

Wiki on processes and products for Life Cycle Assessment (LCA) Overview

MERCE-FRA/DIS/SAS

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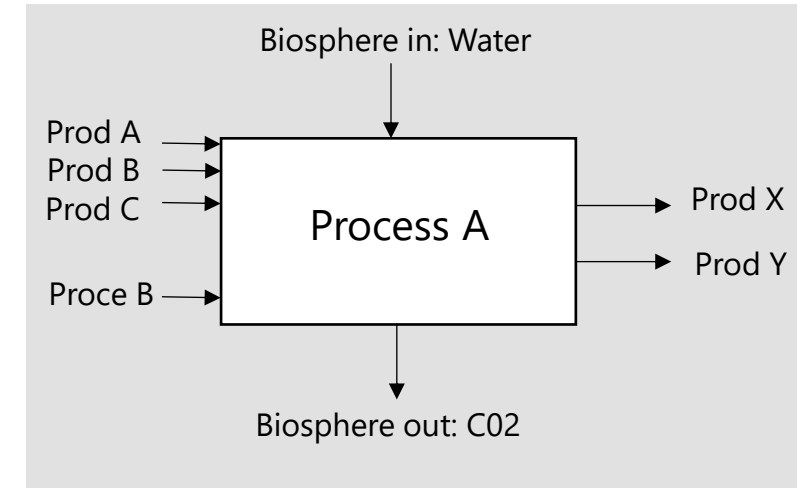
1. Some challenges in LCA – Initial motivation
2. Overview of the project
3. Vision
4. Data structure
5. Data import example
6. Tentative parametric approach

LCA results **without transparency on the processes** used (life cycle inventory - LCI) has **limited scientific value**.

- Impact results give **non explainable information**. Cannot be analyzed by experts.
- Given processes, one can compute and explain impact results.
- Used processes seem to be as important as methodology considered (e.g., PCR/PSR).
 - Using same methodology but different databases, one can observe up to x100 difference.
- No peer review for private databases.

However, there exist **several papers in the public domain providing processes** used in the scope of LCA.

- **Proposal**: Centralize processes in a collaborative « wiki of product and processes ».
- Focus on « downstream » processes unlike e.g., ecoinvent which focuses on « upstream » processes.



PCR: Product category rules.
PSR: Product specific rules.

- Project link: <https://github.com/merce-fra/Wiki-on-processes-and-products-for-LCA>
 - Still at prototype stage. Goal is to illustrate approach.
- Project consists of four main parts:
 1. **The Wiki**: to organize processes and products, that can be found in the public domain, to be used for the **Life Cycle Inventory (LCI)** part of a Life Cycle Assessment (LCA) study.
 2. The **import function** for **Brightway-formatted data**.
 3. **Visualization function**: automatically build a **dependency tree** starting from a chosen product or process node, **with identification of alternative process nodes**.
 4. **AI-based Wiki Edition**: AI to assist in the management of the Wiki. It automates tasks such as page generation (for not brightway-compliant data), inconsistency detection, and product similarity analysis.

Wiki home page

Home

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Overview of the wiki

A **product** can have multiple processes (e.g., due to regional or technical differences). A **process** defines the input and output products (technosphere flows) as well as consumed and emitted biosphere flows. For an electronic device, if no detailed data is available, the process can simply be **the list of its main components**.

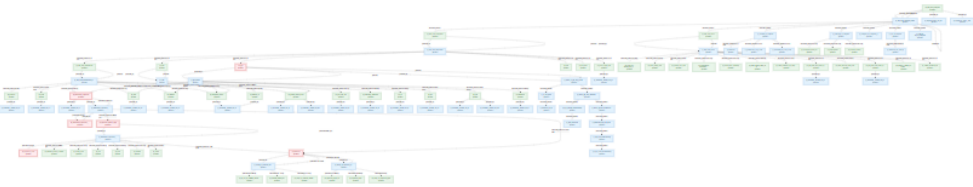
A page is either about a **product** (PD) or a **process** (PS).

- Example of products: [pd_dell_3620_computer](#), [pd_livebox_6](#), [pd_26_ghz_transmit-array_antenna](#), [pd_raspberry_pi4_revb](#), [pd_water_bottle](#), [pd_gpu](#), [pd_fairphone4](#)
- Example of processes: [ps_dell_3620_computer_loubet](#), [ps_livebox_6_production](#), [ps_water_bottle_production](#)

The list of all products and processes can be found at the following pages :

- Products: [pd_db](#)
- Processes: [ps_db](#)

Example of dependency tree for the product [pd_dell_3620_computer](#) generated with the script `build_lca_tree.py` (click [here](#) to see the source image).



