

Guide inspired from :



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Introduction to openLCA

OpenLCA is an open-source software for Life Cycle Assessment (LCA) and sustainability assessment. It has been developed by GreenDelta since 2006 (www.greendelta.com). As open-source software, it is freely available, without license costs (www.openlca.org). The source code can be viewed and changed by anyone. Furthermore, the open-source nature of the software makes it very suitable for use with sensitive data. The software, as well as any models created, can be shared freely if the database license allows it. openLCA can be used for several different applications, for example:

- LCA, Life Cycle Costing (LCC), Social Life Cycle Assessment (S-LCA)
- Carbon & water footprints
- Environmental Product Declaration (EPD)
- The United States Environmental Protection Agency (EPA) Design for the Environment label
- Integrated Product Policy (IPP)

This text explains how to carry out the first steps in working with openLCA such as installation and importing databases. This document then provides an overview of some openLCA operations and features including descriptions of how to use them. It is a short version of the openLCA Comprehensive User Manual adapted to the course content. If some information are lacking or if you want to go deeper in your understanding of the software, you can refer to the original manual at: http://www.openlca.org/wp-content/uploads/2020/02/openLCA_1.10_User-Manual.pdf

www.openlca.org offers many different services to openLCA potential and current users. The website provides links to **download the software**, the source code, the openLCA LCIA (Life Cycle Impact Assessment) Method Pack, case studies, and user manuals, among other things. There are also links to instructional videos and documents in the "Learning and Support" section (www.openlca.org/learning). The ask.openLCA website (<https://ask.openlca.org>) is a question and answer website which serves as a public support platform. Furthermore, the openLCA team manages a twitter account (@openLCA) and a LinkedIn group (openLCA: free, professional Life Cycle Assessment (LCA) and Footprint software) to keep users up-to-date on news and recent developments.

LINK FOR DOWNLOADING: <http://www.openlca.org/download>

Installation

The installation of openLCA is slightly different for Windows, Mac and Linux, respectively. The following sections will explain how to install the software on different systems.

Windows

The fastest way to get openLCA is to download the ZIP-archive. After decompressing, simply launch the executable file (Figure 1) and the program starts. No installation is needed.

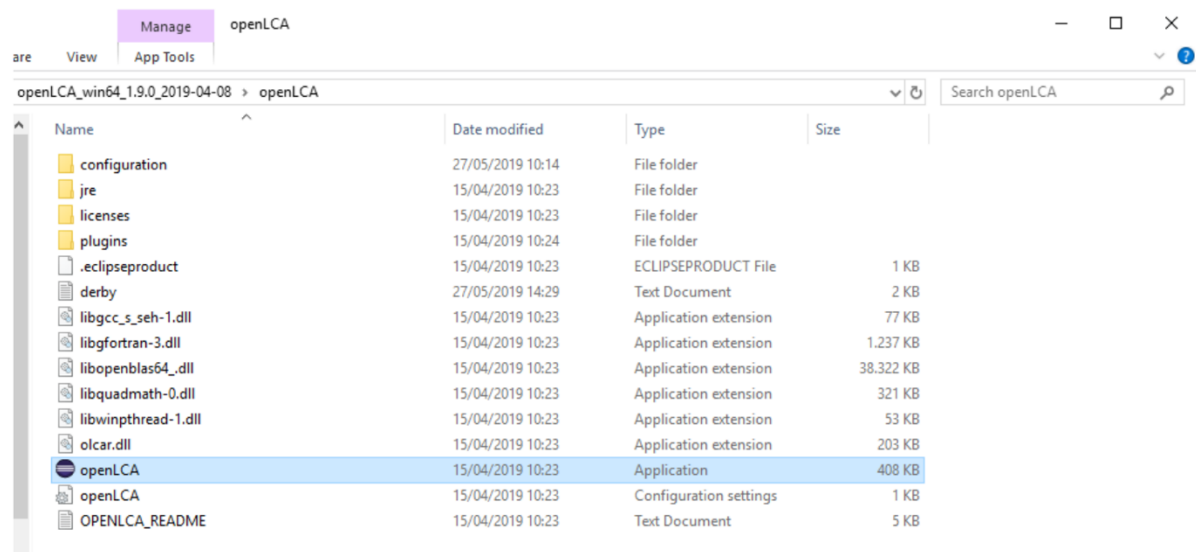


Figure 1: A decompressed ZIP file

Alternatively, the software can be installed. Start by downloading the installer file from the downloads page of the openLCA website. As usual in Windows installation, you can select whether openLCA should be used only by the user who installs (i.e. by you), or by anybody working on the computer (Figure 2).

