The world's most consistent and transparent Life Cycle Inventory database

Introduction to the ecoinvent version 3.1 database

ecoinvent User Meeting, Bordeaux, France

30 August 2015

Gregor Wernet

Executive Manager

ecoinvent

Agroscope EMPA EPFL ETH PSI

What is ecoinvent?

- ecoinvent is a **not-for-profit** association created by 5 Swiss research institutes
- ecoinvent **started out** as the Swiss national LCI network
  - Publishes the **ecoinvent database**
- Publish **useful** and **relevant** life cycle **inventory data** in a centrally organized form

What is ecoinvent?

- Origin: Several LCA projects in the 1990s with a common need for background data
  - Small, loosely connected pools of data
- Decision to create a unified database for use in Switzerland and Europe
  - Swiss supply chains are very international, broadens the applicability
  - Version 1 published in 2003, version 2 in 2008

ecoinvent – Quality Features

- **Consistent**
  - Fully interlinked database
- **Reliable**
  - Independent expert review for all data
  - Continuously developed and improved over 15 years
- **Transparent**
  - Full access to both unit process data and all calculation results
  - Individual documentation of each dataset

Development of version 3

- Develop the database into a global database
  - Change in scope
- Allow more flexibility for the users
  - More access to the underlying modelling
  - Change of underlying assumptions
- Upgrade the code infrastructure
  - New data format, calculation software, data entry tool
- Be prepared for future developments

Some features of version 3

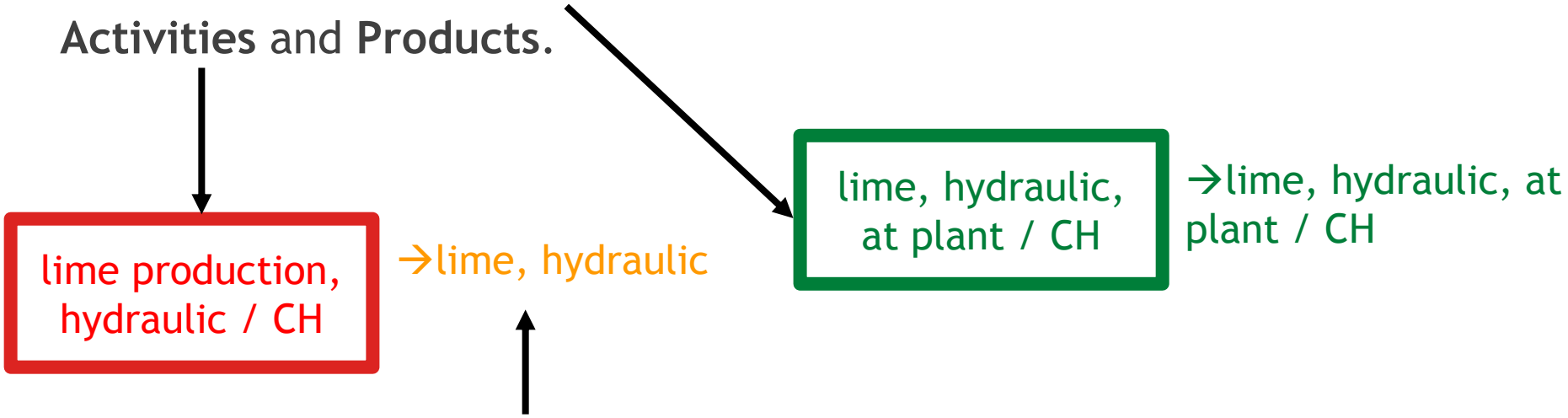
- Definition of products and activities
- Waste flows in version 3
- System models
- Consumption mixes and markets
- Global supply chains
- Differences between versions 2 and 3

ecoinvent – a global LCI database

- Used by more than 7000 users in more than 40 countries
- Included in or available for the leading LCA and eco-design software tools

Activities and Products in version 3 versus Process in version 2

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



- **Activities** result in **Products**, which bear different names than the Activities producing them.

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

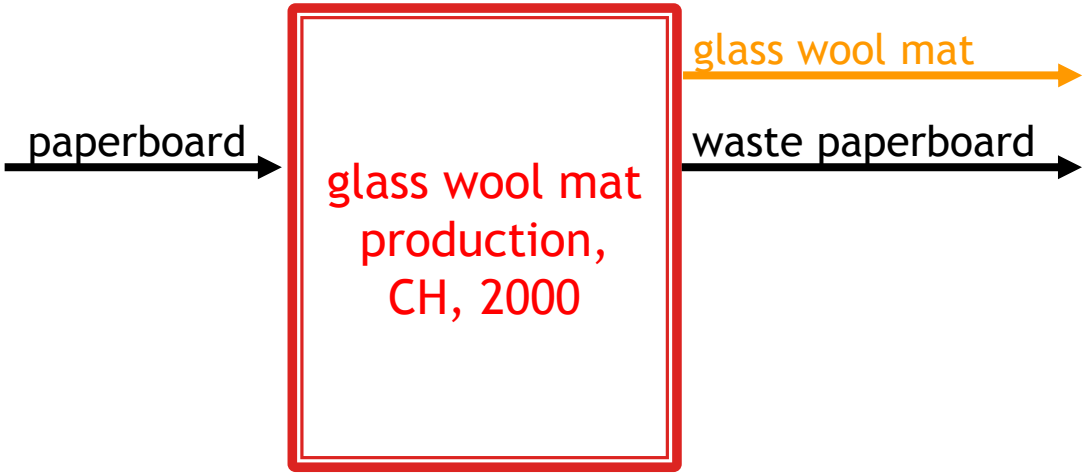
- Different activities can now produce the same product
  - Different producers of same product can now be identified
- Naming has changed between v2.2 and v3
  - Dissociation between product and activity name
  - Naming rules added for consistency reasons

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

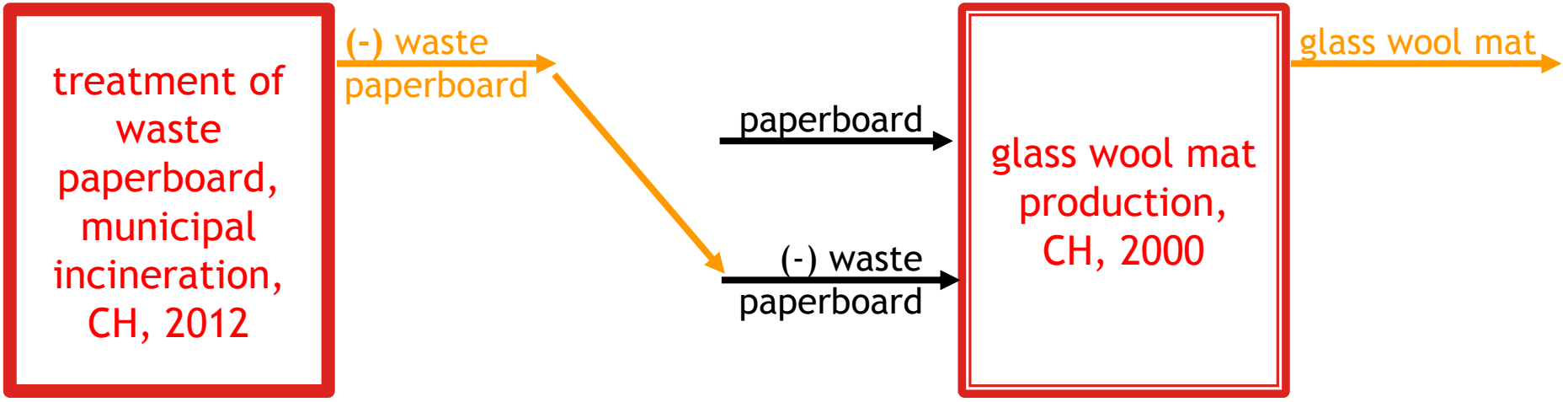
Correspondence file between v2.2 and v3.01 available on the website

