Social Hot Spots Database in openLCA

Quick Overview

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Content

1 SOCIAL HOTSPOTS DATABASE

The social hotspots database (often abbreviated as "SHDB") is the first comprehensive database available for Social LCA and human rights due diligence combining global supply chain modeling capabilities with over 140 country- and 57 sector-specific indicator risks (www.socialhotspot.org). It is available in openLCA and integrates well with the openLCA modelling environment and also with other databases available in openLCA.

SHDB uses the Global Trade Analysis Project's (GTAP - Version 9) 140-region and 57-sector Input/output model in order to enable geographic-specific supply chain modeling. Payment of wages provided by the Global IO model combined with estimates of sector- and country-specific wage rates allows users to estimate labor intensity and report results using Life Cycle Attribute Assessment (scope of a product system at risk of or audited for different social risks/issues).

The modeling system, used together with social risk level characterizations, allows users to express social risks and opportunities relative to each of over 155 different indicators by sector and country.

Users of the database in openLCA will be able to do assessments such as the following:

- Model global product and organization supply chains
- Calculate a product or organization social risks footprint
- Identify product and organization social hotspots

Owing to the special nature of the SHDB is, the import in openLCA and the available data sets deserve some attention and explanation.

1.1 Ordering in nexus, downloading

SHDB is one of the "for purchase" databases in openLCA. The ordering procedure and also the download as .zolca file is identical to all other for purchase databases on https://nexus.openlca.org/ For more information please refer to document "Using nexus and different database in openLCA" on http://www.openlca.org/resources. The only difference you may recognize is that the SHDB licence fees are distinguished either by country type (OECD, non-OECD, and so forth) or sector type(private/public), therefore you will need to select the appropriate license.

1.2 Importing in openLCA

SHDB purchased via Nexus is available in the .zolca format, that can be imported directly into openLCA using two options:

i) On the main menu, go to Database → Restore database (Figure 1), to import the SHDB database from the directory containing the SHDB zolca file.

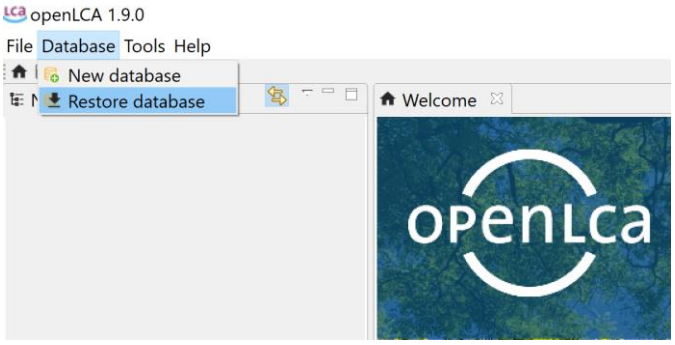
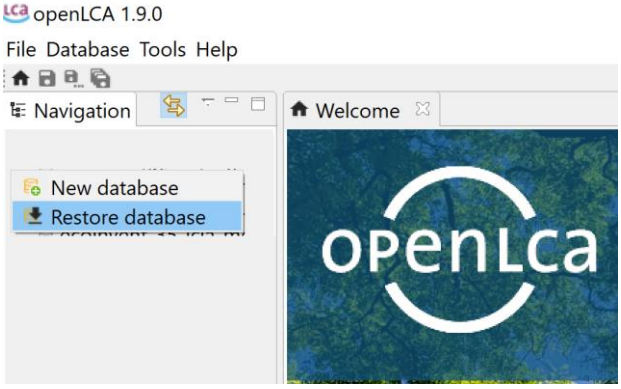


Figure 1: restore database in zolca format from the main menu function

ii) Right-click on the navigation panel, to access the dropdown list. Select the second option from the list, “Restore database” to import the SHDB database from the directory containing the SHDB file downloaded from the nexus website.



2 Using and understanding the SHDB in openLCA

Once the database is imported, the data sets are available per country and industrial sector:

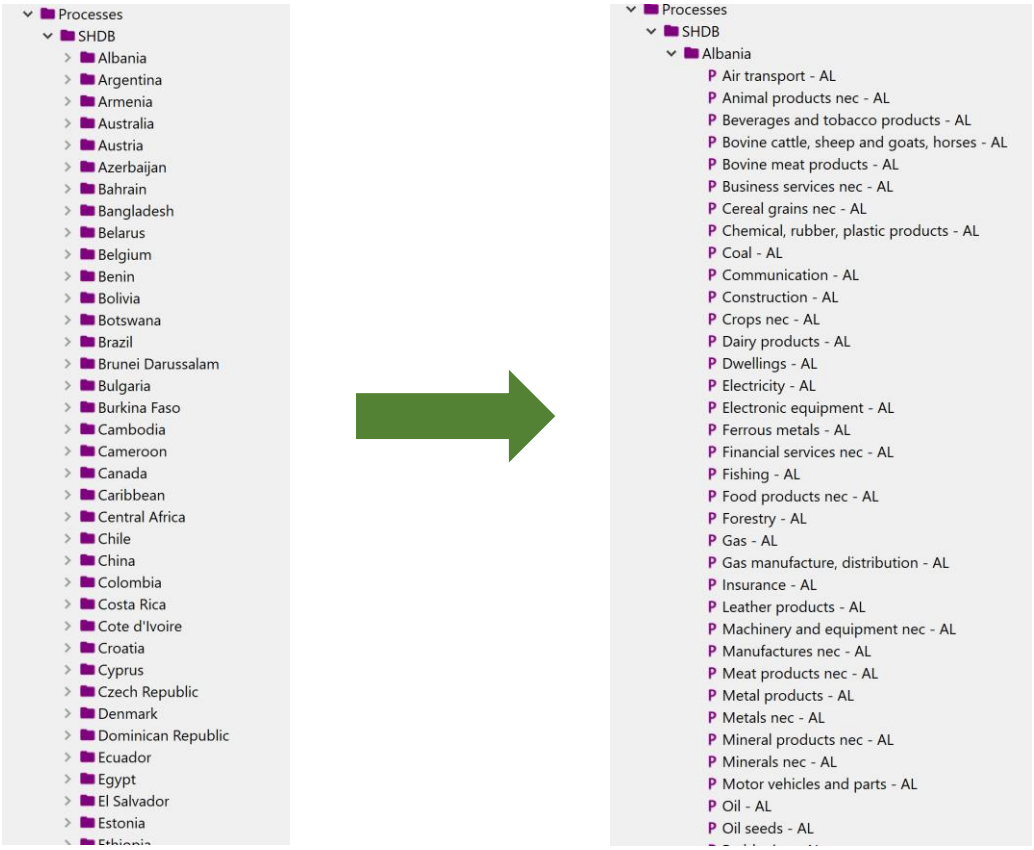


Figure 2: Datasets in SHDB2019

Each data set consists of exchanges of the processes available in the inputs/outputs table. Typically, flows on the input side are products, and flows on the output side are elementary flows, as can be seen in Figure 3 below.

