Introduction to version 3

Agroscope
EMPA
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Webinar series

27 January 2015

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Deputy manager

ecoinvent

ecoinvent Centre

The ecoinvent Centre

- Founded by 5 Swiss Institutes in 1997
- Database up and running since 2002
- The world's leading LCI database for over a decade
- A not-for-profit association

The version 3

- The ecoinvent Centre published the version 3.0 of ecoinvent in May 2013
  - Version 3.1 was published in July 2014
  - Version 3.2 is coming in 2015
  - Releases will happen every year
- This presentation aims to be an operational introduction to version 3
- You can learn more in:
  - http://www.ecoinvent.org/database/ecoinvent-version-3/
  - http://www.ecoinvent.org/support/forum-for-ecoinvent-v3/
  - http://www.ecoinvent.org/support/
  - Future webinars and upcoming ecoinvent matters series!

Content of this webinar

- Starting point: from v2 Process to v3 Activity and Products. Implications in the naming
- Activities and Products. Definition and types
- The creation and use of consumption mixes in version 3
- System models: definition and short overview of the different System Models the v3.1 offers
- New data and new features in version 3.01 and version 3.1

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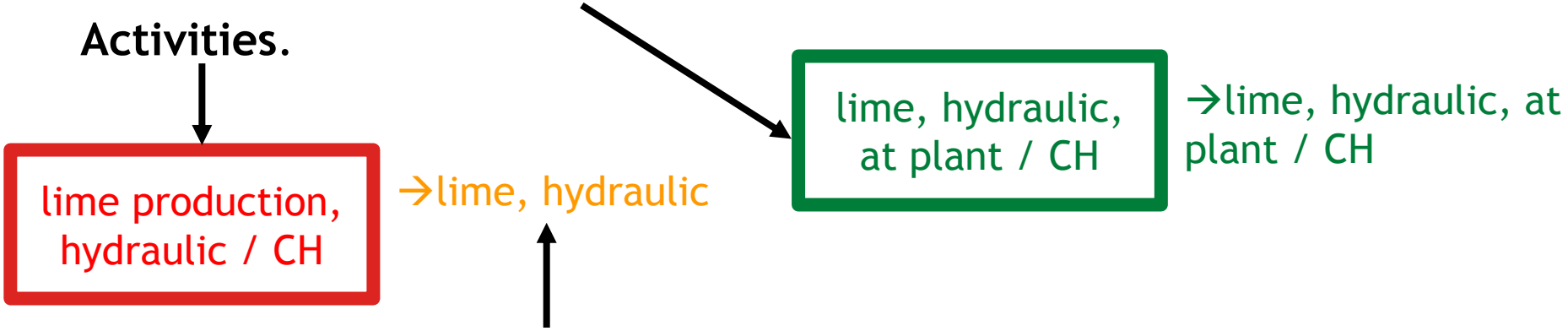
Activities and Products in version 3 versus Process in version 2

- While version 2 had **Processes**, the version 3 is organized in **Activities**.



- **Activities** result in **Products**, which bear different names than the Activities producing them.
- That was only the case in multioutput (unallocated) **Processes** in v2.2.
- While (allocated) **Processes** and the resulting output used to bear the same name.

Activities and Products in version 3 versus Process in version 2

lime production, hydraulic / CH → lime, hydraulic

lime, hydraulic, at plant / CH → lime, hydraulic, at plant / CH

- Different activities can now produce the same product
  - Different producers of same product can now be identified
- Naming has changed between v2.2 and v3
  - Dissociation between product and activity name
  - Naming rules added for consistency reasons

Examples of changes in naming

Ecoinvent v2	Ecoinvent v3	
Process	Activity	Product
electricity, hydropower, at pumped storage power plant	electricity production, hydro, pumped storage	electricity, high voltage
electricity, hard coal, at power plant	electricity production, hard coal	electricity, high voltage
bauxite, at mine	bauxite mine operation	bauxite, without water
chemical plant, organics	chemical factory construction, organics	chemical factory, organics

Check for our correspondence file between v2.2 and v3.01:
www.ecoinvent.org/fileadmin/documents/en/Correspondence_Files/ecoinvent_correspondence_file_v2_2_to_v3_01_130904.xlsx

To retain

- Process are now dissociated into Activities and Products (the outcome)
- This allows different Activities to have the same resulting Product
  - Producers of same product can be easily identified/found
- Naming has changed between version 2 and version 3
  - Correspondence file between v2.2 and v3.01: www.ecoinvent.org/fileadmin/documents/en/Correspondence_Files/ecoinvent_correspondence_file_v2_2_to_v3_01_130904.xlsx
  - Change report: http://www.ecoinvent.org/fileadmin/documents/en/Change_Report/05_DocumentationChanges_20130904.pdf

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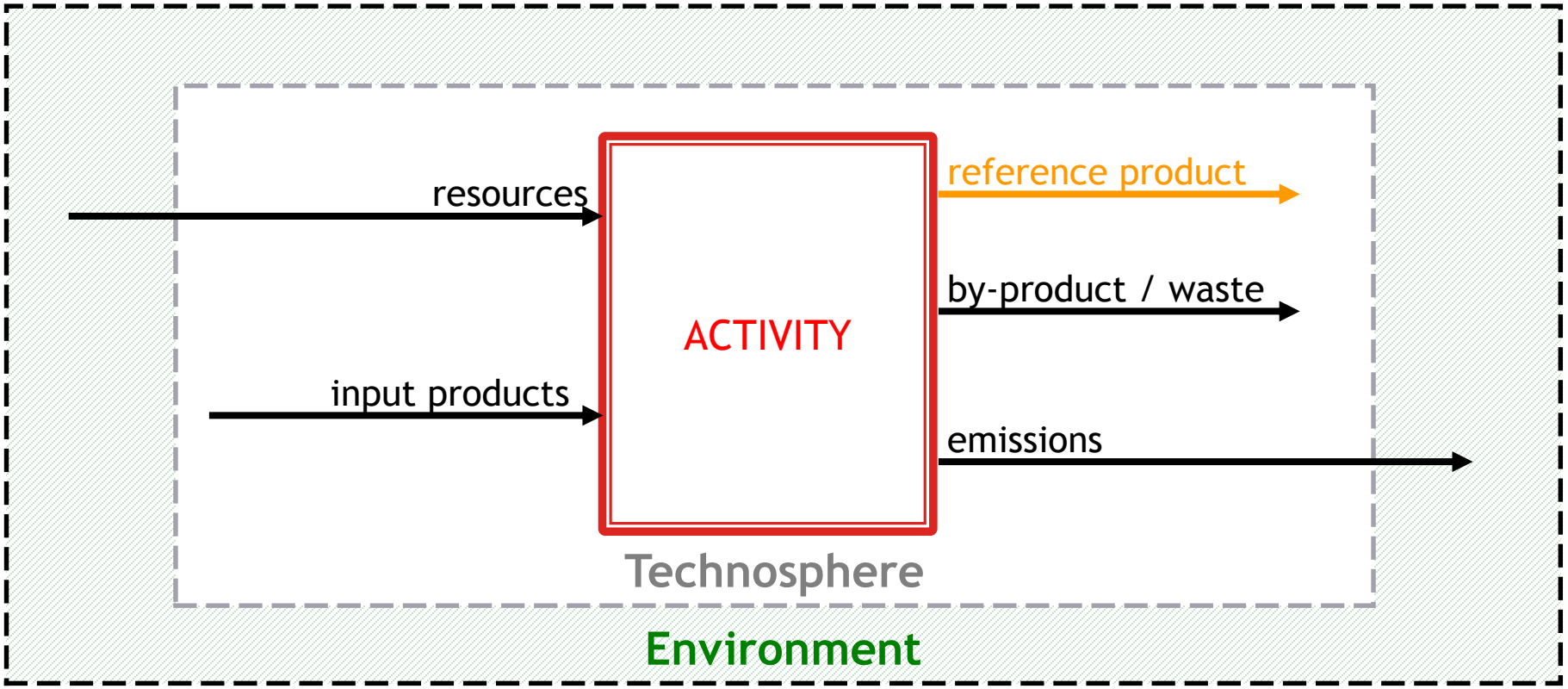
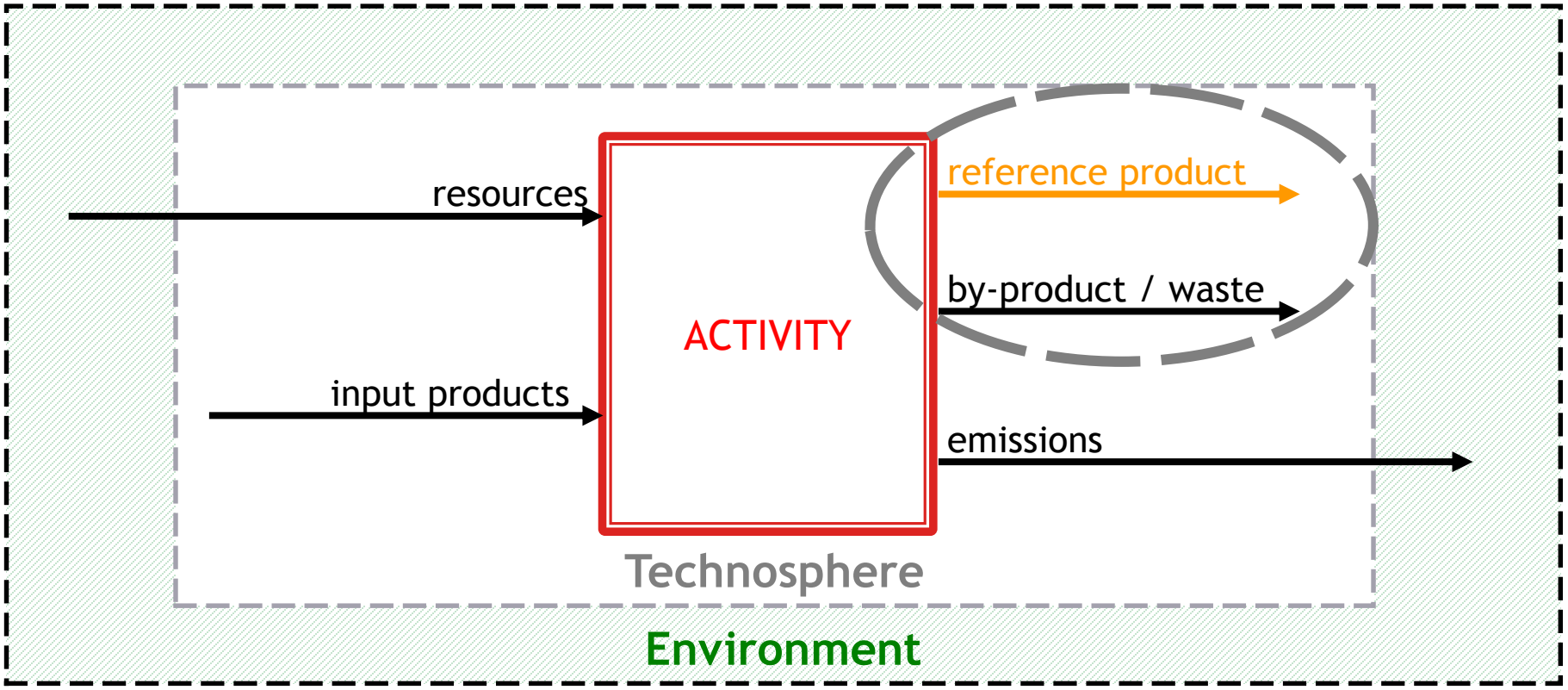
Definition of Activity

- An Activity is a unit process that represents a human activity and its **exchanges with the environment** and with the **products** of other human activities (Technosphere).



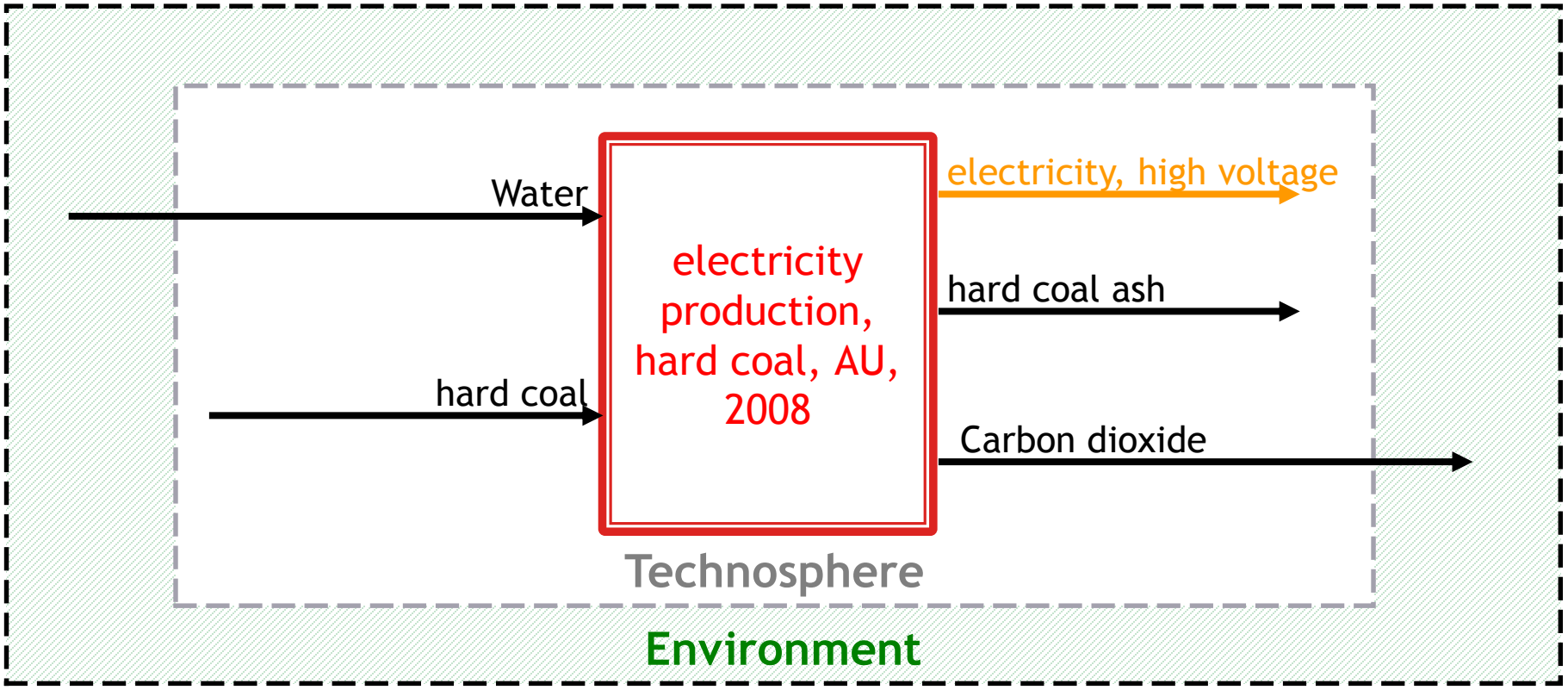
Definition of Activity

- Activities when unallocated produce two types of products



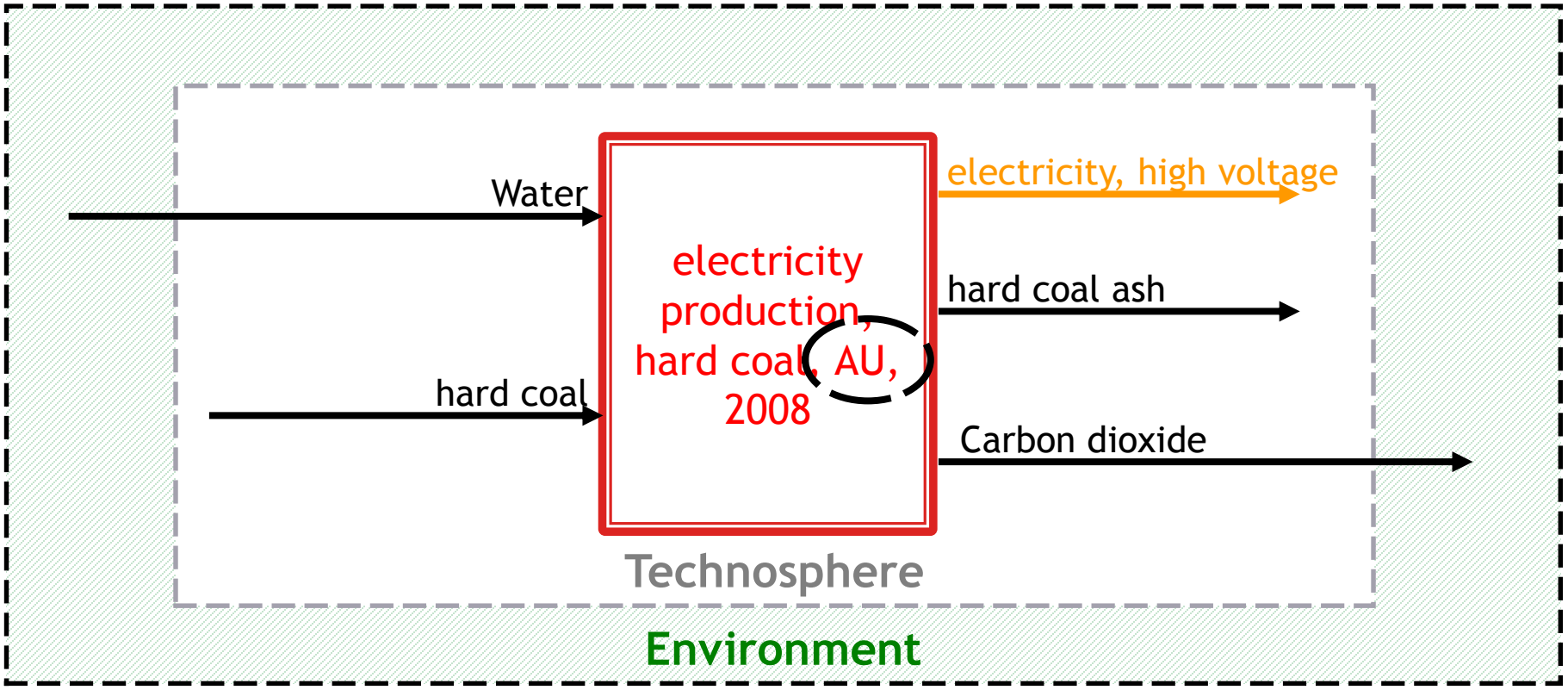
Different types of activities: transforming activities

- Transforming activities are human activities that **transform** inputs, so that the output of the activity is different from the inputs



Different types of activities: transforming activities

- Different transforming activities can produce the same product
- Different Geography



