



openLCA user guide
for the 1.4 beta version

Version: 1.0

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Introduction

With openLCA 1.4 we started a new development branch of openLCA. We rewrote large parts of the internals of openLCA to support huge product systems and efficient calculation of such systems. OpenLCA 1.4 supports the ecoinvent 3 database and provides an improved management and evaluation mechanism for parameters. The software has passed a first public test round but is at present still considered as beta.

Aim of this text is to explain for users how to install and use openLCA.

Compared to the 1.3.x series, openLCA 1.4 brings the following changes:

- Database management: openLCA 1.4 supports local databases and connections to remote MySQL databases (e.g. for team work). To optimize caching and for simplifying the user interface, openLCA 1.4 allows only one active database connection at a time. Local databases can be easily exchanged via the context menu in the navigation tree.
- It is now much faster to create and calculate a product system.
- Management of parameters and the evaluation mechanism for parameters is now more refined. It is now possible to overwrite parameters of a specific process in a product system or project variant and keep parameters with the same name in other processes unchanged. For projects, it is now possible to have a parameter grid which shows the different parameter values in the project variants, which is quite convenient in scenario calculations.
- The usability of some features should be better now, e.g. editing uncertainty information for processes, searching a parameter in a system, adding a flow to a process, searching for an object (see the search text in the top right), etc.

openLCA 1.4 download and installation

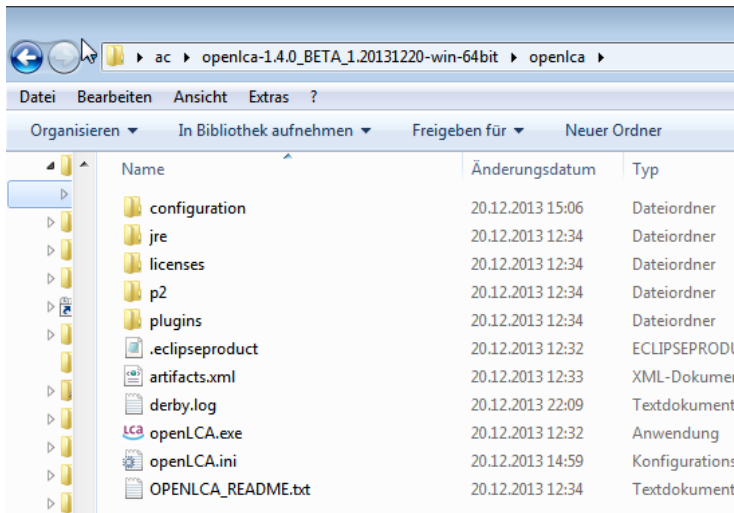
The new openLCA version 1.4 beta is available from the openLCA download page (www.openlca.org/downloads) in a Windows 64 and 32 bit version initially.

[openLCA 1.4 beta version for ecoinvent 3](#)

[openLCA 1.4 beta win 32 bit](#)

[openLCA 1.4 beta win 64 bit](#)

To install, just download and extract the zip archive, for example to your user directory.

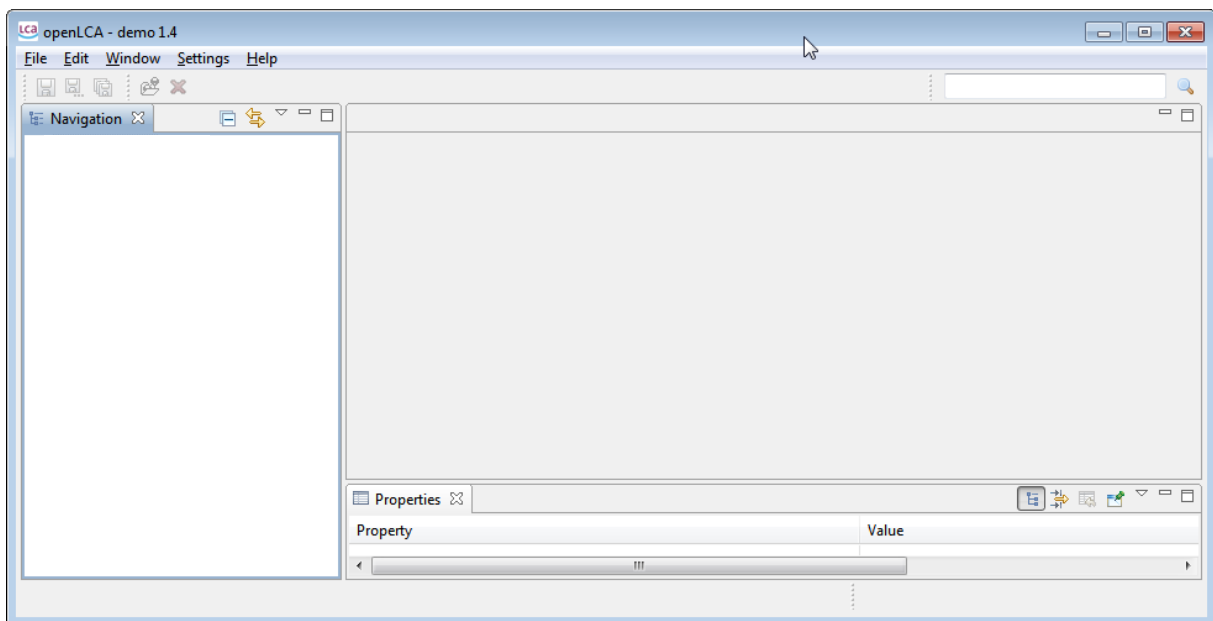


Then, start openLCA by opening openLCA.exe.

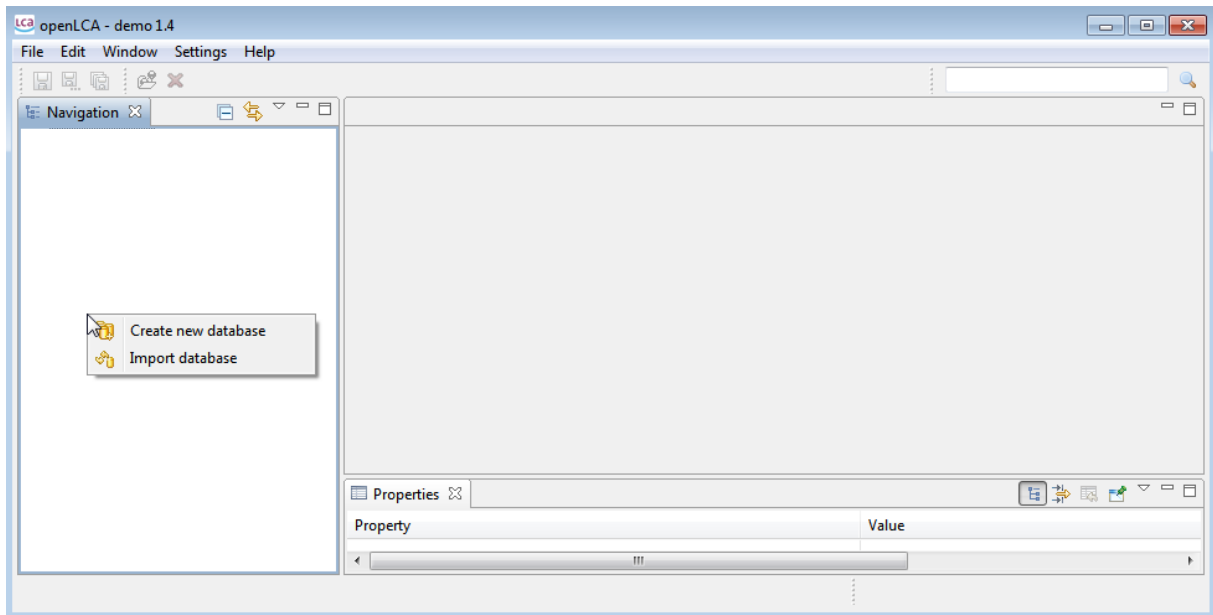
openLCA 1.4 overview

First start, import and creation of databases

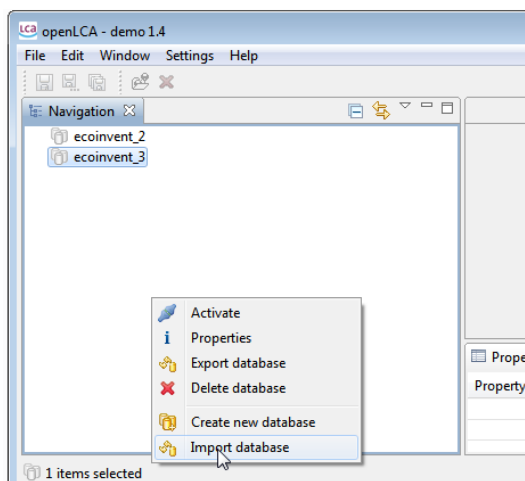
Once started, openLCA looks as follows



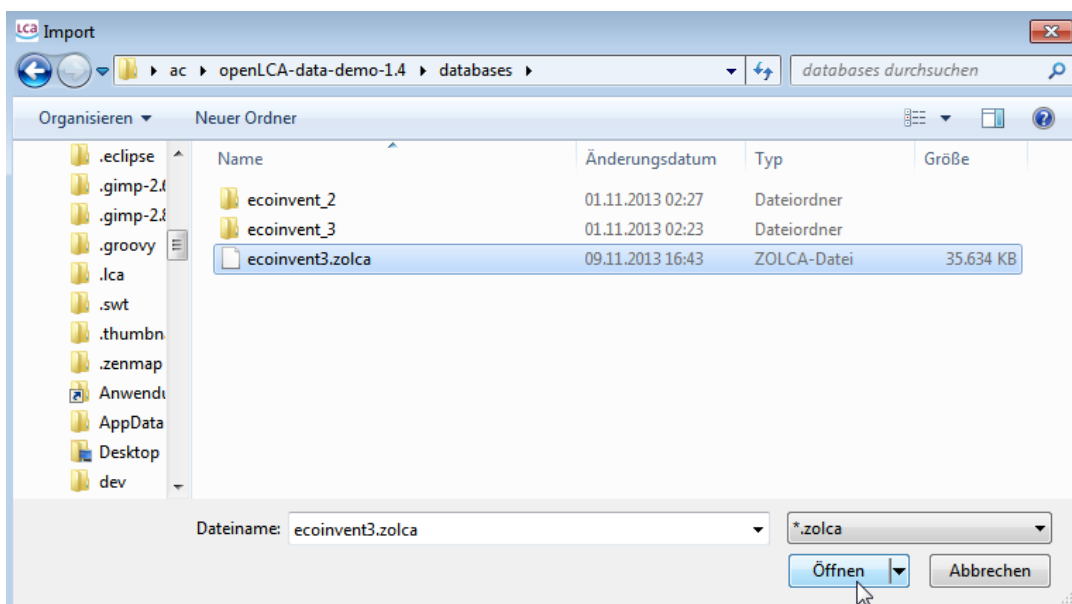
Right-click in the empty white navigation window and either create a database or import a complete database.