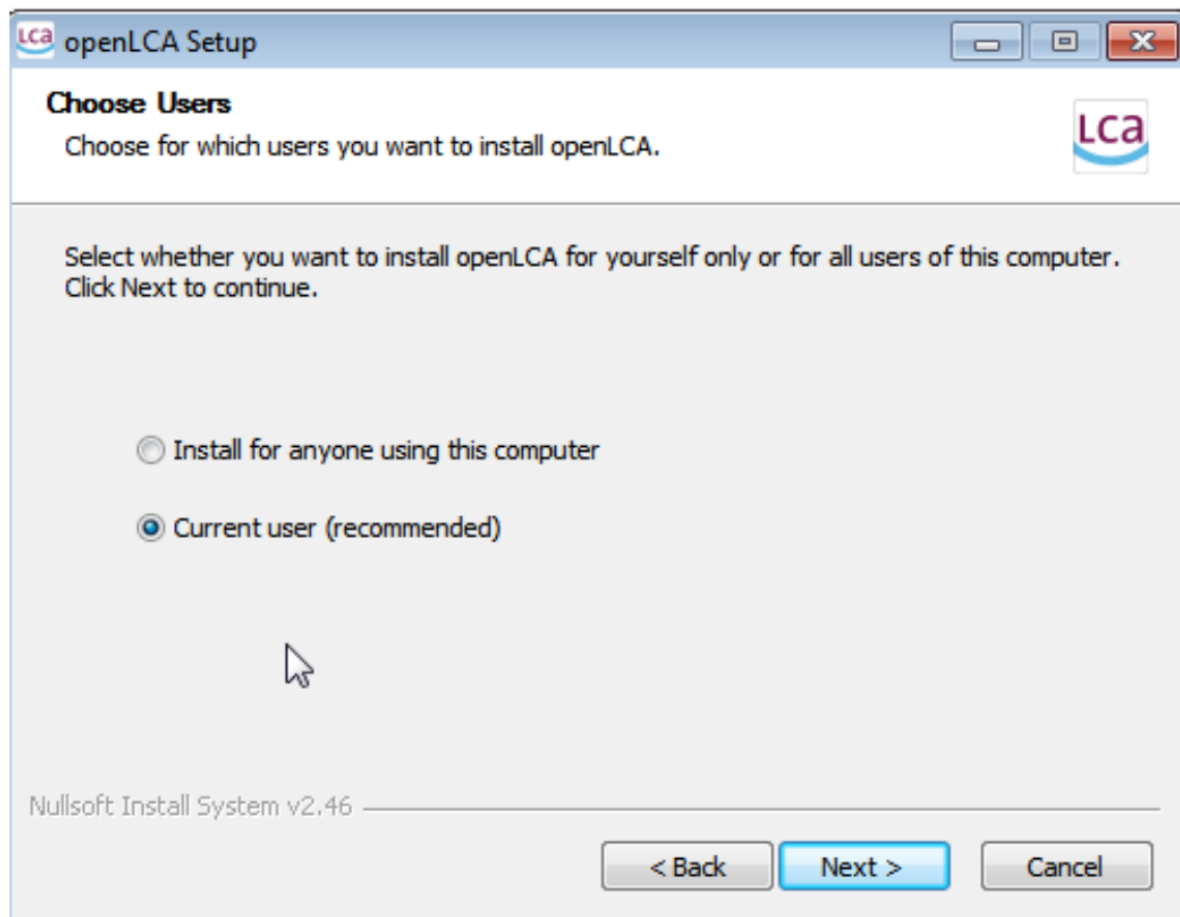


Figure 2: Setup screen for installation in Windows

Follow the installation steps to the end and you can begin working with openLCA.