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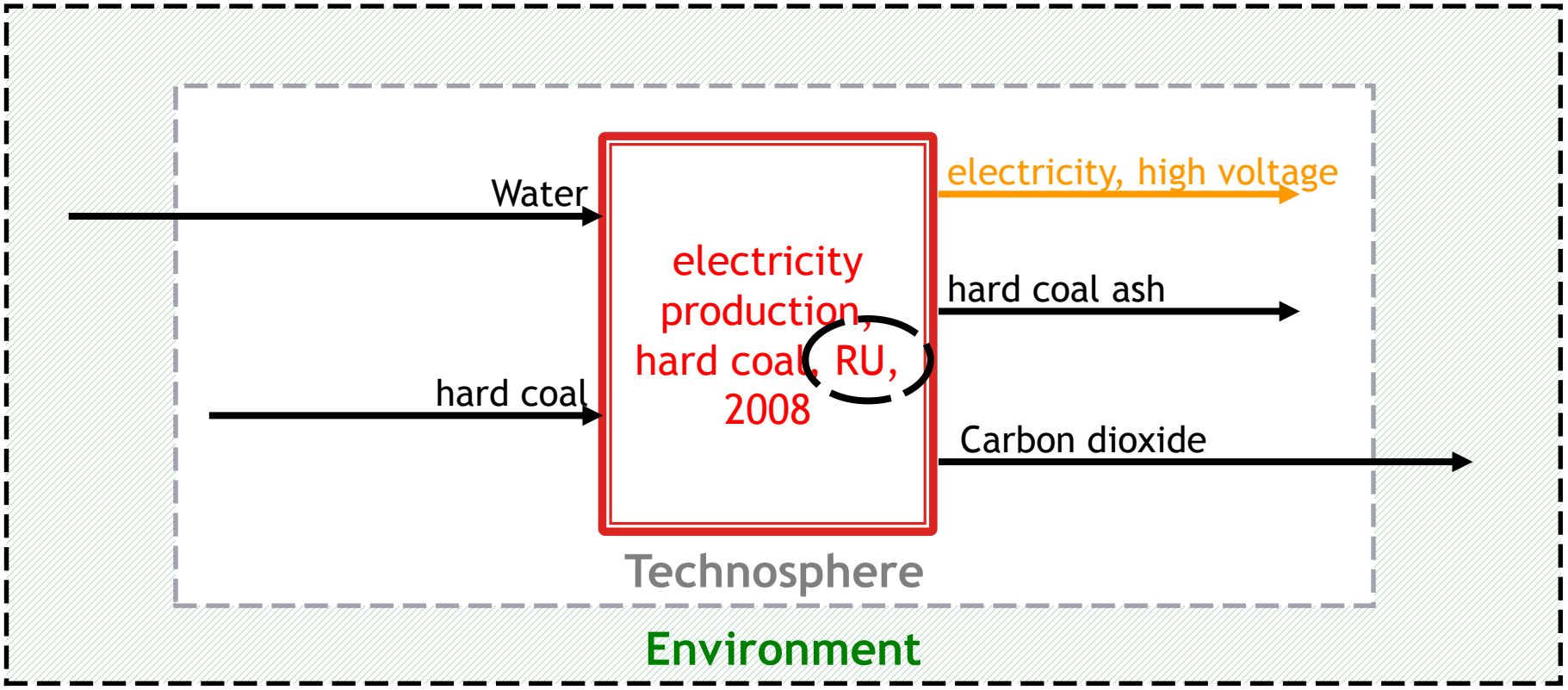
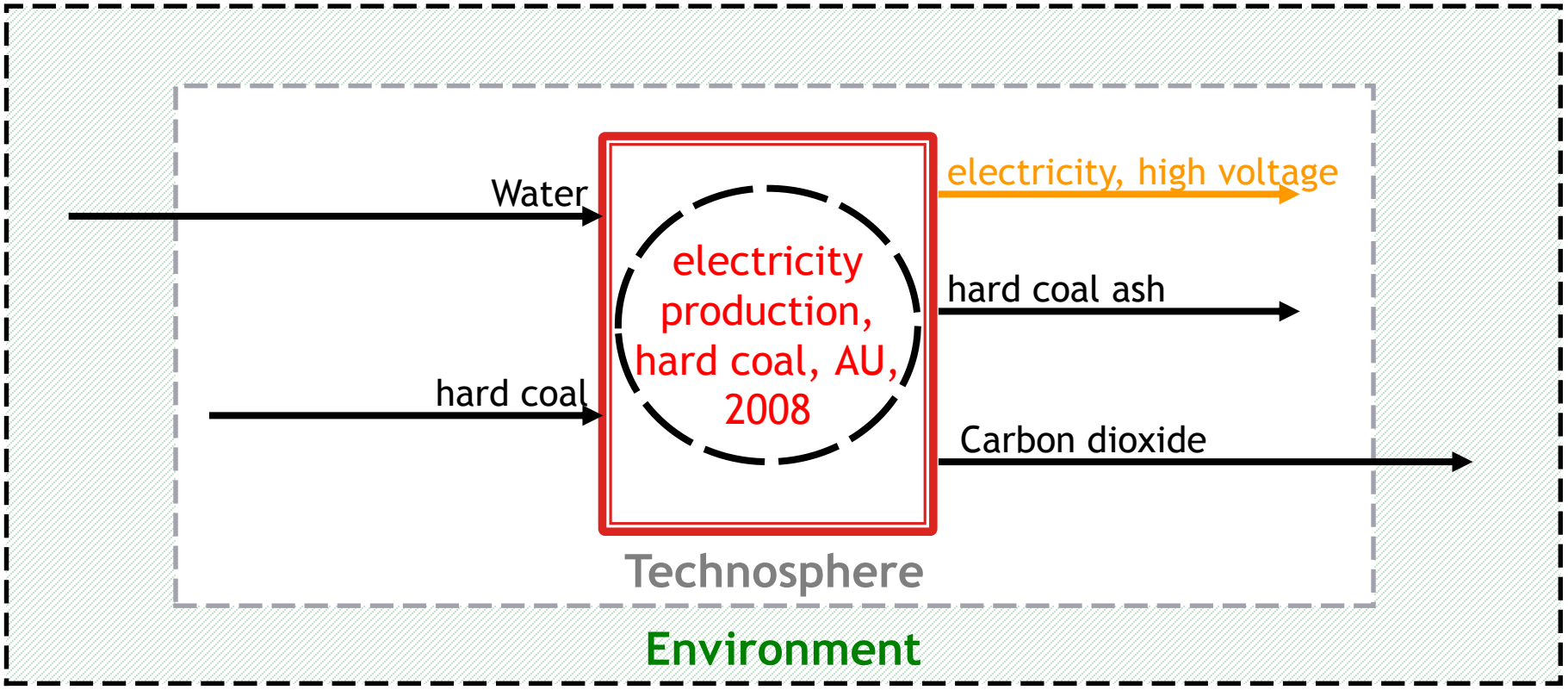


Different types of activities: transforming activities

- Different transforming activities can produce the same product
- Different Technology



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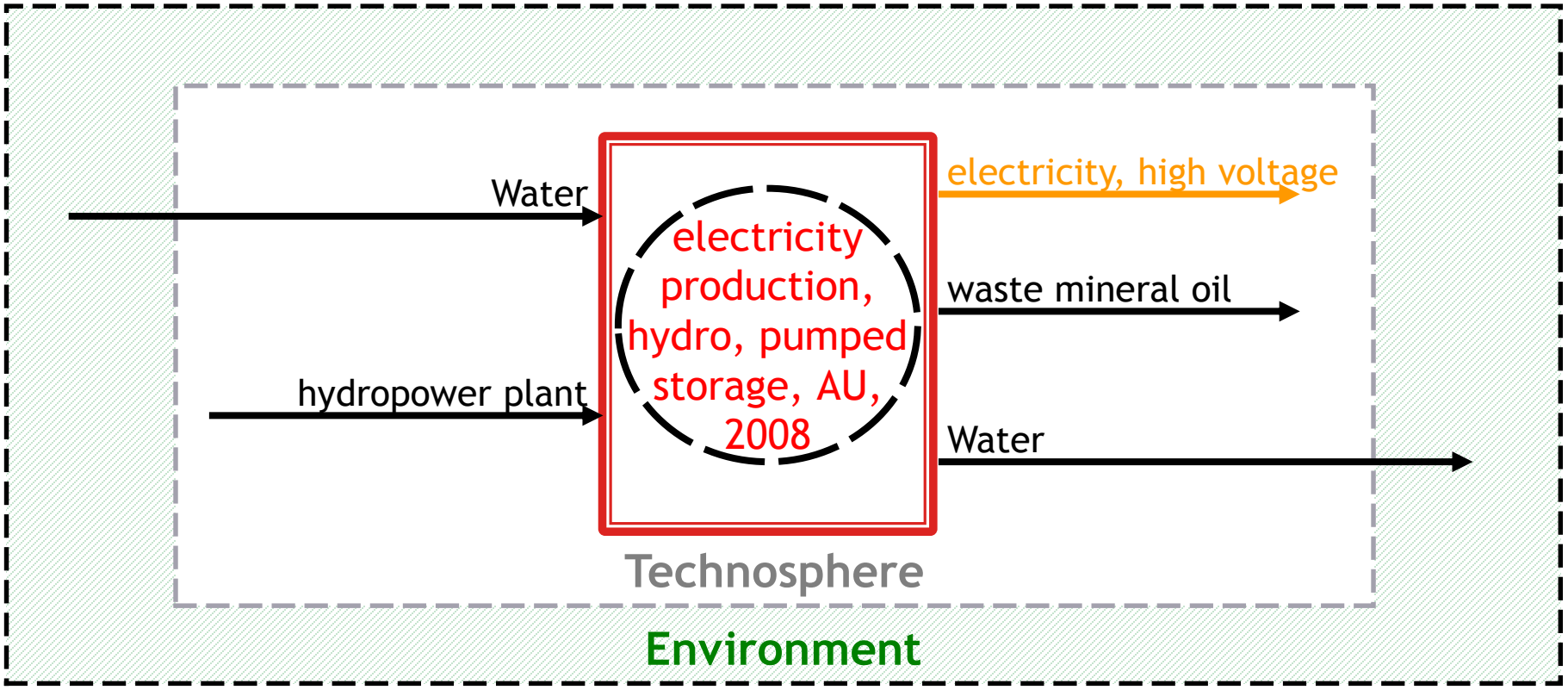
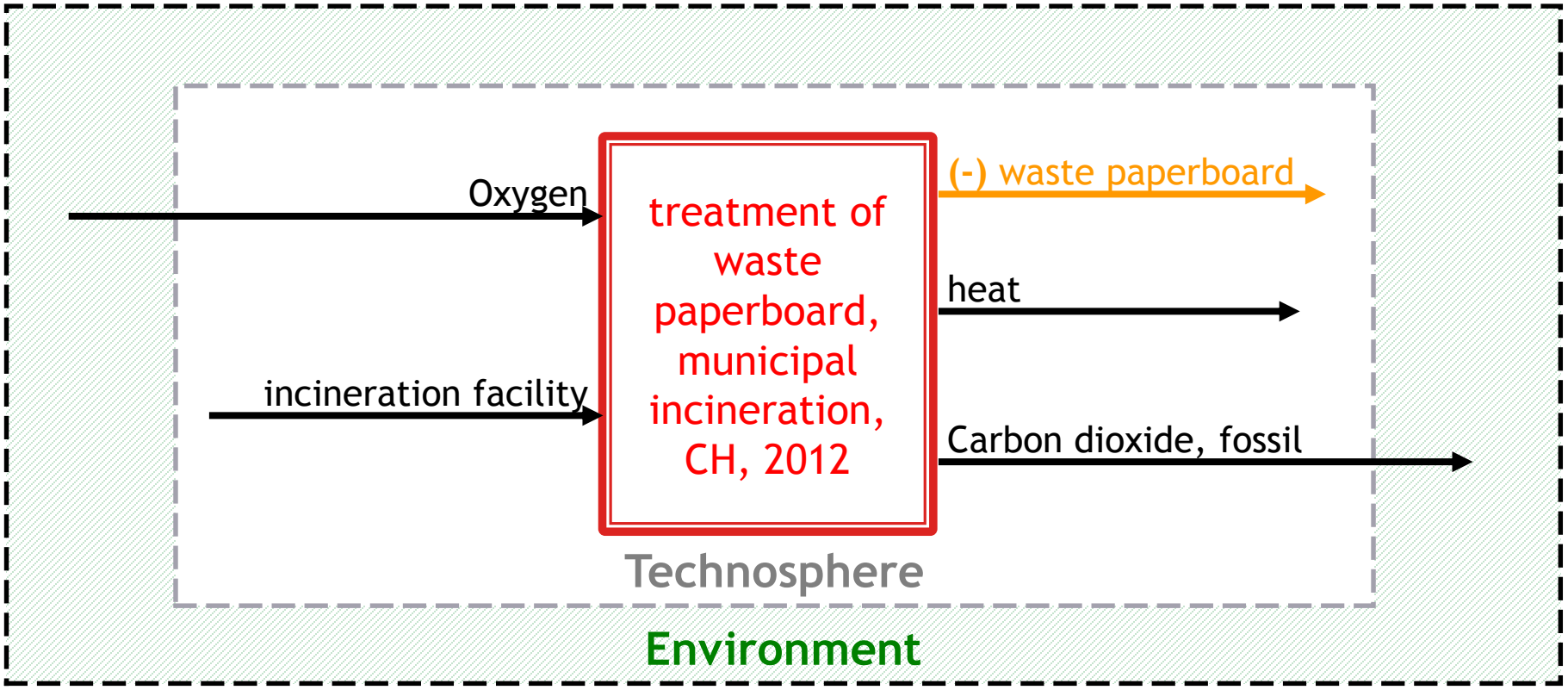


Special type of transforming activity: treatment activities

- A transforming activity with a reference product with a negative sign

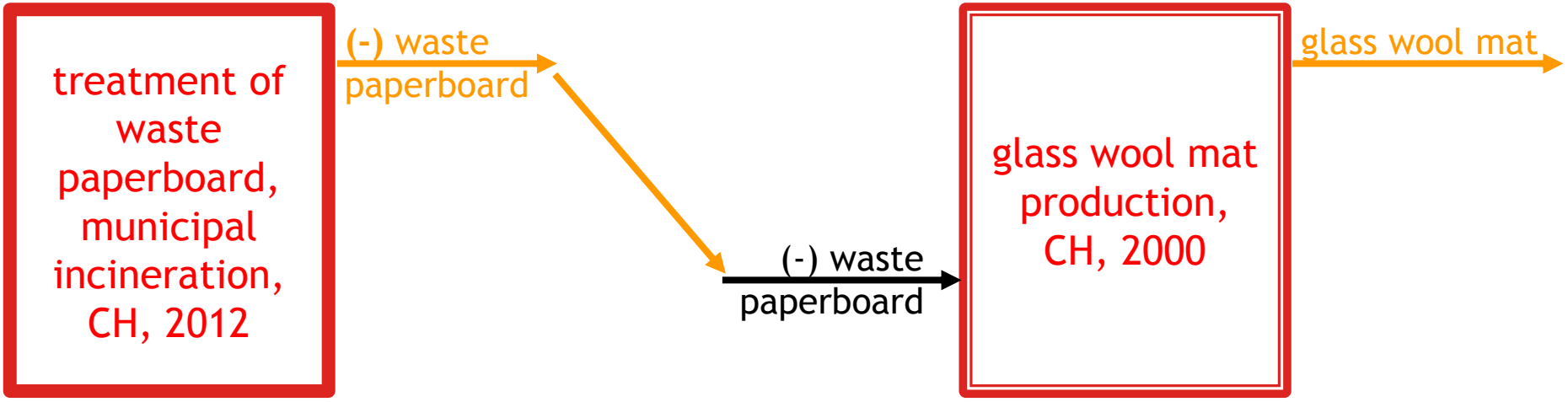


Special type of transforming activity: treatment activities

- A transforming activity with a reference product with a negative sign:
- The activity is supplying the service of treating or disposing of the reference product.

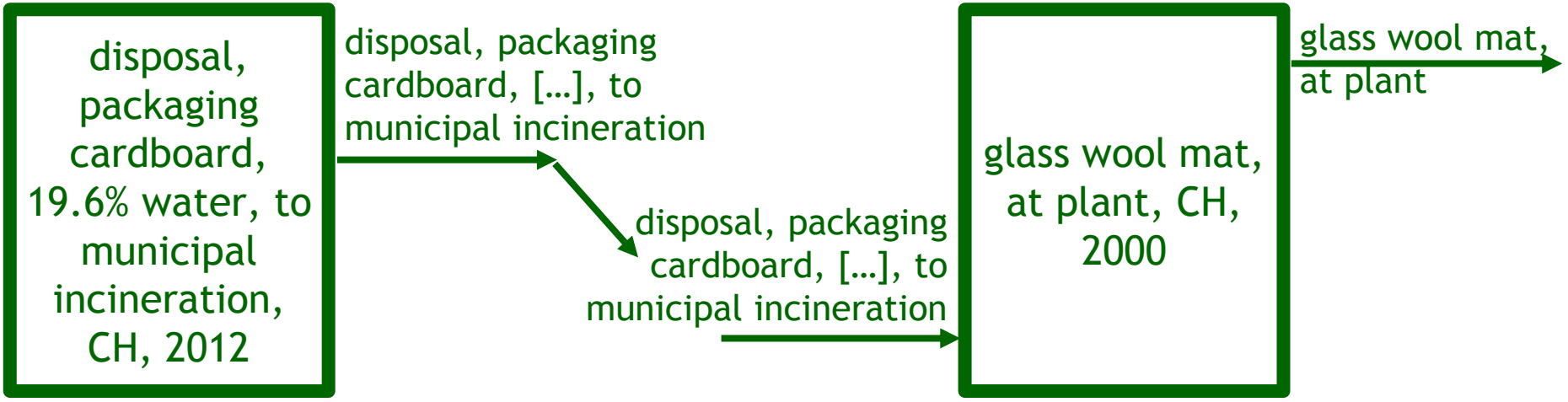
Special type of transforming activity: treatment activities

- The negative sign allows to maintain mass balance.
  - in the waste producing activity
  - in the treatment activity



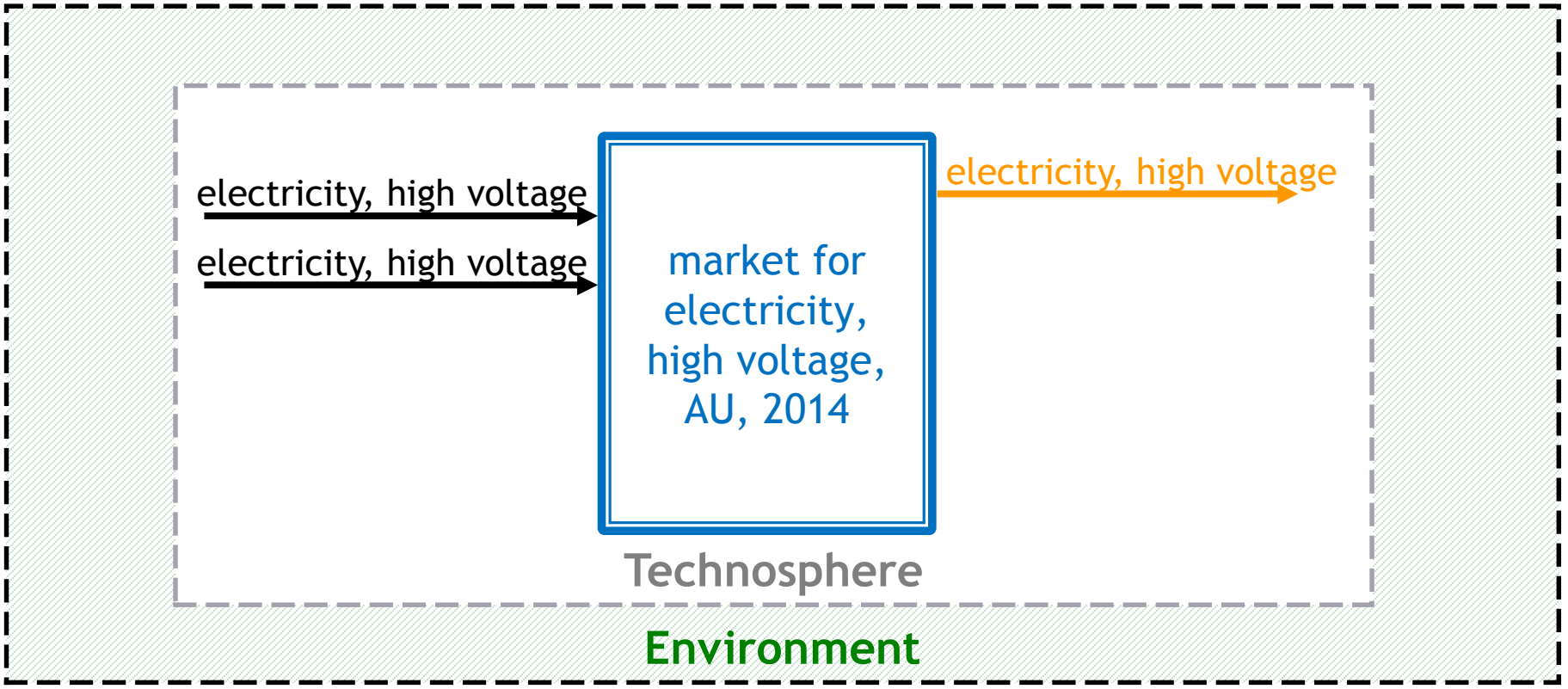
Treatment chains: not so new

- Waste treatment was modeled similarly in v2
- The difference is the sign change, that allows now to maintain mass balance