For importing e.g. the ecoinvent 3 database, select the “.zolca” file that you obtained from us.



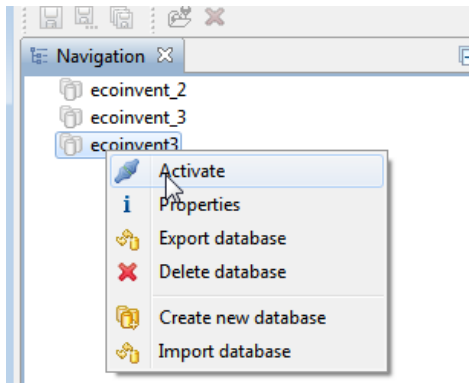
(I have previously already imported ecoinvent_2 and ecoinvent_3 but am now importing another ecoinvent3 database, therefore you see already two databases in my navigation view)



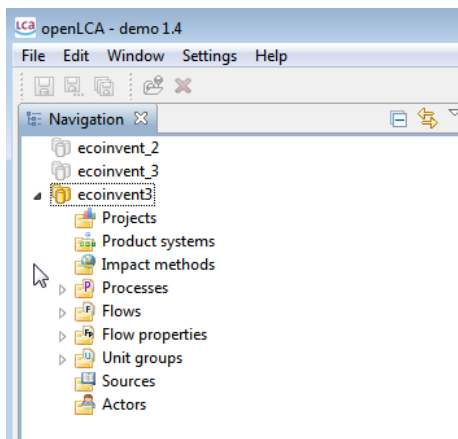
After you have confirmed the selection, the import starts, and when it is finished, you have a new database icon in your navigation window in openLCA.

At first it is greyed out (as any other database after the first start); you need to activate it in order to work with the database.

You activate the database by right-clicking with your mouse on the respective database icon. Also a double-click works.

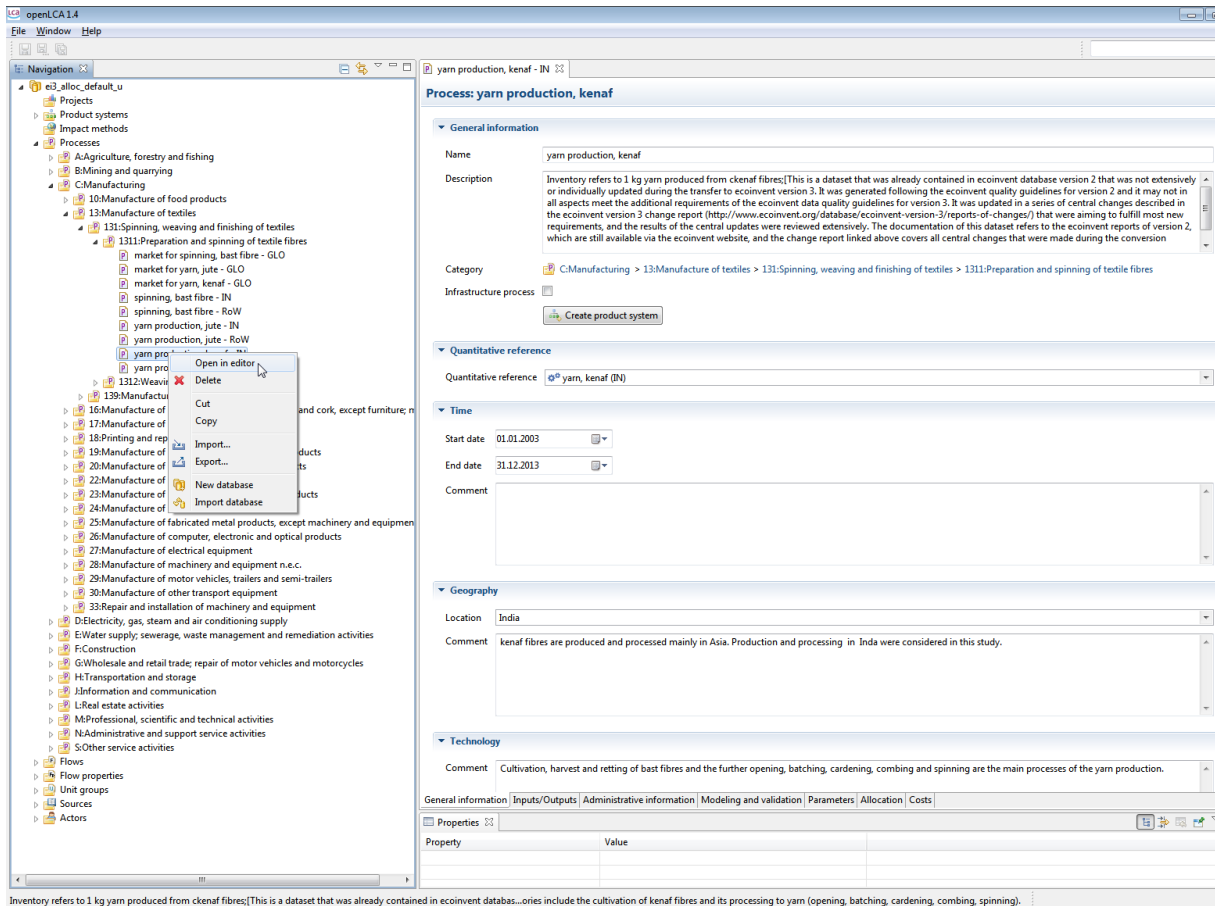


Once the database is active, the category tree unfolds, which looks similar to previous openLCA versions.



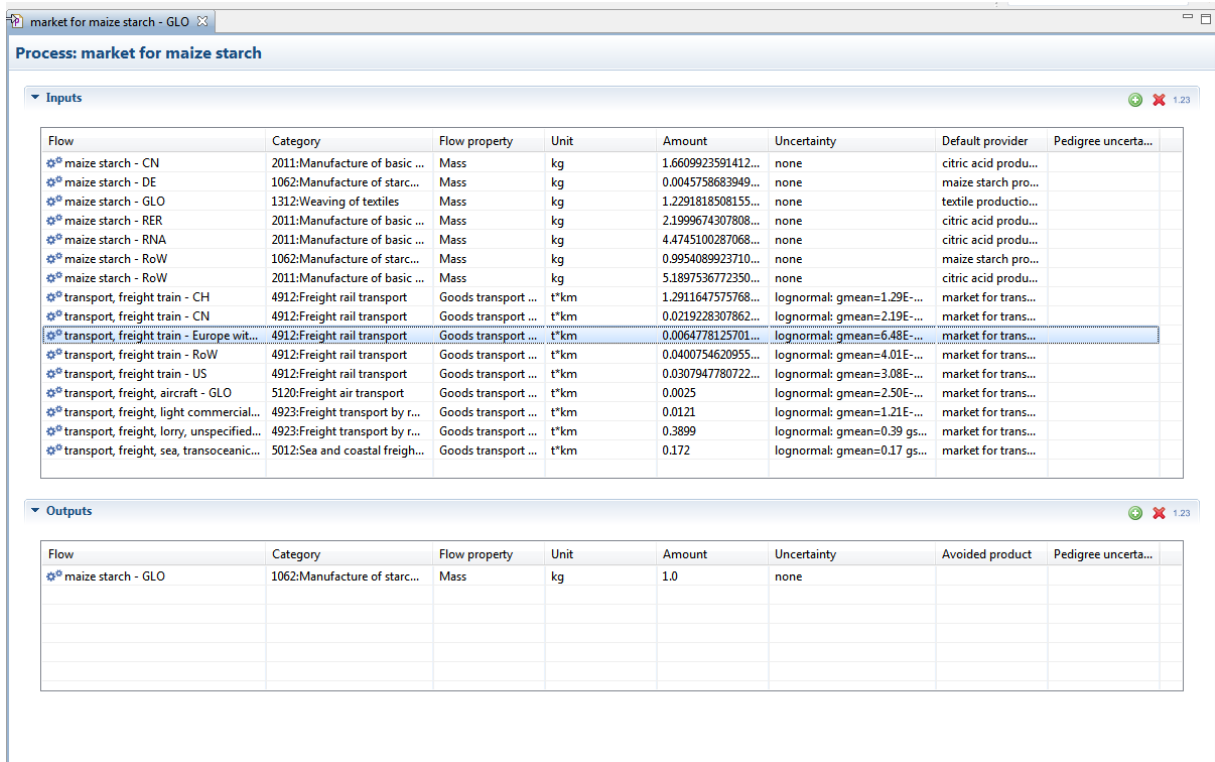
Working with elements in openLCA

Working with elements in openLCA is quite similar as in the previous versions. You can still check the elements (as for example processes) in the category tree and open them (double-click or right-click and open – here for example a process data set)...



(screenshot shows an improved ecoinvent 3 database that you can obtain from us if you order ecoinvent 2&3 database from openLCA nexus, here: <https://nexus.openlca.org/>)

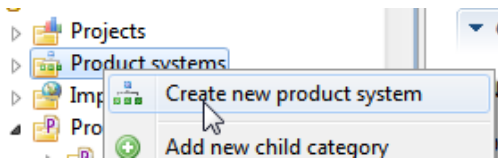
..and find in the tabs on the bottom of each editor often several sub-pages, for process data sets for example the input/output flows.



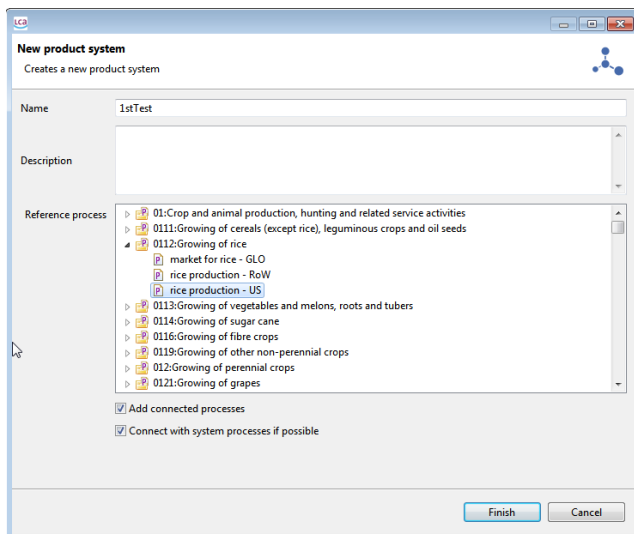
Working with product systems

Product systems model life cycles in openLCA; working with them and calculating them is therefore highly important and important also for the software test.