[+ Add a custom footer](#)

Pages 209

Find a page...

- Home
 - Overview of the wiki
 - pd_0.05mm_al_blank_coil
 - pd_0.12mm_al_blank_coil
 - pd_26_ghz_transmit_array_antenna
 - pd_al_coil_of_0.05mm_cathode_etch...
 - pd_al_coil_of_0.05mm_etched_foil
 - pd_al_coil_of_0.12_mm_anode_forme...
 - pd_al_coil_of_0.12mm_anode_formed...
 - pd_al_scrap
 - pd_alpo4
 - pd_anode_formed_foil
 - pd_antenna_elements
 - pd_antenna_unit
 - pd_backup_batteries
 - pd_baseband_unit

Show 194 more pages...

GitHub home page

Wiki-on-processes-and-products-for-LCA

Public

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main 1 Branch 0 Tags

Go to file

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corlay-MERCE Minor update 2be99a3 · 45 minutes ago 90 Commits

Build_tree	Minor update	yesterday
Database_edition	Minor update	45 minutes ago
.gitignore	Major update to directly generate markdown format (drop d...	2 months ago
LICENSE.txt	Add license	5 months ago
README.md	Minor update	45 minutes ago

README BSD-3-Clause license

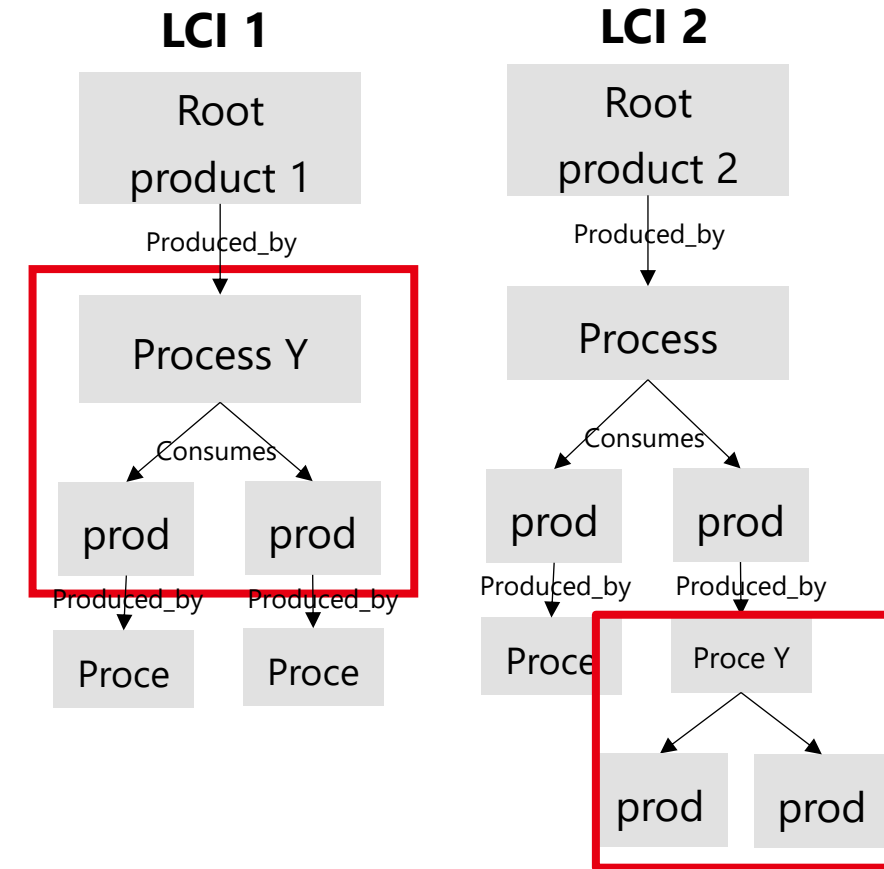
[Update (06/10/2025), initial import tree: The initial scope and structure of an inventory is an important information to keep.

- For instance, the quantity used in a sub-process are often established with respect to the root product LCI scope.
- Moreover, new processes may be added under an existing product.

