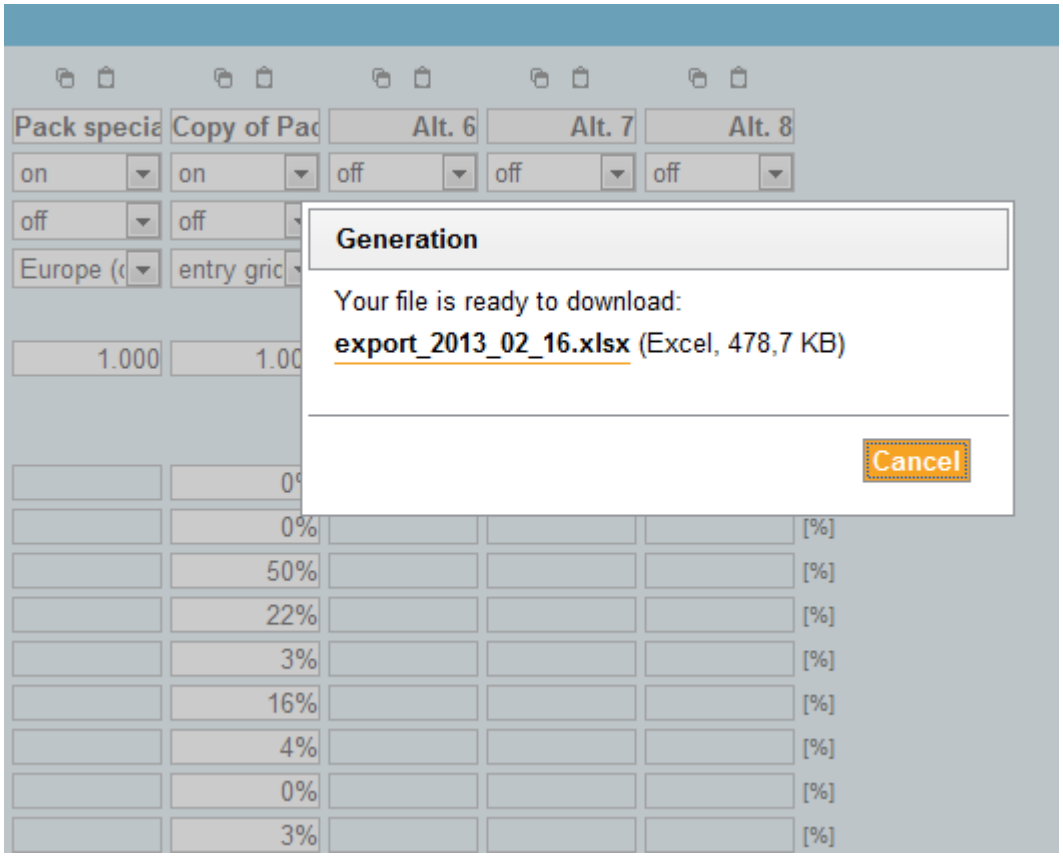
Single results from the screenversion landscape (examples):



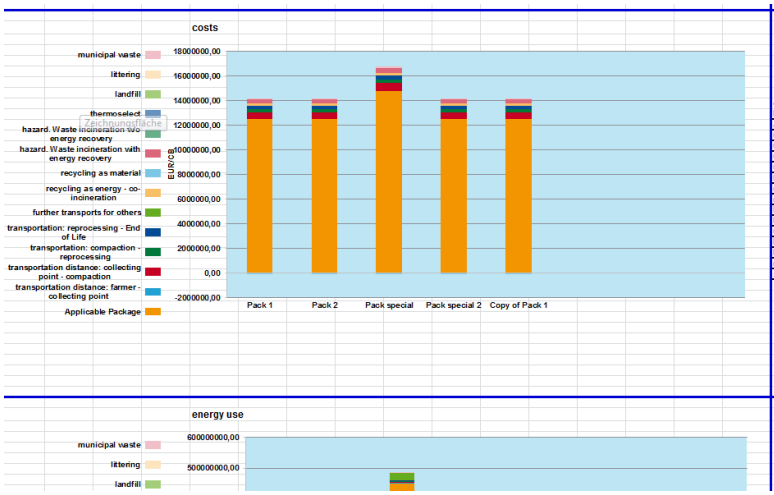
Both reports will be exported as pdf-files and can be saved by the user. Please remember the disclaimer you agreed on before you entered the WEB-based calculator system.

After downloading the reports, the user may go back to ‘General information’. This step deletes the calculation results. To re-display the results, you should again click on ‘overview’ and another follow the calculation steps as above.

Clicking the ‘export’-function, an Excel file is created that can be downloaded.



This Excel file can be used for additional calculations, modification of graphs concerning colors, design, display results, forms etc.. It is an output sheet and does not calculate anything. It reflects the case study where it was extracted from. Please remember the disclaimer you agreed on before you entered the WEB-based calculator system.



costs

EUR/CB	Pack 1	Pack 2	Pack special	Pack special 2	Copy of Pack 1
Applicable Pac	12504760,00	12504760,00	14777740,00	12504760,00	12504760
transportation	0,00	0,00	0,00	0,00	0
transportation	554620,00	554620,00	660000,00	554620,00	554620
transportation:	252100,00	252100,00	300000,00	252100,00	252100
transportation:	252100,00	252100,00	300000,00	252100,00	252100
further transpo	0,00	0,00	0,00	0,00	0
recycling as er	201680,00	201680,00	240000,00	201680,00	201680
recycling as m	-97698,33	-97698,33	-115495,11	-97698,33	-97698
hazard. Waste	324063,09	324063,09	383383,71	324063,09	324063
hazard. Waste	0,00	0,00	0,00	0,00	0
thermoselect	0,00	0,00	0,00	0,00	0
landfill	0,00	0,00	0,00	0,00	0
littering	0,00	0,00	0,00	0,00	0
municipal wast	93289,42	93289,42	108259,26	93289,42	93289
sum	14084913,58	14084913,58	16653887,86	14084913,58	14084913

For publication of results to the public, a critical review described in ISO 14040 and 14044 is recommended. If comparative assertions are the goal of the publication, the critical review by independent third parties and experts is needed.

If there are additional questions, please get in contact with Crop Life International.

Version 2_Apr 19, 2013.

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