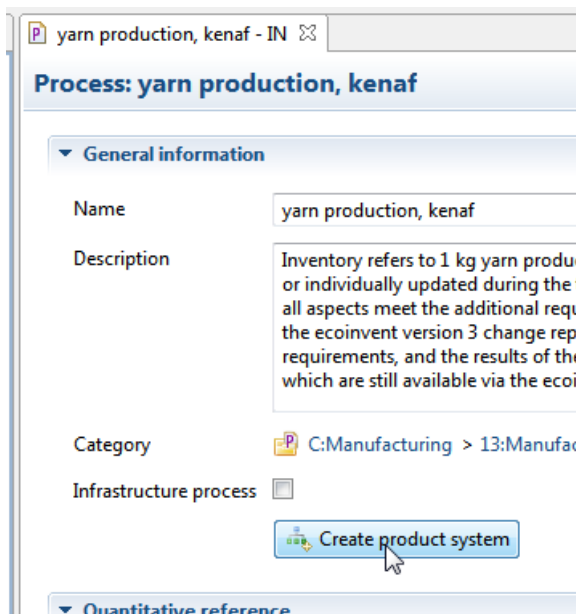
You create a product system as in previous versions of openLCA (right-click on the category tree, product system, then select 'create new product system'.



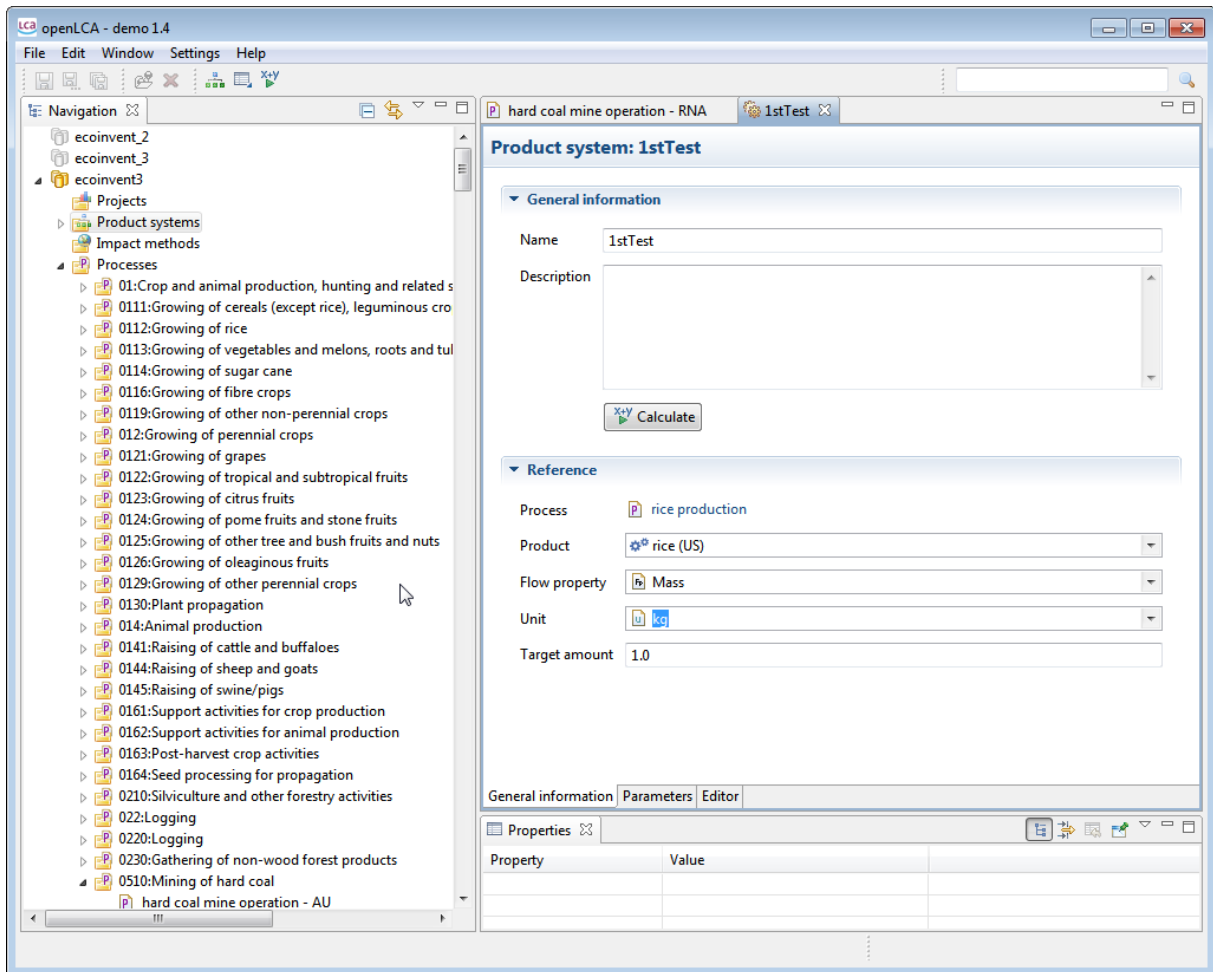
Then, select the reference process and click whether you want the processes to be connected automatically, as in earlier versions.



As an alternative, you can now also create a product system directly from any process in openLCA, with a click on the create product system button on the general information section of a process:

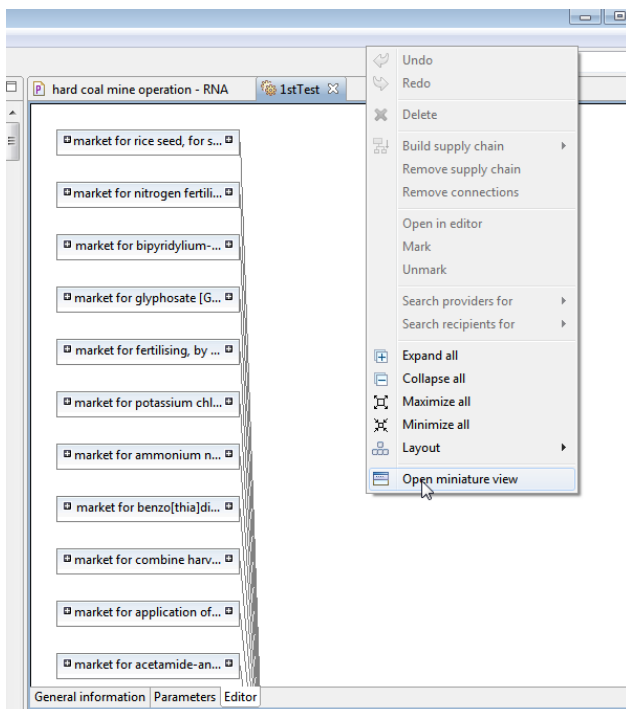


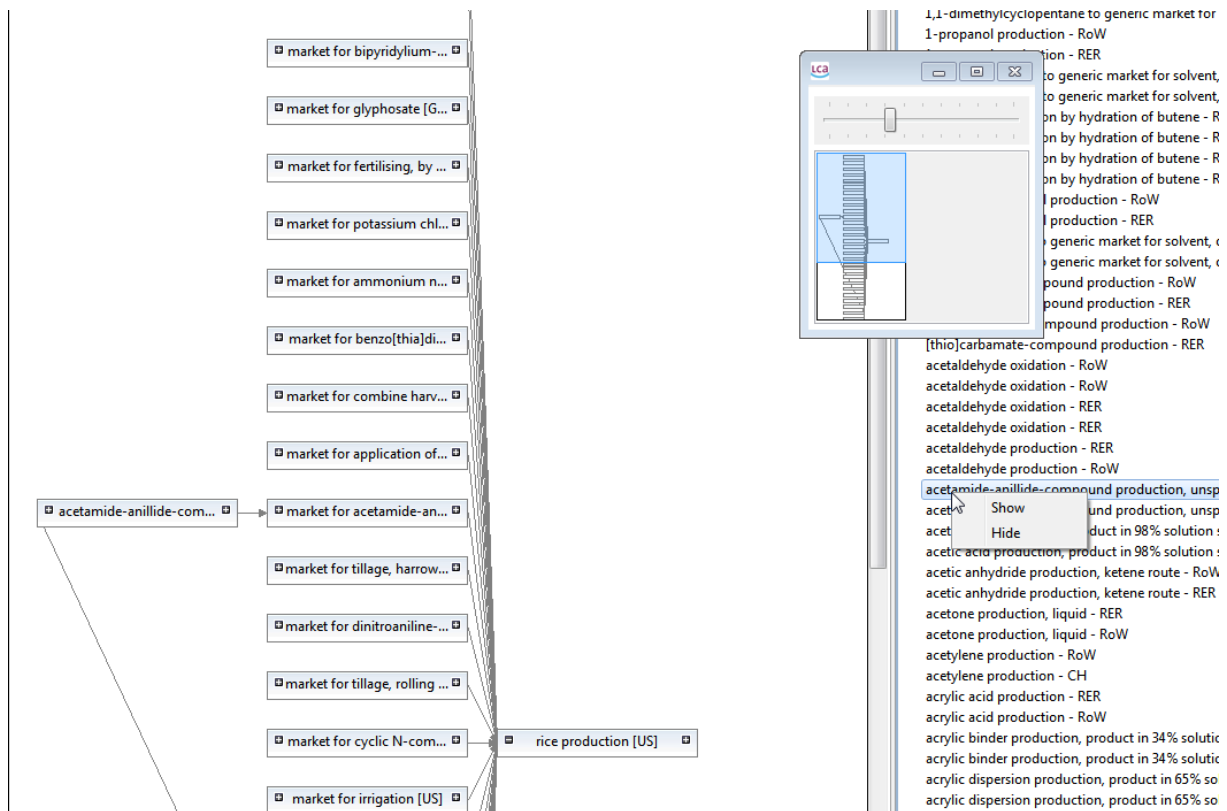
The product systems then opens..



..you can check the graphical editor (page ,editor' on the product system).

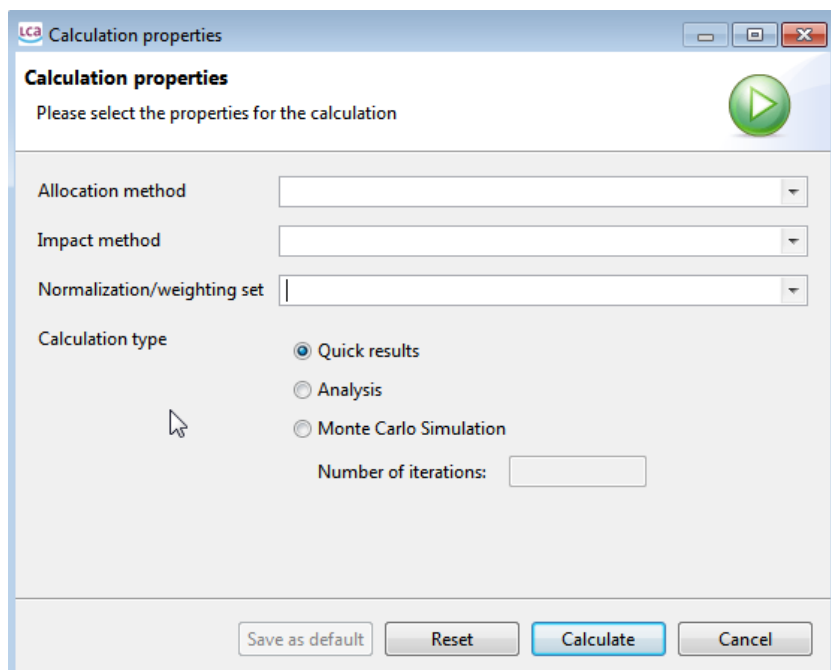
A right-click on the editor page gives you access to the miniature view and to actions possible with the editor (expand, collapse, asf.)