Waste flows in ecoinvent version 3



Waste flows in ecoinvent version 3

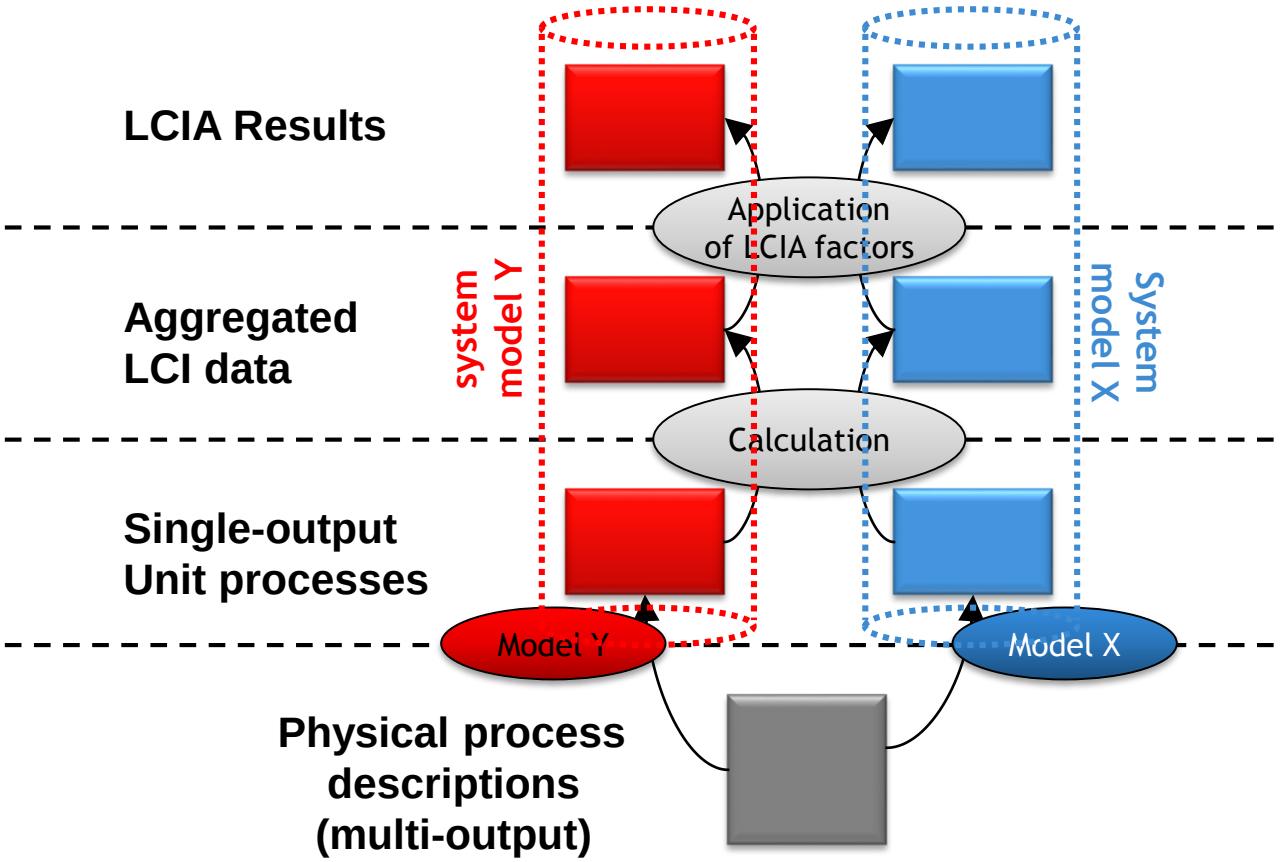
- The negative sign maintains mass balance.
  - in the waste producing activity
  - in the treatment activity
- The modeling is identical to older versions otherwise



System models in version 3

- A **system model** is a collection of modeling choices made for the database
  - Solving the allocation problem
  - Recycling and waste streams
  - Handling constraints in suppliers
- In version 3, **multiple system models** are possible
  - Different perspectives at the same database

System models in version 3



System models in ecoinvent v3

- Allocation at the point of substitution
- Allocation, Recycled Content cut-off
- Consequential (long-term, small-scale)
- Other models possible
  - Waste/Recycling system models
  - Other allocation choices
  - Integration with specific standards
  - Complete mass- or carbon-based allocation (Mass Flow Analysis)

Recycled content cut-off

- Cut-off modeling approach of version 1 and 2
- Implemented as a new **system model** in version 3
  - “Allocation, cut-off by classification”
- Based on a **product-level** classification
  - *Ordinary, allocatable by-products*
  - *Recyclable materials*
  - *Wastes*
  - All products are **classified consistently** throughout the database

Recycled content cut-off

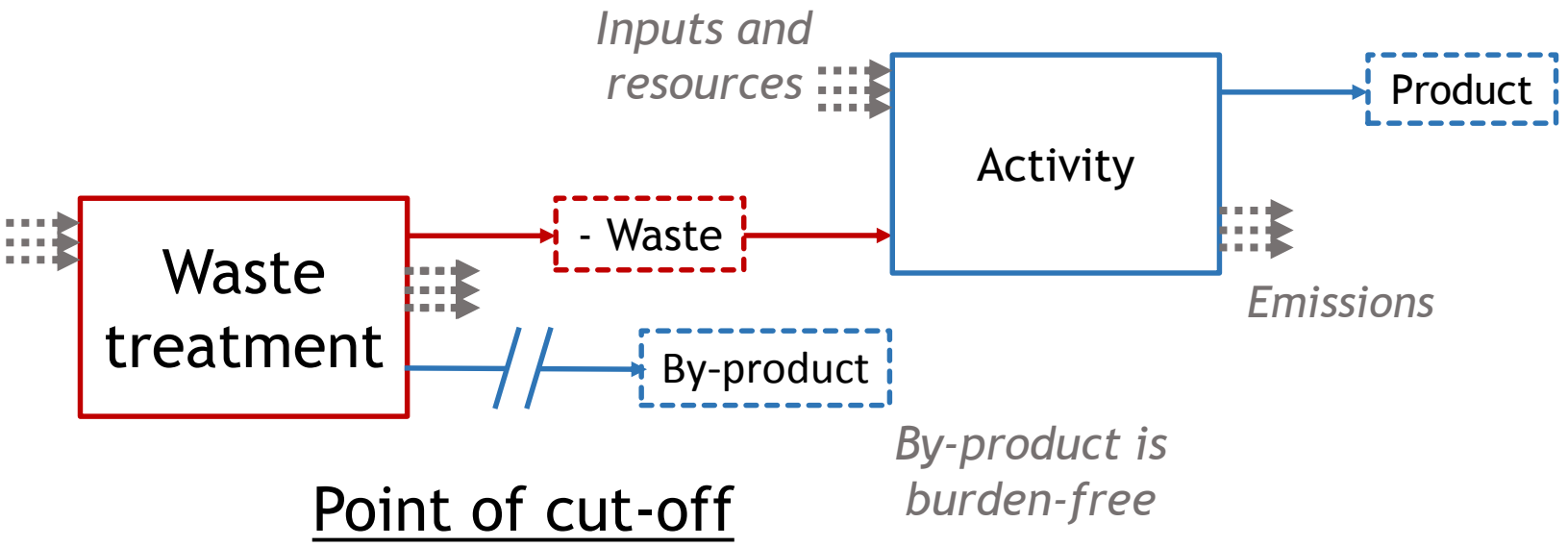
- Fundamental concept:
  - **No credit** for recycling or waste treatment by-products
  - **Full burdens** for waste treatment, but **no burdens** for recycling
- Uses a **cut-off** to separate primary and secondary use phases
- Consequence: Burden of **primary production** is completely with the **first use** of the product
  - Use of recycled products is encouraged
  - Waste treatment with beneficial by-products is **not** encouraged