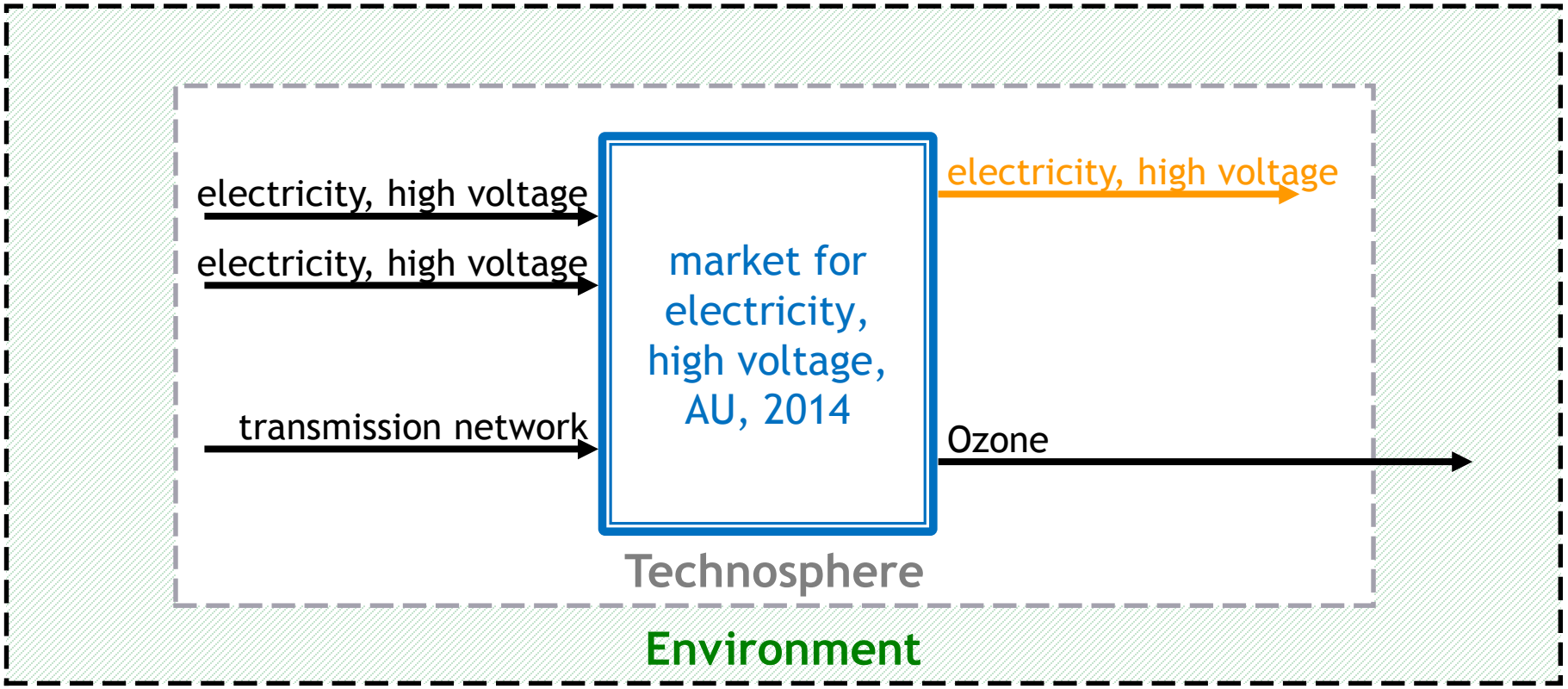
Different types of activities: market activities

- Market activities are consumption mixes.
- They provide products from producing activities to the consuming activities that use them an inputs.



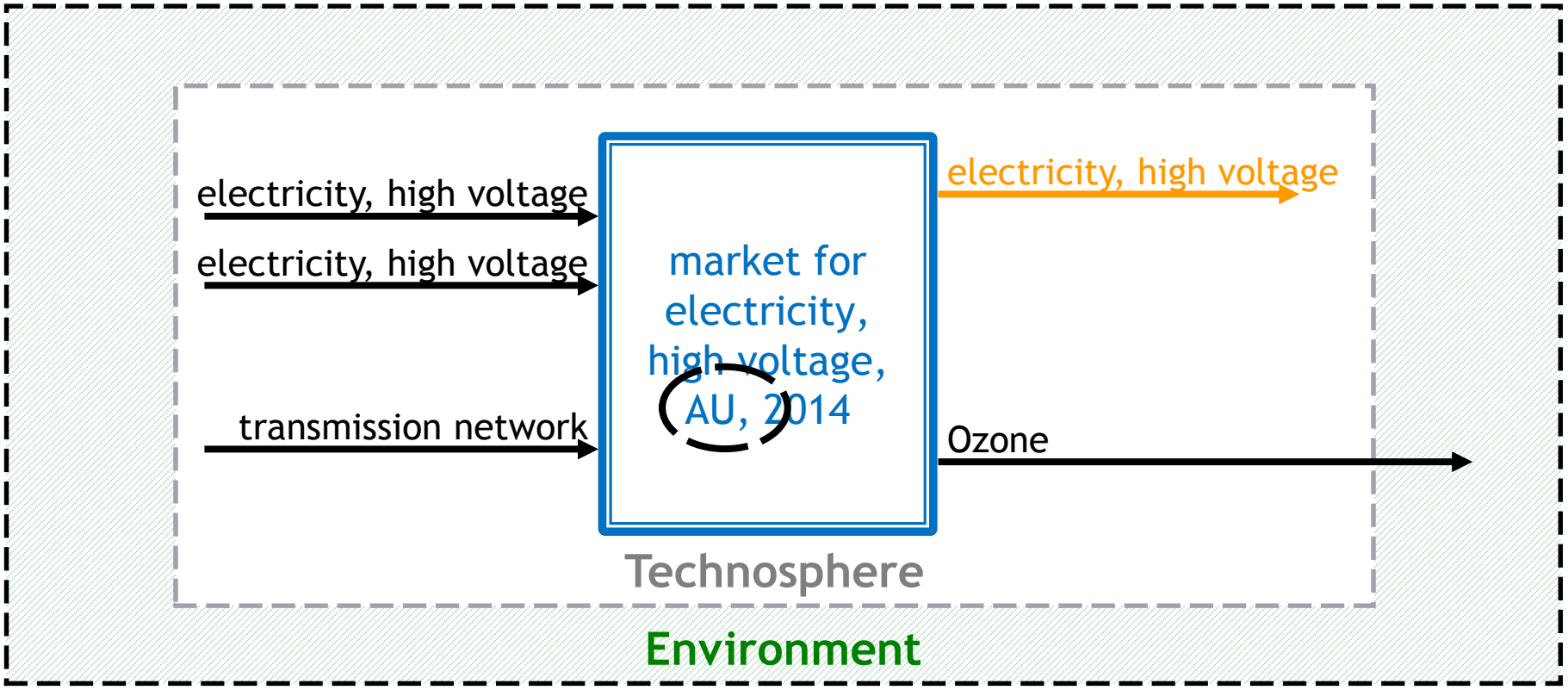
Different types of activities: market activities

- They add information to the consumption mix:
  - Default information relative to the transport of the product
  - Information about losses



Different types of activities: market activities

- Markets for same product can have different geographical localisations



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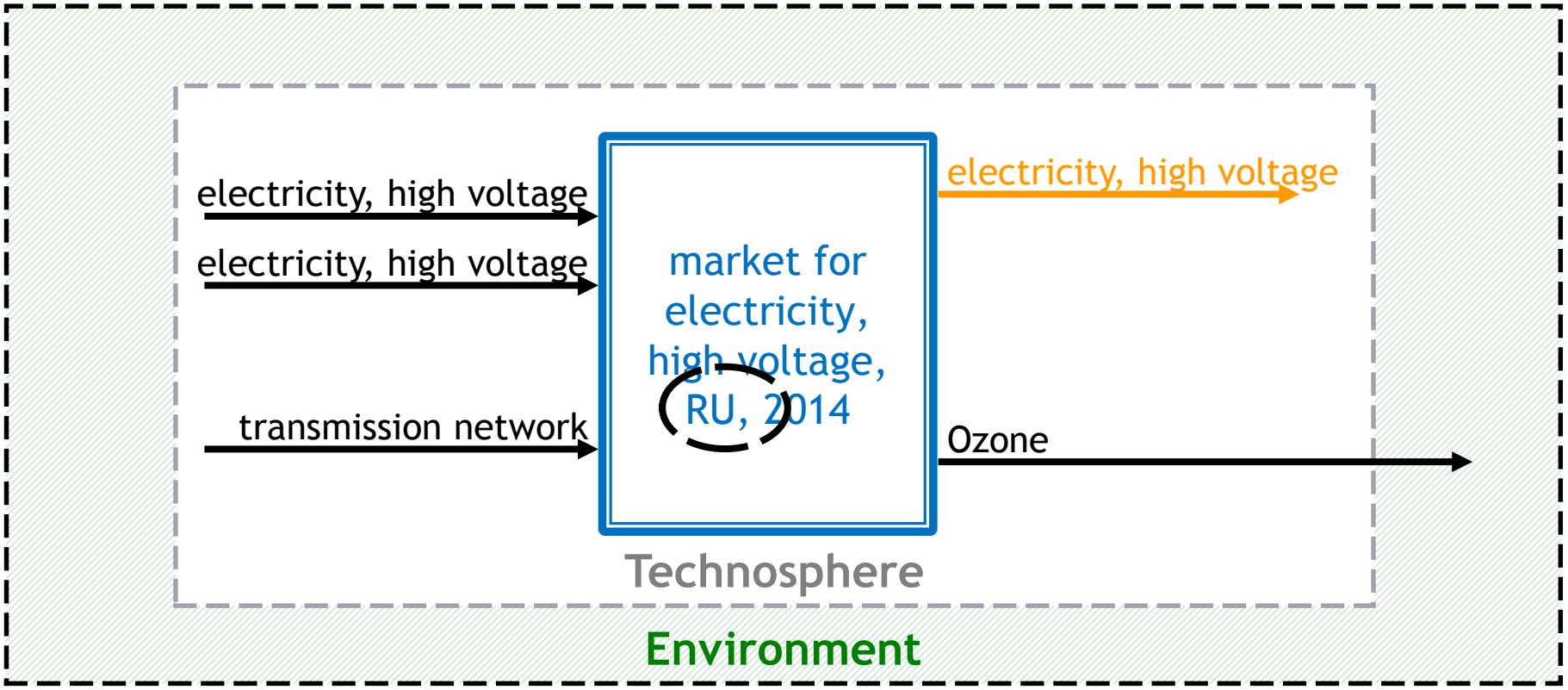
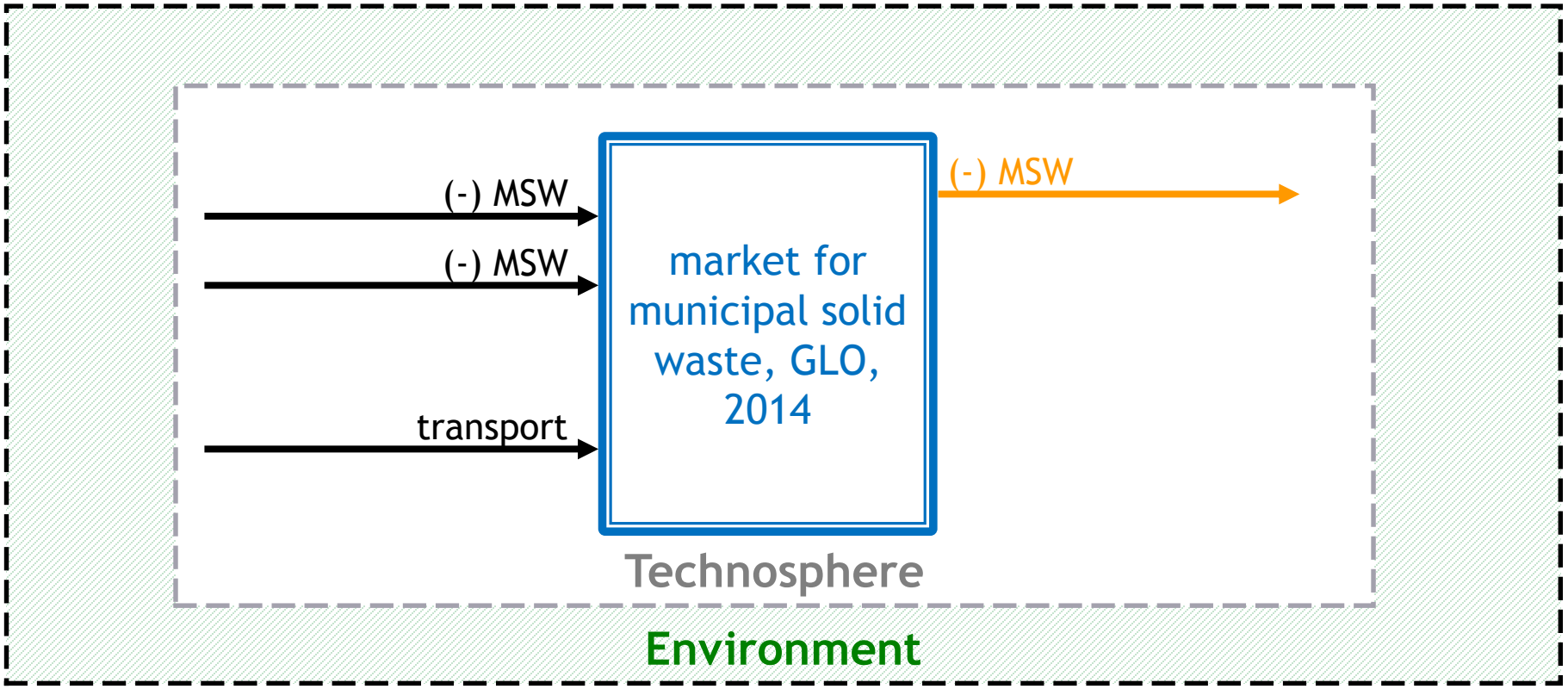
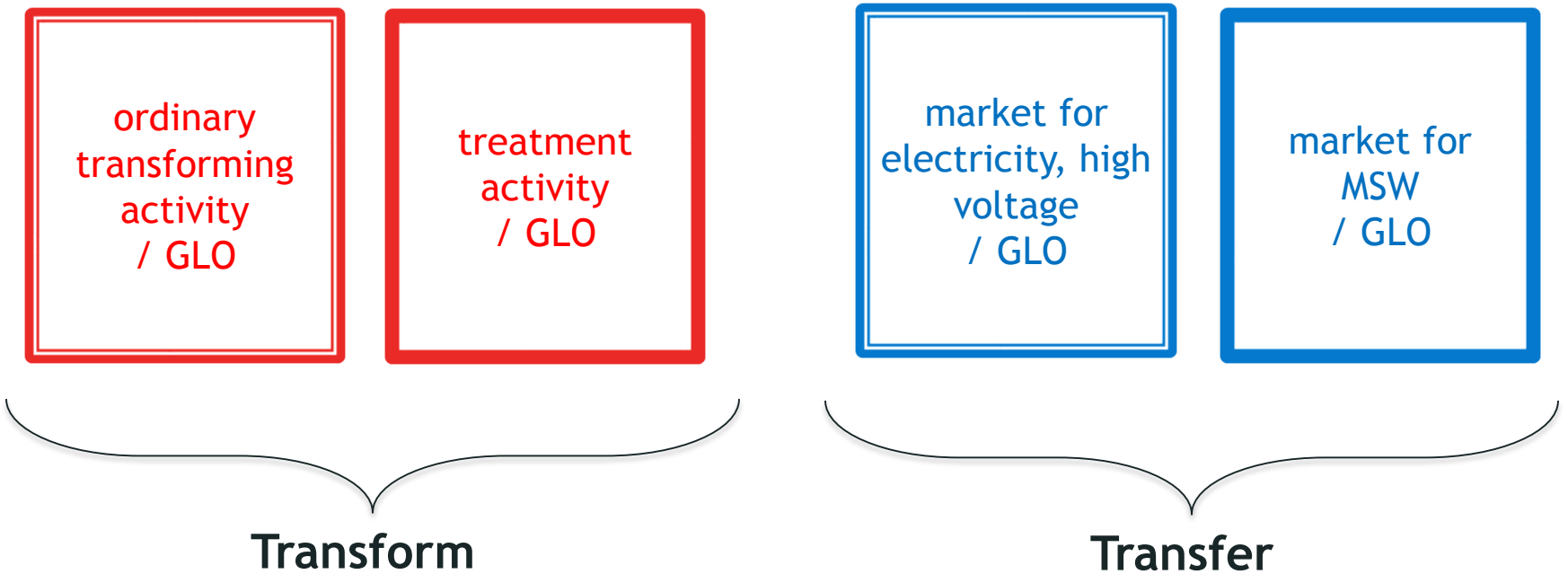


Different types of activities: market activities

- They also exist for wastes:
  - Representing the consumption mix of the waste treatment
  - Bearing as well default transport information



Types of activities: summary



To retain

- Two basic types of activities are present in the database: transforming and market activities.
- Market activities are consumption mixes, where transport information and losses of the product during transport (when relevant) have been added.
- Treatment of waste is modeled like in v2 (entry of disposal in waste producing activities), except that in v3 negative signs allow the maintenance of mass balance in the activities.

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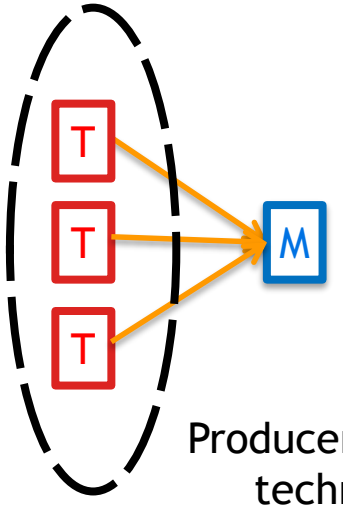
Consistent generation and use of consumption mixes

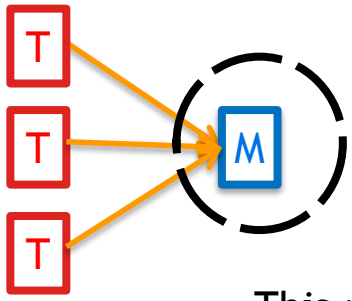
- The transforming activities produce products that supply the markets, depending on their geographical localisation



Producers of the same product (different technologies), in the geographical boundaries of the Market

Consistent generation and use of consumption mixes

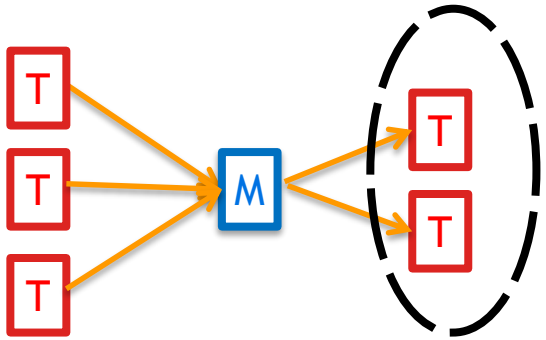
- The transforming activities produce products that supply the markets, depending on their geographical localisation.
  - There exists always at least one GLO market per product, but regional markets do also exist when it is necessary.



This market describes the geographical boundaries around which producing and consuming activities are linked

Consistent generation and use of consumption mixes

- The transforming activities produce products that supply the markets, depending on their geographical localisation.



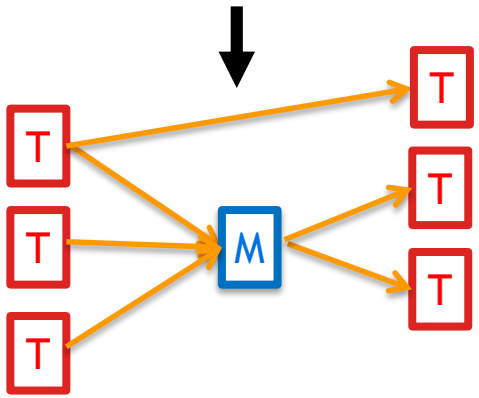
Consumers of the same product, in the geographical boundaries of the Market

- There exists always at least one GLO market per product, but regional markets do also exist when it is necessary.
  - Consuming activities of those products will get their inputs automatically from the markets that better cover their geography.

Consistent generation and use of consumption mixes

- The transforming activities produce products that supply the markets, depending on their geographical localisation.

Direct link between producer and consumer



- There exists always at least one GLO market per product, but regional markets do also exist when it is necessary.
  - Consuming activities of those products will get their inputs automatically from the markets that better cover their geography.