To calculate a modeled system, click on calculate. For the Monte Carlo simulation, the optimized caching procedure from openLCA 1.3.0 is not yet implemented therefore the simulation is currently quite slow in the beta version.

Please note the remarks on memory allocation for very large systems (such as ecoinvent) in the remarks section.



The ecoinvent database as such does of course not contain an impact assessment method. For demonstration purposes, I created a very simple one as follows:

Impact method: IPCC2007_100a

Impact category: GWP

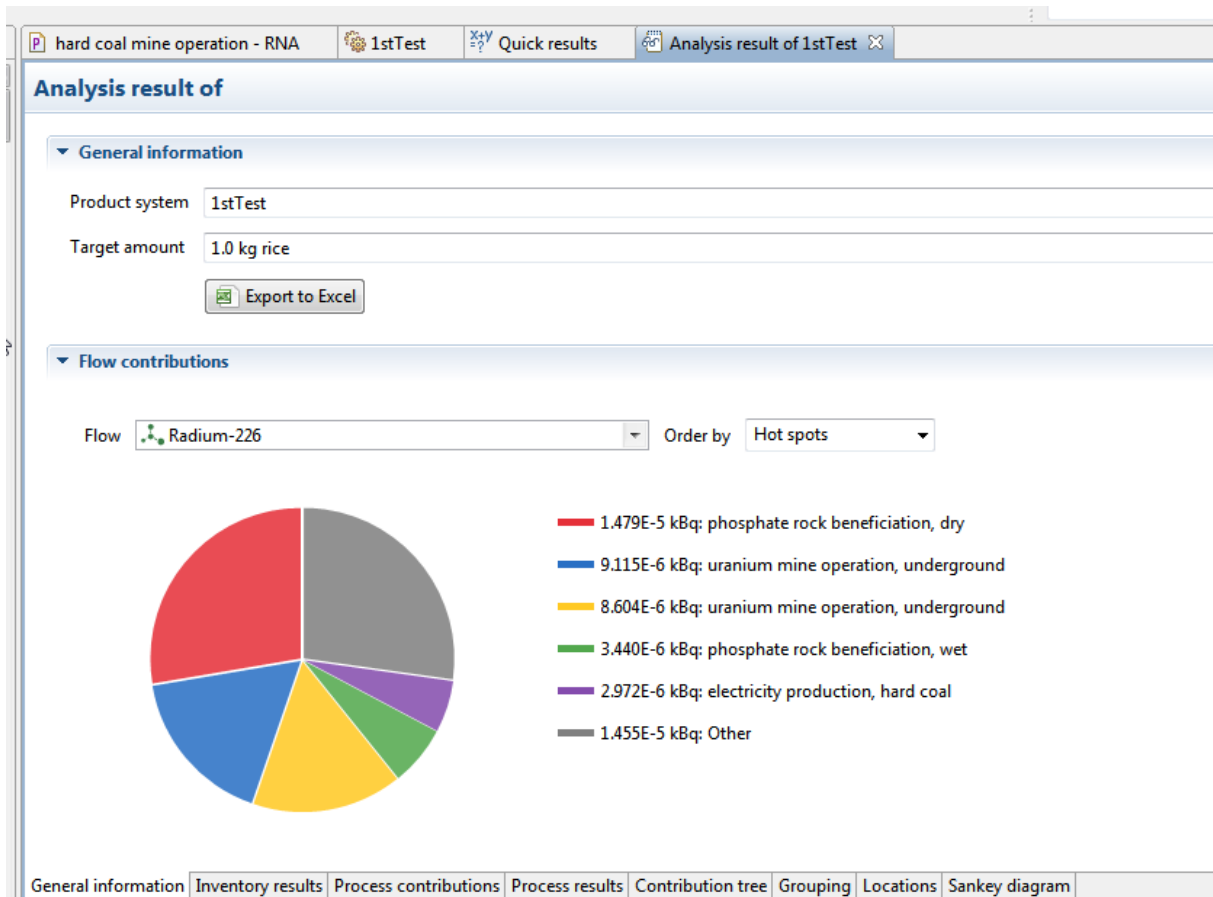
Flow	Category	Flow property	Unit	Factor	Uncertainty
Carbon dioxide	air/low population density	Mass	kg	1.0	none
Carbon dioxide	air/unspecified	Mass	kg	1.0	none
Carbon dioxide, biogenic	air/high population density	Mass	kg	1.0	none
Carbon dioxide, biogenic	air/low population density	Mass	kg	1.0	none
Carbon dioxide, biogenic	air/low population density, long-term	Mass	kg	1.0	none
Carbon dioxide, biogenic	air/lower stratosphere + upper troposphere	Mass	kg	1.0	none
Carbon dioxide, biogenic	air/unspecified	Mass	kg	1.0	none
Carbon dioxide, fossil	air/high population density	Mass	kg	1.0	none
Carbon dioxide, fossil	air/low population density	Mass	kg	1.0	none
Carbon dioxide, fossil	air/low population density, long-term	Mass	kg	1.0	none
Carbon dioxide, fossil	air/lower stratosphere + upper troposphere	Mass	kg	1.0	none
Carbon dioxide, fossil	air/unspecified	Mass	kg	1.0	none
Carbon dioxide, from soil or biomass stock	air/high population density	Erosion Resistance (Occ.)	kg	1.0	none
Carbon dioxide, from soil or biomass stock	air/low population density	Erosion Resistance (Occ.)	kg	1.0	none
Carbon dioxide, from soil or biomass stock	air/low population density, long-term	Erosion Resistance (Occ.)	kg	1.0	none
Carbon dioxide, from soil or biomass stock	air/lower stratosphere + upper troposphere	Erosion Resistance (Occ.)	kg	1.0	none
Carbon dioxide, from soil or biomass stock	air/unspecified	Erosion Resistance (Occ.)	kg	1.0	none
Carbon dioxide, land transformation	air/high population density	Mass	kg	1.0	none
Carbon dioxide, land transformation	air/low population density	Mass	kg	1.0	none
Carbon dioxide, land transformation	air/low population density, long-term	Mass	kg	1.0	none
Carbon dioxide, land transformation	air/lower stratosphere + upper troposphere	Mass	kg	1.0	none
Carbon dioxide, land transformation	air/unspecified	Mass	kg	1.0	none

In the following I simply add some screenshots for your orientation, taken from the analysis and from the quick calculation.

Inventory results

Inputs

Flow
Aluminium
Aluminium, 24% in bauxite, 11% in crude ore, in ground
Anhydrite, in ground
Argon-40
Barite, 15% in crude ore, in ground
Basalt, in ground
Borax, in ground
Bromine, 0.0023% in water
Cadmium, 0.30% in sulfide, Cd 0.18%, Pb, Zn, Ag, In, in ground
Calcium carbonate, in ground
Carbon dioxide, in air
Carbon, in organic matter, in soil
Cerium, 24% in bastnasite, 2.4% in crude ore, in ground
Chromium, 25.5% in chromite, 11.6% in crude ore, in ground
Chrysotile, in ground



hard coal mine operation - RNA 1stTest Quick results Analysis result of 1stTest

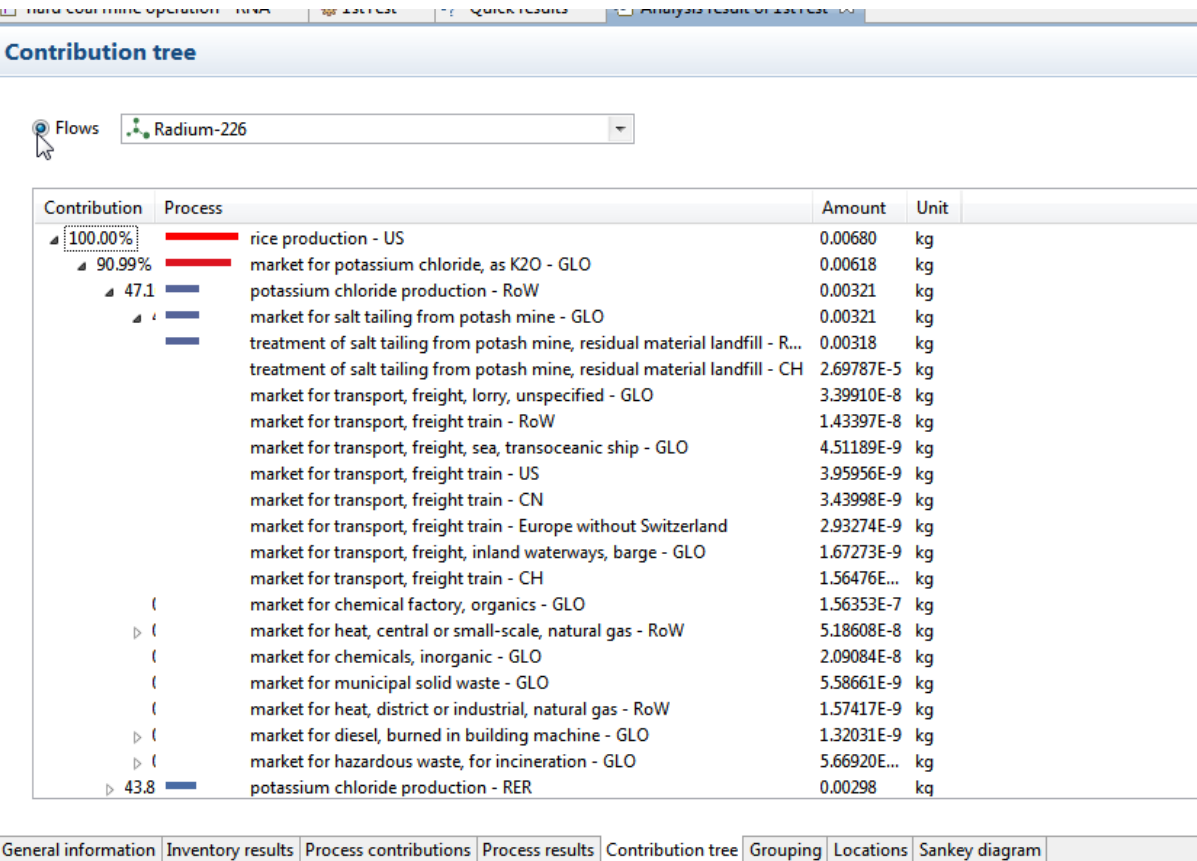
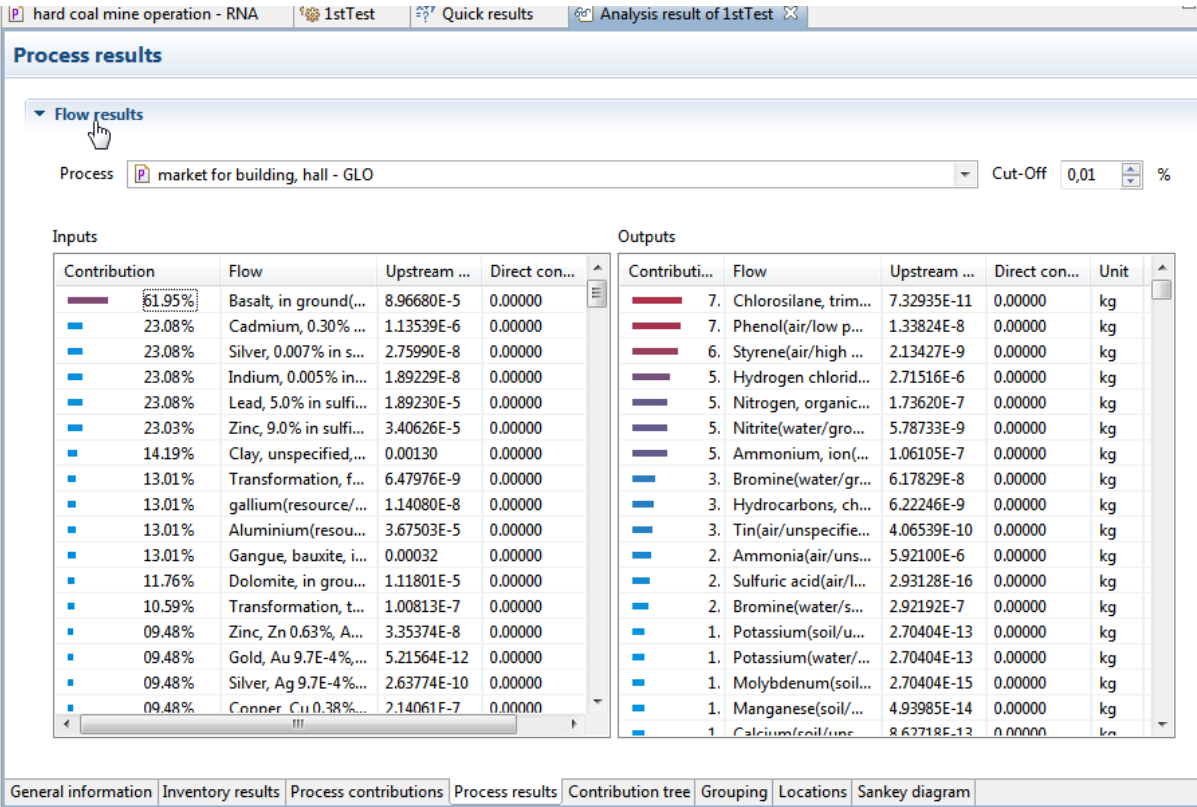
Process contributions