Inputs/Outputs: Fuel oil

Inputs

Flow	Category	Amount	Unit	Costs/Reven...	Uncertainty	Avoided waste	Provider	Data quality ...	Description
Transport Equipment - BY	Belarus/Industries	1.29383E-6	USD		none				
Transport Equipment - BT	Bhutan/Industries	1.88359E-7	USD		none				
Transport Equipment - BF	Burkina Faso/Industries	1.61736E-7	USD		none				
Transport Equipment - BI	Burundi/Industries	1.04493E-7	USD		none				
Transport Equipment - TD	Chad/Industries	1.19306E-7	USD		none				
Transport Equipment - CO	Colombia/Industries	3.32178E-7	USD		none				
Transport Equipment - CG	Congo/Industries	1.56661E-7	USD		none				
Transport Equipment - CD	DR Congo/Industries	1.48669E-7	USD		none				
Transport Equipment - GH	Ghana/Industries	1.28186E-7	USD		none				

Outputs

Flow	Category	Amount	Unit	Costs/Reven...	Uncertainty	Avoided pro...	Provider	Data quality ...	Description
Public sector corruption; very high ...	Value Chain Actors/Corrupt...	0.01044	h		none				
Rate of fatal accidents at workplace...	Workers/Health and Safety ...	0.01044	h		none				
Rate of non-fatal accidents at work...	Workers/Health and Safety ...	0.01044	h		none				
Right of Association; no risk	Workers/Freedom of associ...	0.01044	h		none				
Right of Collective bargaining; low ...	Workers/Freedom of associ...	0.01044	h		none				
Right to Strike; low risk	Workers/Freedom of associ...	0.01044	h		none				
Sanitation coverage; very high risk	Local Community/Safe and...	0.01044	h		none				
Sector average wage, per month; ...	Workers/Fair Salary	0.01044	h		none				
Social responsibility along the supp...	Value Chain Actors/Promot...	0.01044	h		none				

Figure 3: inputs/outputs table of a process in SHDB2019

2.1 A product system as a complete life cycle model

Due to the large amount of data in the SHDB, technical preconditions of openLCA and your computer should be checked and eventually adapted before using the database for modelling.

After importing SHDB, it is recommended to increase the maximum memory usage of openLCA, considering the RAM of the computer. For computers with 32 GB memory the maximum memory usage of openLCA should be around 27 GB. For computers with smaller RAM sizes the maximum memory usage of openLCA has to be lower; it can never be higher than the RAM available as hardware (and some parts of the RAM are always required for the operation system etc.). You can experiment with the maximum allocated memory. If your computer is not able to provide sufficient memory, openLCA will not start.

To increase the maximum memory usage, go to File→ Settings→ Configuration and then specify the maximum memory usage (see Figure 4 below). Restart openLCA, after closing the window, for the changes to take effect.

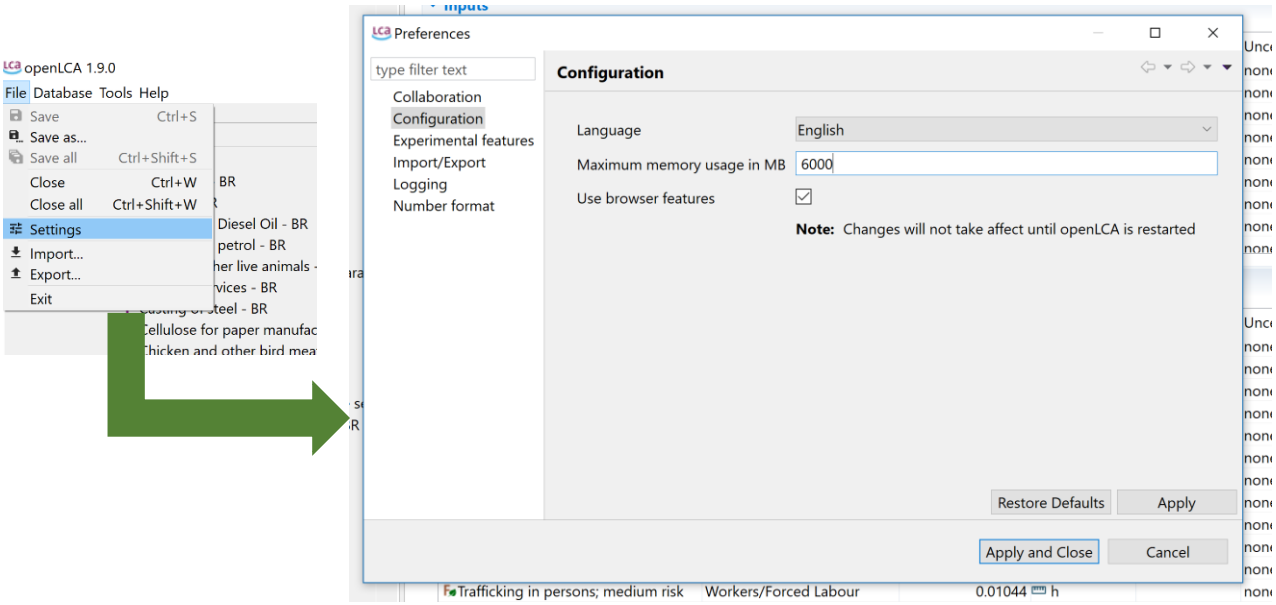


Figure 4: Increasing maximum memory usage in openLCA

After increasing the maximum memory usage, to create a product system, open the database, go to Product systems→ New product system to open a pop-up window (Figure 5 below). On the window, select the reference process for creating the product system, select “Auto-link processes” to connect the processes in the product chain, “Prefer default providers” for provider linking, and either “Unit process” or “System process” for preferred process type, finally click on “finish” to proceed.

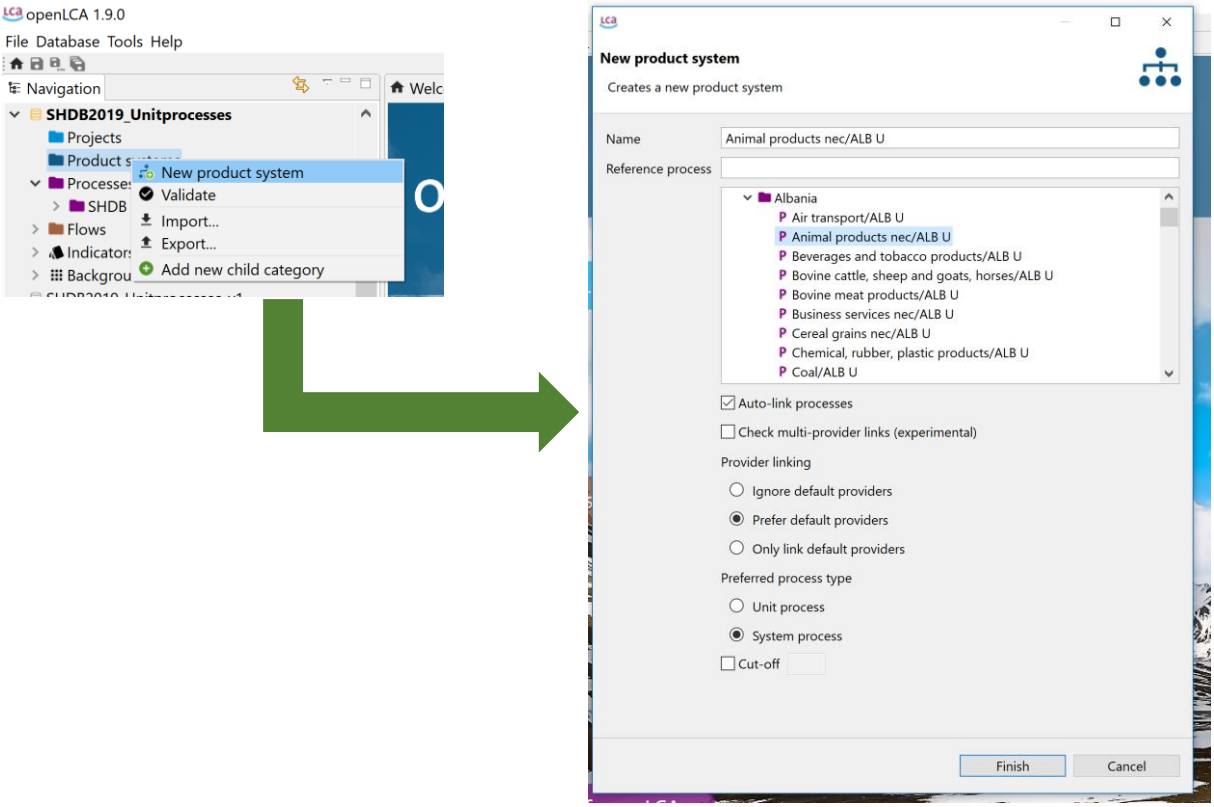


Figure 5: Creating a product system in openLCA-I

... alternately:

Open a process and select "Create product system" for the respective process, as shown in Figure 6 below. This will open the pop-up window shown in Figure 5 above. Repeat the same steps as above to create a product system for the respective process.