Mac

Software required:

- Java in version 8; install Java before beginning with the openLCA installation (Java SE Development Kit for Mac OS available under <http://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html>).

Start by downloading the correct file from the downloads page of the openLCA website. Once the download is complete, find the program in the "Downloads" folder and transfer it into "Applications". Double-click on the program to open it. A warning message will appear because the application was downloaded from the internet and not from the App Store. Select "open". This message will only appear the first time you open the program.

Linux

For Linux, a 64-bit version is available. Hardware required:

- CPU with 2 GHz or higher
- 1 GB RAM (for analysing product systems with ~2500 processes, such as ecoinvent 2)
- >3 GB RAM (for analysing product systems such as ecoinvent 3)
- 500 MB free hard disk space + space for databases (e.g. ecoinvent 3 requires ~250MB)

We recommend installing libgfortran3 for high-performance calculations.

Welcome to openLCA

When you start openLCA for the first time, it does not contain any data. On the left-hand side, you see an empty Navigation field. On the right, you see the Welcome page in the so-called "Editor".



Figure 3: openLCA Welcome page

The Welcome page provides quick links to openLCA Nexus, instructional videos, case studies, this user manual, the openLCA download page where you can download the latest version of the software as well as LCIA methods and, finally, a link to more information on the openLCA network and its users. On the top-right part of the page, the "Search" function gives you the possibility to look for anything you like in openLCA

(e.g. flows, processes, social indicators, currencies, etc.) searching in all or in one specific section.

Main menu functions

The following options are available under "File":

- "Save" / "Save As..." / "Save All": save current work open in editor tabs
- "Close" / "Close All": close the current/all windows open in the editor.
- "Settings":

Databases

Following installation, openLCA does not contain any data, therefore the 'navigation' section on the left is empty. It is possible to have more than one database. Databases are independent of each other and only one database is "active" at a time. All the others are "inactive". It is also possible to combine databases. To change this, you can either:

- Create a new, empty database
- Restore a database

Restoring a database

In the scope of the course, you will use an existing database provided by your teachers. You have to download and restore it in openLCA. To restore this database, right-click in the navigation window and select "restore database". Select the .zolca file in your folders, and click on "Open". Databases can be heavy, and the importation can take time.

Combining databases

It is possible to combine databases into one openLCA database. To combine databases, import the first database (we recommend importing the largest database first as otherwise, the time it takes to compile the databases can be much longer). Then activate the database by double-clicking on it. At this point, you can import the other databases. The software will then combine the two databases.

openLCA supports the following import formats:

- zolca
- Ecospold1
- Excel
- ILCD
- SimaPro CSV
- JSON-LD

To import a database, select "File", "Import", and then choose the format of the database you want to add. It can be whole database or just certain product systems. You also can add it directly into the active database by right-clicking on it, select "File", "Import", and then choose the format of the database you want to add.

Exporting data

openLCA supports data export in the following formats:

- Ecospold (impact methods, processes,)
- ILCD Zip-file (actors, flow properties, flows, LCIA methods, processes, product systems, sources, unit groups)
- ILCD Network Export (entire databases, processes)
- Excel (processes, quick results, analysis results, Monte Carlo simulation results, product systems)
- JSON-LD
- "Copy" function for all openLCA tables

Exporting data in ILCD ZIP-file format

openLCA can export the actors, flow properties, flows, LCIA methods, processes, product systems, sources and Unit groups in ILCD format. To do so, activate the database from which you would like to export. Then click on "File" → "Export". The export wizard will pop up. Select what database elements you would like to export in ILCD format. Then select a directory and the processes, flows, etc. to be exported and select "Finish".

Exporting data as JSON-LD file

Databases can be exported in JSON-LD format. To export these file types, activate the database from which you would like to export processes/impact assessment methods. Then click on "File" → "Export". The export wizard will pop up. Select "JSON-LD" to export processes as JSON-LD files. In the next window select the elements to be exported and click "Finish".