Flow contributions

Flow: Carbon dioxide, fossil Order by: Total contributions Cut-off: 2 %

Contribution	Process	Total amount	Single amount	Unit
100.00%	rice production	0.25773	0.00000	kg
44.21%	market for drying of bread grain, seed and legumes	0.11394	0.00000	kg
44.11%	drying of bread grain, seed and legumes	0.11369	0.00000	kg
36.01%	market for heat, district or industrial, other than natur...	0.09281	0.00000	kg
29.70%	heat production, at hard coal industrial furnace 1-10...	0.07655	0.07430	kg
27.41%	market for irrigation	0.07064	0.00000	kg
27.41%	irrigation	0.07064	0.00000	kg
13.52%	market for ammonia, liquid	0.03484	0.00000	kg
12.14%	market for electricity, high voltage	0.03130	0.00000	kg
11.93%	electricity production, hard coal	0.03075	0.02923	kg
11.85%	market for electricity, medium voltage	0.03055	0.00000	kg
11.85%	electricity voltage transformation from high to medi...	0.03055	0.00000	kg
11.64%	market for polyethylene, high density, granulate	0.03001	0.00000	kg
11.49%	market for agricultural machinery, unspecified	0.02961	0.00000	kg
11.47%	agricultural machinery production, unspecified	0.02956	0.00000	kg
11.10%	ammonia production, steam reforming, liquid	0.02860	0.02706	kg
07.74%	polyethylene production, high density, granulate	0.01994	0.01977	kg
07.44%	market for heat, central or small-scale, other than nat...	0.01917	0.00000	kg
06.57%	market for electricity, low voltage	0.01694	0.00000	kg

General information | Inventory results | Process contributions | Process results | Contribution tree | Grouping | Locations | Sankey diagram



hard coal mine operation - RNA 1stTest Quick results Analysis result of 1stTest

Grouping

Groups

- 1st_testgroup
- Other

- electricity production, hard coal - MRO, US only
- electricity production, hard coal, aluminium industry - GLO
- electricity production, hard coal, at coal mine power plant - ROW
- electricity production, high voltage, for Swiss Federal Railways - CH
- electricity production, hydro, aluminium industry - GLO
- electricity production, hydro, pumped storage - ASCC
- electricity production, hydro, pumped storage - AU
- electricity production, hydro, pumped storage - MRO, US only
- electricity production, hydro, pumped storage - GB
- electricity production, hydro, pumped storage - CA-MB

Results

Flows Radium-226

Group	Amount	Unit
Other	5.347871150301095E-5	
1st_testgroup	0.0	

0.000: 1st_testgroup

5.348E-5: Other

General information Inventory results Process contributions Process results Contribution tree Grouping Locations Sankey diagram

Grouping

Groups

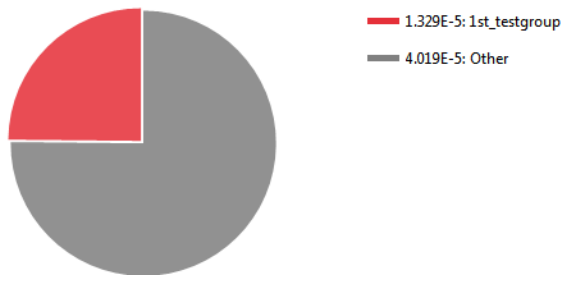
- 1st_testgroup
- Other

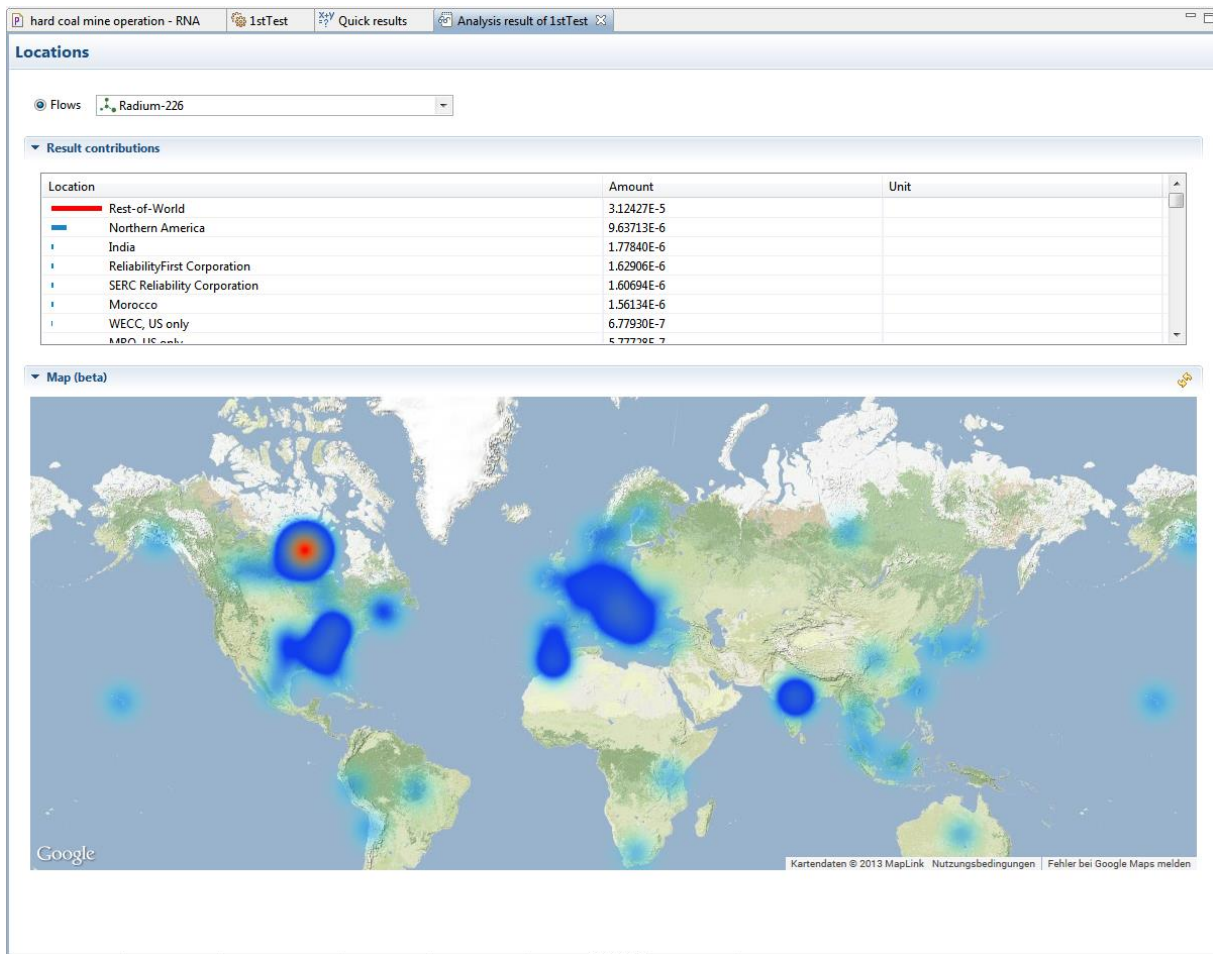
- ⚙️ electricity production, hard coal - GB
- ⚙️ electricity production, hard coal - SERC
- ⚙️ electricity production, hard coal - MX
- ⚙️ electricity production, hard coal - RoW
- ⚙️ electricity production, hard coal - AT
- ⚙️ electricity production, hard coal - TRE
- ⚙️ electricity production, hard coal - CA-ON
- ⚙️ electricity production, hard coal - MRO, US only
- ⚙️ electricity production, hard coal, aluminium industry - GLO
- ⚙️ electricity production, hard coal, at coal mine power plant - CN
- ⚙️ electricity production, hard coal, at coal mine power plant - RoW