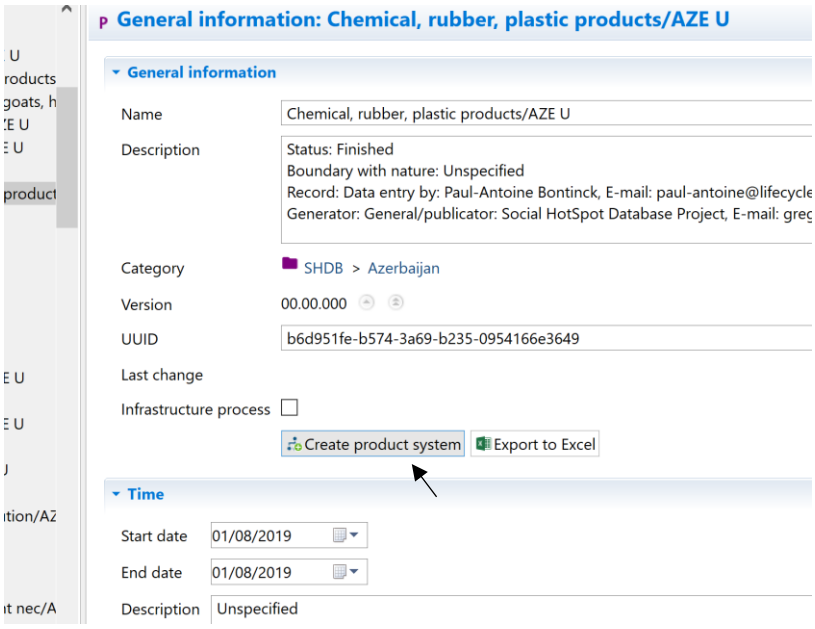
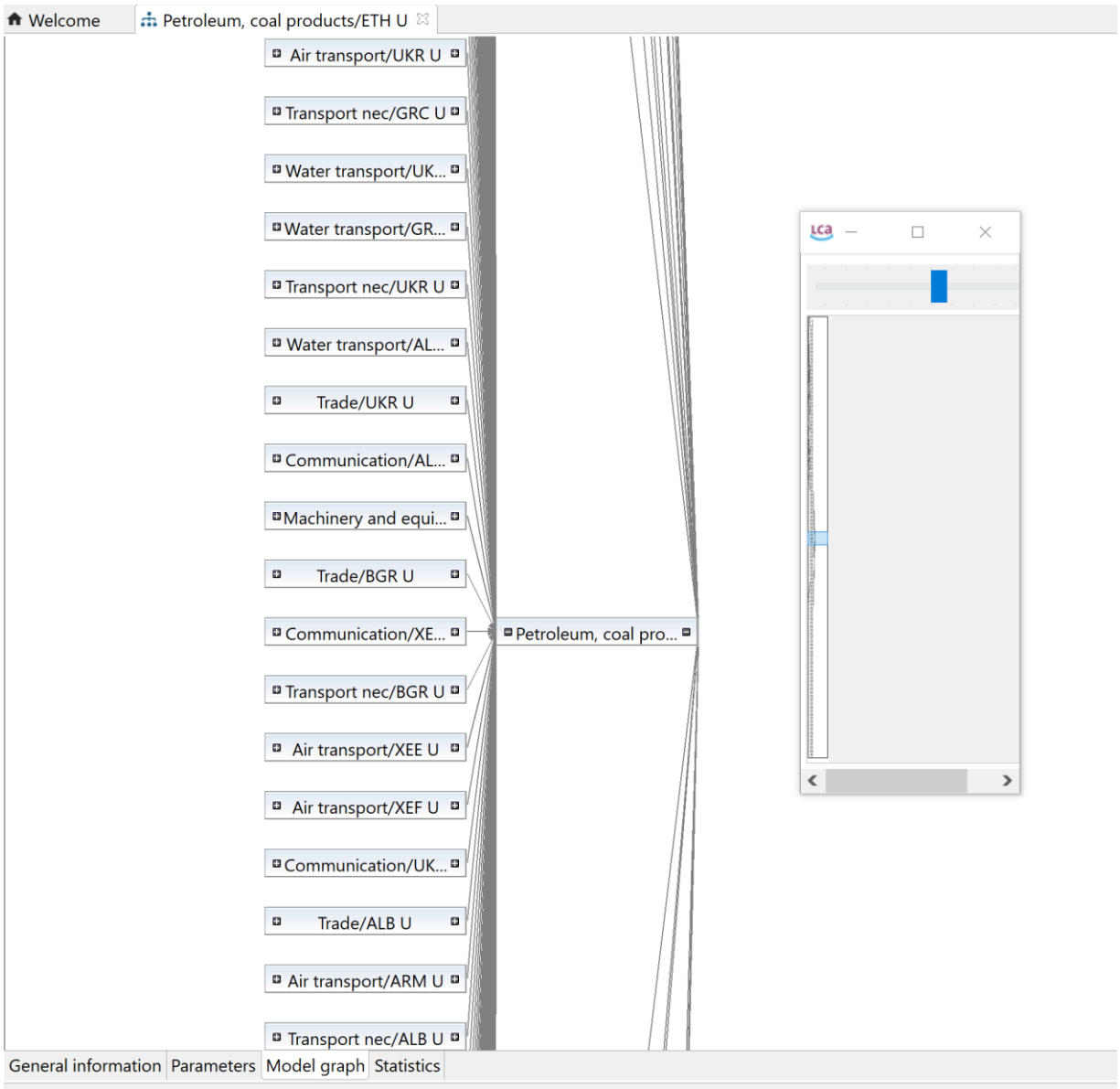


Figure 6: Create a product system in openLCA-II

The resulting product system is a typical “IO type” model, with many interconnections between the different processes. For our system, already in the first tier, there are about hundred different processes connected.



This is also the reason for increasing the maximum memory usage before creating a product system or making a calculation of the product system.

If we calculate the product system...

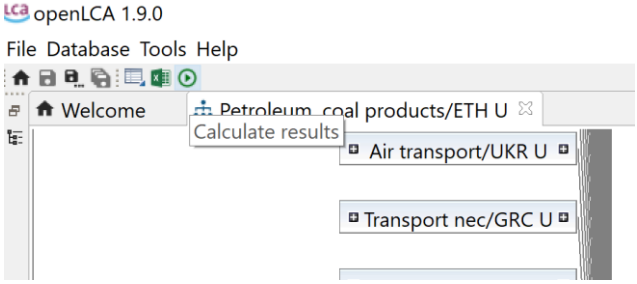


Figure 7: To calculate the product system

.. we can both do a quick calculation and also an in-depth analysis. An LCIA (life cycle impact assessment method) can be selected from the four LCIA methods available in the database.