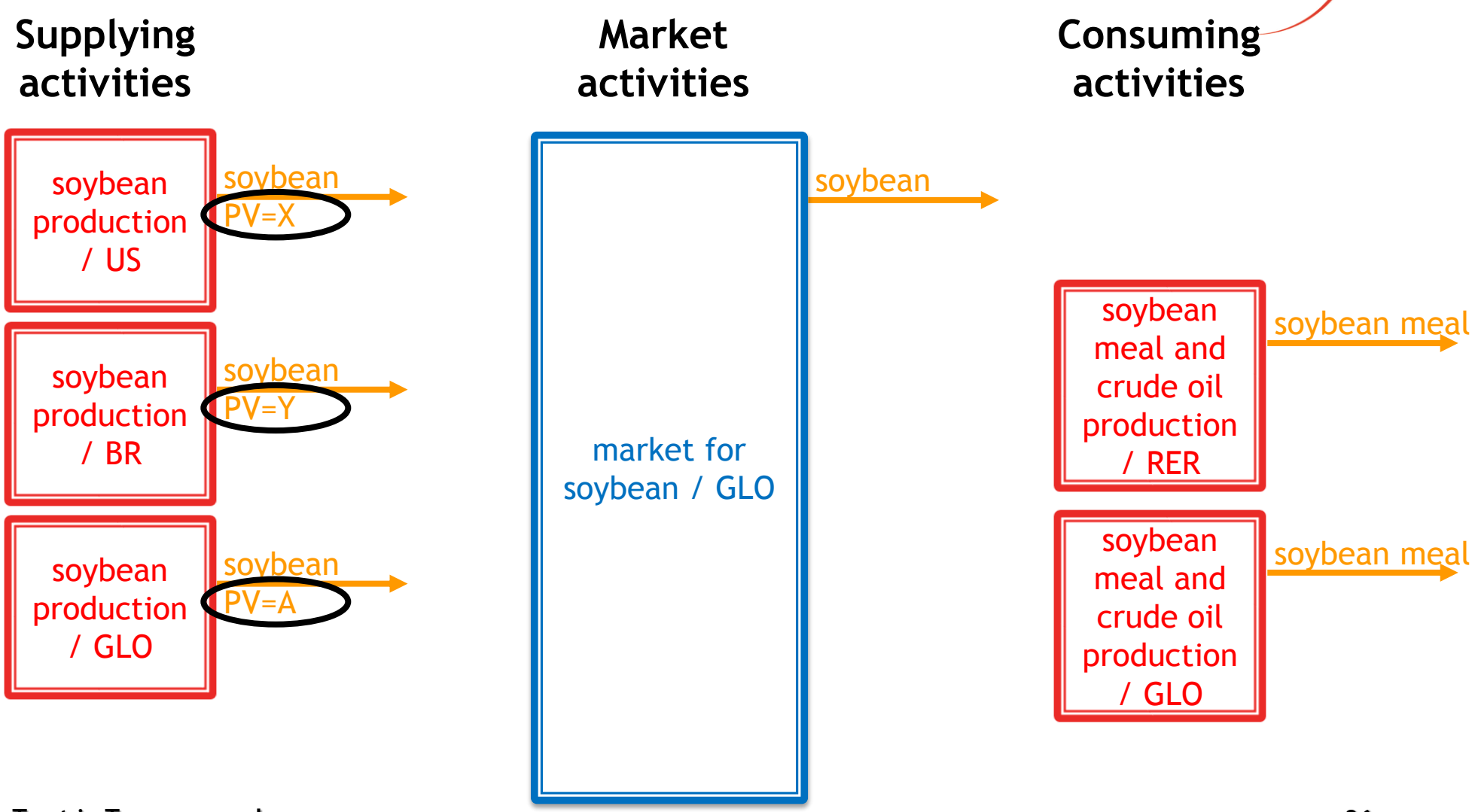
- Direct links to producers can also be used instead of consumption mixes.

Geographical coverage

- Consumption mix supply and use is automatically established, based on geographical localisation of Markets, supplying and consuming activities

- Geographical coverage has been completed throught the introduction of GLO DS
  - Each transforming activity has a GLO counterpart
  - Each product has at least a GLO market

Example: supply and use of the consumption mix



Visualization: production volumes in ecoQuery

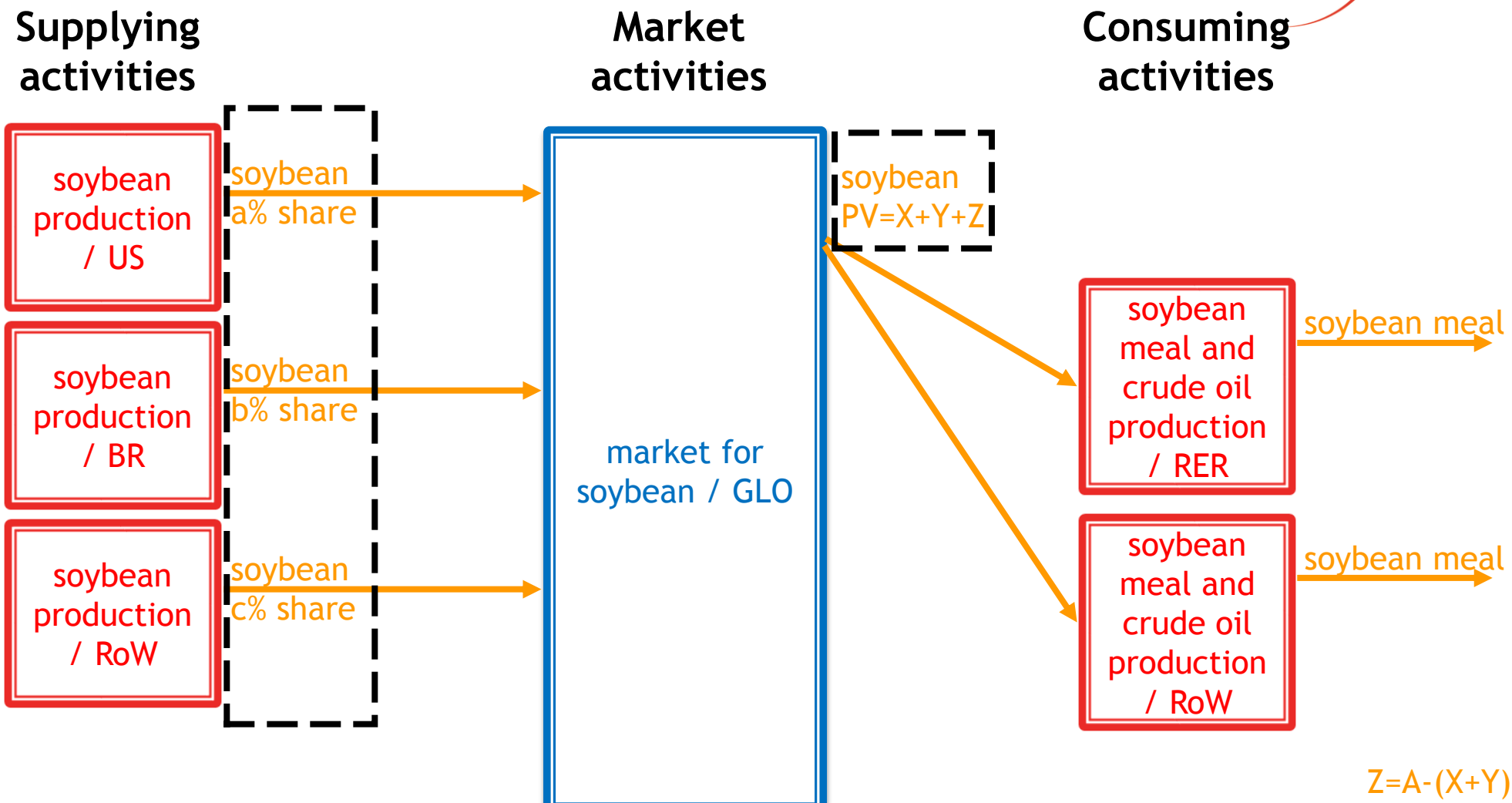
- Production volumes have been added for each product

Unit Process Exchanges	soybean production, BR			
Name	**Amount**	**Unit**	**Uncertainty**	**SD**
Reference Products				
– soybean	1	kg		

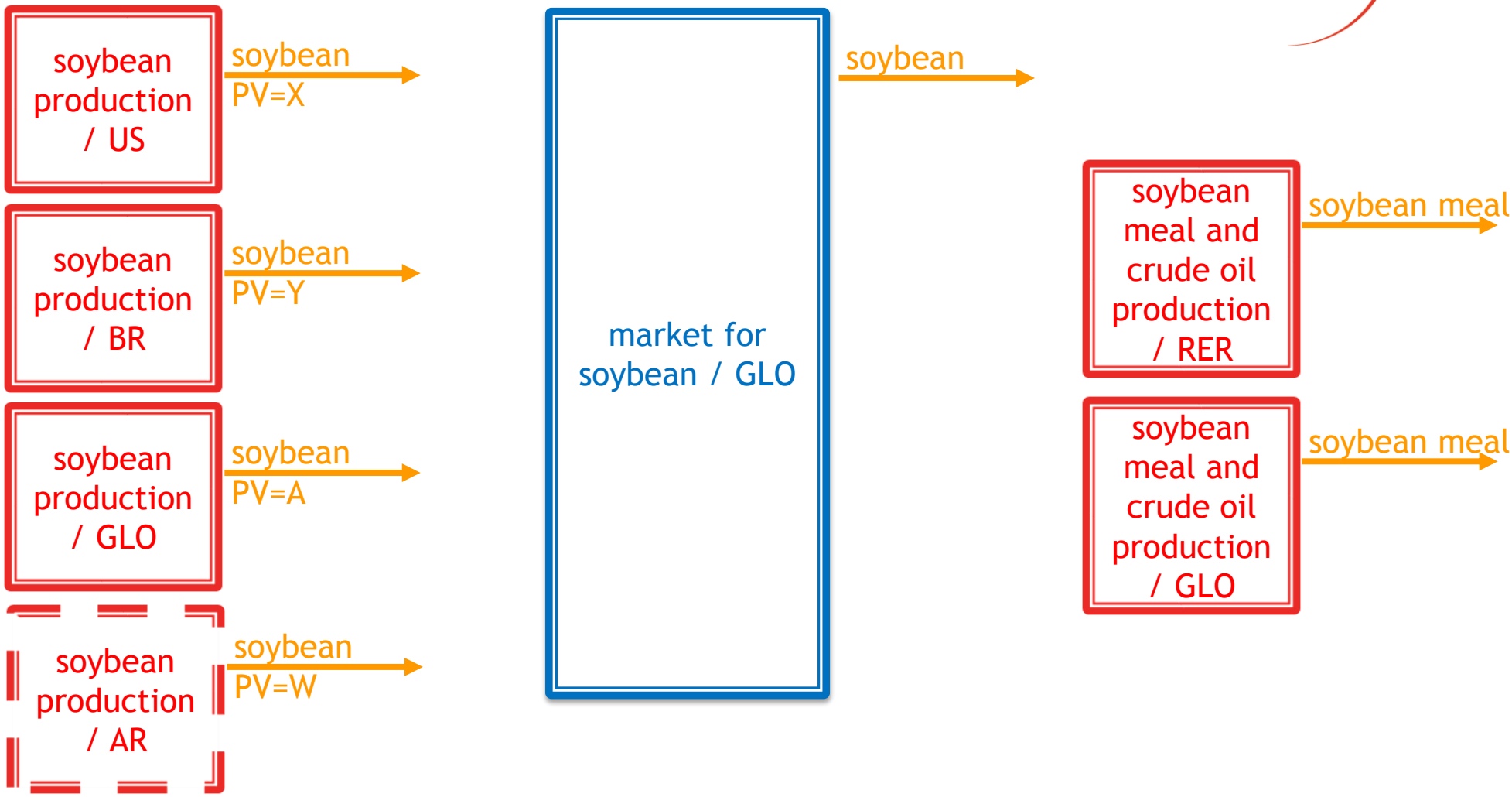
Page Numbers		Annual Production Volume	26816331786,5
Production Volume Variable Name		Production Volume Mathematical Relation	55234463000*(1-0.5145)
Production Volume Comment	Total production in Brazill is around 55 million tons. In a 20 year perspective (1190-2009) roughly 49% are produced on existing stock, i.e. without any land use changes.	Specific Allocation Property	

https://ecoquery.ecoinvent.org

Example: supply and use of the consumption mix



Actualisation is done automatically



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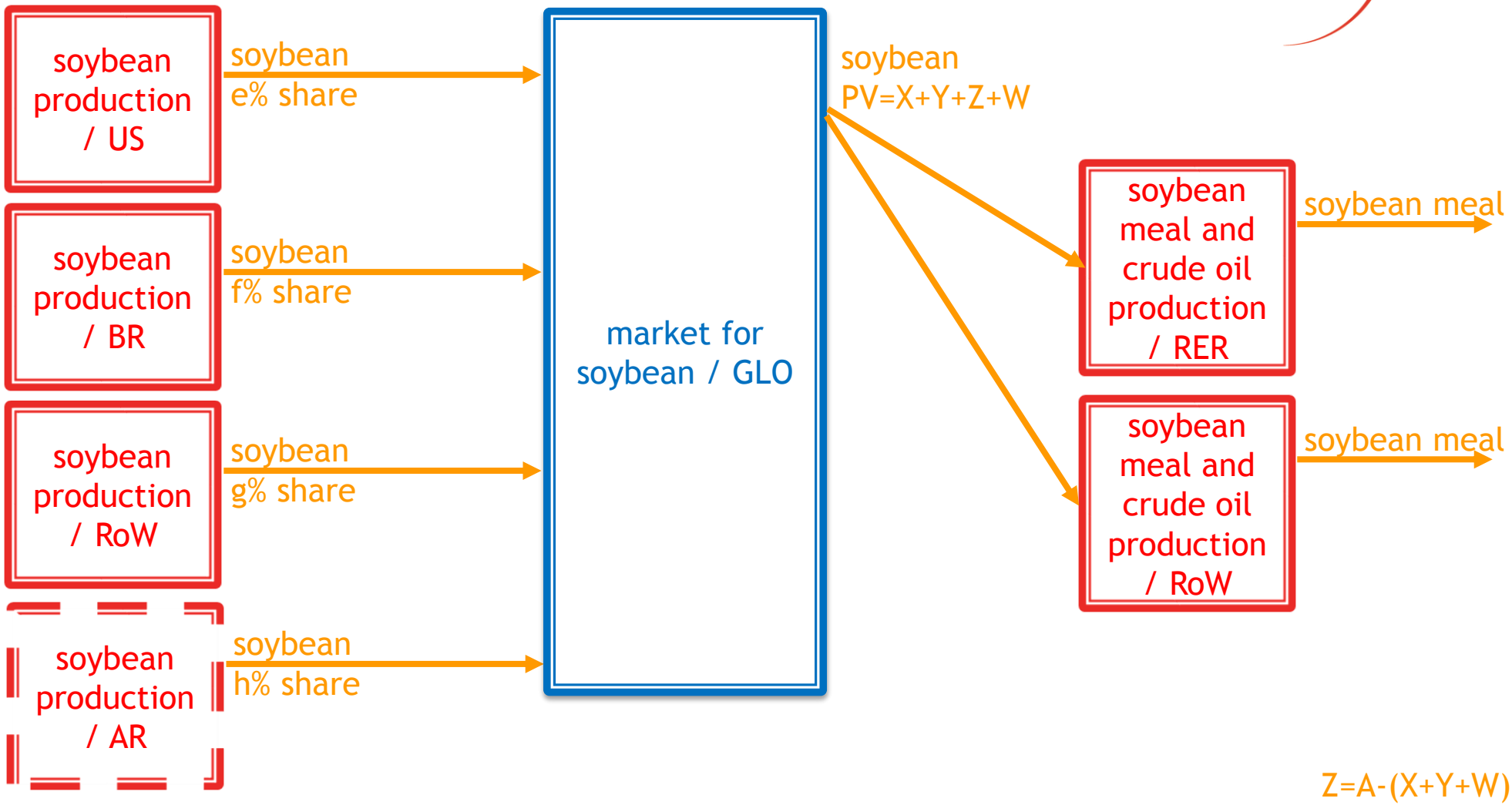
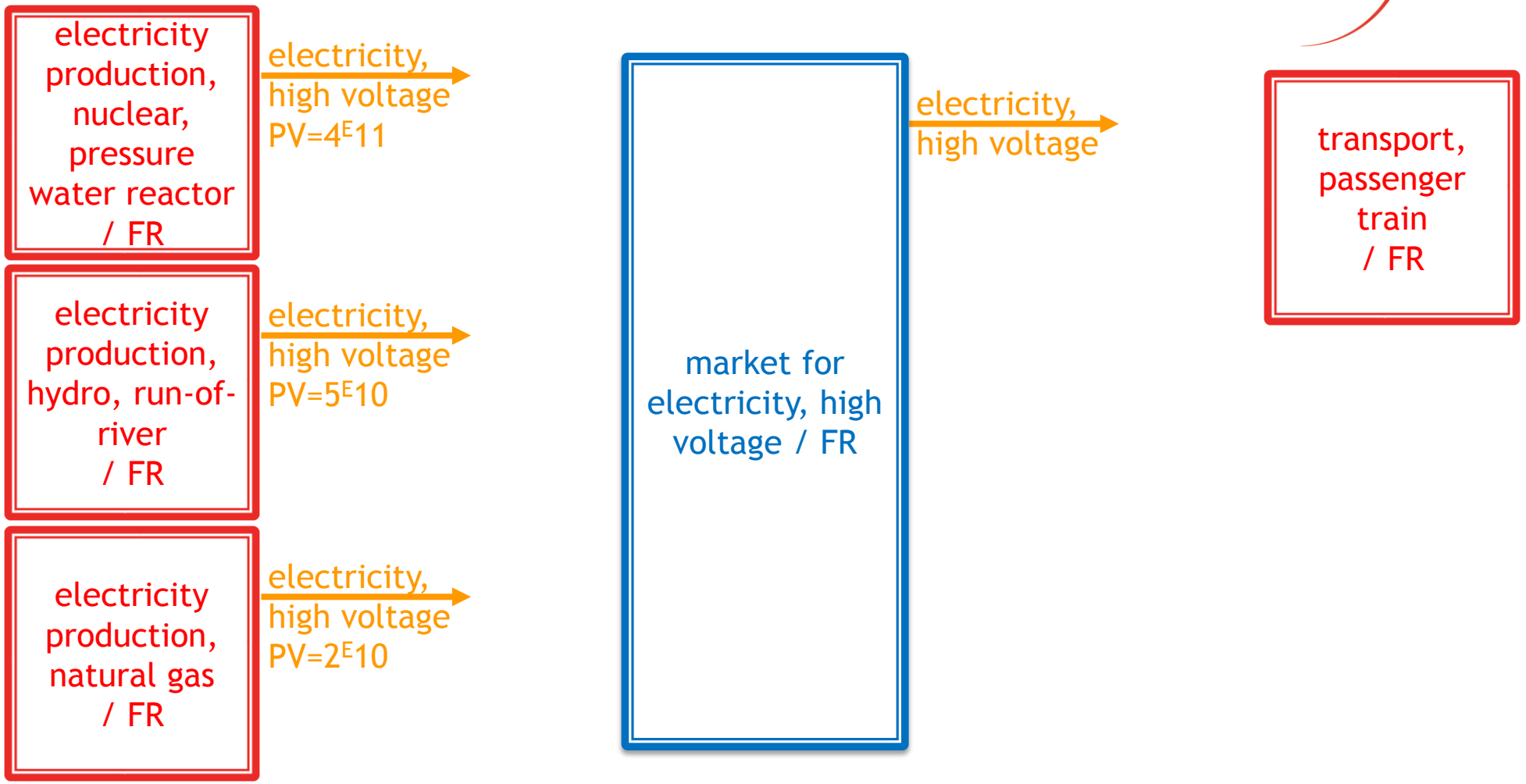
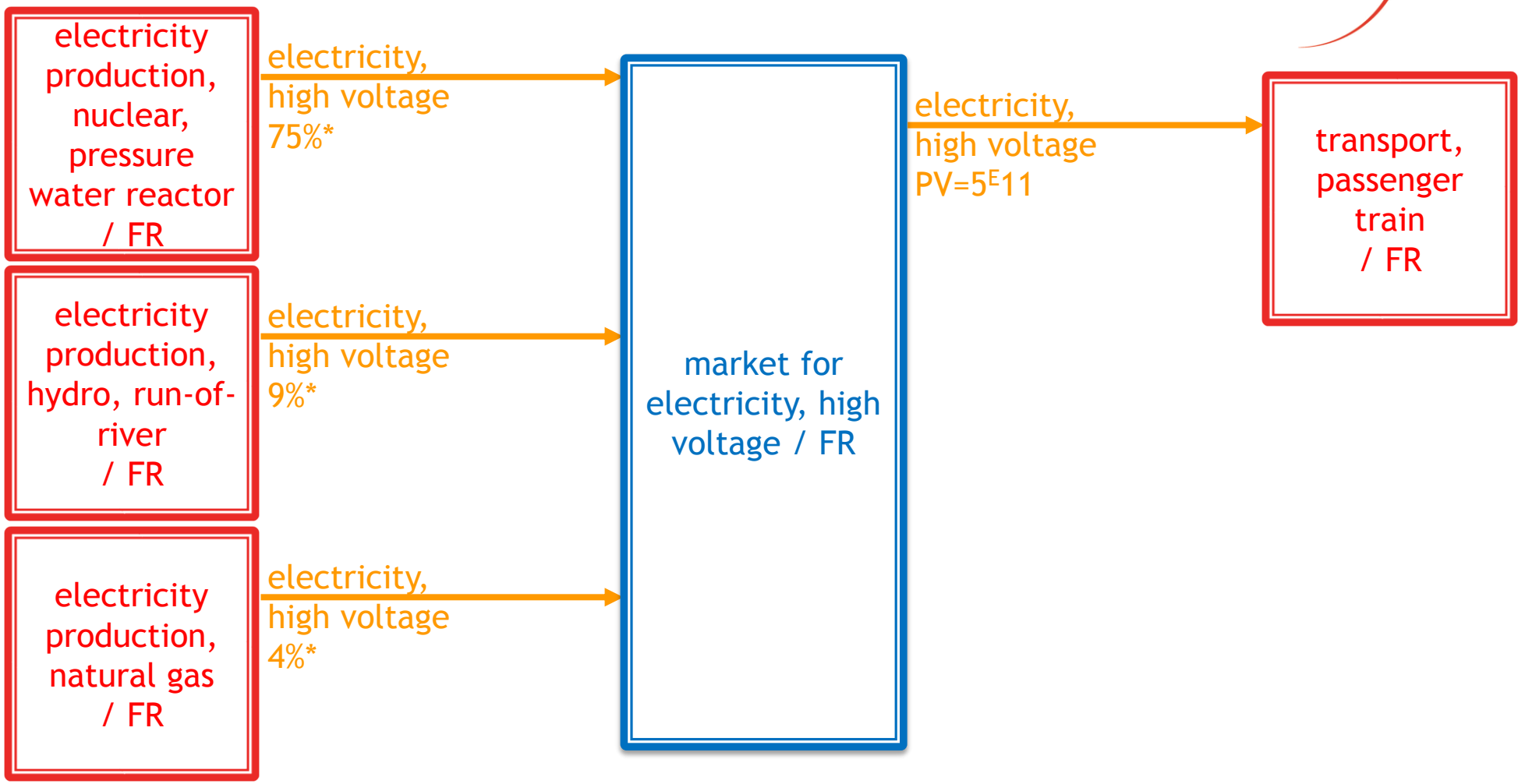