Recycled content cut-off

- Ordinary by-products
  - Allocated directly
  - Most products in the database (~90%)
  - Allocated according to values chosen by the data provider to reflect the ISO hierarchy

Recycled content cut-off

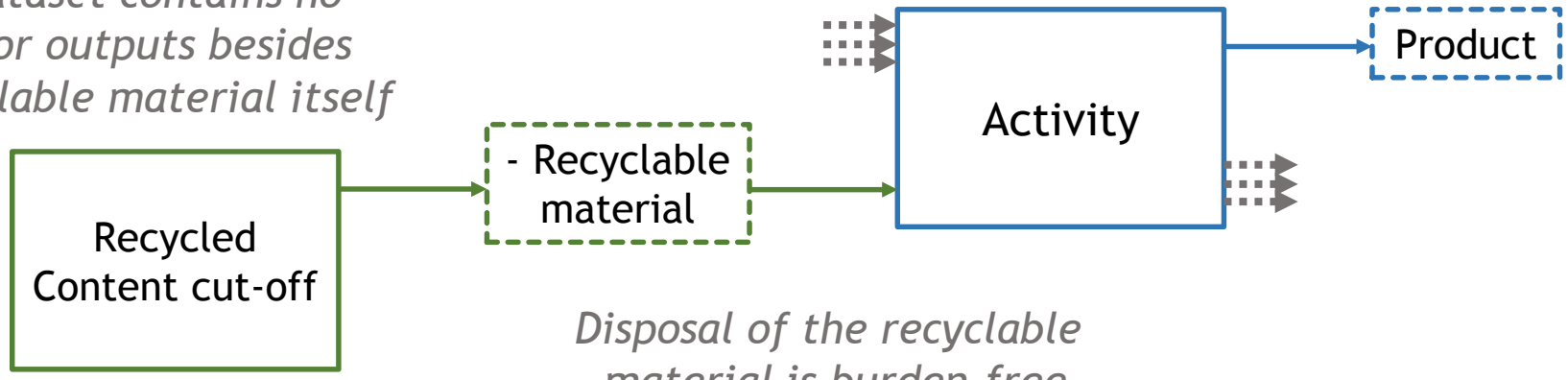
- Wastes (~8%)



Recycled content cut-off

- Recyclable Materials (~2%)

This dataset contains no inputs or outputs besides the recyclable material itself