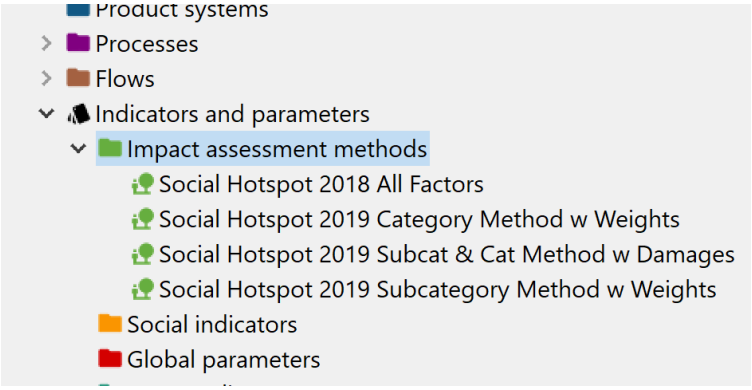


Figure 8: LCIA in SHDB2019

Even if no LCIA method is selected, the flows per process already contain the assessment (as low risk, medium risk, high risk), therefore, disaggregated results are also available.

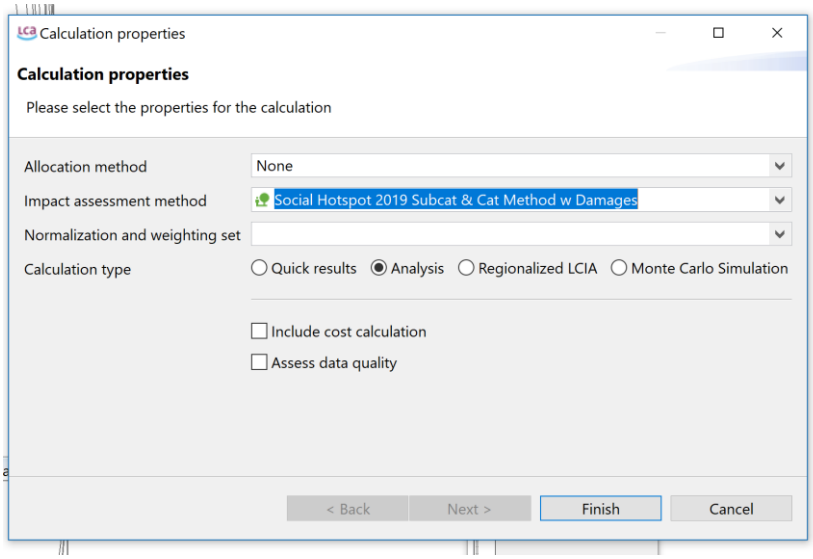


Figure 9: Calculating the product system

The quick results are the “life cycle inventory” of the system:

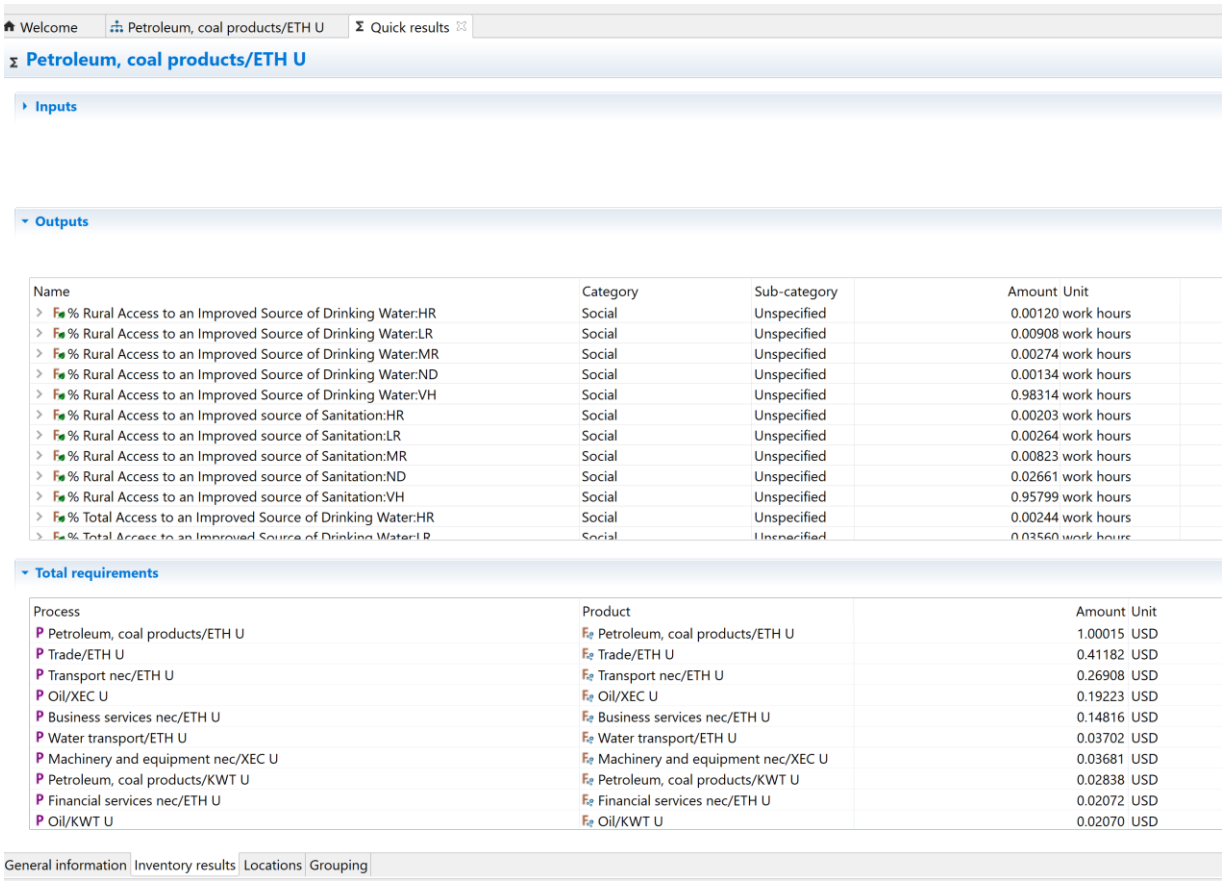


Figure 10: Quick results calculation of a product system

The analysis results allow a more in-depth analysis in openLCA.

2.1.1 The analysis of the product system

The analysis of the product system will be opened in the editor where you have access to different analysis tools such as general information, process contributions, grouping, locations, sun burst diagram, Sankey diagram.

On “General information” tab, information for the product system that was calculated is displayed, including information on the allocation method, target amount and LCIA method used for the calculation. The "Flow contributions" section shows a bar chart illustrating the five processes with the highest direct contribution to the selected inventory flow. Change the results information displayed by selecting the desired flow from the list (i.e. it includes all the flows from the LCI results). Likewise, the "Impact category" section displays the five processes with the highest direct contribution to the selected impact assessment category. The charts can be exported as images (.png) by clicking on the button on the top right corner of each section. There is also a button for directly exporting to Excel all the LCI and LCIA results of the calculation. The content of the Excel file will vary depending on the type of calculation performed (i.e. Analysis export will contain information of the upstream total contributions too).