Currently, performing a LCI includes the following challenges:

- **Scientific contributions** are often referenced by the end product, but may also include **sub-process data valuable for other studies**.
- **Several processes** may exist to produce **the same product**.
- This **open** wiki is designed to efficiently list and compare **multiple approaches** for performing the inventory of a product. It references data at the **process level**.
- Easy to **compare existing options** and **select the most suitable approach**.

Example where LCI 1 and LCI 2 contain mutually beneficial data



 Common process in LCI 1 and LCI 2

Electrolytic capacitors

- Theecoinvent reference to produce an [electrolytic capacitors](#) was originally added when importing the inventory of the [Dell computer](#).
- A second inventory was imported as data from a **research paper** dedicated to this topic. The import script automatically detected that the process produces a product already present in the wiki.
- Visualization script identifies that **two alternative processes now exist** for this node in the tree starting at the [Dell computer](#) node. **Red nodes in the graph.**
- This enables researchers studying the Dell computer to easily update their LCA with the alternative process for the electrolytic capacitors and compare the results.
- Link to the tree: raw.githubusercontent.com/wiki/merce-fra/Wiki-on-processes-and-products-for-LCA/out_tree/graph_pd_dell_3620_computer.svg

pd_electrolytic_capacitors

corlay edited this page on Jul 3 · 3 revisions

Product: pd_electrolytic_capacitors

List of processes

- Ecoinvent: market for capacitor_electrolyte_type_<2cm_height | GLO
- [ps_electrolytic_capacitors_aging_and_inspection_zhang](#)

pd_gpu

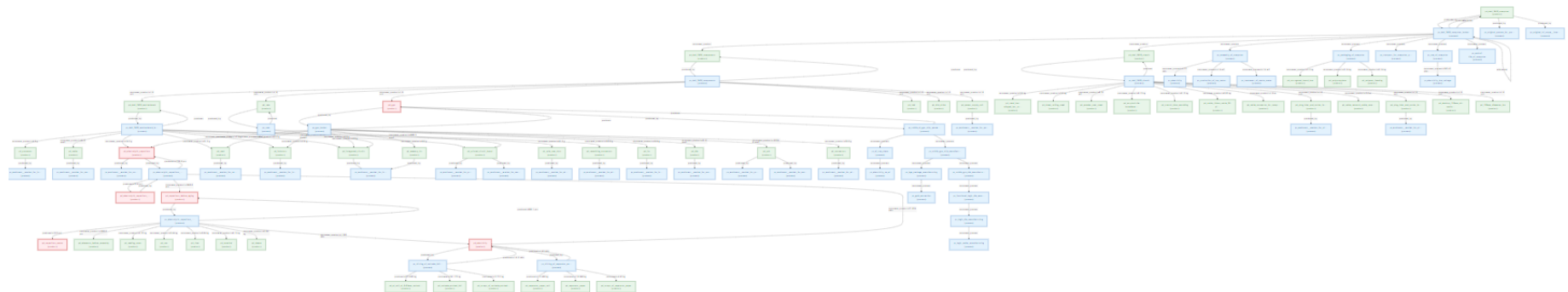
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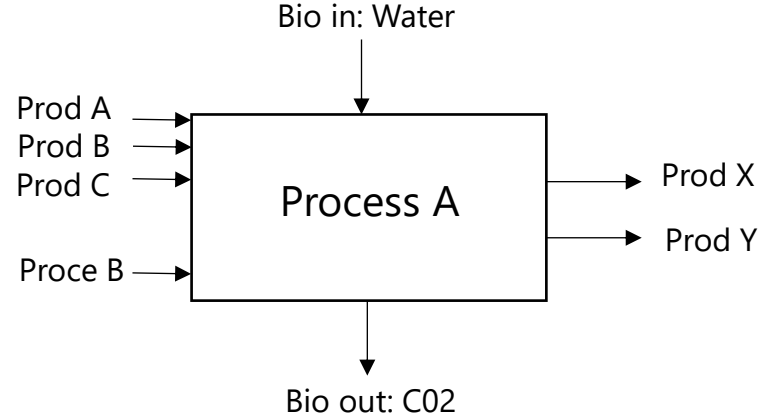
Product: pd_gpu

List of processes

- [ps_gpu_loubet](#)
- [ps_nvidia_ai_gpu_chip_parameter_appa](#)

May be similar to the following products





Product

- One product is always produced by a process.
- Several processes can be proposed for the same product (technical or geographic difference).