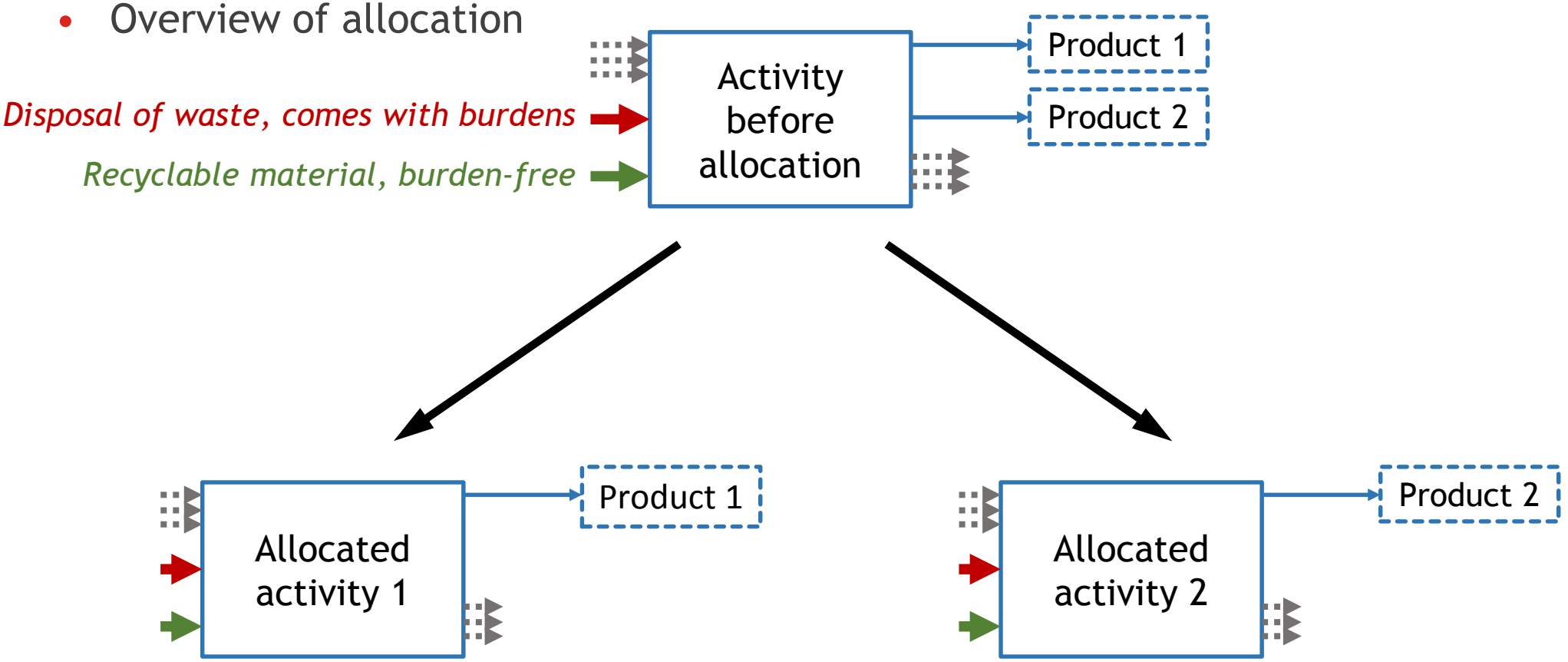


Disposal of the recyclable material is burden-free

Point of cut-off

Recycled content cut-off

- Overview of allocation



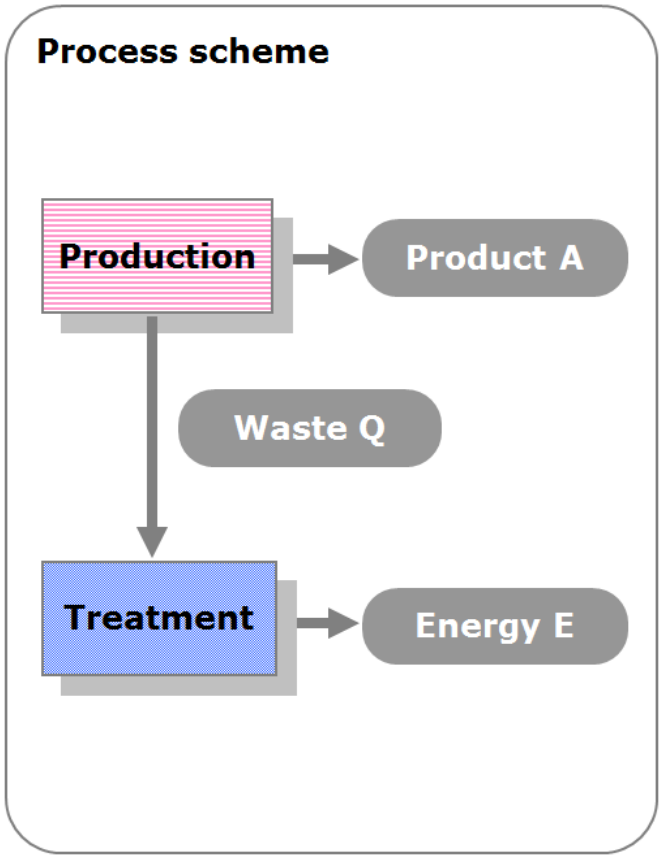
Recycled content cut-off

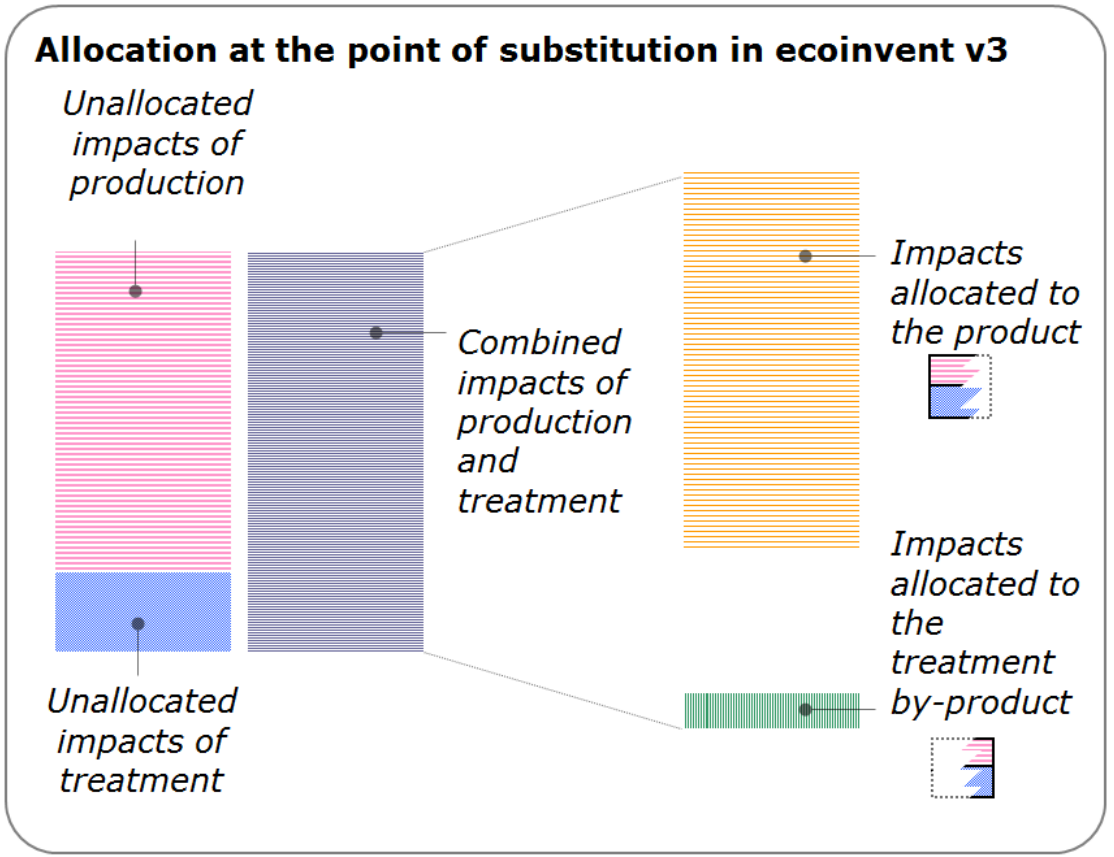
- Consistent application of the cut-off
- Consistent process structure based on product classification
- Flexible application through product choice
- Simple allocation process to follow and reproduce
- Clear datasets to modify or adapt

Allocation at the point of substitution

- Physical allocation where possible, otherwise **allocation at the point of substitution**
- The **point of substitution** is the point where a recycling/treatment process results in a **marketable product** (i.e. a good produced purely for economic gain)
  - At this point economic allocation is feasible