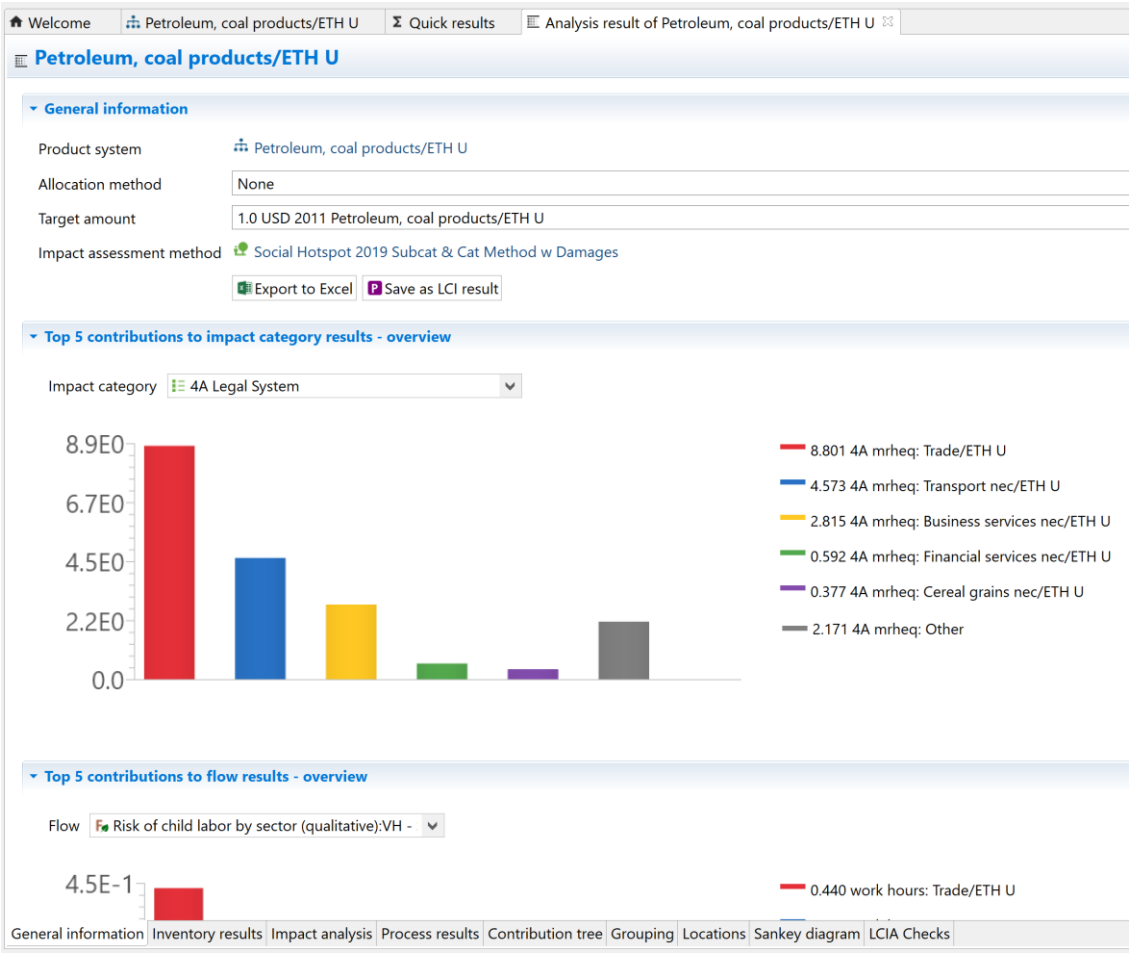


Figure 11: General information tab from analysis of the product system

On the “Inventory results”, the results tab contains a table of all the product system’s inputs and outputs, displaying the amounts and units for each entry (in alphabetic order). To see the list of flows in a different order, simply click one of the headers. The information presented in all openLCA tables can either be copied from the results editor and pasted elsewhere (e.g. in excel, notepad, etc.), or be exported directly in an Excel file with the “Export to Excel” function.

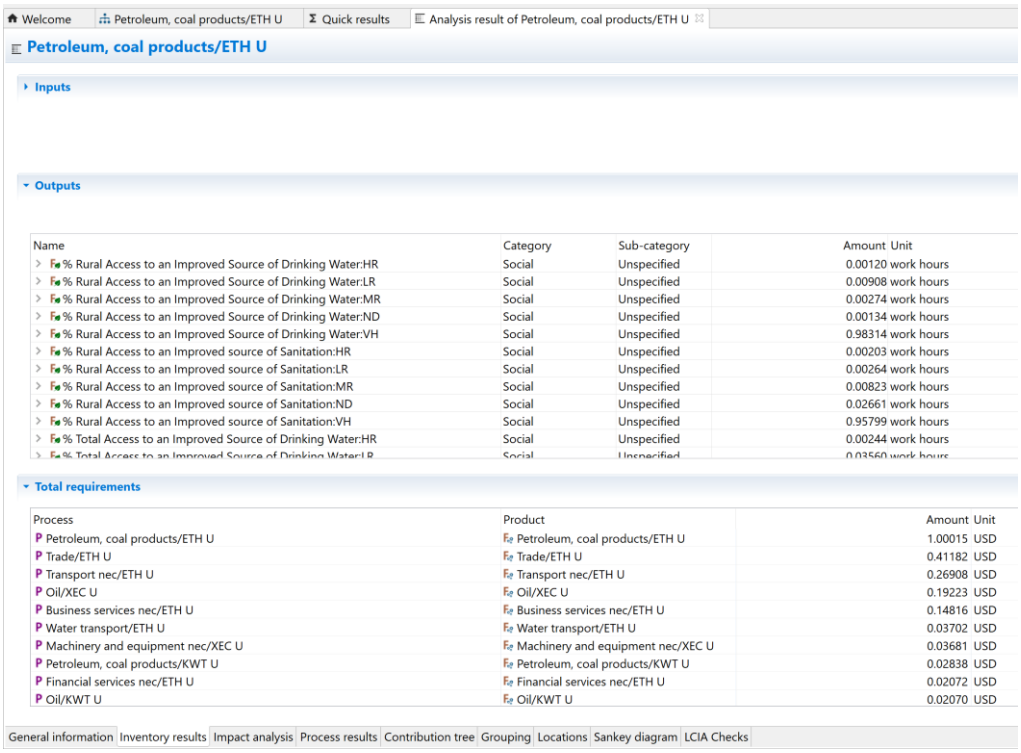


Figure 12: Inventory results tab

On the Impacts Analysis" tab, the table lists the results and reference units for the respective impact assessment method categories. Like the inventory tables, the entries here can also be sorted by any of the headers.

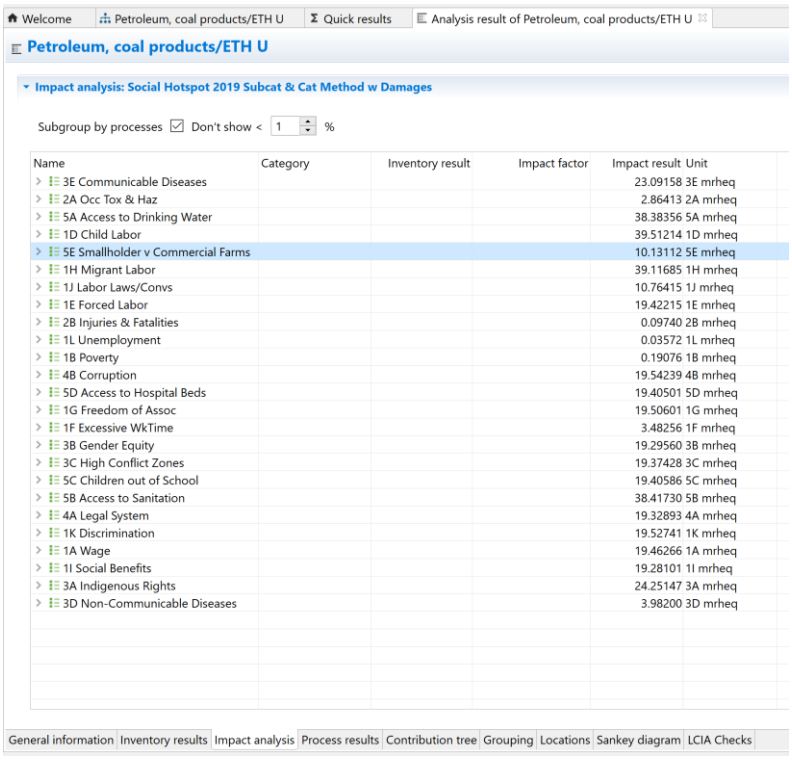
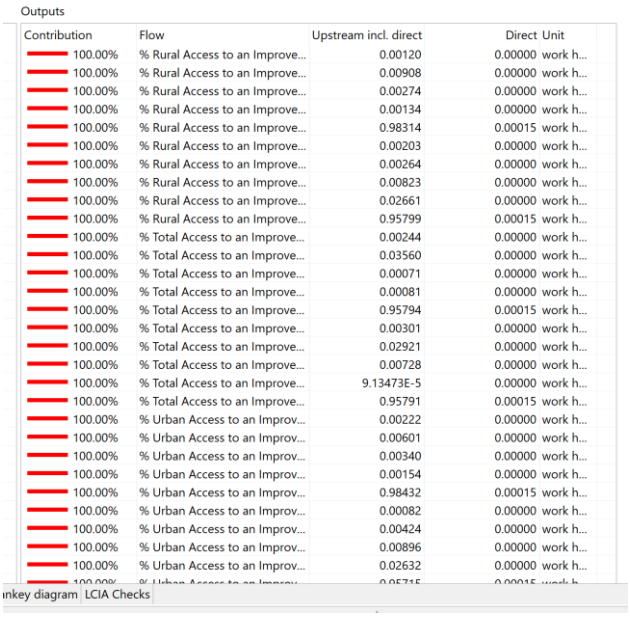