Example: different technologies

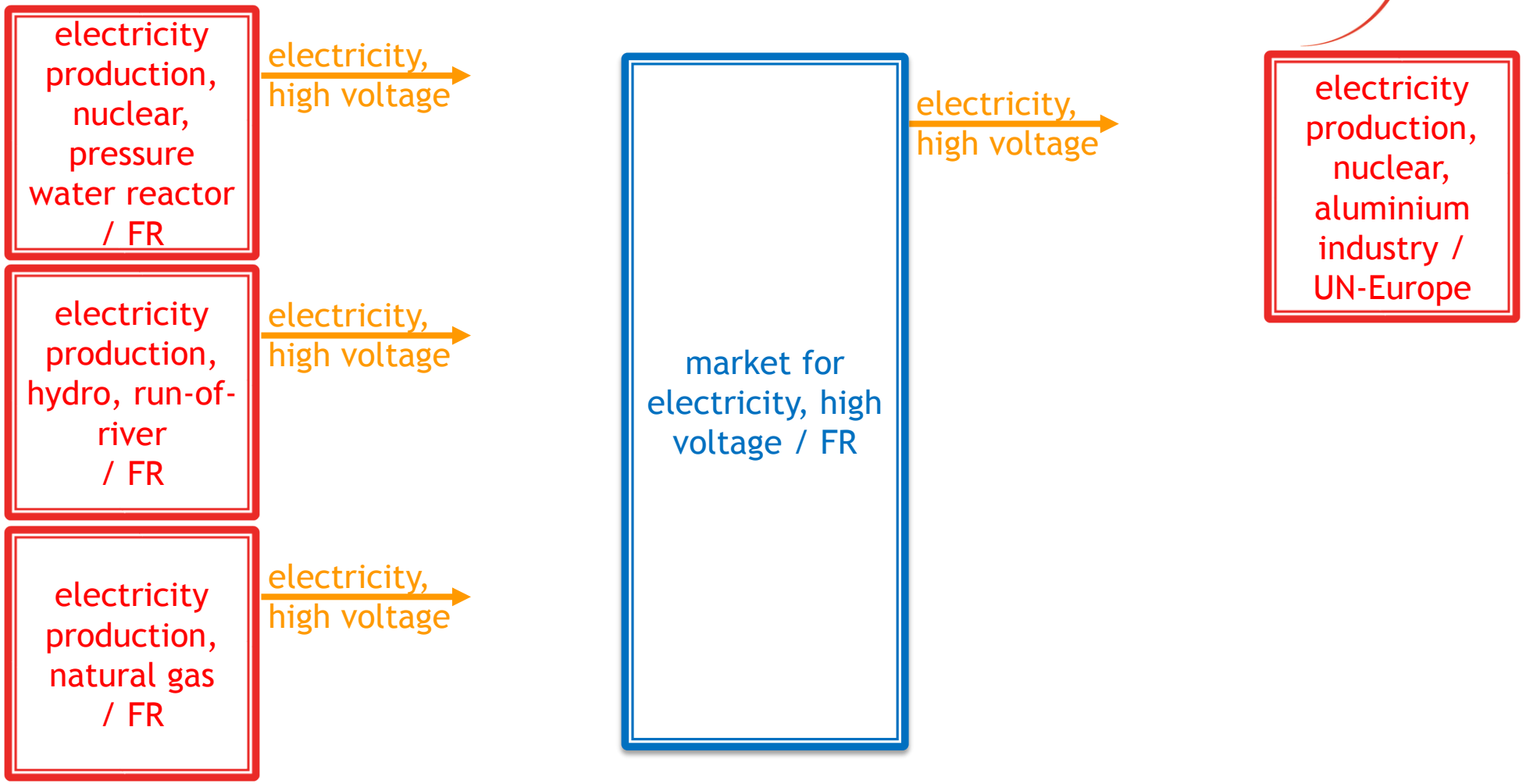


Example: different technologies

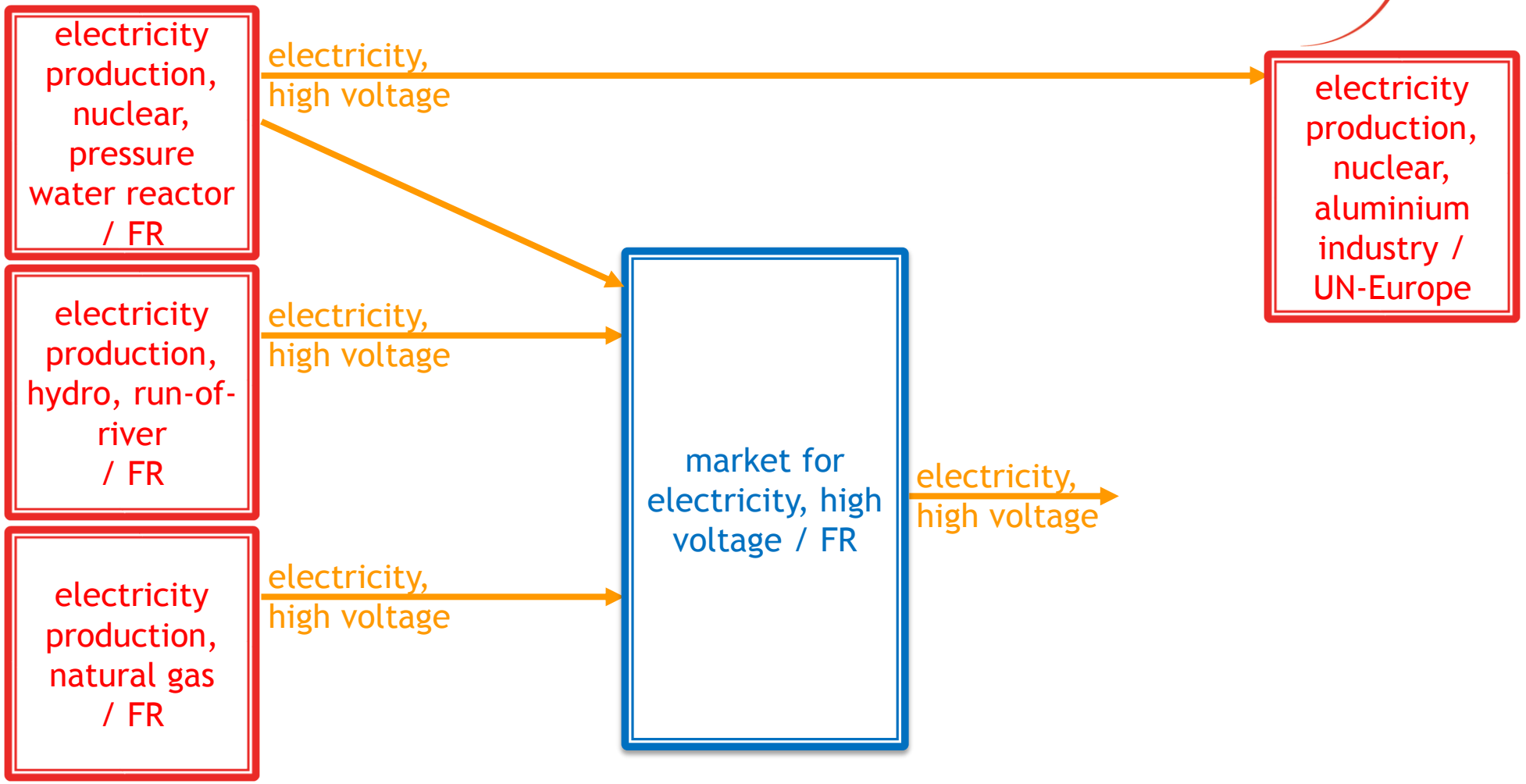


*Consider there are other suppliers to the market, so addition is not up to 100% in this example

Use of direct links to overcome markets



Use of direct links to overcome markets



You have the choice!

- As user, you can always choose between the outcome of the supplying activities or the consumption mix

Search: barley grain

#		Name	Reference Product	Loc.	Time Period
6	☐	barley production	barley grain [kg]	DE	01.01.2000 - 31.12.2004
7	☐	barley production	barley grain [kg]	ES	01.01.2000 - 31.12.2004
8	☐	barley production	barley grain [kg]	FR	01.01.2000 - 31.12.2004
9	☐	barley production	barley grain [kg]	GLO	01.01.2000 - 31.12.2004
16	☐	market for barley grain	barley grain [kg]	GLO	01.01.2011 - 31.12.2011

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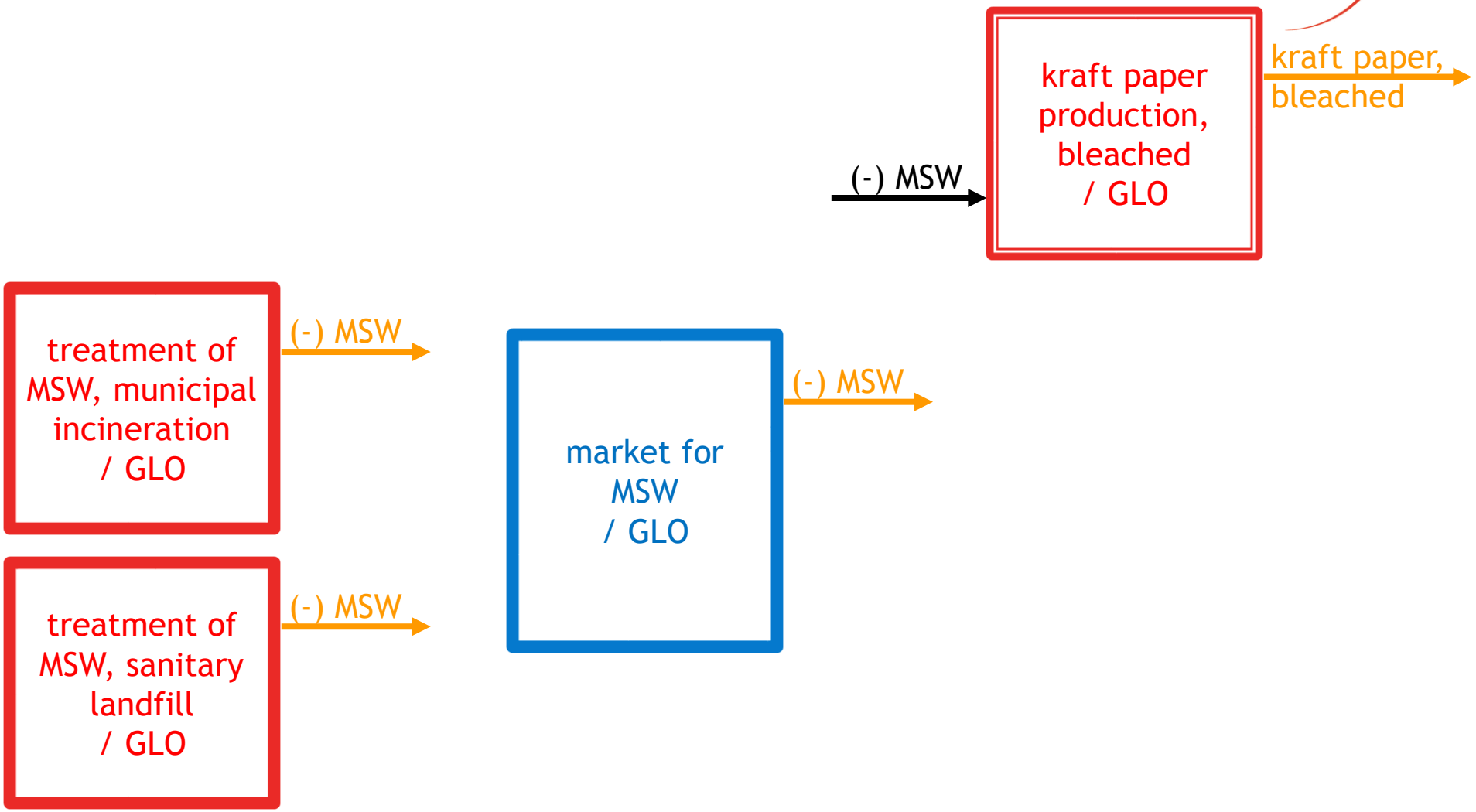
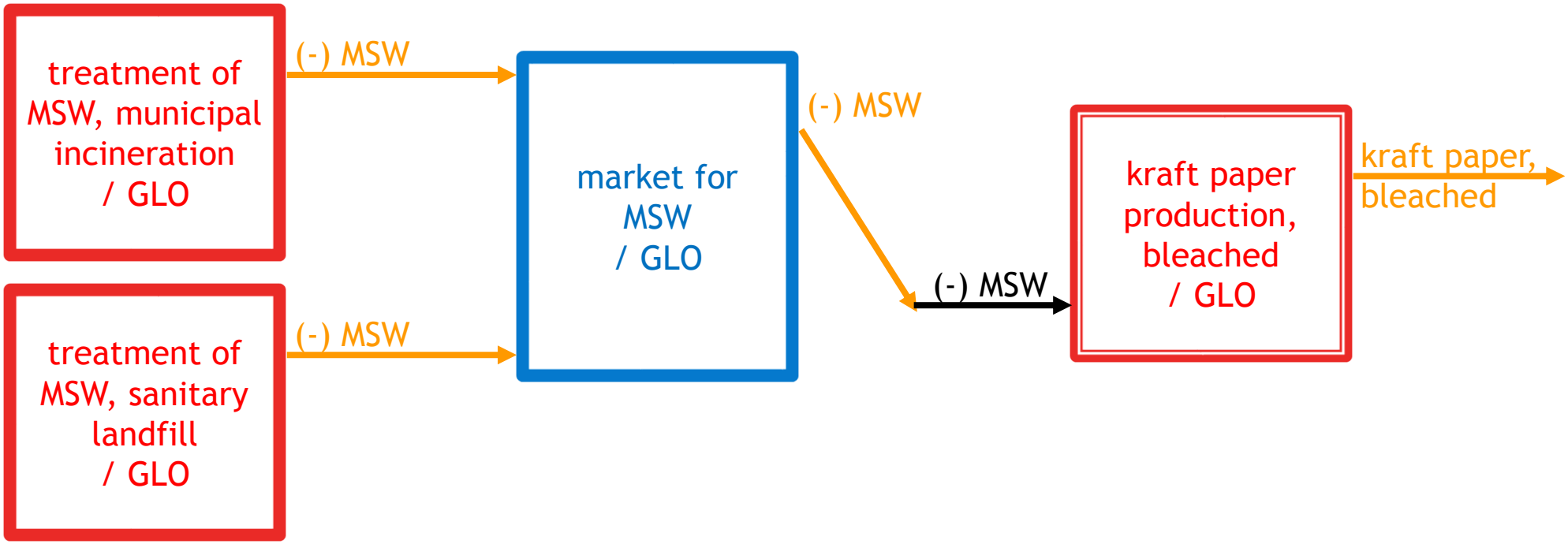
Generation of consumption mixes of wastes



Generation of consumption mixes of wastes

- Consumption mix (**market**) generation and use follow same rules as described:
  - based on geography
  - based on product name (different technologies, same market)
  - using production volumes to define market shares



To retain

- Markets link together producing and consuming activities in the geographical boundaries they (the market) describe
- As user, you can always choose between the outcome of the supplying activities or the consumption mix (market)
- Treatment of waste is done as in version 2, but with the added consistency of maintaining mass balance through the introduction of negative signs