Results

Flows Radium-226

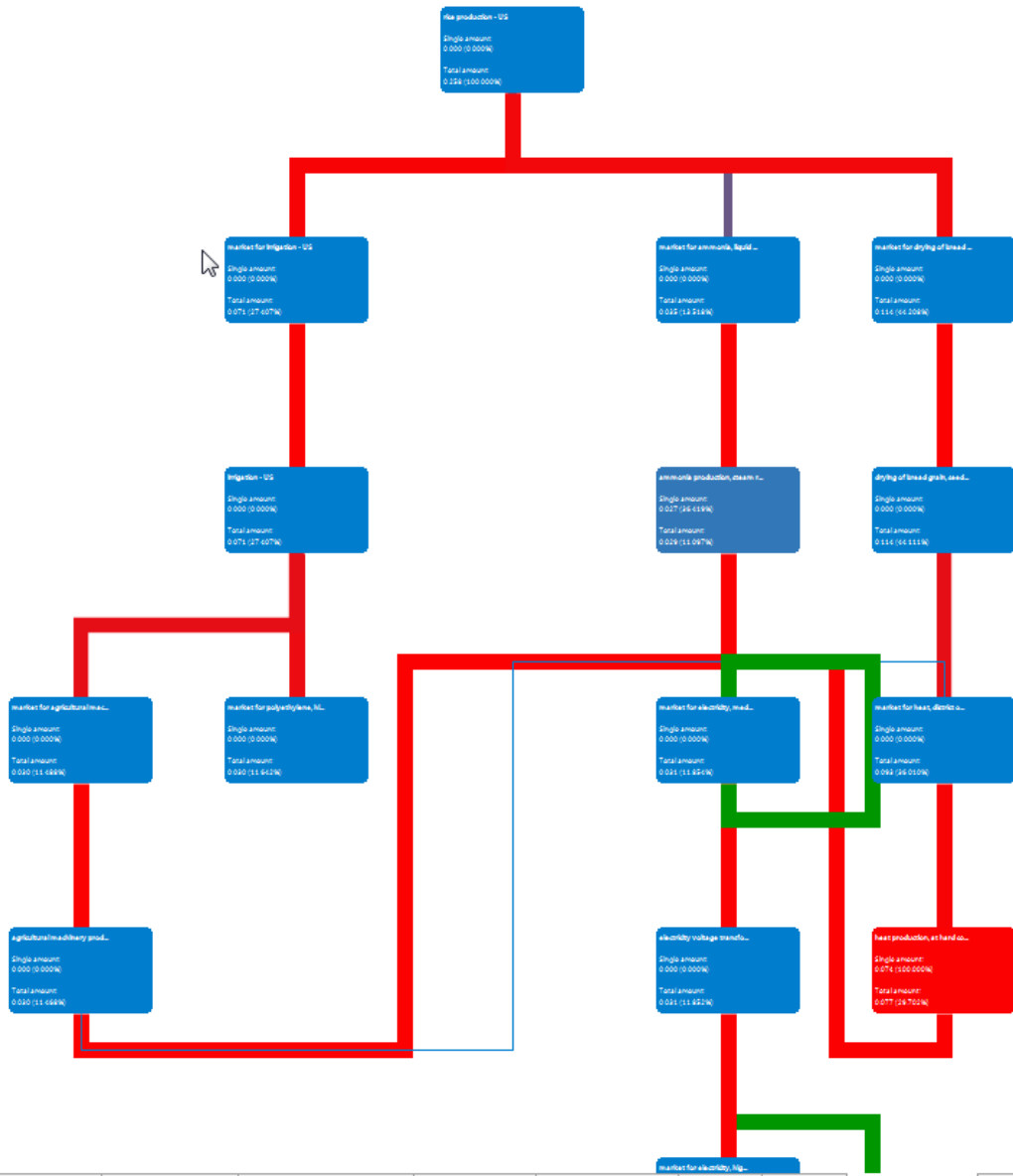
Group	Amount	Unit
Other	4.018797603107009E-5	
1st_testgroup	1.329073547194087E-5	

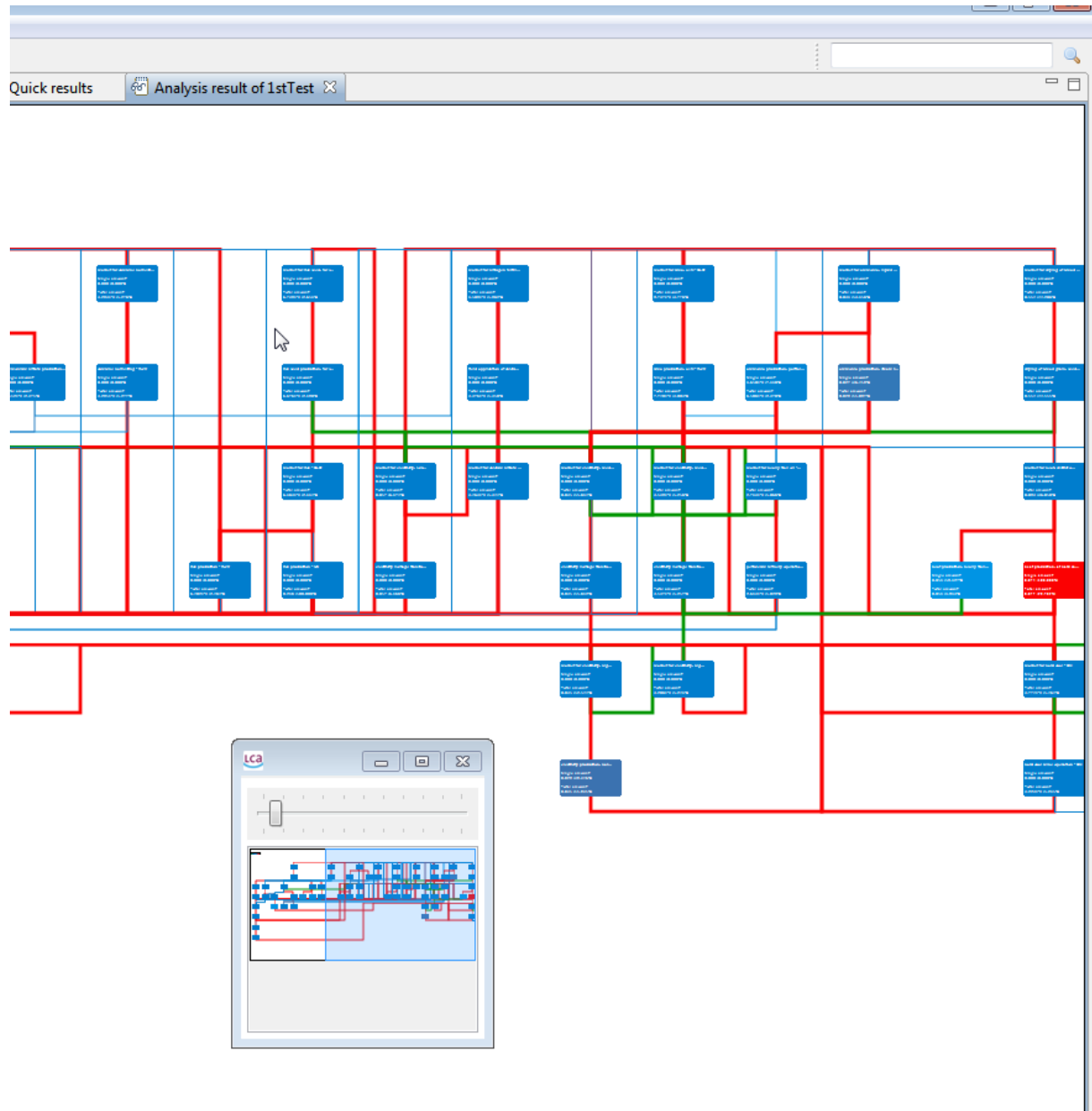


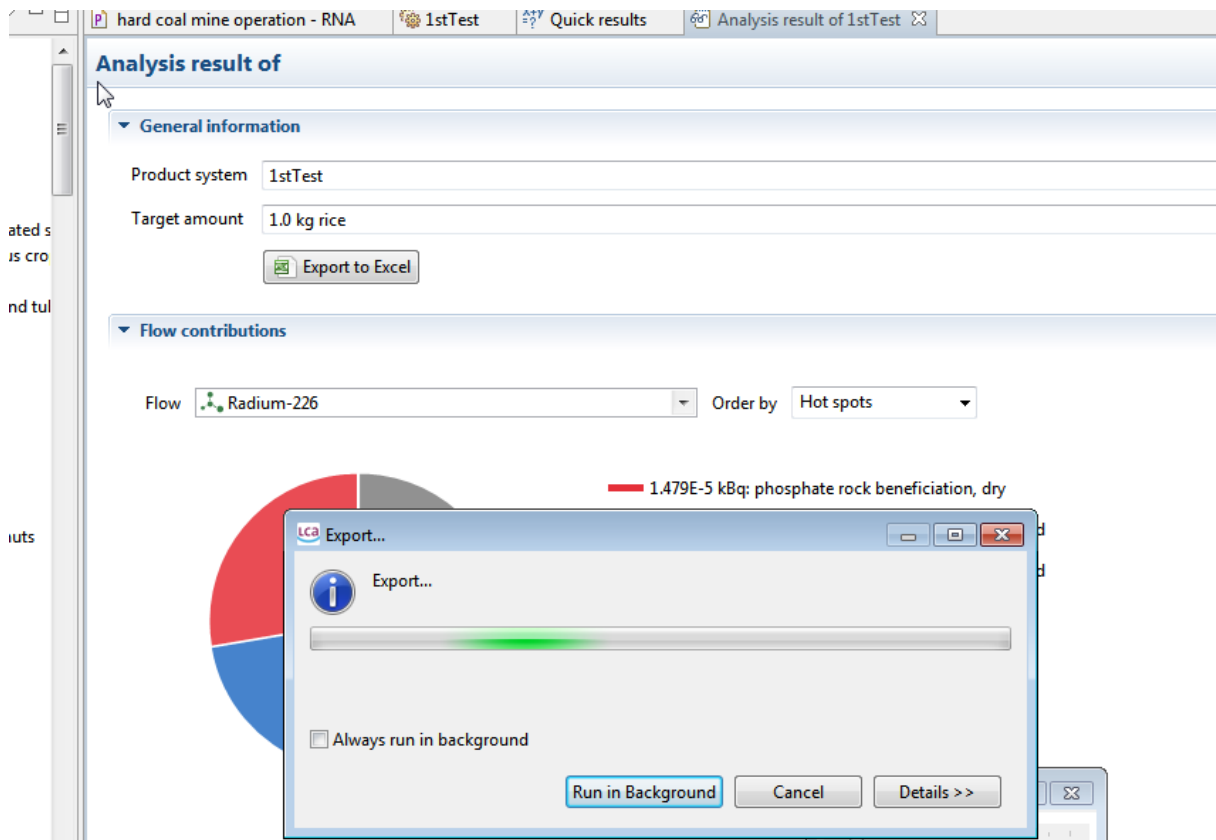


(remember to click on the refresh button – the arrows on the right – to fill the map with data from the analysis)