Figure 13: Impact Analysis tab

On the “Process results” tab, both the direct and the total upstream contributions are displayed. In the section “Flow results”, select a process from the list and the input and output flows included in that process dataset (i.e. direct) and also within any process of its supply chain (i.e. upstream total=upstream + direct) will be listed. The percentage displayed in the “Contribution” column refers to the proportion of the total inventory result for that flow which corresponds to the upstream total value of the selected process.


Outputs

Contribution	Flow	Upstream incl. direct	Direct	Unit
100.00%	% Rural Access to an Improve...	0.00120	0.00000	work h...
100.00%	% Rural Access to an Improve...	0.00908	0.00000	work h...
100.00%	% Rural Access to an Improve...	0.00274	0.00000	work h...
100.00%	% Rural Access to an Improve...	0.00134	0.00000	work h...
100.00%	% Rural Access to an Improve...	0.98314	0.00015	work h...
100.00%	% Rural Access to an Improve...	0.00203	0.00000	work h...
100.00%	% Rural Access to an Improve...	0.00264	0.00000	work h...
100.00%	% Rural Access to an Improve...	0.00823	0.00000	work h...
100.00%	% Rural Access to an Improve...	0.02661	0.00000	work h...
100.00%	% Rural Access to an Improve...	0.95799	0.00015	work h...
100.00%	% Total Access to an Improve...	0.00244	0.00000	work h...
100.00%	% Total Access to an Improve...	0.03560	0.00000	work h...
100.00%	% Total Access to an Improve...	0.00071	0.00000	work h...
100.00%	% Total Access to an Improve...	0.00081	0.00000	work h...
100.00%	% Total Access to an Improve...	0.95794	0.00015	work h...
100.00%	% Total Access to an Improve...	0.00301	0.00000	work h...
100.00%	% Total Access to an Improve...	0.02921	0.00000	work h...
100.00%	% Total Access to an Improve...	0.00728	0.00000	work h...
100.00%	% Total Access to an Improve...	9.13473E-5	0.00000	work h...
100.00%	% Total Access to an Improve...	0.95791	0.00015	work h...
100.00%	% Urban Access to an Improv...	0.00222	0.00000	work h...
100.00%	% Urban Access to an Improv...	0.00601	0.00000	work h...
100.00%	% Urban Access to an Improv...	0.00340	0.00000	work h...
100.00%	% Urban Access to an Improv...	0.00154	0.00000	work h...
100.00%	% Urban Access to an Improv...	0.98432	0.00015	work h...
100.00%	% Urban Access to an Improv...	0.00082	0.00000	work h...
100.00%	% Urban Access to an Improv...	0.00424	0.00000	work h...
100.00%	% Urban Access to an Improv...	0.00896	0.00000	work h...
100.00%	% Urban Access to an Improv...	0.02632	0.00000	work h...

ınkey diagram | LCIA Checks

Figure 14: Process results tab

The “Contributions tree” tab, that is unique to “Analysis” calculation, provides the upstream total LCI or LCIA results per tier in the product system, breaking down the results into the upstream total contributions of the providing processes within each supply chain.

Once the major total contributor has been identified in the “Process results”, this tab is particularly interesting to analyse which is the process in its supply chain contributing the most to that upstream total value.

Another feature in openLCA is the “Locations” tab which shows the localized risks and impact categories on a world map. Figure 16Figure 16: Locations tab shows the location of a specific inventory flow considering the locations of all the processes emitting/consuming it along the whole supply chain. It also allows to view the location of the impacts for a specific impact category, based on the locations of the relevant elementary flows along the life cycle. The size of the circles as well as their colours represent the magnitude of the impact or inventory result (i.e. red=higher impact/higher flow amount in the inventory).