Flows

Creating a new flow

To create a new flow, right-click on the "Flows" folder and select "New flow". Name flow and define flow type and reference flow property, then click "Finish". A new flow window will open in the editor.

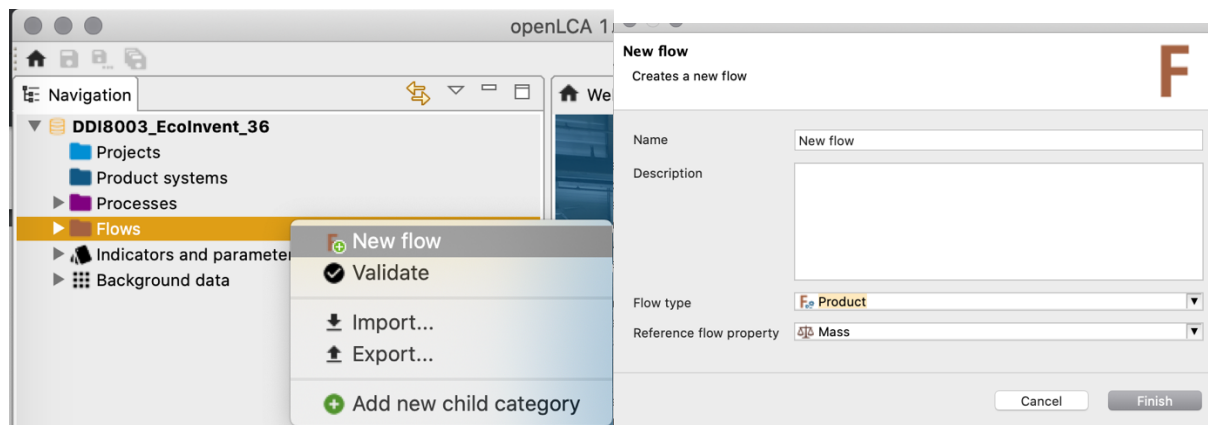


Figure 4: Creating a new flow

It is possible to define if the flow type is a product, an elementary flow or a waste flow. Furthermore, a reference flow property must be defined (e.g. duration, energy, volume, etc.).

In the General Information tab, you can see and change the name and add a description. Additional flow properties can be added in the “Flow properties” tab.

Processes

Processes can be either “unit processes” or “system processes”. A process is an activity that transforms an input into an output. The simplest form of a process in openLCA is a unit process. In the left half of Figure 4, each process from A to G is a unit process.