Allocation at the point of substitution



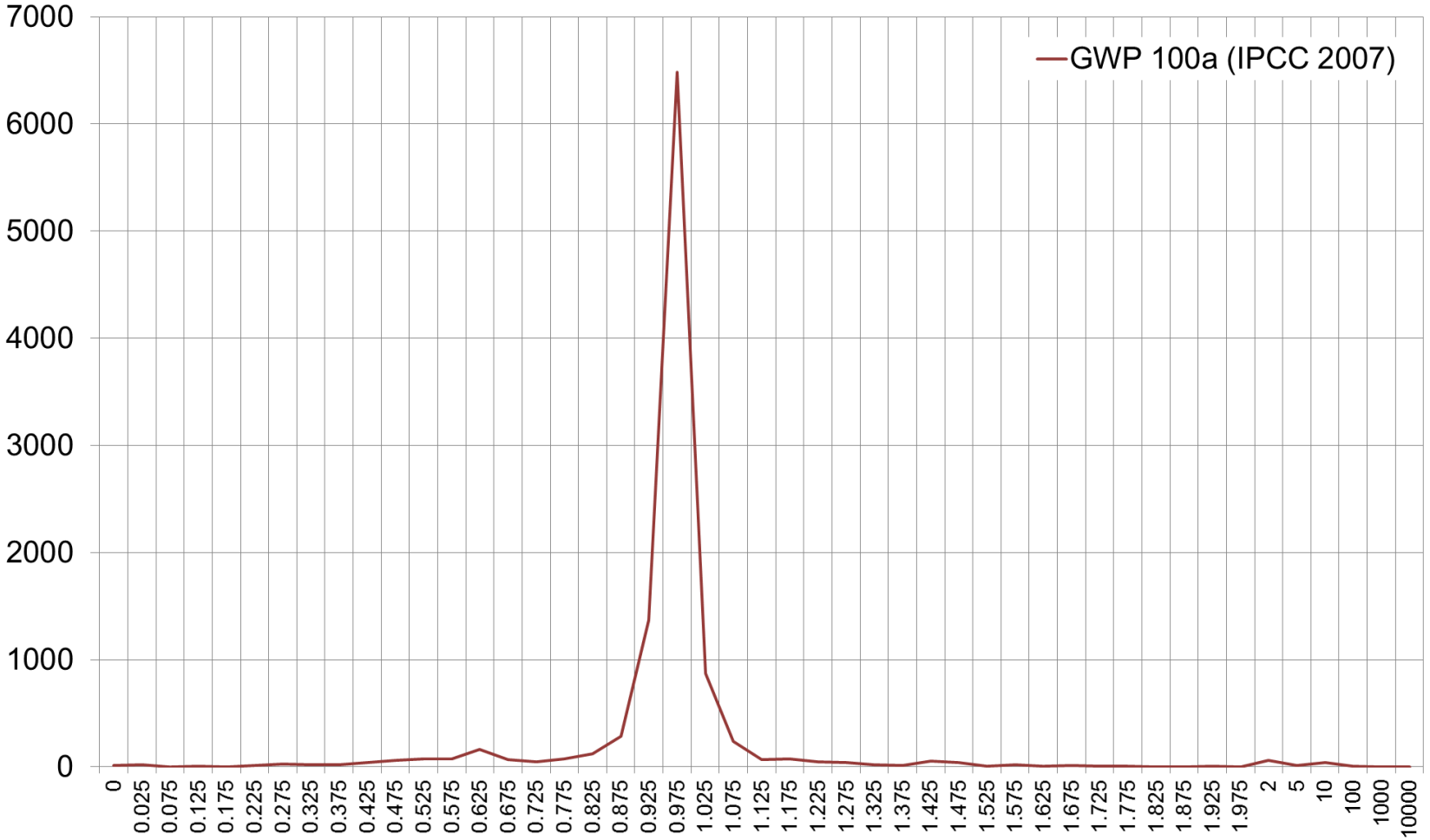


Graph: G. Doka

Cut-off vs APOS

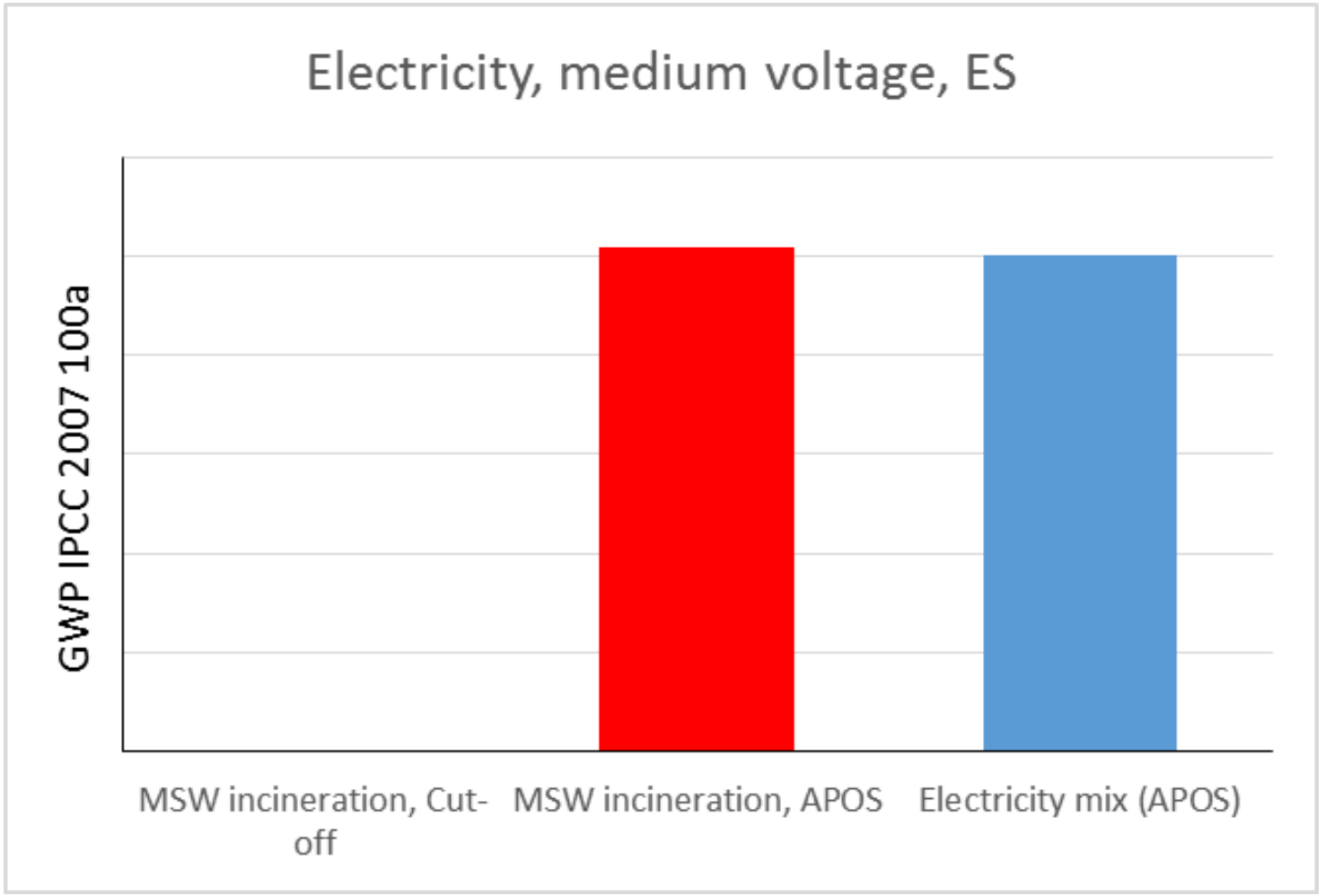
- Difference in allocation of **wastes treatment products** and **recyclable materials**
  - No other differences in the models
- Differences **only for these products**
  - 8% of products in the database are wastes, few have significant by-products in treatment
  - 2% of products in the database are recyclable materials