Product system: 1stTest
Flow: Carbon dioxide, fossil
Cut-off: 10.000%



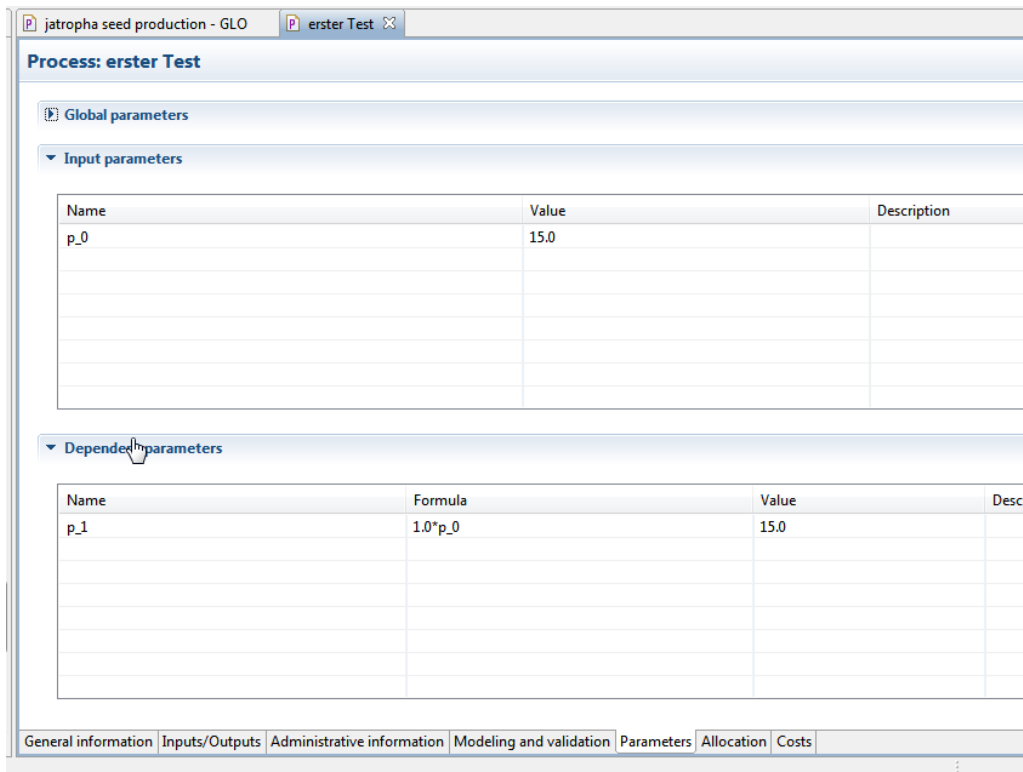




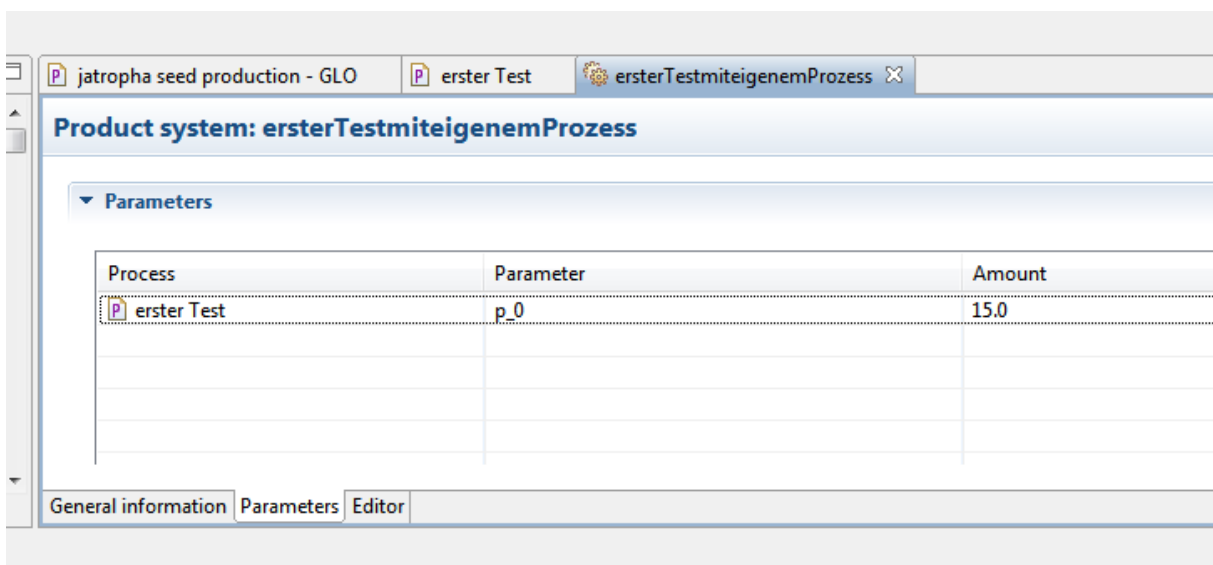
For a more detailed look and comparison of results, it is often helpful to export the results to excel.

Parameters

The parameter handling has been refined in openLCA 1.4. While previously every parameter was 'global' and therefore the same parameter name was not allowed twice, a parameter is now always linked to a process; you can therefore have several parameters named, e.g., 'water_content', for different processes.

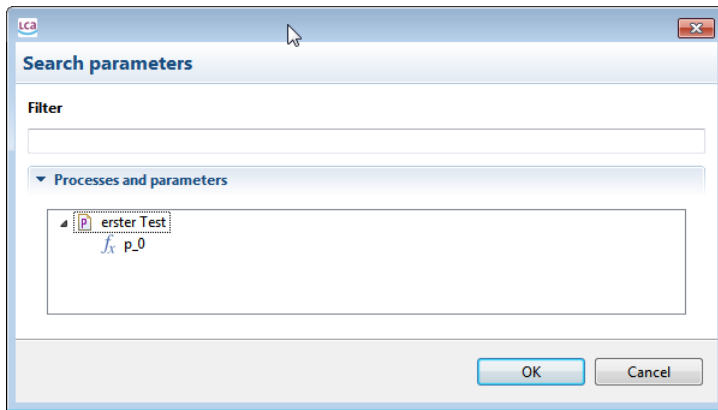


Further, parameters are now distinguished in dependent and independent (=input) parameters. For product systems and projects, you can overwrite parameters defined in the processes:



This is much more transparent than before we believe, and gives more flexibility to parameter handling.

A parameter editor is now available where you can search for the parameters in use. It opens when you want to add a parameter on projects or product systems. You can also filter the parameter and processes to narrow down the selection.



Projects

The project editor has been enhanced and improved. It allows now sensitivity analyses with parameter changes. The workflow for project calculation has been changed and improved as well; now it is always the case that the product systems in a project are calculated newly, which ensures that the results are up to date.

Project: erstesTestProjekt

General information

Name: erstesTestProjekt

Description:

LCIA Method: IPCC2007_100a

Calculate

Variants

Name	Product system	Flow property	Amount	Unit
Variant 1	1stTest	Mass	1.00000	kg
Variant 2	ersterTestmiteigenemProzess	Mass	1.00000	kg

Parameters

Parameter	Process	Variant 1	Variant 2
p_0	erster Test	10.0	15.0

Project setup | General information

Allocation

Modelling allocation is completely changed in the new 1.4 version. For a process data set, the allocation page lists all the allocation factors that are applied, for the different allocation approaches available: physical, economic, and causal. For causal, you can enter any factors.

For example, a process like the following

The screenshot shows the 'Process: allocation_example' window. It has two main sections: 'Inputs' and 'Outputs'. The 'Inputs' section contains a table with one row: 'whey' with a flow of 10.0 kg. The 'Outputs' section contains a table with two rows: 'refinery gas' (1.0 kg) and 'yarn, jute - GLO' (1.0 kg). The bottom of the window has a navigation bar with tabs: 'General information', 'Inputs/Outputs', 'Administrative information', 'Modeling and validation', 'Parameters', 'Allocation', and 'Costs'.

Flow	Category	Flow pr...	Unit	Amount	Uncertainty	Default...	Pedigr...
⚙️ whey		Mass	kg	10.0	none		

Flow	Category	Flow pr...	Unit	Amount	Uncertainty	Avoide...	Pedigr...
⚙️ refinery gas		Mass	kg	1.0	none	<input type="checkbox"/>	
⚙️ yarn, jute - GLO	131:Spinning...	Mass	kg	1.0	none		

(which does not make sense in reality but is here just used to demonstrate the allocation) produces 1kg yarn and 1kg gas from 10kg whey.

The allocation subpage initially looks like this:

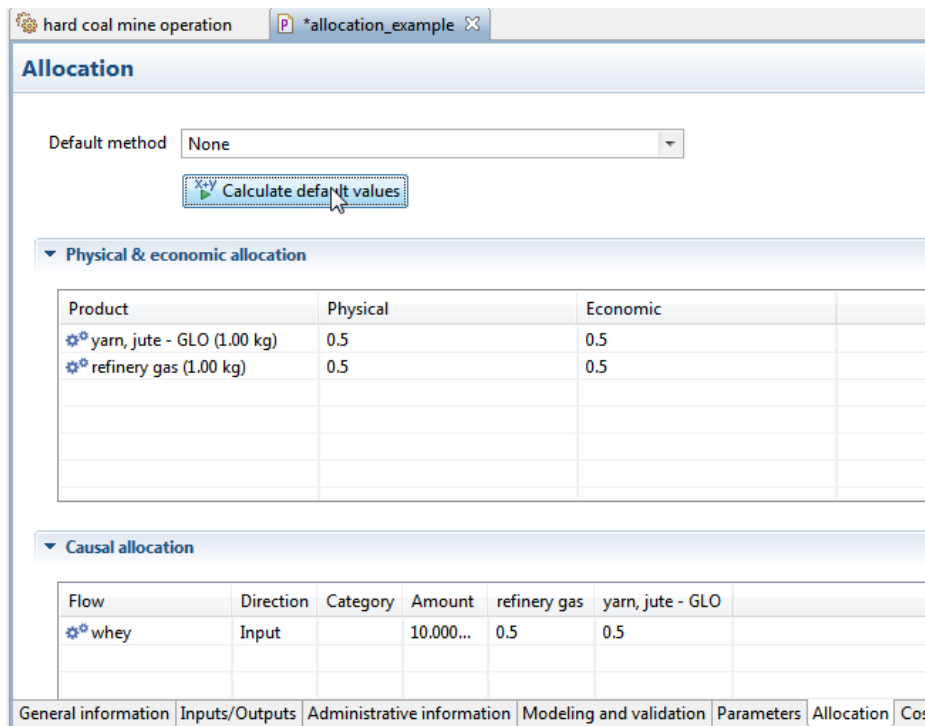
The screenshot shows the 'Allocation' subpage. It features a 'Default method' dropdown menu set to 'None' and a 'Calculate default values' button. Below this are two sections: 'Physical & economic allocation' and 'Causal allocation'. The 'Physical & economic allocation' table shows 1.0 kg of yarn and 0.0 kg of refinery gas. The 'Causal allocation' table shows the flow of whey (1.0000...) and its allocation to refinery gas (0.0) and yarn, jute - GLO (0.0).