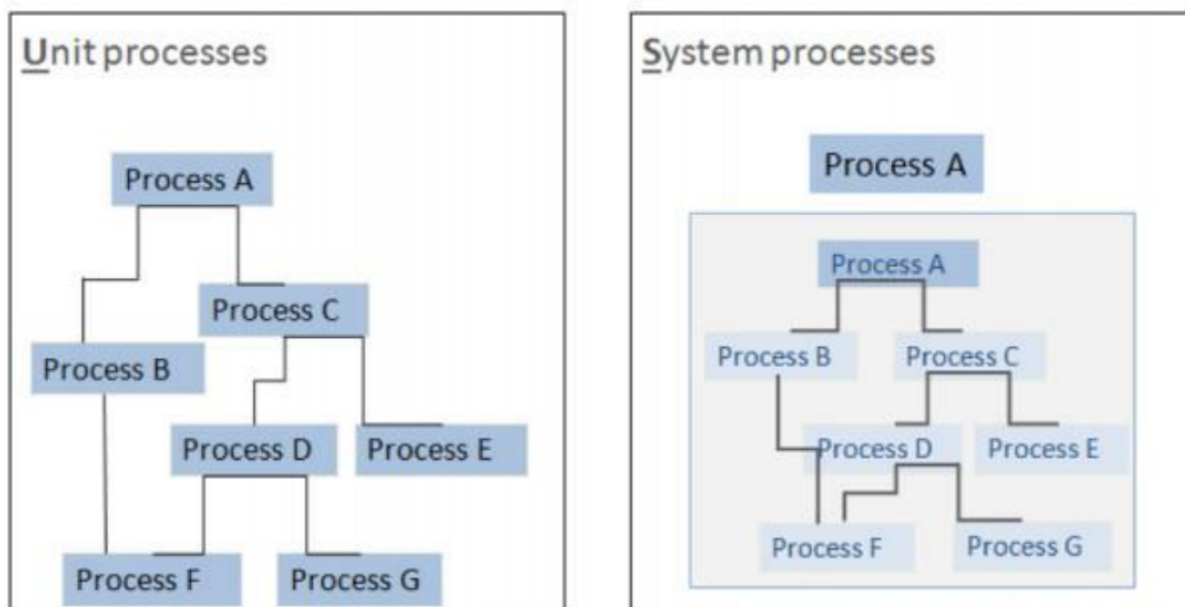


Figure 5: Difference between unit process and system process

Figure 5 shows how unit processes and system processes are displayed in the navigation window.

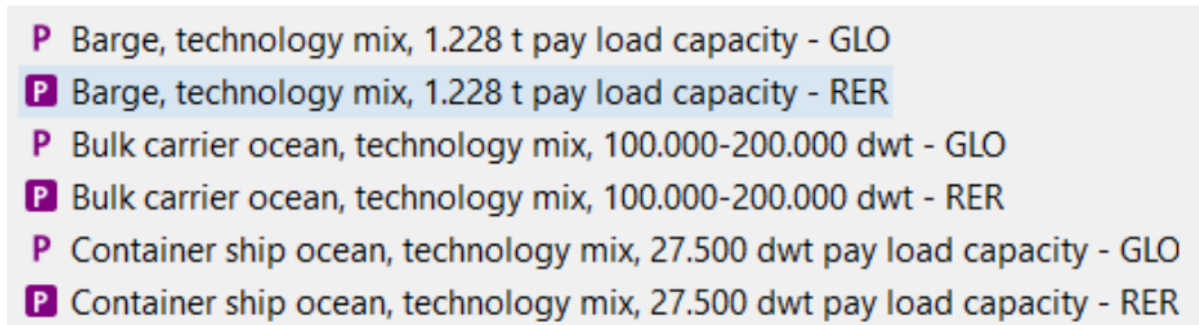


Figure 6: Unit processes (purple font colour) and system processes (white font colour on purple background)

Creating a new process

To create a new process, right-click on the “Processes” folder and select “New process”. Name the process and select a quantitative reference (the reference output of this process). It is also possible to create a new product flow for the process. The product flow will automatically be given the same name as the process. Once "Finish" is clicked, the new process will open in the editor. An input flow or any elementary flow can also be used as a quantitative reference.

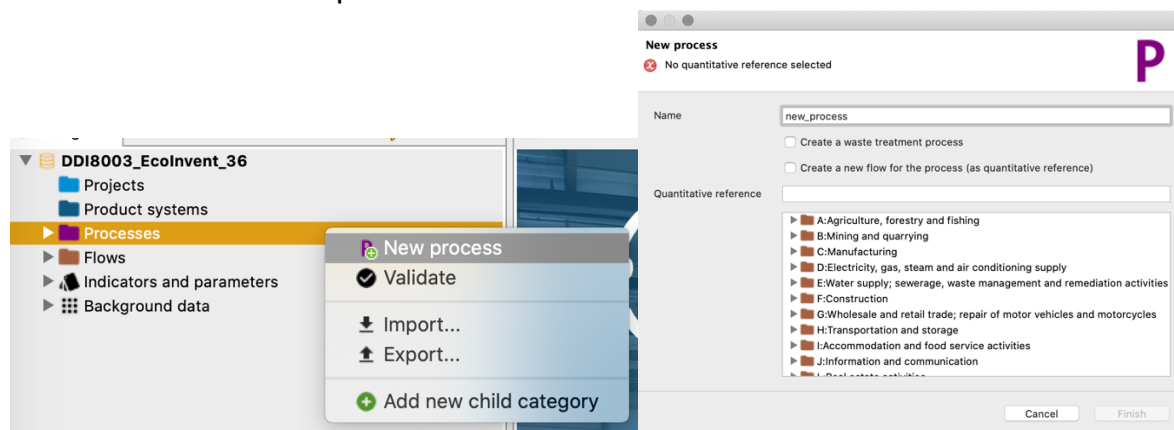


Figure 7: Creating a new process

In the General Information tab of a process, you can change the name, add a description, set the quantitative reference, and add time, geography, technology and data quality information.