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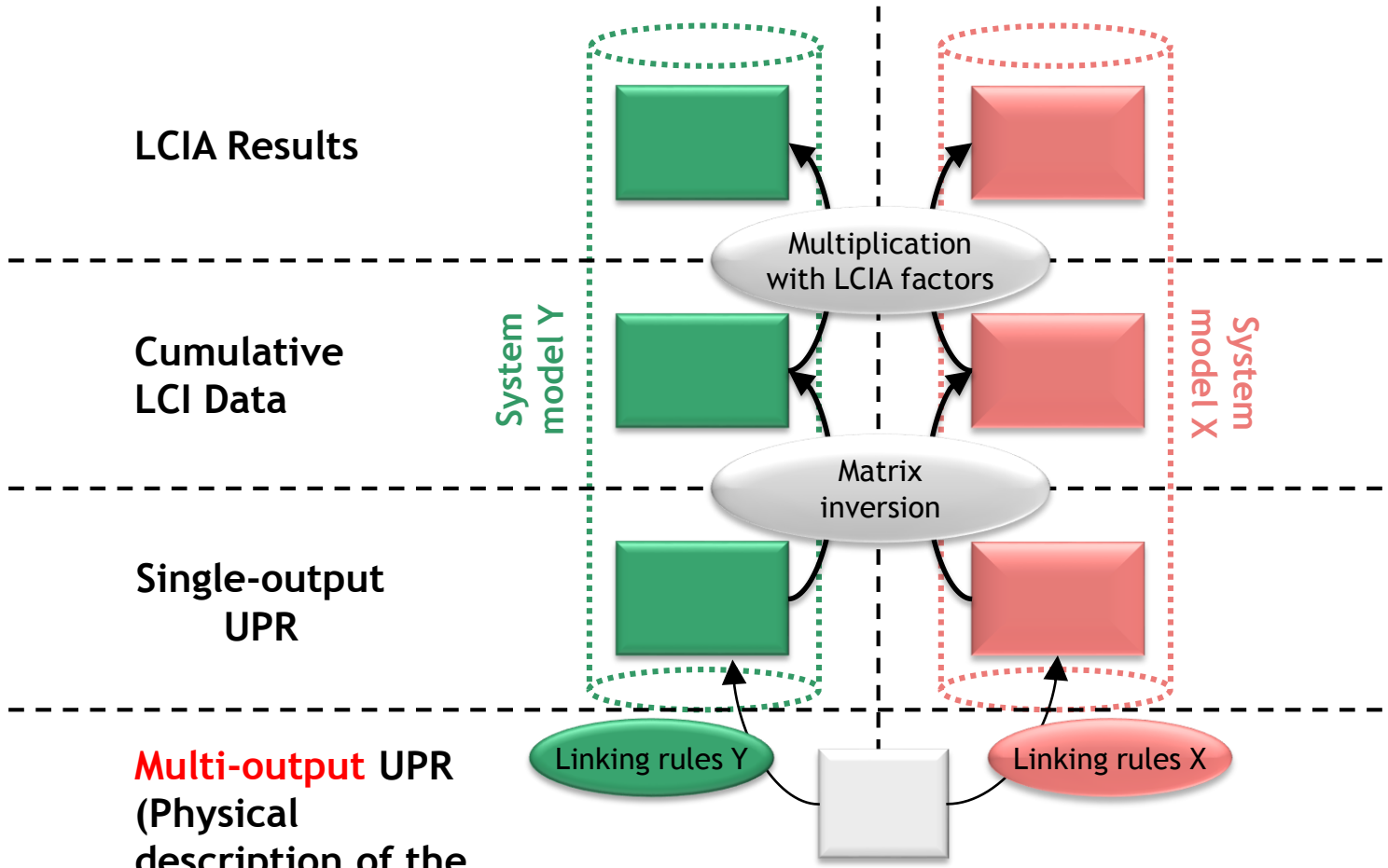
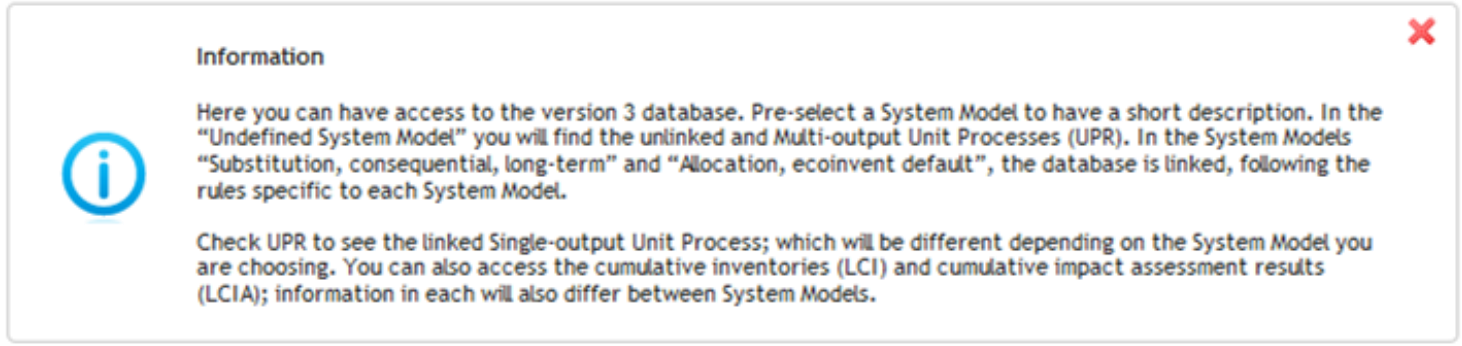
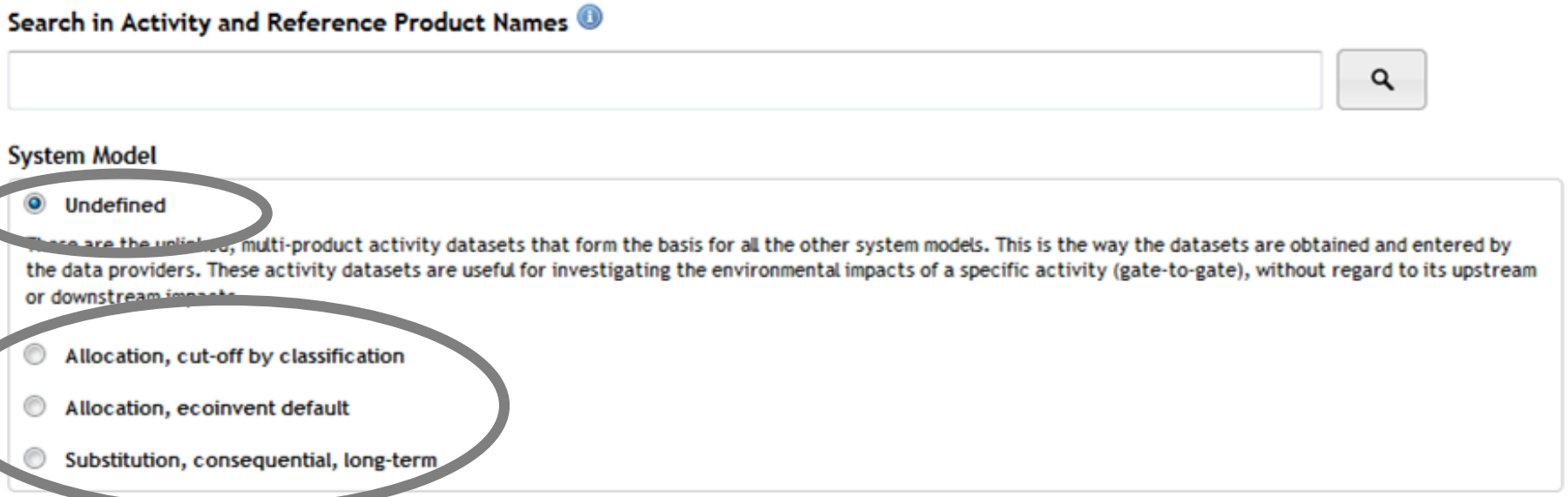
Same undefined DS, different results



Visualization: the database in ecoQuery



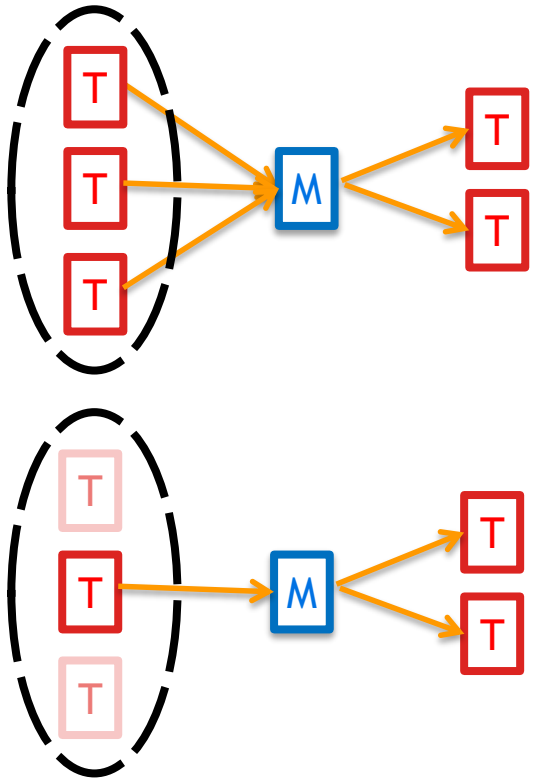


https://ecoquery.ecoinvent.org

Two important differences between System Models

- **How to deal with by-products**
  - Allocation
    - Allocation, cut-off by classification
    - Allocation, ecoinvent default
  - Substitution (system expansion)
    - Substitution, consequential, long-term

- **Which producers supply the consumption mix**
  - Average suppliers
    - Allocation, cut-off by classification
    - Allocation, ecoinvent default
  - Marginal suppliers (unconstrained suppliers)
    - Substitution, consequential, long-term



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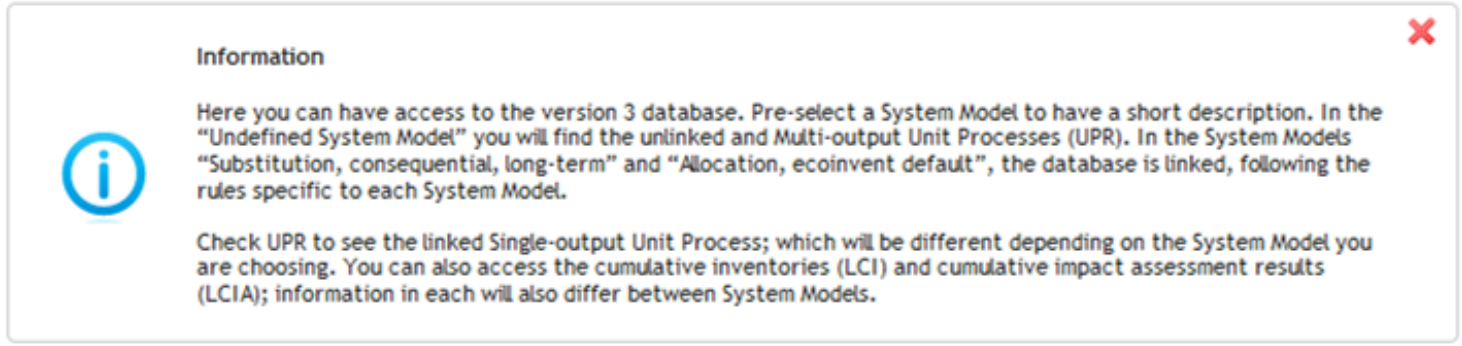

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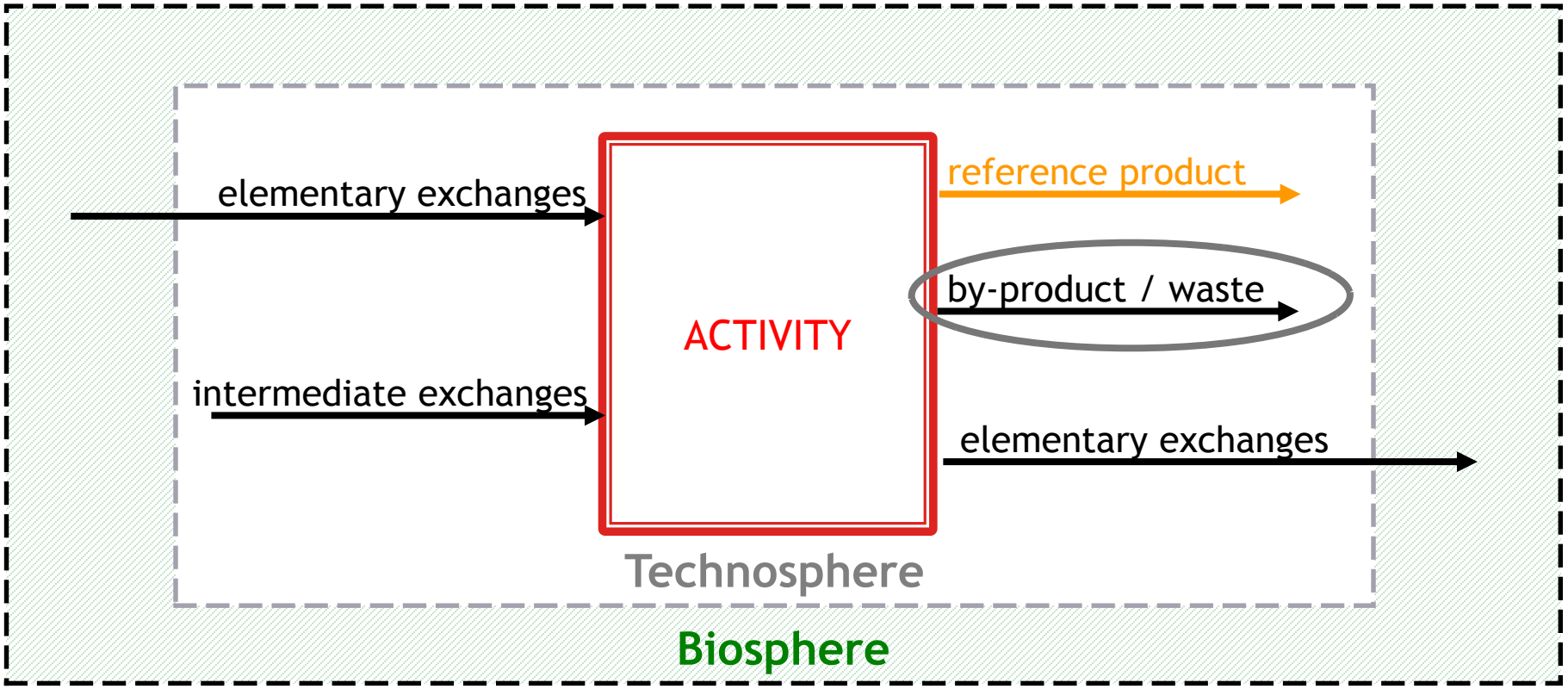
Dealing with by-products in v2

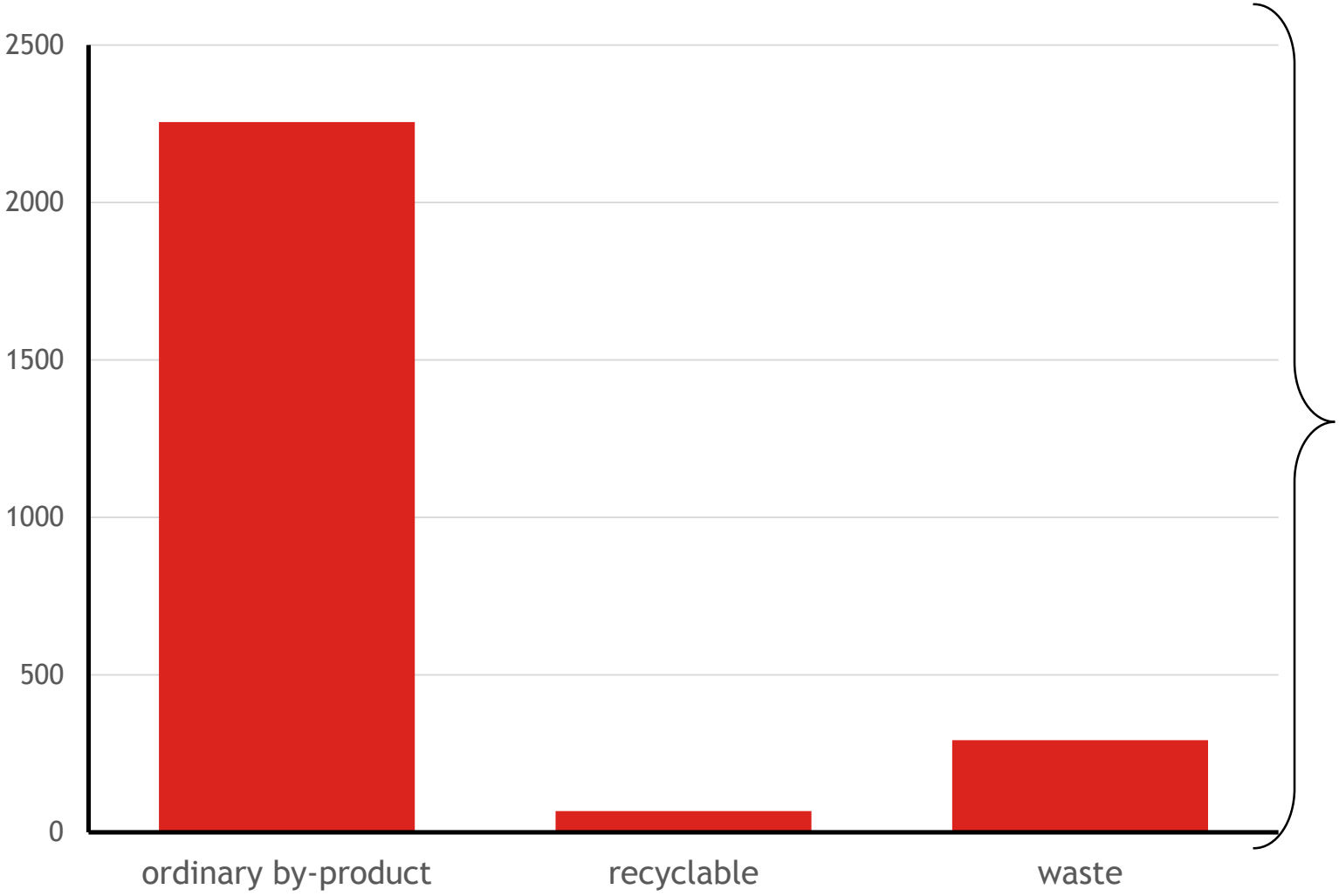
- By-products were classified (informally) in 3 different classes:
  - By-product: allocated as a co-product
  - Recyclable material: cut off (recycled content method), simply not listed in datasets
  - Waste: did not exist as a by-product, but as a “product of treatment service” as an input
- Any by-products of treatment usually cut off
- Problems
  - Boundaries between the different classes not clearly defined
  - Transparency lost due to missing flows
  - Mass balances not possible (service inputs have the wrong sign)

«Allocation, cut-off by classification» System Model

- No cut-off within activity in v3
- All co-products are considered in the activities (completeness)
- Allocation: Physical or Economical