Default method: None

Product	Physical	Economic
⚙️ yarn, jute - GLO (1.00 kg)	1.0	1.0
⚙️ refinery gas (1.00 kg)	0.0	0.0

Flow	Direction	Category	Amount	refinery gas	yarn, jute - GLO
⚙️ whey	Input		1.0000...	0.0	0.0

Clicking on 'calculate default values' calculates automatically all the physical and economic allocation factors. Note that units are only converted within one unit group (mass: ton and kilogram is converted, but ton and litre is not converted).



In absence of costs, a uniform price (all products cost the same) is assumed. Also, the causal factors are calculated as default from the physical factors. Physical and economic factors are provided for the products (because for the other flows, they are all the same, for each product), while the causal factors are provided for each non-product flow separately, for each product.

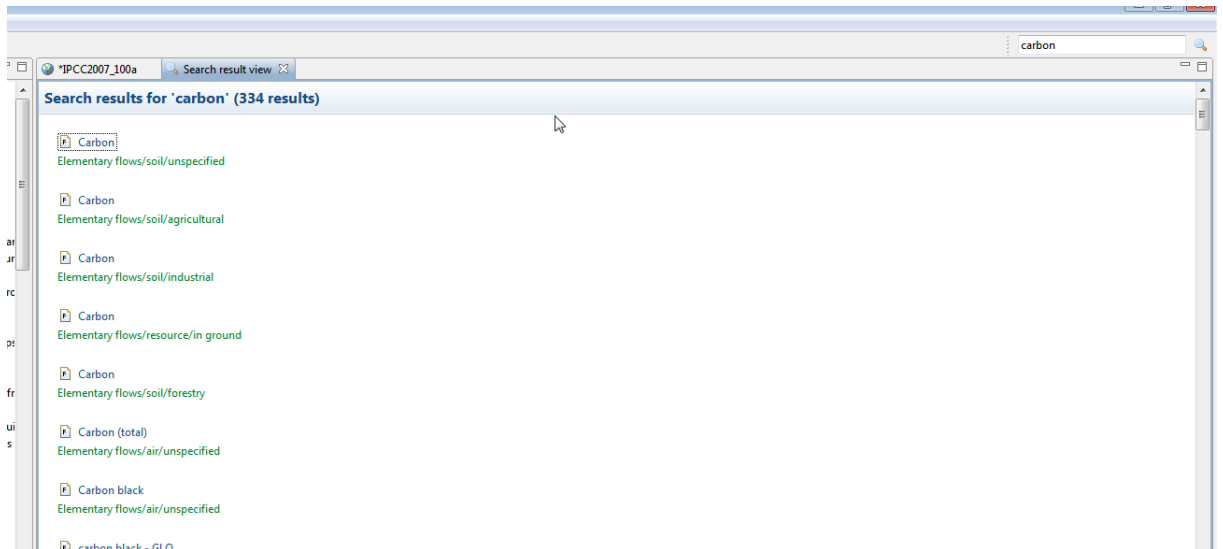
All the factors can be changed and no 100% checks are performed to avoid misleading warnings that are caused by intended user models; they will be overwritten with a new calculation of default values.

We believe this new approach is much faster and more transparent than the previous modelling.

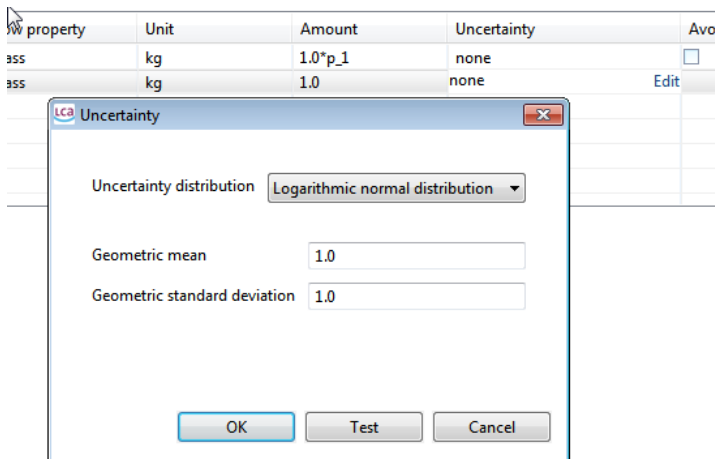
Some other things that have been changed

Not everything that changes with version 1.4 should be described in detail here; some of these points where maybe a short overview is sufficient are:

- the **search** is now more streamlined (you do not need to select a database any more) and is more like in a search engine; it is always available, on the top right

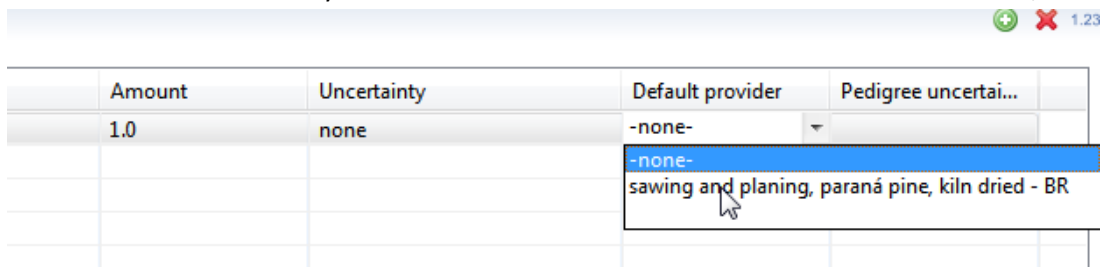


- **uncertainty for exchanges** can now be entered directly in the uncertainty field (we skipped the properties here and think this is now more easy to use and faster);



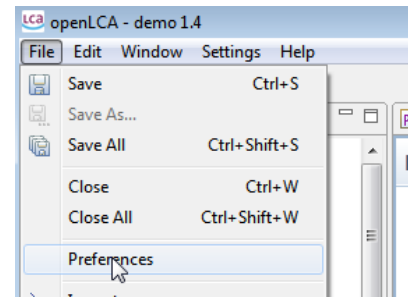
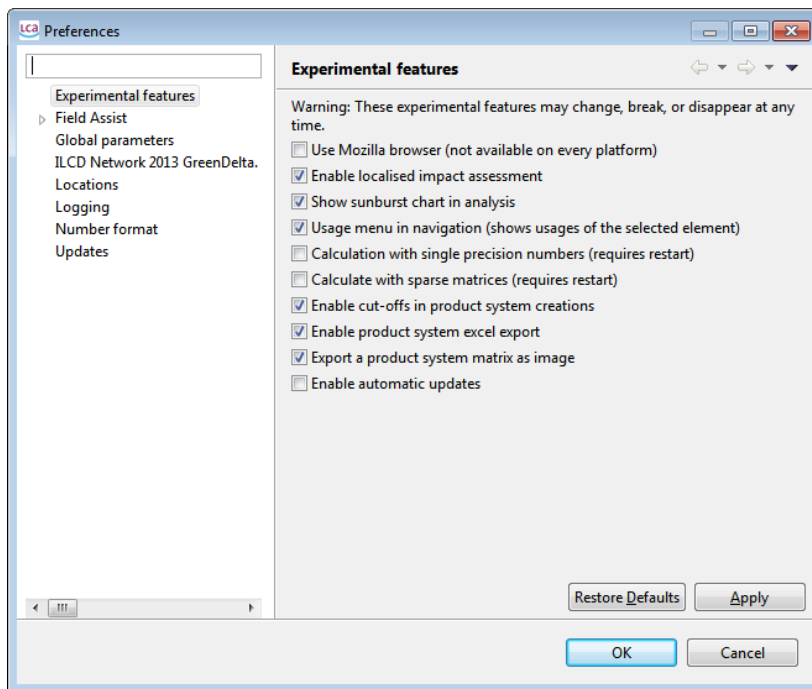
If you click once in the field, an 'edit' appears; clicking on it again opens a small editor where you can enter and also check the probability distribution and its parameters.

- For products on the input side of a process, you can now specify **default provider processes** (in the process editor), i.e. those processes that deliver the respective product by default. This feature existed already since version 1.3 but it is now in use for several databases;



Experimental features

In the preferences (which you can access via File / Preferences) you can check several features that are by default not activated.



A quick explanation:

- Mozilla browser: gives usually nicer maps, but is not available on 64 bit systems
- Sunburst chart: might not work on systems that can't use Mozilla
- Usage menu: shows where an element is used



- Single precision calculation: Saves some memory and time but still can yield surprising results due to rounding errors (default is double precision calculation)
- Sparse matrix calculation: calculates with a different, sparse matrix approach; saves some memory but is still experimental
- Enable cut-offs: A cut-off can be specified when the product system is created; it leads to smaller systems obviously, with a precisely defined system boundary.
- Product system excel export: This enables export of complete analysis results to excel. Depending on the size of your product system, the export can be memory consuming.

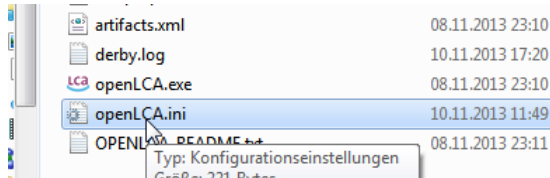
Practicalities for using the beta version

The openLCA 1.4 version is still under development. Thus,

- It is not recommended to use it for case studies already;

- b) For calculating large product systems (such as ecoinvent 3), you should reserve a larger amount of memory.

For a 64 bit version: In order to run the analysis of an ecoinvent 3 system, you have to increase the memory settings in the openlca.ini file (next to the openLCA executable), e.g. to a value of -Xmx4096M (see http://openlca.org/documentation/index.php/Adapt_the_RAM_allocation).



This means your computer needs to have 4GB of free RAM memory.

On a Windows 32 bit computer this will not work but you can try the experimental feature "Calculate with sparse matrices" (under Preferences/Experimental features) to do at least a quick calculation.

A version that needs much less memory is still under development.

Contact

GreenDelta GmbH
Müllerstrasse 135
13349 Berlin, Germany

GreenDELTA

www.greendelta.com; openlca@greendelta.com

openLCA website: www.openlca.org. openLCA documentation: www.openlca.org/documentation

Feedback is welcome!

For obtaining an optimized ecoinvent 3 database, go to <https://nexus.openlca.org/> and order an ecoinvent 2&3 database.