Parameters

Parameters can be used on the process, Impact assessment method, product system, project and database levels. Parameters can be used instead of concrete values for inputs/outputs. They can be defined as simple values, formulas or complex functions. Parameters can overwrite each other (e.g. the value set for a parameter in a process can be overwritten on the product system/project levels).

New global, input and dependent parameters can be created within a process or impact assessment method. These are then also available in product systems and projects. To create a global parameter, you can select "Global parameters" in the "Indicators and Parameters" section in Navigation and if you right-click a tab for the creation of a new global parameter pops up. At this point you can enter the name, description, type (if it is an input or a dependent parameter) and amount (see Figure 8). To load the global parameter just created select the "reload" button in the "Global parameters" section in "Parameters" tab in a process or impact assessment method (see Figure 74).

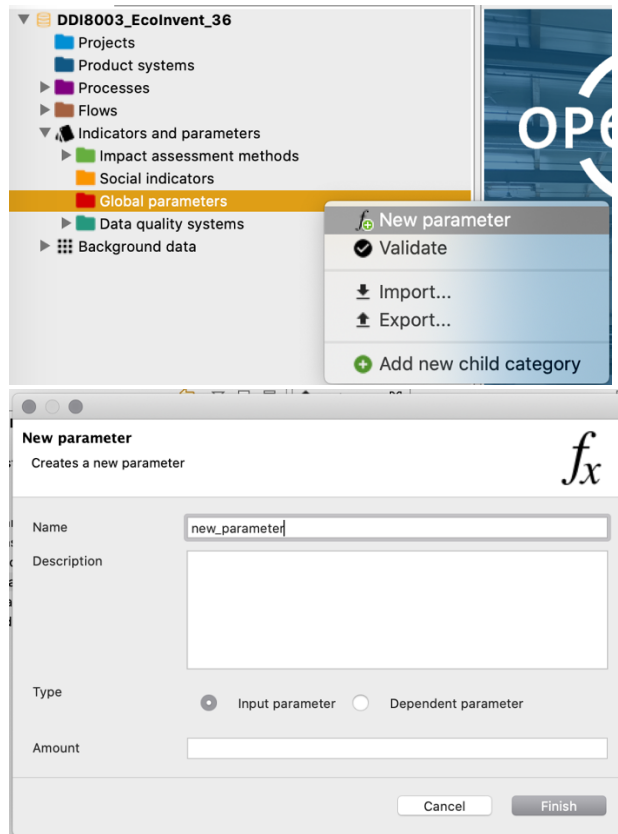


Figure 8: Creation of a global parameter

Product system

As in ISO 14040, the life cycle model of a product is called a product system. There are different ways to create, edit and complete product systems, depending on the database and user preferences, which will be explained in the following section.

Creating a new product system

There are two ways to create a new product system. For option one, begin by right-clicking on the "Product systems" folder and select "New product system". The second option is to create a product system directly from the reference process. To do this, go to the "General Information" tab of the process and select the button "Create product system". That is what you will do in class.