Process

- Process may or may not produce a product.
- It is composed of technosphere flows and biosphere flows.
- Technosphere flow:
 - Consumption of products and processes.
- Biosphere flow:
 - Consumption and emission of biosphere elements.
- Original root and process node.

- Page of product X:

- [Process A](#)
- [Process B](#)
 - Original process for product as root node.
 - Original LCI scope
 - Original tree
- [Process C](#)
- Process E = Ecoinvent process (non clickable)

Blue: clickable

- Page of process A:

- Technosphere flow:
 - Production
 - [Product X](#)
 - [Product Y](#)
 - Consumption
 - [Product A](#)
 - Quantity
 - [Product B](#)
 - [Product C](#)
 - [Process B](#)
- Biosphere Flow:
 - Emission
 - [CO2](#)
 - Consumption
 - [water](#)
- Original root product and process nodes
 - Product: [XXX](#)
 - Process: [XXX](#)
- Information:
 - Publi ref...

Note: does not include parametric approach

The **original scope and structure of an inventory** is an important information to keep.

- For instance, the quantity used in a sub-process are often established with respect to the root product LCI scope.
- New processes may be added under an existing product → lose track of original path in tree.

Page structure (see [pd_livebox_6](#) or [Dell computer](#) for examples):

- When importing an inventory, the **LCI scope should be specified**.
- The root process of a root product is **clearly indicated**.
- This LCI scope is added under the **original process of the root product of the inventory**.
- The **original tree path is computed and added under the original process of the root product of the inventory (link to rn_ file)**.
- **A link** to the original root product and process nodes is added in **each child process page**.

pd_dell_3620_computer
corlay edited this page 3 hours ago · 2 revisions

🔗 Product: pd_dell_3620_computer

🔗 List of processes

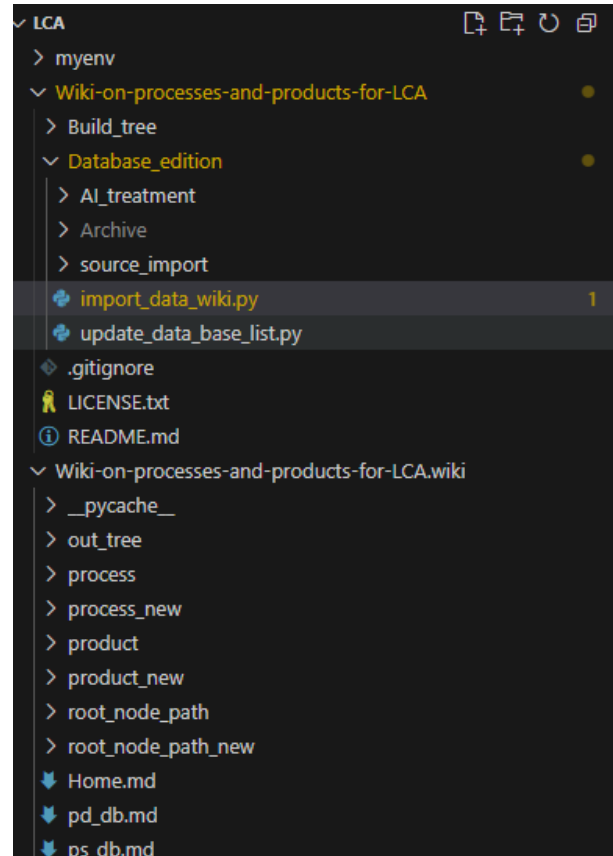
- [ps_dell_3620_computer_loubet](#)
 - Original process for product as root node.
 - Original LCI scope: Inventory of one computer for one year.
 - Original tree path: [rn_pd_dell_3620_computer_ps_dell_3620_computer_loubet](#)

🔗 Original root product and process nodes

- Product: [pd_livebox_6](#)
- Process: [ps_livebox_6_production](#)