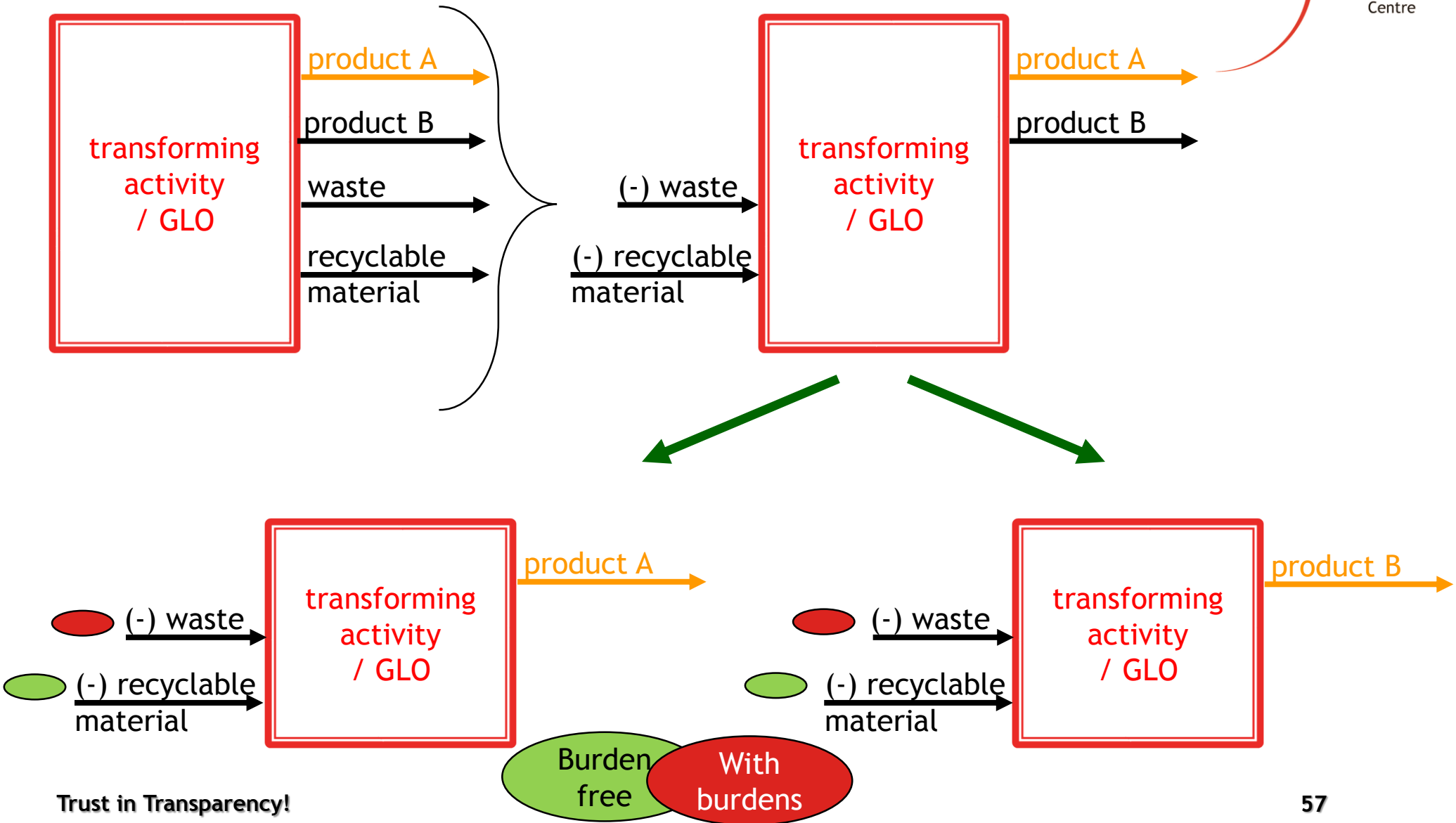


«Allocation, cut-off by classification» System Model

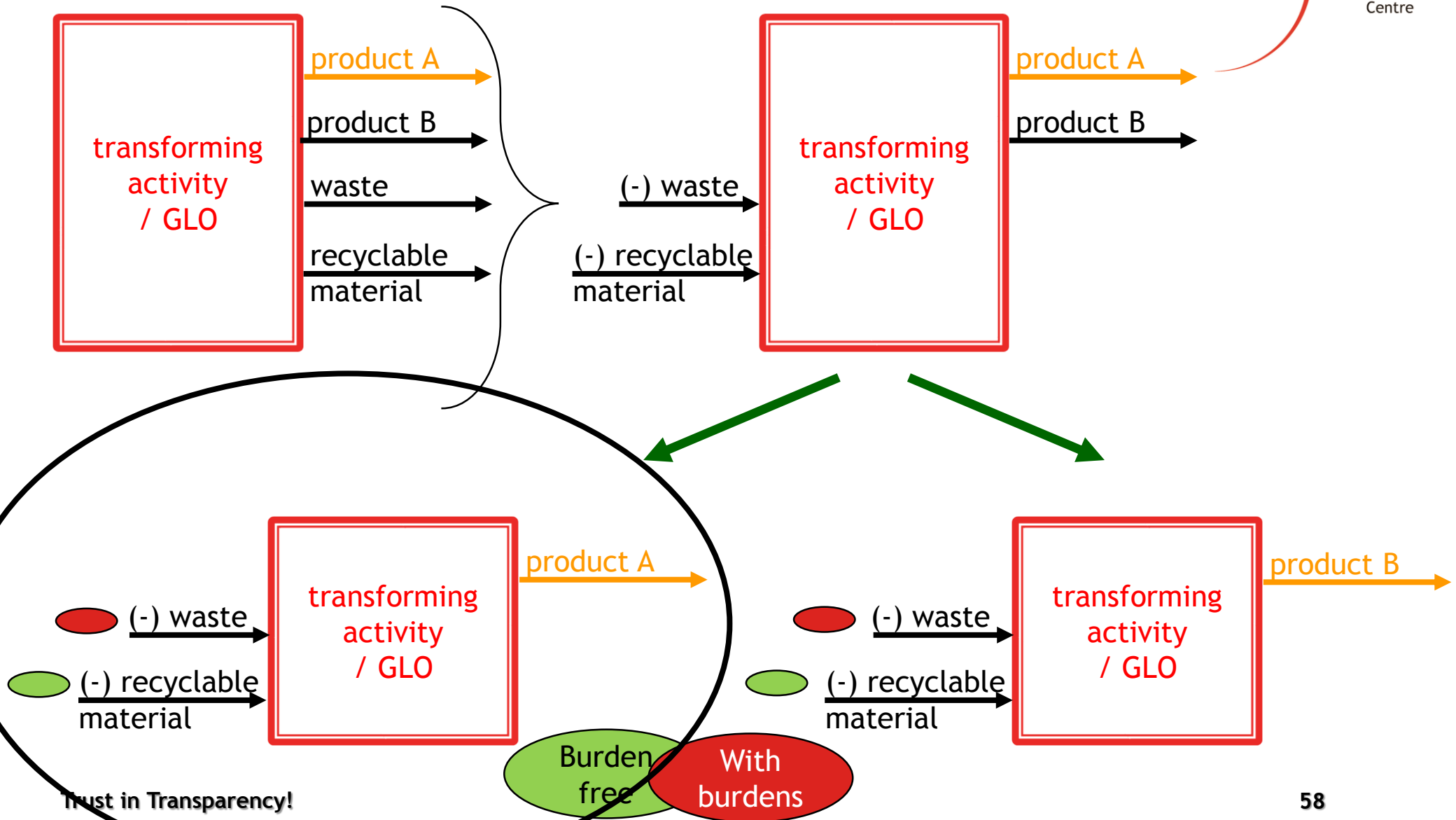


This product-level classification determines **how the by-product is allocated in the cut-off System Model**

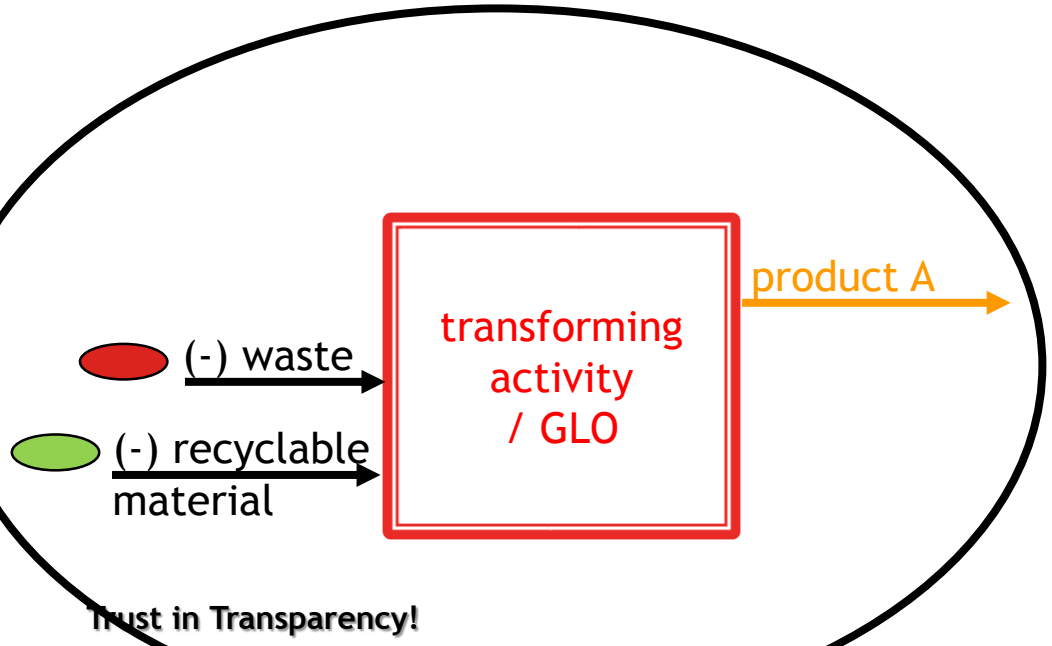
«Allocation, cut-off by classification» SM



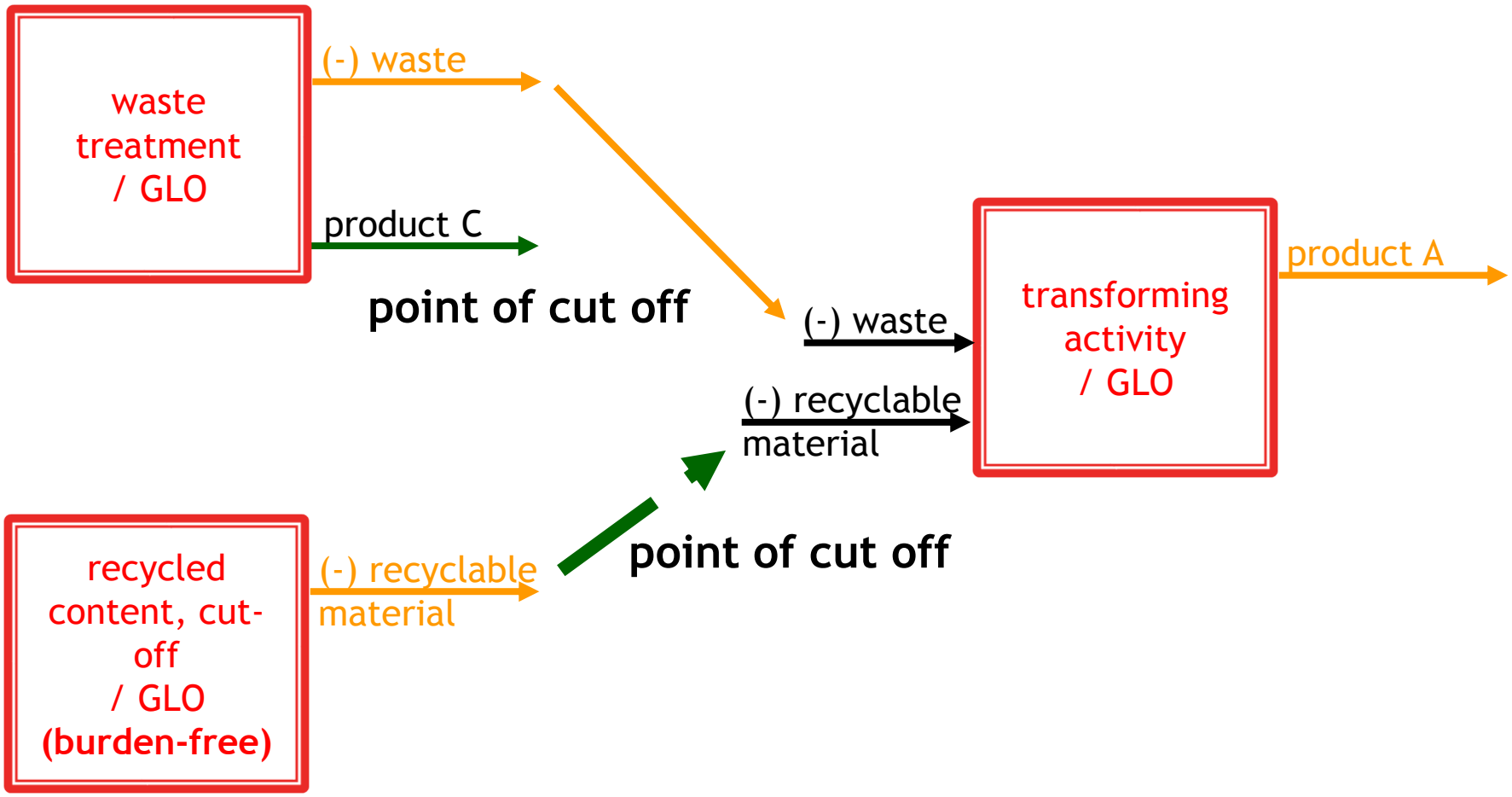
«Allocation, cut-off by classification» SM



«Allocation, cut-off by classification» SM



«Allocation, cut-off by classification» SM



Short overview on the other SM

- **«Allocation, ecoinvent default»**
  - Allocation at the point of substitution (point in a treatment chain where economic allocation is possible; susbtitution can be applied)
  - Physical or economical allocation

- **«Substitution, consequential, long-term»**
  - Applies substitution (system expansion)

Why do some results differ from v2.2?

- **Dataset updates** (ie electricity) modify results
- Correction in the allocation approach on some products (mass vs economic)
- Updates in the default transport distances (systematic approach)
- Consistent generation and use of consumption mixes

To retain

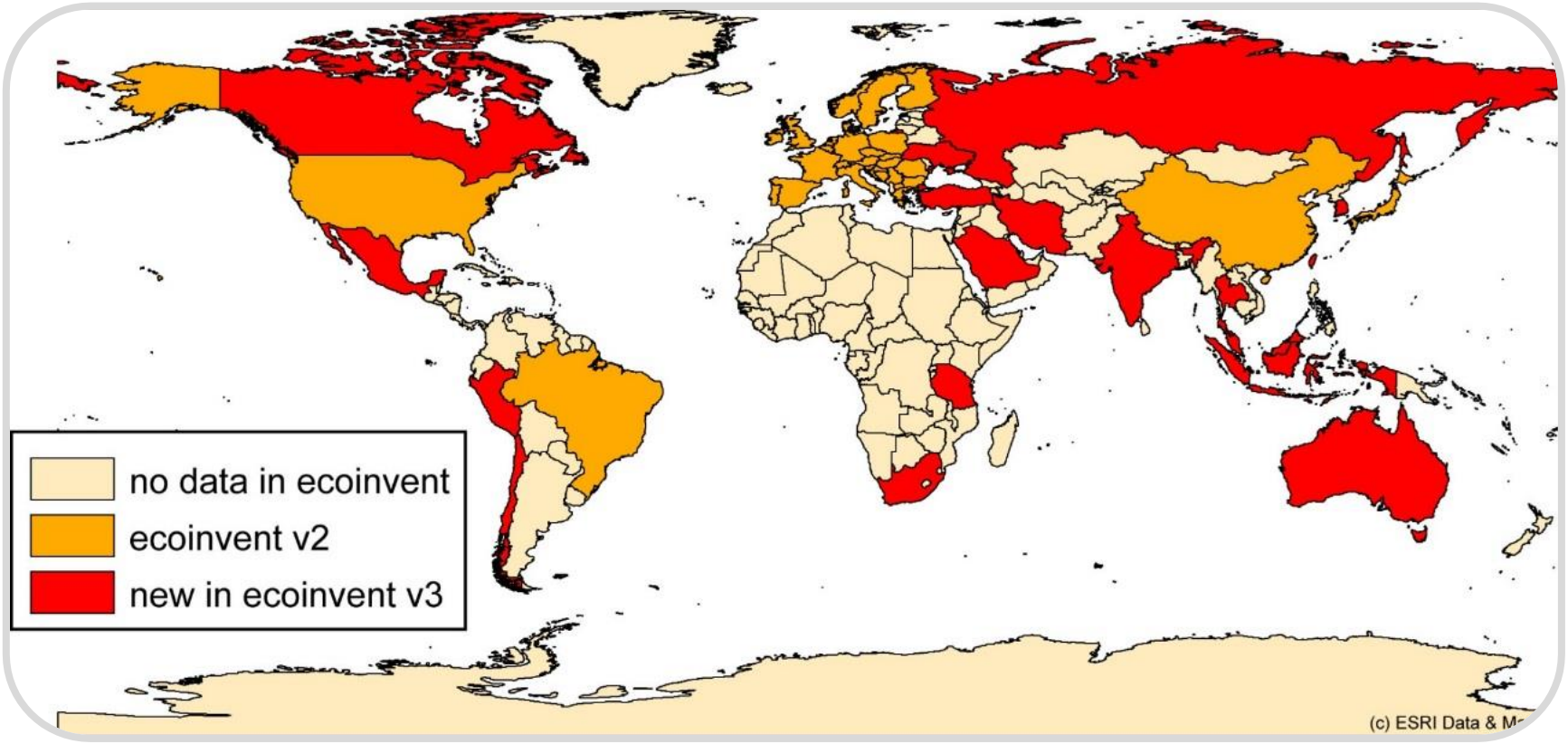
- The generation of the database as unallocated unit processes allows the construction of several System Models based on the same data (as well as easier update of supply chains)
- The construction of a System Model is based on the definition of modelling choices coded in specific linking rules (algorithms)
- Three System Models are available in version 3.1
- You have to choose the SM that best fits the goal and scope of your study

Content of this webinar

- Starting point: from v2 Process to v3 Activity and Products. Implications in the naming
- Activities and Products. Definition and types
- The use of consumption mixes in version 3
- System models: definition and short overview of the different System Models the v3.1 offers
- New data and new features in version 3.01 and version 3.1

New data added to version 3.01

New electricity data in v3: 90% produced electricity in the world



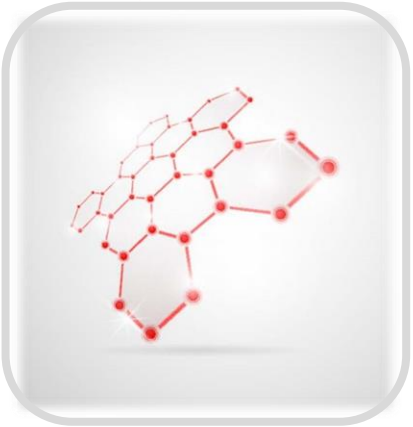
Graph: PSI

New data added to version 3.01

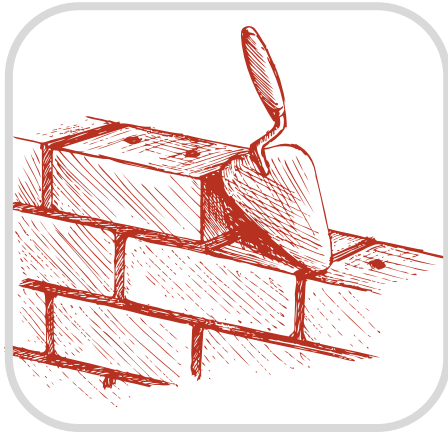
Passenger transport (road)