Welcome | fish canning plant construction and maintenance | fish canning plant | C... |

General information: fish canning plant construction and maintenance | fish canning plant | Cutoff, S

General information

Name: fish canning plant construction and maintenance | fish canning plant | Cutoff, S

Description: The activity represents the construction and maintenance along its lifetime of a fish canning (including fish pre-processing of raw material. The life cycle inventories were produced based on a sample of 1 Peruvian plant (processing capacity: representatives. This dataset may be adapted to other global production sites. System boundaries of fish processing maintenance. From cradle, i.e. including all upstream activities. End of life treatment of the plant

Category: C:Manufacturing > 10:Manufacture of food products > 102:Processing and preserving of fish, crustaceans and

Version: 03.02.003

UUID: 8ae267bc-4e8b-4acd-9b03-b7521da610db

Last change: 2019-12-03T16:16:11+0100

Infrastructure process: ☐

Create product system Direct calculation Export to Excel

Time

Start date: 01/01/2011

End date: 31/12/2019

General information Inputs/Outputs Administrative information Modeling and validation Parameters Allocation Social aspects Impact analysis

Result analysis

Quick results tab contents

The option “Quick results” provides information on direct impacts. Upstream impacts are not represented here (they are included in the analysis results).

Analysis

The option “Analysis” provides information on direct as well as upstream impacts. All the tabs with information on direct impacts from the quick results are included in the analysis. Upstream impacts are shown in the tabs “Process results”, “Contribution tree”, “Sun Burst” and “Sankey diagram”.

The contribution tree is unique to the Analysis calculation. It breaks down process contributions to flows and impact categories, displaying upstream totals.

Ecoinvent (from <https://www.ecoinvent.org/support/faqs.html>)

What does “Market” mean? (<https://www.ecoinvent.org/support/faqs/methodology-of-ecoinvent-3/what-is-a-market-and-how-is-it-created.html>)

A market activity is an activity that does not transform inputs, but simply transfers the intermediate exchange from one transforming activity to another transforming activities that consumes this intermediate exchange as an input, e.g. from glycerine at

the supplier to glycerine at the consumer. A market dataset collects all activities with the same reference product in a certain geographical region. Furthermore, it includes average transports of that product within the geography, as well as inputs of the product itself to cover losses in trade and transport. In other words, they are consumption mixes of a certain product in a certain geographical region. There are either global or local markets, depending on real-life conditions and on the availability of local transforming activities for specific products.

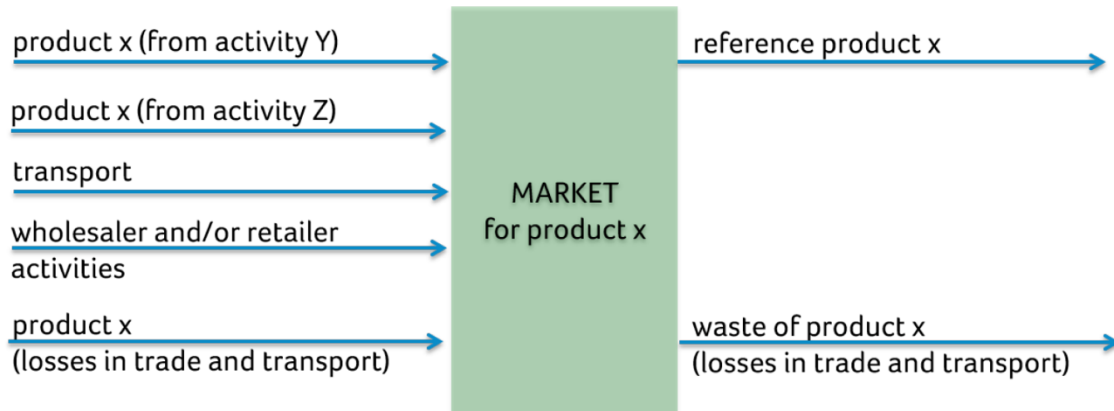


Figure 9: Market activity (from Ecoinvent.org)

What do the shortcuts, such as CH, RER, RoW and GLO mean?

Every activity present in the ecoinvent has a geographic location. This geographic locations are reported using internationally accepted shortcuts. For example Switzerland has the shortcut CH, Czechia CZ and China CN. The list of geographies available in ecoinvent can be found. Certain geographical location shortcuts are not as well know or commonly used. For example, GLO means global and represents activities which are considered to be an average valid for all countries in the world. RER shortcut represents Europe. RoW represents the Rest-of-the-World.