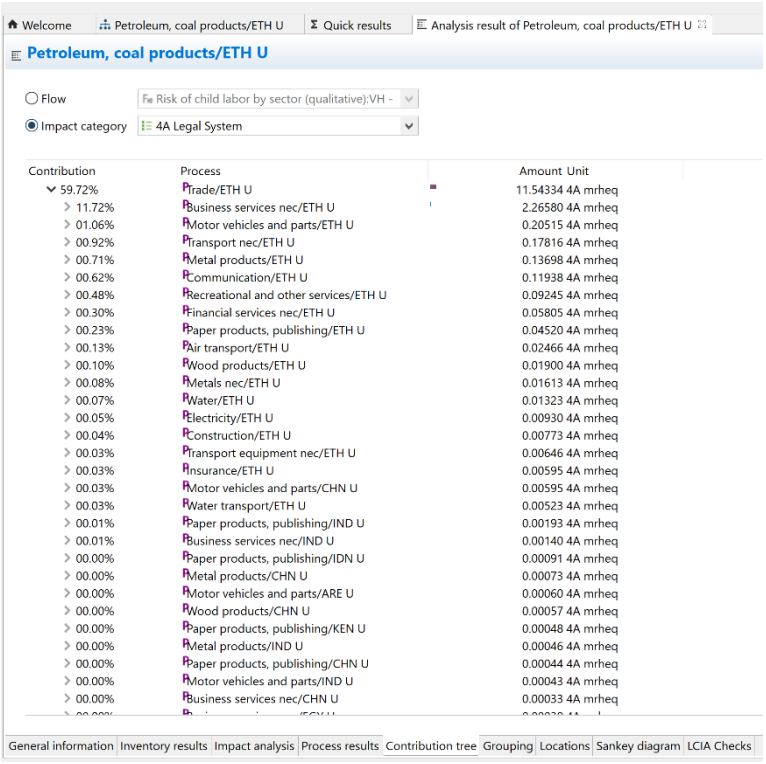


Figure 15: Contribution tree tab

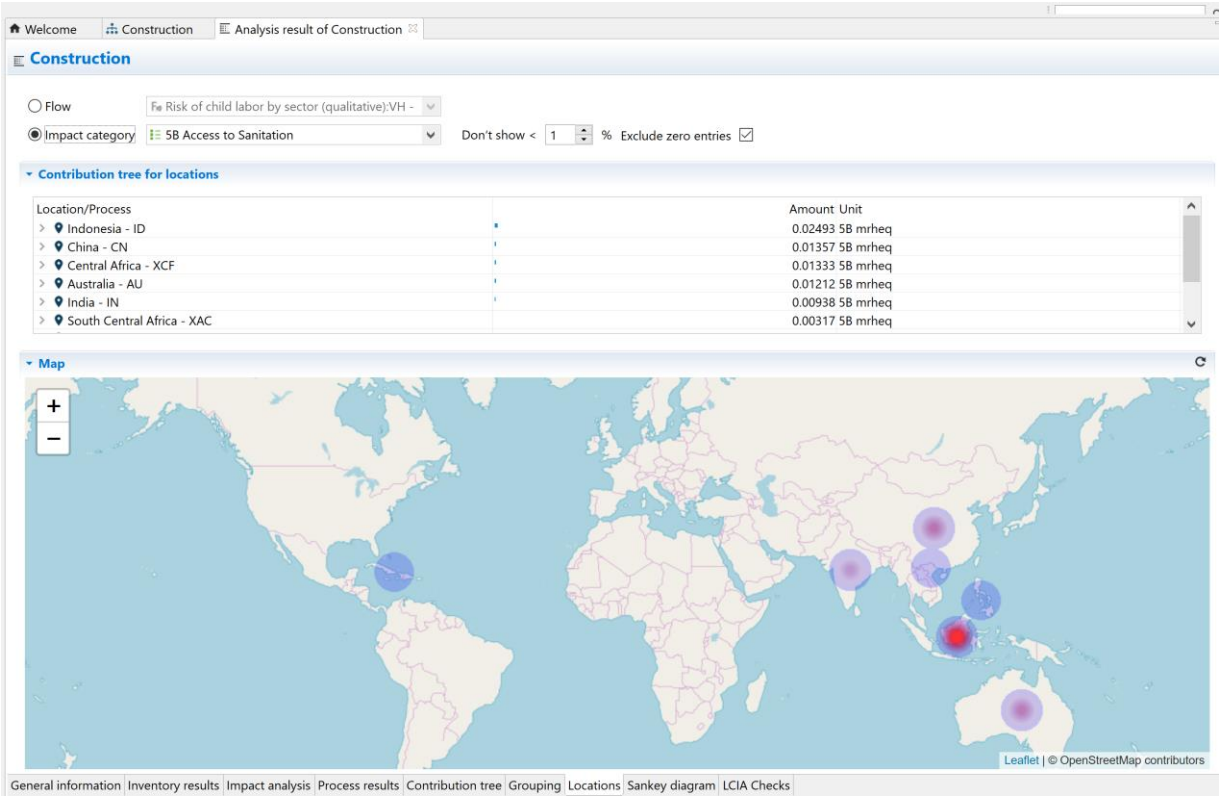


Figure 16: Locations tab

On the “Sankey diagram” two information at the same time can be read for selected flow or category: the process contribution represented by colours and upstream contribution share to a

process represented by the thickness of the line. In the Sankey diagram, the “Direct contribution” refers to the direct contribution of the process while “Upstream total” is the upstream total contribution of the process. The width of the lines is related to the amount of the total upstream impact of that process to the receiving one. To open up a process in a new editor tab, simply double-click on it.

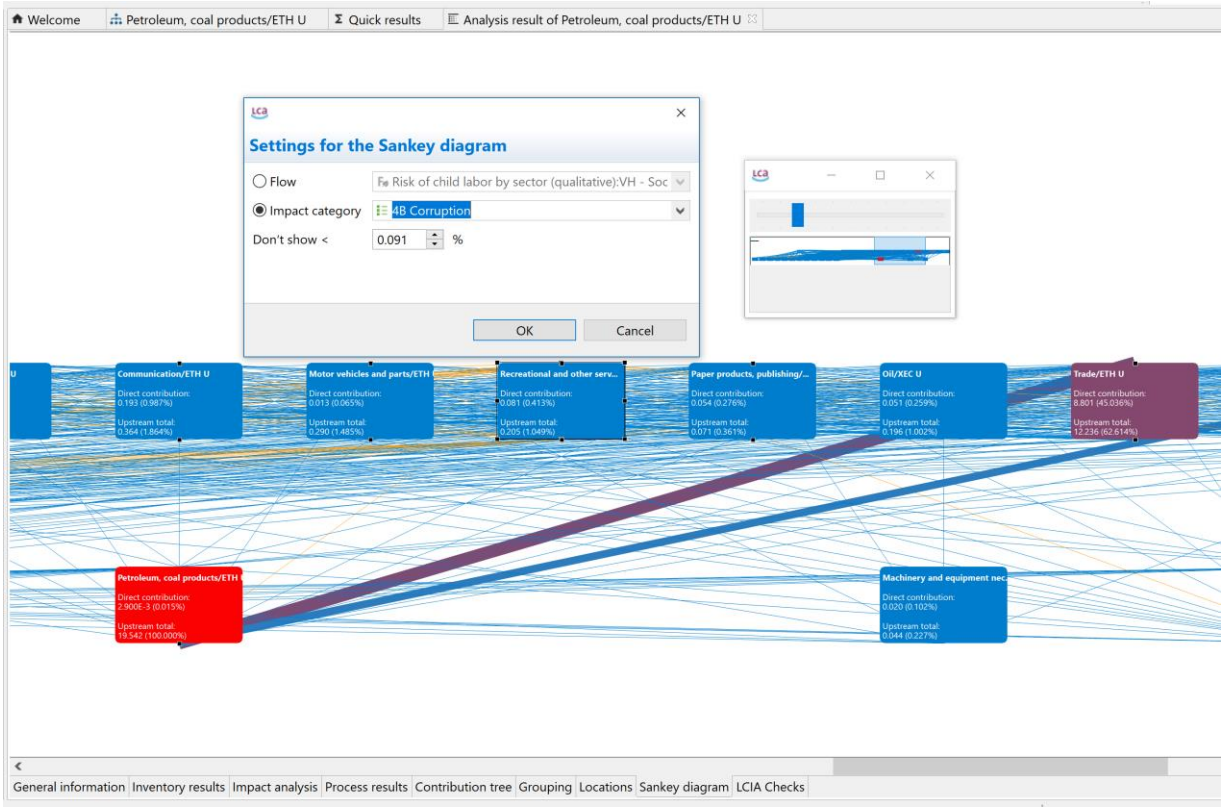


Figure 17: Sankey Diagram

Another recently added feature is the “LCIA Checks” tab which lists out all the flows from the product system that are not included in the LCIA method selected for calculation.

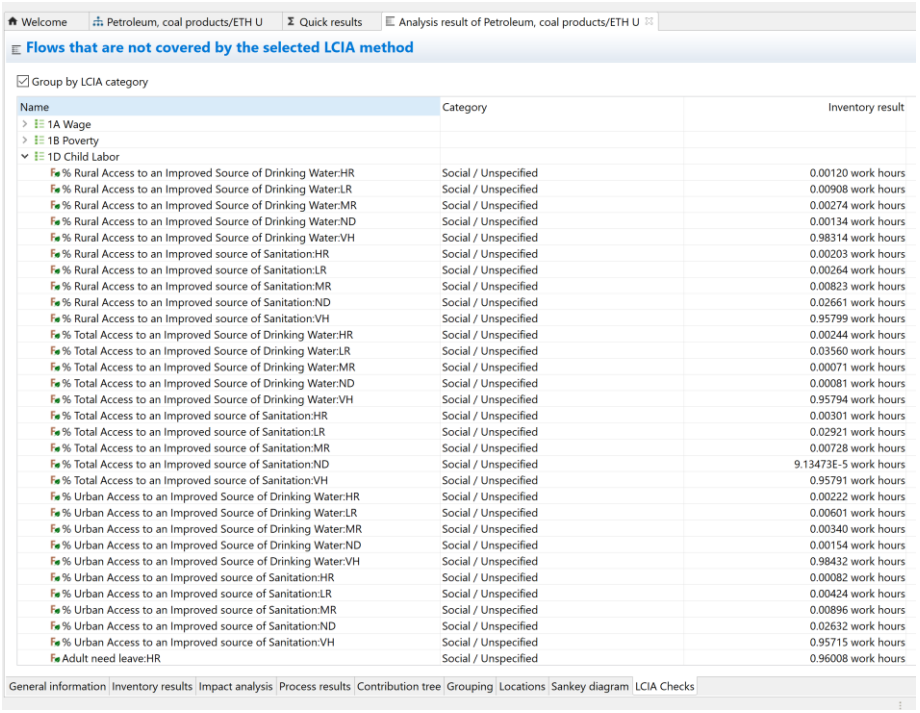


Figure 18: LCIA checks tab

This feature provides the user with an important piece of information as the flows listed in this tab will not show any contribution to final impact results. Uncovered flows can be displayed per impact category by selecting the box “Group by LCIA category”.