Cut-off vs APOS

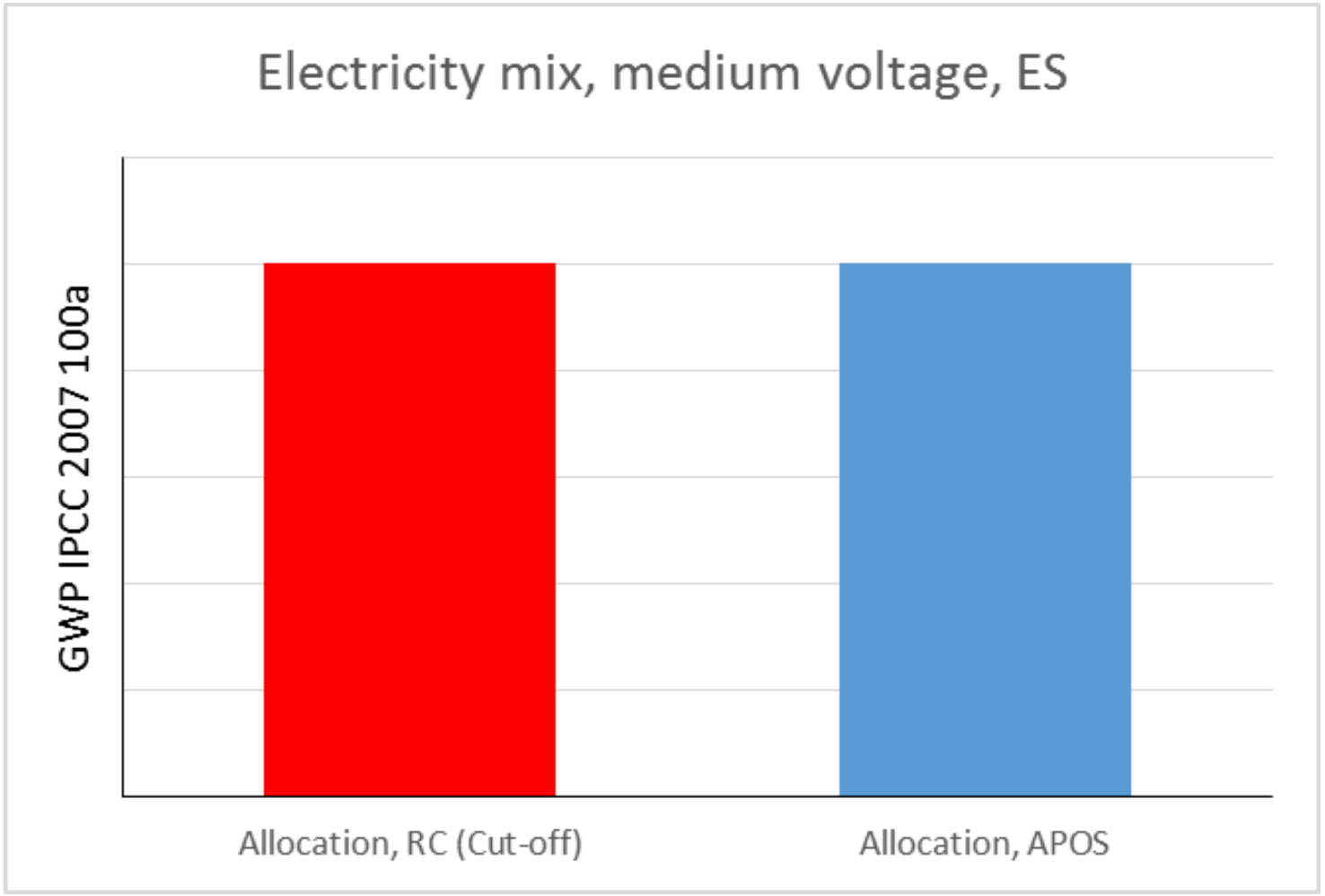


APOS divided by Cut-off

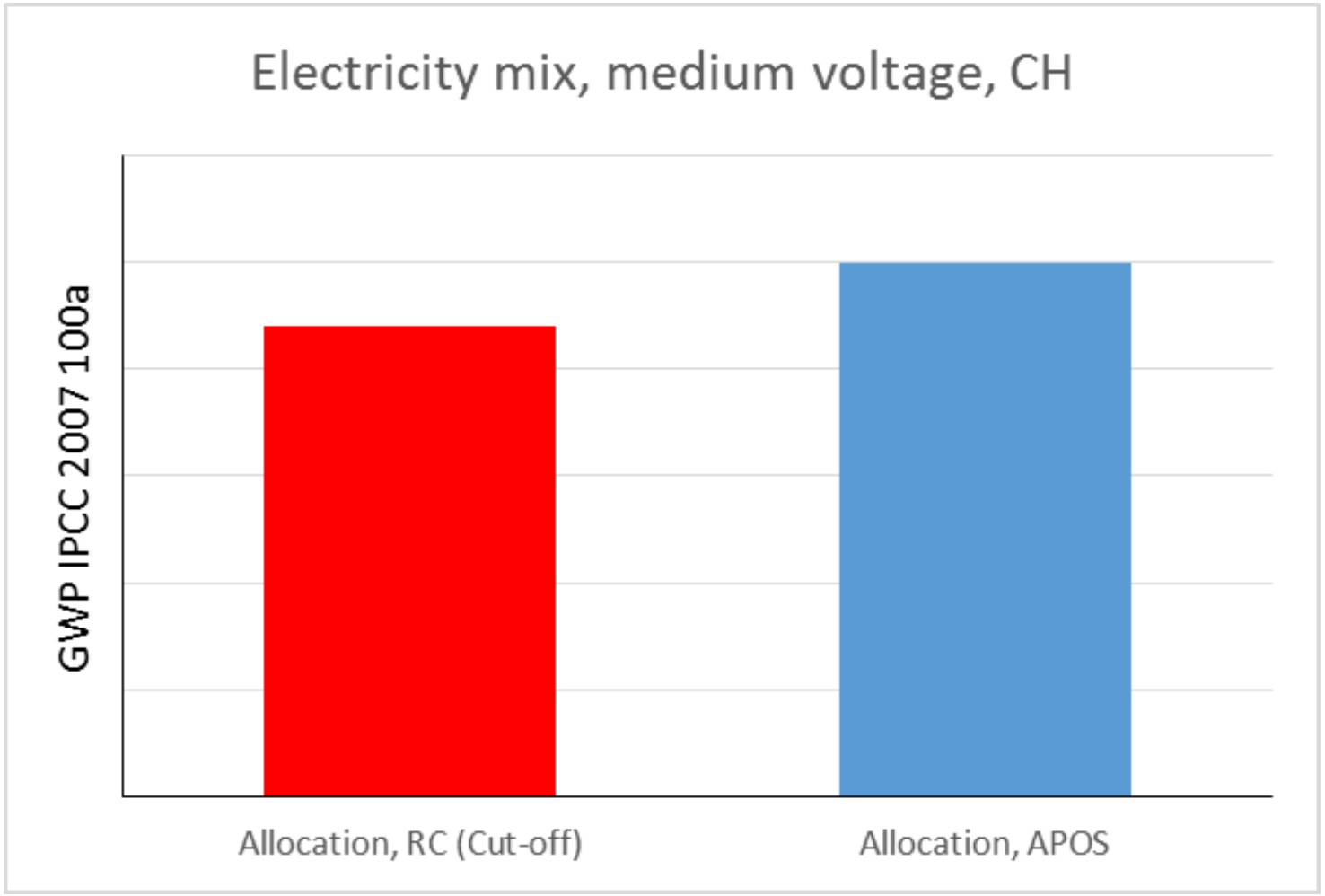
Cut-off vs APOS



Cut-off vs APOS



Cut-off vs APOS



Cut-off vs APOS

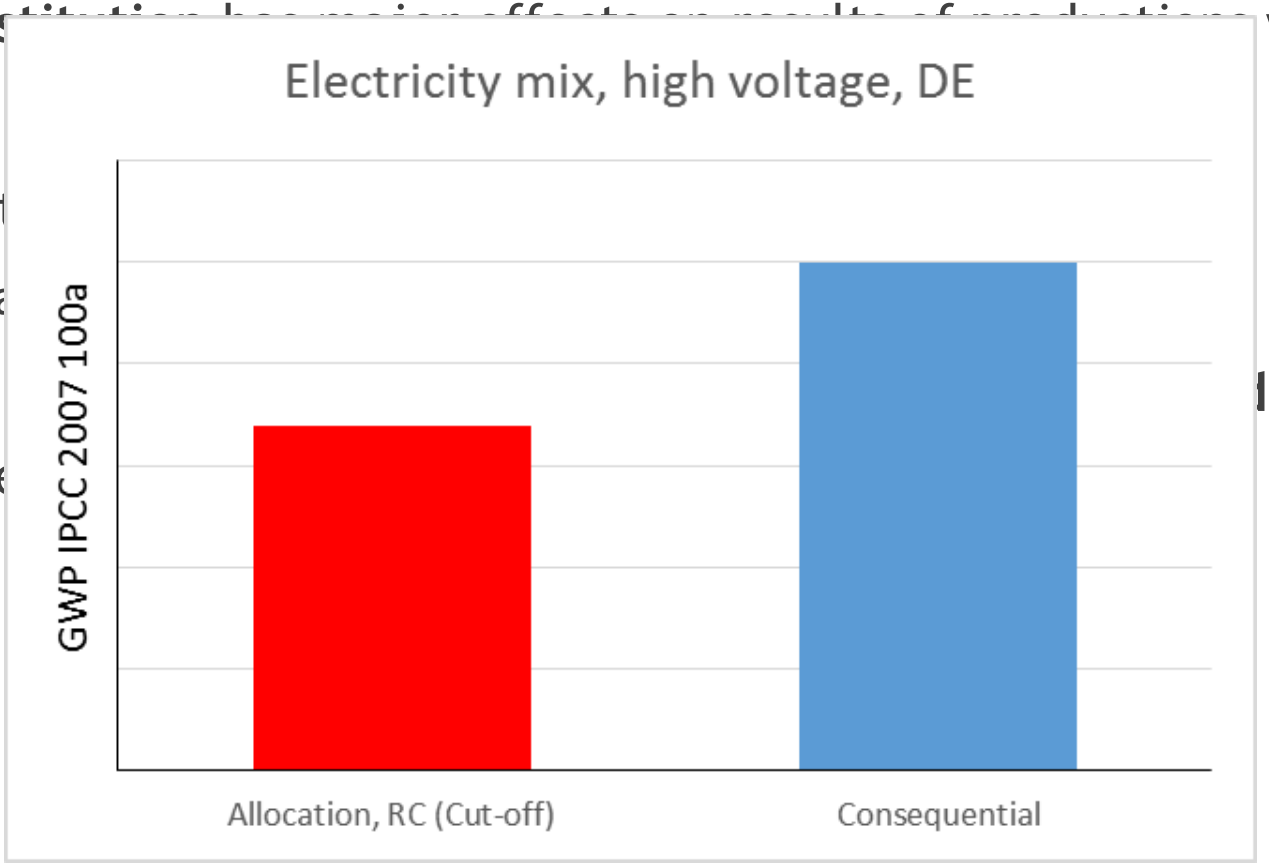
- Slightly **lower impacts** for most products in the database **in APOS**
- **Non-zero impacts** for products no longer cut off
- Impacts are **shifted** between products, but of course not created or removed
- Two available system models allow a **sensitivity analysis** in cases where recycling or cut materials are important

Attributional vs Consequential