Biofuels

Fruits and veggies



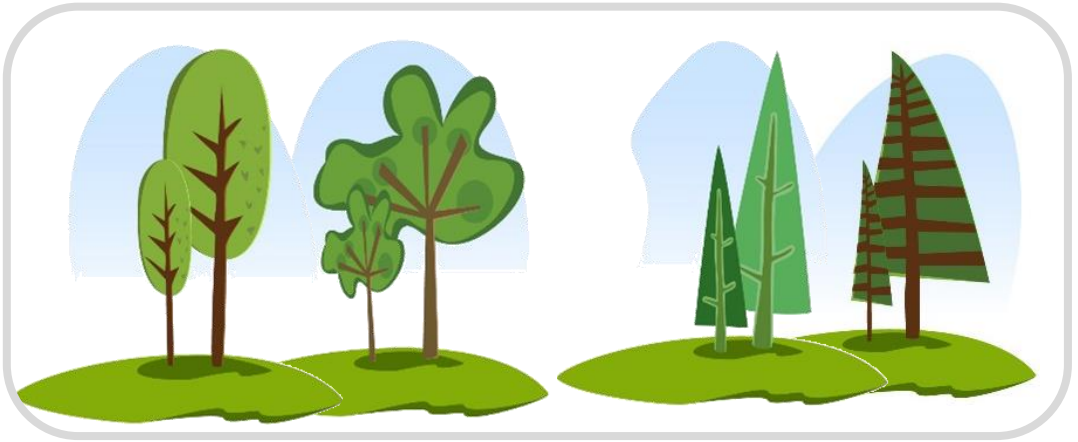
Chemicals



Building materials

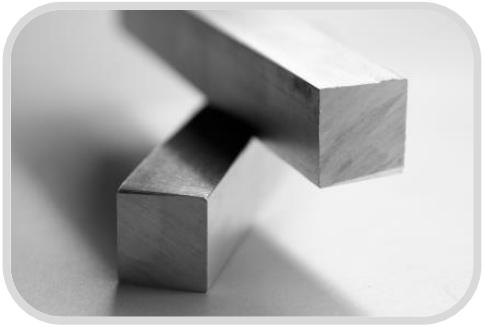
New data added to version 3.1

Freight transport by road



Wood sector:
forestry,
machinery,
wood-based products,
wood-preservation

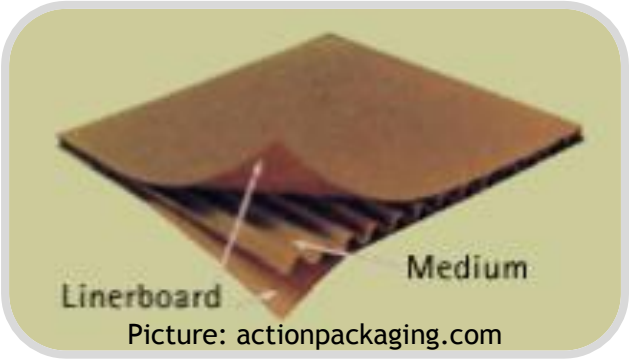
New data added to version 3.1



Aluminium supply chain

New tap water production activities in GLO, Québec, CH, Europe

Incineration
Heat production



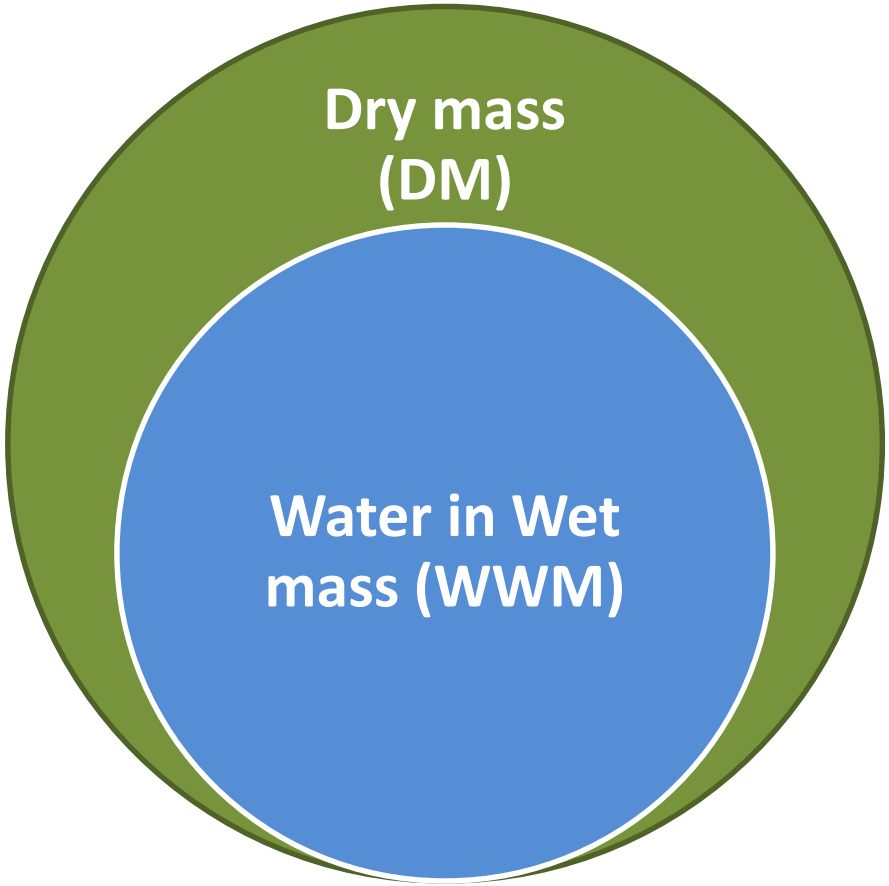
Picture: actionpackaging.com

Cardboard

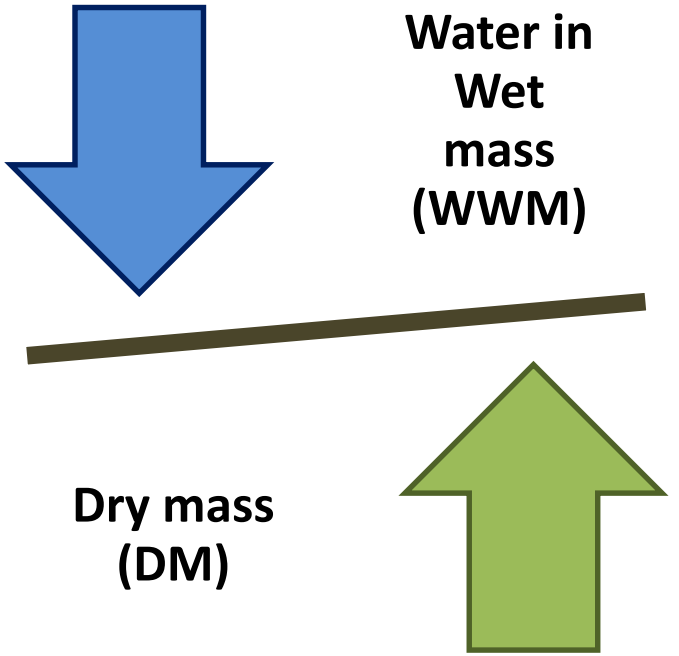
Dairy; Soja derivatives

Compulsory properties: mass related

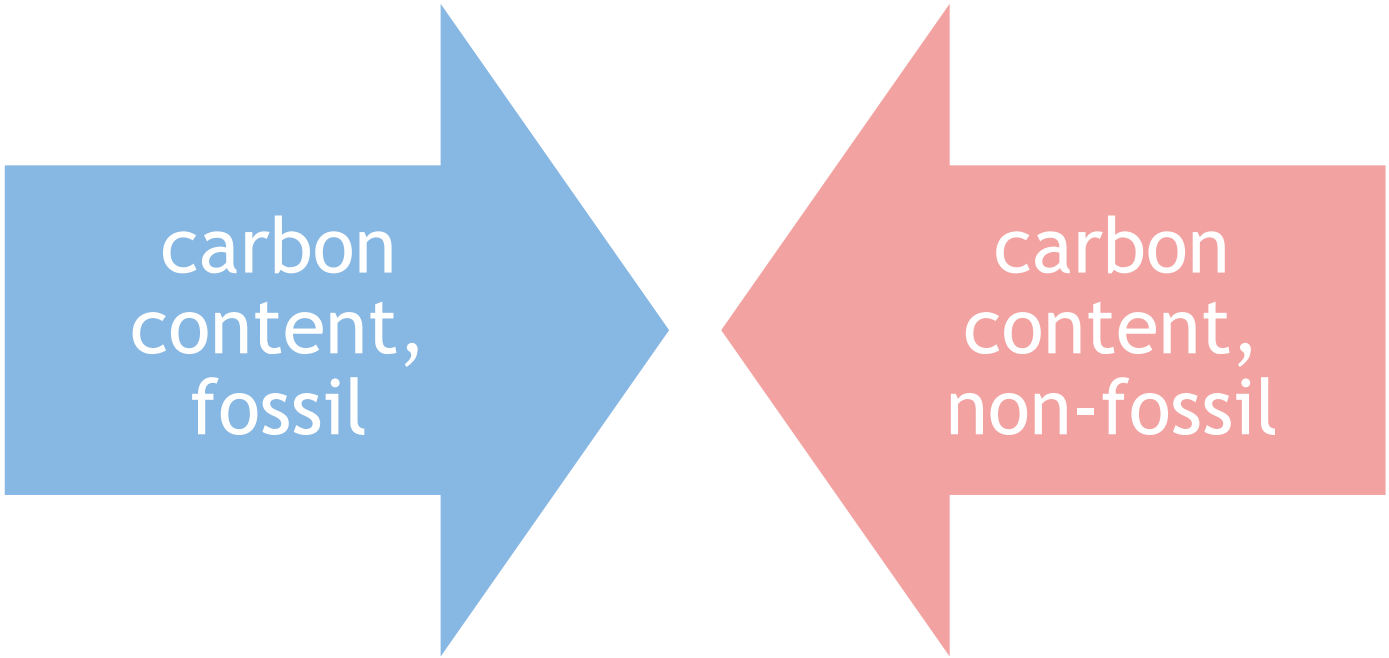
Wet mass (WM)



Water content (U)



Compulsory properties: carbon content



Visualization: properties in ecoQuery

- https://ecoquery.ecoinvent.org
- Properties are available for all products

Exchanges Properties — **barley production, DE**

Name	Amount	Unit	Uncertainty	SD
Reference Product				
By-product classification: allocatable product				
barley grain				
+ carbon content, fossil	0	dimensionless		
+ carbon content, non-fossil	0.46538	dimensionless		
+ dry mass	0.86	kg		
+ energy content	15.583	MJ		
+ water content	0.16279	dimensionless		
+ water in wet mass	0.14	kg		
+ wet mass	1	kg		

Properties are associated to products

- The same product can have different properties depending on the activity producing it: different geographies

Exchanges Properties	barley production, DE			
Name	Amount	Unit	Uncertainty	SD
Reference Product				
By-product classification: allocatable product				
barley grain				
+ carbon content, fossil	0	dimensionless		
+ carbon content, non-fossil	0.46538	dimensionless		
+ dry mass	0.86	kg		
+ energy content	15.583	MJ		
+ water content	0.16279	dimensionless		
+ water in wet mass	0.14	kg		
+ wet mass	1	kg		

Properties are associated to products

- The same product can have different properties depending on the activity producing it: different geographies

barley production, ES

Exchanges Properties				
Name	Amount	Unit	Uncertainty	SD
Reference Product				
By-product classification: allocatable product				
barley grain				
+ carbon content, fossil	0	dimensionless		
+ carbon content, non-fossil	0.46538	dimensionless		
+ dry mass	0.85	kg		
+ energy content	15.402	MJ		
+ water content	0.17647	dimensionless		
+ water in wet mass	0.15	kg		
+ wet mass	1	kg		

Properties are associated to products

- The same product can have different properties depending on the activity producing it: different technologies

Exchanges Properties	fatty alcohol sulfate production, coconut oil, RER			
Name	Amount	Unit	Uncertainty	SD
Reference Product				
By-product classification: allocatable product				
fatty alcohol sulfate				
+ carbon content, fossil	0	dimensionless		
+ carbon content, non-fossil	0.52427	dimensionless		
+ dry mass	1	kg		
+ water content	0	dimensionless		
+ water in wet mass	0	kg		
+ wet mass	1	kg		

Properties are associated to products

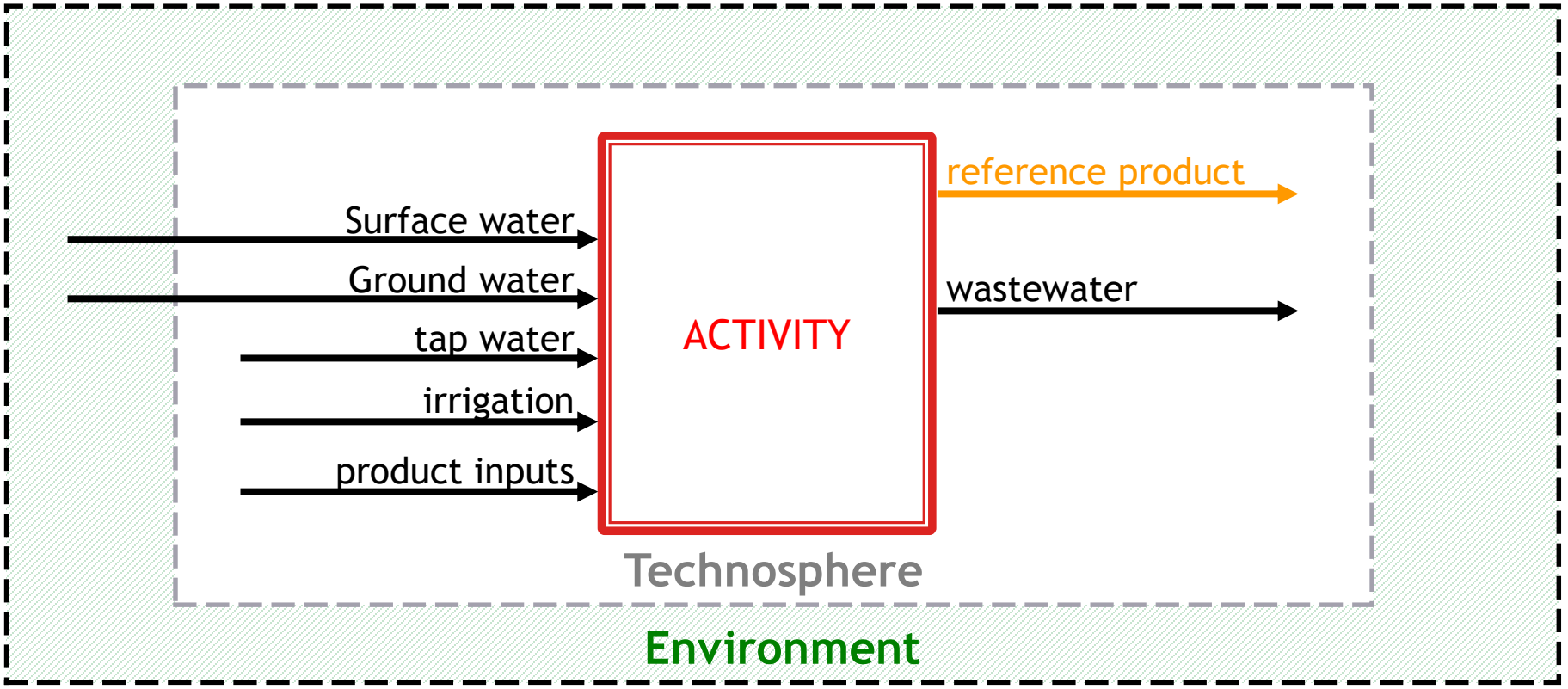
- The same product can have different properties depending on the activity producing it: different technologies

Exchanges Properties — **fatty alcohol sulfate production, petrochemical, RER**

Name	Amount	Unit	Uncertainty	SD
Reference Product				
By-product classification: allocatable product				
fatty alcohol sulfate				
+ carbon content, fossil	0.52427	dimensionless		
+ carbon content, non-fossil	0	dimensionless		
+ dry mass	1	kg		
+ water content	0	dimensionless		
+ water in wet mass	0	kg		
+ wet mass	1	kg		

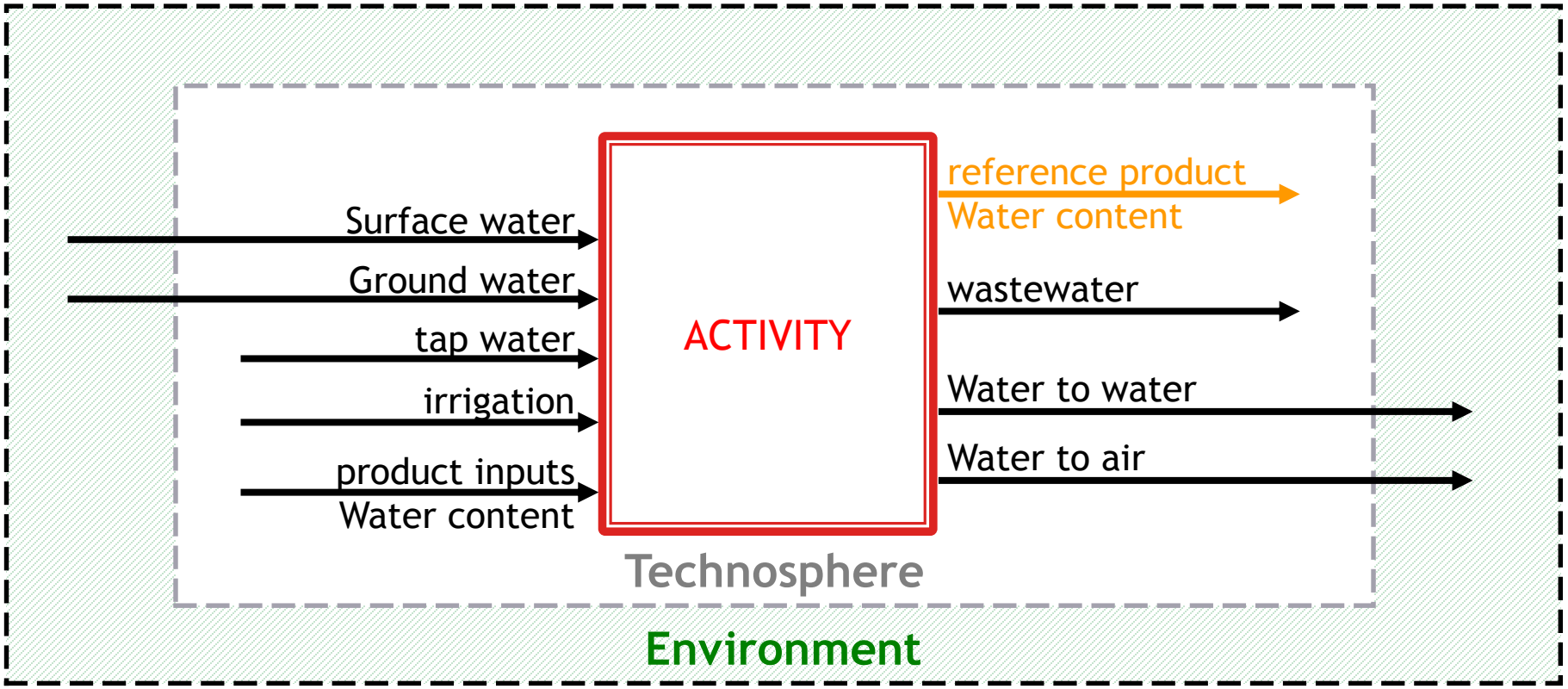
Update of water flows

- Water flows have been updated from v2

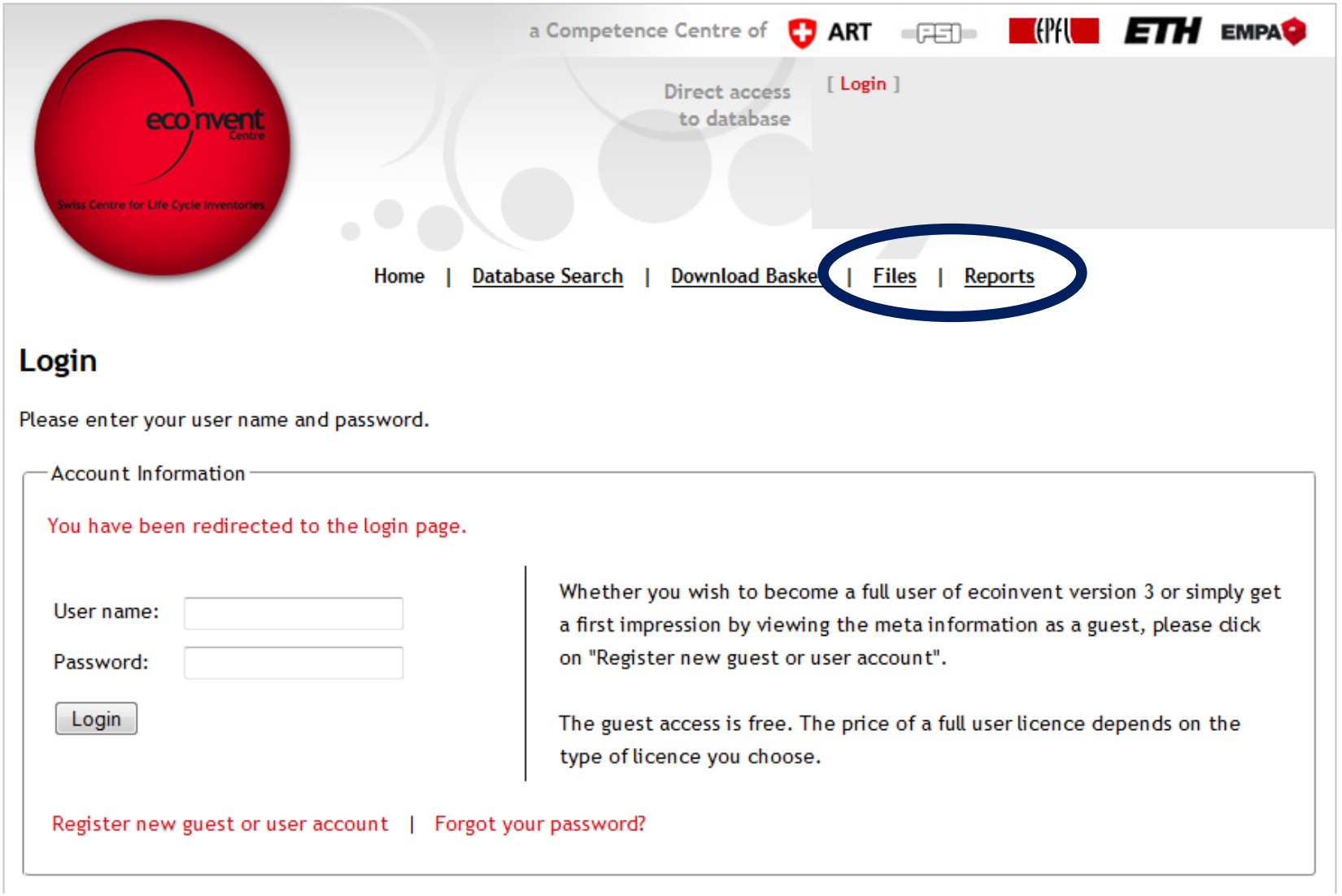


Update of water flows

- Water flows have been updated from v2
- New flows added. Water content added
- Water balance ensured at Unit Process level



ecoQuery: Reports and Files



To retain

- There are new activities in version 3.01 and 3.1 concerning several sectors
  - Check the latest Activity Overview file: www.ecoinvent.org/fileadmin/documents/en/Activity_Overview/eiv3.1/activity_overview_for_users_3.1_undefined.xlsx
- New features include new properties: mass-related and carbon-content related
- Water balance is ensured at the Unit Process level

Thank you for your interest in ecoinvent v3!

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Deputy Manager

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