GitHub Project

with code to
import/edit pages



```
Wiki-on-processes-and-products-for-LCA > Database_edition > import_data_wiki.py > ...
1  # -----
2  # Description: [python code to import data (create product and process pages) from Excel files that are
3  # compatible with the Brightway format]
4  # [Directly generates GitHub Wiki markdown pages (.md) for product and process]
5  # Author: [Vincent Corlay - Mitsubishi Electric R&D Centre Europe]
6  # -----
7  from brightway2 import *
8  import os
9
10 # Define paths for database files
11 base_path_source = "../Wiki-on-processes-and-products-for-LCA/" # EDIT THIS PATH IF NEEDED, parent folder
12 # for source files
13 base_path_target = "../Wiki-on-processes-and-products-for-LCA.wiki/" # Parent folder for generated wiki
14 # markdown files
15 source_file_path = "Database_edition\\source_import\\Example_bw\\Livebox_6.xlsx"
16
17 #Define some meta data
18 root_node_LCI_scope = "Inventory of one livebox 6" # Functional unit for the processes
19
20 General_information = "From Youtube videoby Deux Ex Silicium: Dans les entrailles de la LIVEBOX 6 :
21 analyses, mesures et décorticage de son électronique, link: https://www.youtube.com/watch?v=VryPNmlxxas :
22 added_by = "Vincent Corlay (v.corlay@fr.mercede.mee.com)"
23 source_file = "Livebox_6.xlsx"
24
25 path = base_path_source + source_file_path
26 imp = ExcelImporter(path) #Brightway import function to import data from Excel files
```

Wiki Project

Markdown pages located in
process & product folders.
New pages created in
process_new &
product_new folders.

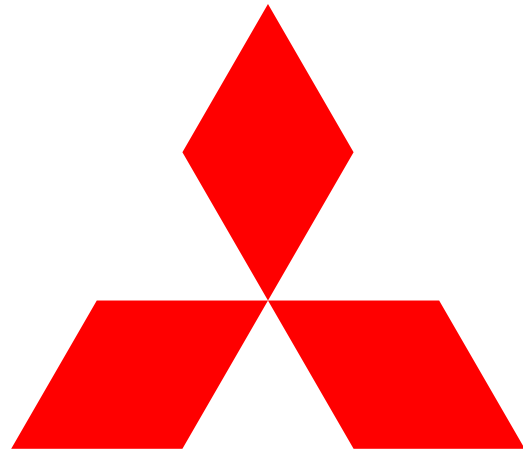
The example of **Appa's parametric GPU model** has been added to the wiki to help identify necessary adaptations. This process is now listed under the [GPU product page](#) of the wiki.

In the [Appa GPU process branch](#), the wiki page structure updated as follow to handle the parametric model.

- New **"Parameters" section**: List of the input parameter names.
- New **"parameters" field**: Added to the metadata following a process name in the "Consumption" section.
- **Models** (based on Appa's "Parameter Matching"):
 - If a model is used by a single process, it is added as a local model under that process.
 - If a model is used by multiple processes, consider creating a Global Model section to avoid duplication.
- New **"Impact Flow"** section: Allows for impact formulas based on parameters (e.g., see [logic wafer](#)).

⌵ Process: ps_nvidia_ai_gpu_chip_parameter_appa
⌵ Characteristics
⌵ Parameters
<ul style="list-style-type: none">• cuda_core• architecture• energy_per_inference• inference_per_day• lifespan• usage_location
⌵ Global Models (used by several process)
⌵ Technosphere Flow
⌵ Production
<ul style="list-style-type: none">• pd_gpu - Quantity: None unit
⌵ Consumption
Process:
<ul style="list-style-type: none">• ps_ai_use_phase<ul style="list-style-type: none">◦ Local model:<ul style="list-style-type: none">▪ $\text{inference} = f(\text{inference_per_day}, \text{lifespan})$◦ Parameters: energy_per_inference, inference, usage_location◦ Quantity: None◦ Database: Not specified• ps_nvidia_gpu_chip_manufacturing - parameters: architecture, cuda_core - Quantity: None - Da

⌵ Process: ps_logic_wafer_manufacturing
⌵ Characteristics
⌵ Parameters
<ul style="list-style-type: none">• fab_location• masks
⌵ Global Models (used by several process)
⌵ Technosphere Flow
⌵ Production
⌵ Consumption
Process:
Chimaera (to be classified - put in process by default):
⌵ Biosphere Flow
⌵ Impact Flow
<ul style="list-style-type: none">• Category: "('EF v3.0', 'climate change', 'global warming potential (GWP100)')_tec◦ Amount: $(0.049 * \text{masks} + 0.3623) * 3.14159 * \text{pow}(15, 2)$ #impact originally i



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