2.2 Linking the SHDB with other data in openLCA

So far, we have only considered the SHDB “standalone”; it is of course also possible, and often interesting, to combine SHDB with data from other sources. SHDB is based on the economic input/output tables which has advantages as it considers the entire supply chain. However, its dependency on cost information raises the question whether different national economic input output tables cause poor level of aggregation.

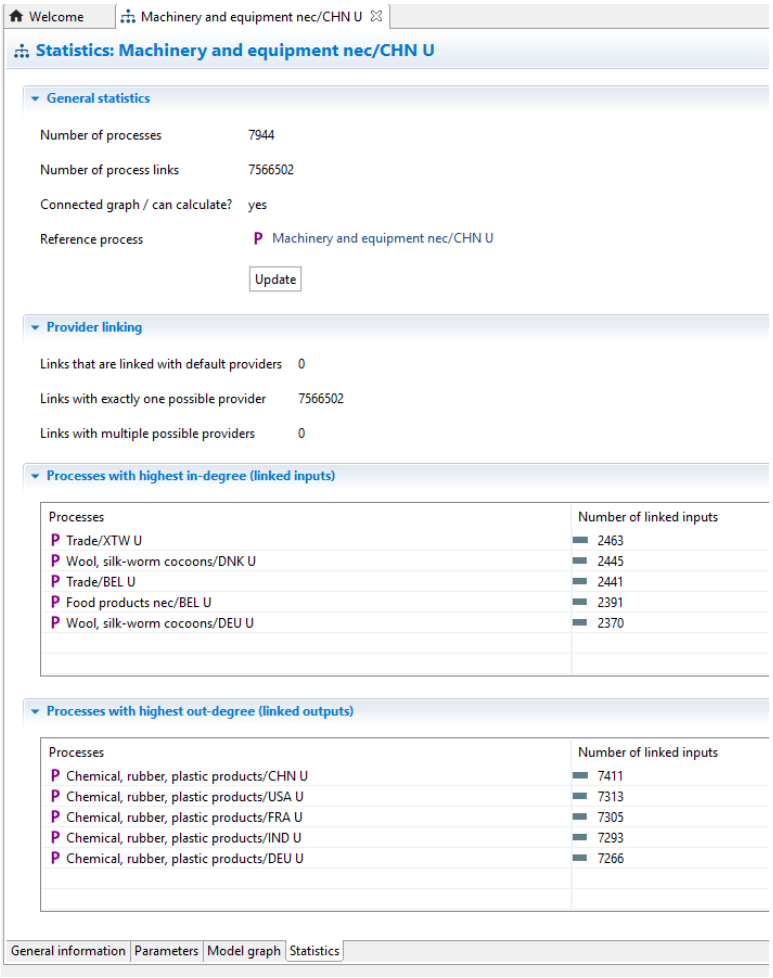
An approach is proposed as called hybrid EIO-LCA which replaces the price-proportionality assumption with a process-based methodology analysis (Paulo Ferrao, Jorge Nhambiu 2010) This can be done in two main ways.

First, a SHDB process can use other products from other sources. This is a bit interesting since the SHDB claims to already represent a full economy as it is an input output model; therefore, this modelling step requires some thoughts.

Second, SHDB process information can be linked to processes from another source, e.g. ELCD or ecoinvent. If the “other” (non-SHDB) process is a unit process, there is risk to either have two models that are not fully consistent (e.g. a full ecoinvent life cycle model and a full SHDB life cycle model) and/or to double count impacts that are linked to different processes in the non-SHDB life cycle and at the same time reflected in the SHDB model.

2.3 SHDB in openLCA: tips, known issues, further reading

SHDB is an IO database, with each process dataset representing one sector in one country. The processes contain many input products provided by other sectors. The unit process version of the SHDB creates product systems in openLCA that with almost 8,000 processes, so fewer than a complete ecoinvent 3.5 system, but the entire system is heavily connected, processes containing links to more than 2300 other processes.



This makes the calculation memory-intense. 10 GB of allocated RAM for openLCA is recommended, for calculating the full unit process product systems.

➔ Tips

SHDB is a somewhat uncommon LCA database; every single model contains several thousand connections to other processes. It is therefore recommended to

- increase the memory available for openLCA (go to file / settings / configuration, enter the amount of memory you will - and your computer can – grant to openLCA), or
- Set a cut-off for the product system modelling if you do not have sufficient memory for a full system calculation. Typical values for the cut-off are 0.0001 or lower. If you have the feeling that meaningful elements are excluded with a specified cut-off, you can of course experiment with different values, in sensitivity analyses.

Further reading:

■ For social LCA in general:

- Andrews, E. S., Barthel, L.-P., Beck, T., Benoit, C., Ciroth, A., Cucuzella, C., Gensch, C.-O., Hérbert, J., Lesage, P., Manhart, A,. Mazeau, P., Mazijn, B., Methot, A.-L., Moberg, A., Norris, G., Parent, J., Prakash, S., Reveret, J.-P., Spillemaeckers, S., Ugaya, C. M. L., Valdivia, S., Weidema, B.: UNEP/SETAC Life Cycle Initiative: Guidelines for social life cycle assessment of products, 2009; http://lcinitiative.unep.fr/default.asp?site=lcinit&page_id=A8992620-AAAD-4B81-9BAChttp://lcinitiative.unep.fr/default.asp?site=lcinit&page_id=A8992620-AAAD-4B81-9BAC-A72AEA281CB9A72AEA281CB9

■ For the social hot spots database:

- New Earth. 2013. Social Hotspots Database V2. www.socialhotspot.org; https://www.socialhotspot.org/resources.html
- Benoît-Norris,C. Data for Social LCA (Editorial). 2013. The International Journal of Life Cycle Assessment, Online First: http://link.springer.com/content/pdf/10.1007%2Fs11367-013-0644-7.pdf
- Benoit-Norris, C.; Cavan, D.A.; Norris, G. Identifying Social Impacts in Product Supply Chains: Overview and Application of the Social Hotspot Database. Sustainability 2012, 4, 1946-1965, http://www.mdpi.com/2071-1050/4/9/1946/pdf.

■ For openLCA:

- www.openlca.org, www.openlca.org/documentation.

3 References

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- Ciroth, A.: Aggregation in Social LCA Case Studies, presentation, SETAC Case Study Symposium Copenhagen, Nov. 26 - 28, www.greendelta.com/uploads/media/SETAC_CPH_ac_socialaggr.pdf

- Ferrao, P., Nhambiu, J. (2010): A Comparison Between Conventional LCA and Hybrid EIO-LCA: Analyzing Crystal Giftware Contribution to Global Warming Potential, Handbook of InputOutput Economics in Industrial Ecology, 219-230.

4 Contact

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