- Consequential modelling assesses **changes**
- Use of **Substitution** has major effects on results of productions with significant by-products
- Consequential uses **marginal suppliers**
  - may be an improvement or more impactful than average suppliers
- **Consumption of by-products** creates demand for **primary production** in consequential

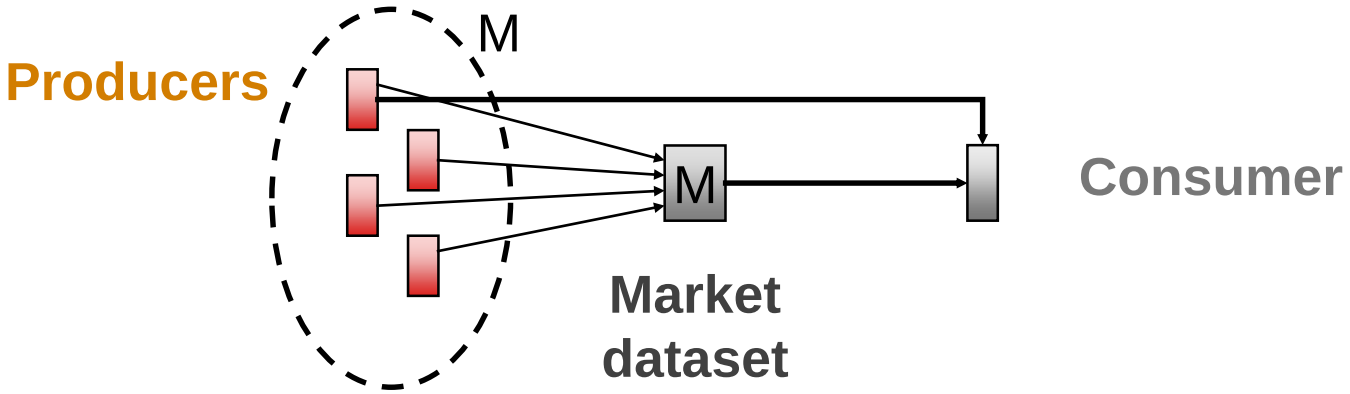
Attributional vs Consequential

- Consequential modelling assesses **changes**
- Use of **Subs** with significant
- Consequent
  - may be a
- **Consumpti** **luction** in conseque



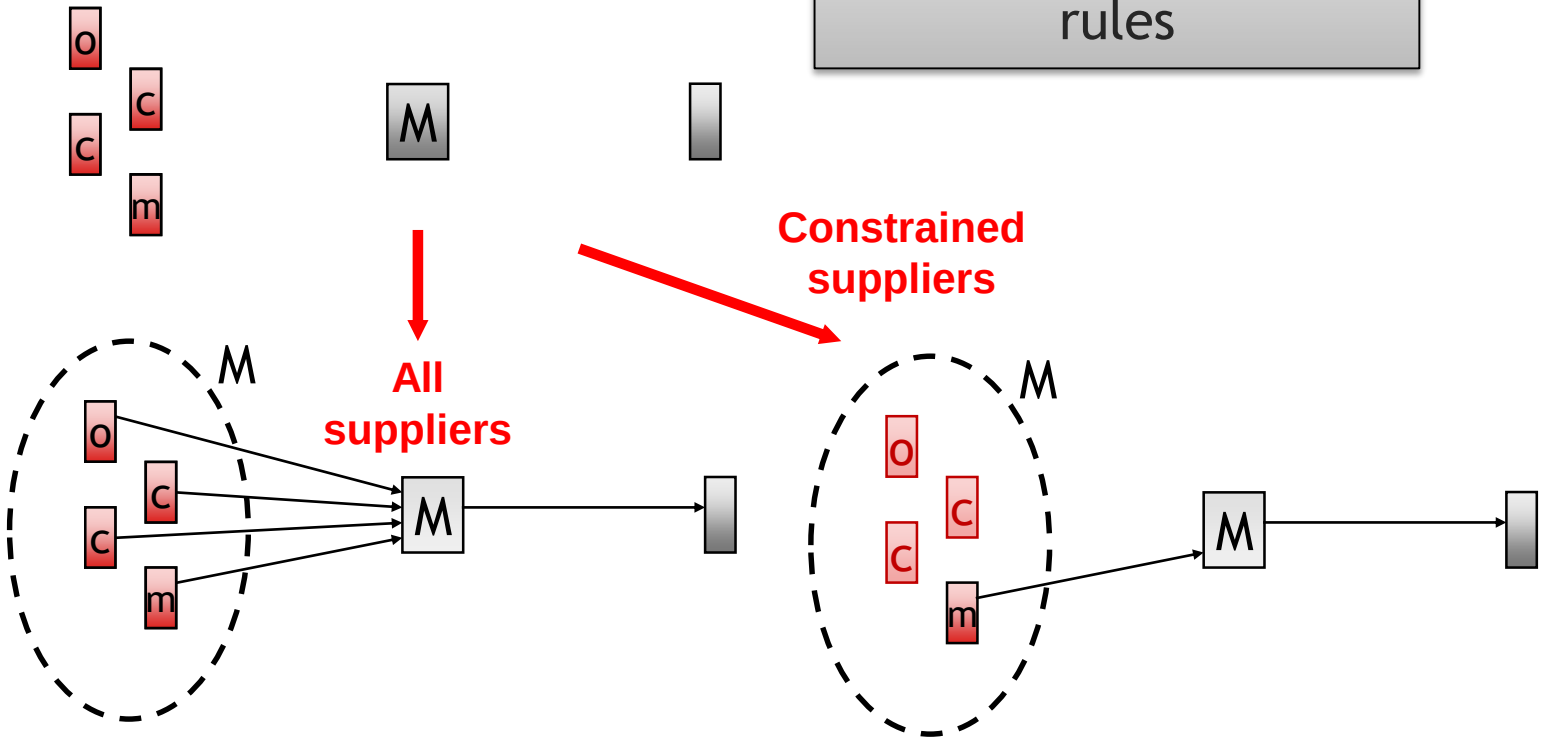
Market datasets

- **Separation** of product and activity names
  - More that one activity can produce the same product
- **Market datasets** are available for all products
- Markets describe the **consumption mix** for a product and region



Market datasets

System models may have different linking rules



Market datasets

- **Market datasets** provide consistent consumption mixes of a product for a region
- **Additional information** is included
  - Transport, losses during transport
  - …
- Linking rules can be **modified** to create **multiple system models**
- **Consistent availability** of consumption mixes
  - Always a choice between the individual producers or the market average

The choice remains

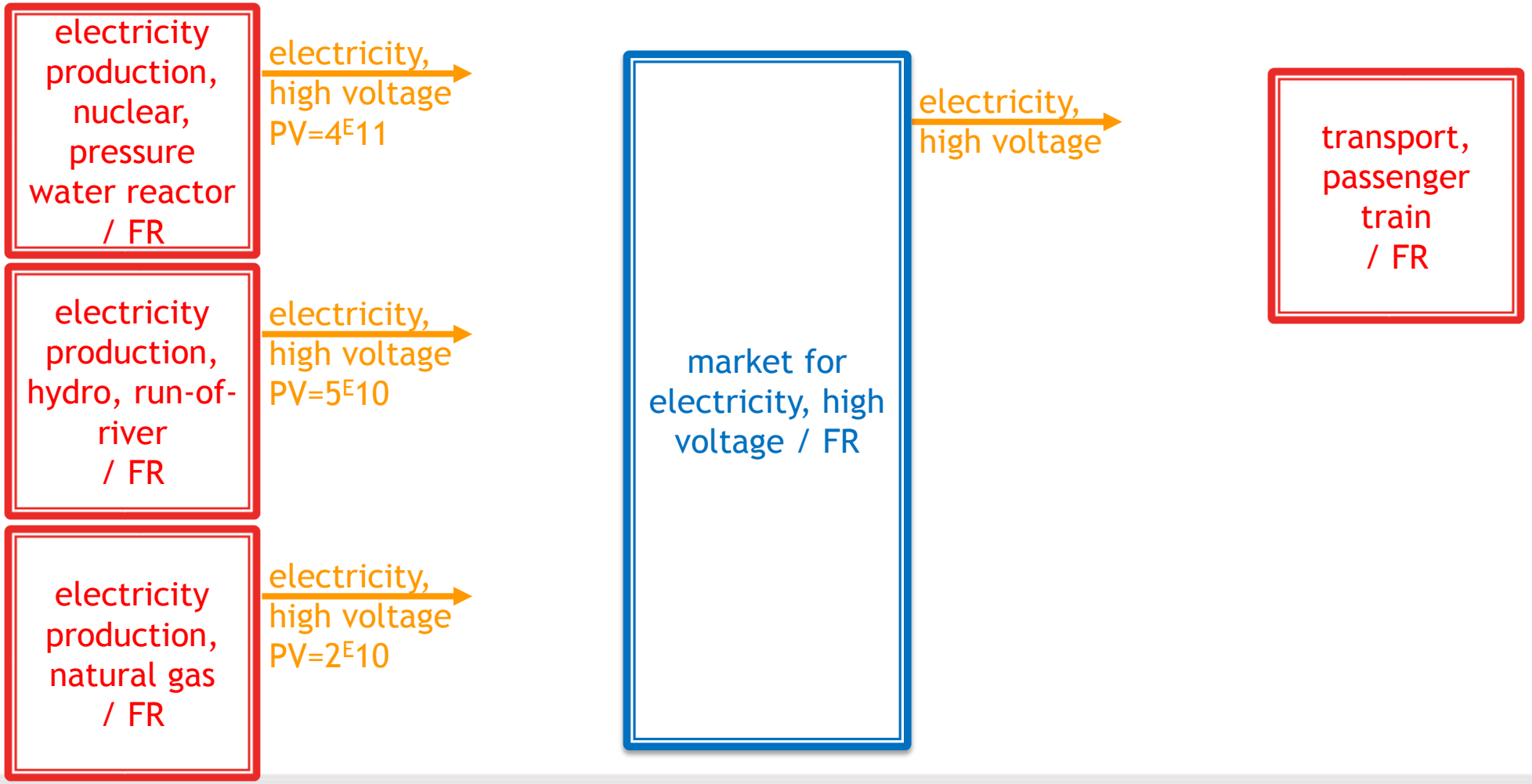
- As user, you can always choose between the supplying activities and the consumption mix

Search: barley grain

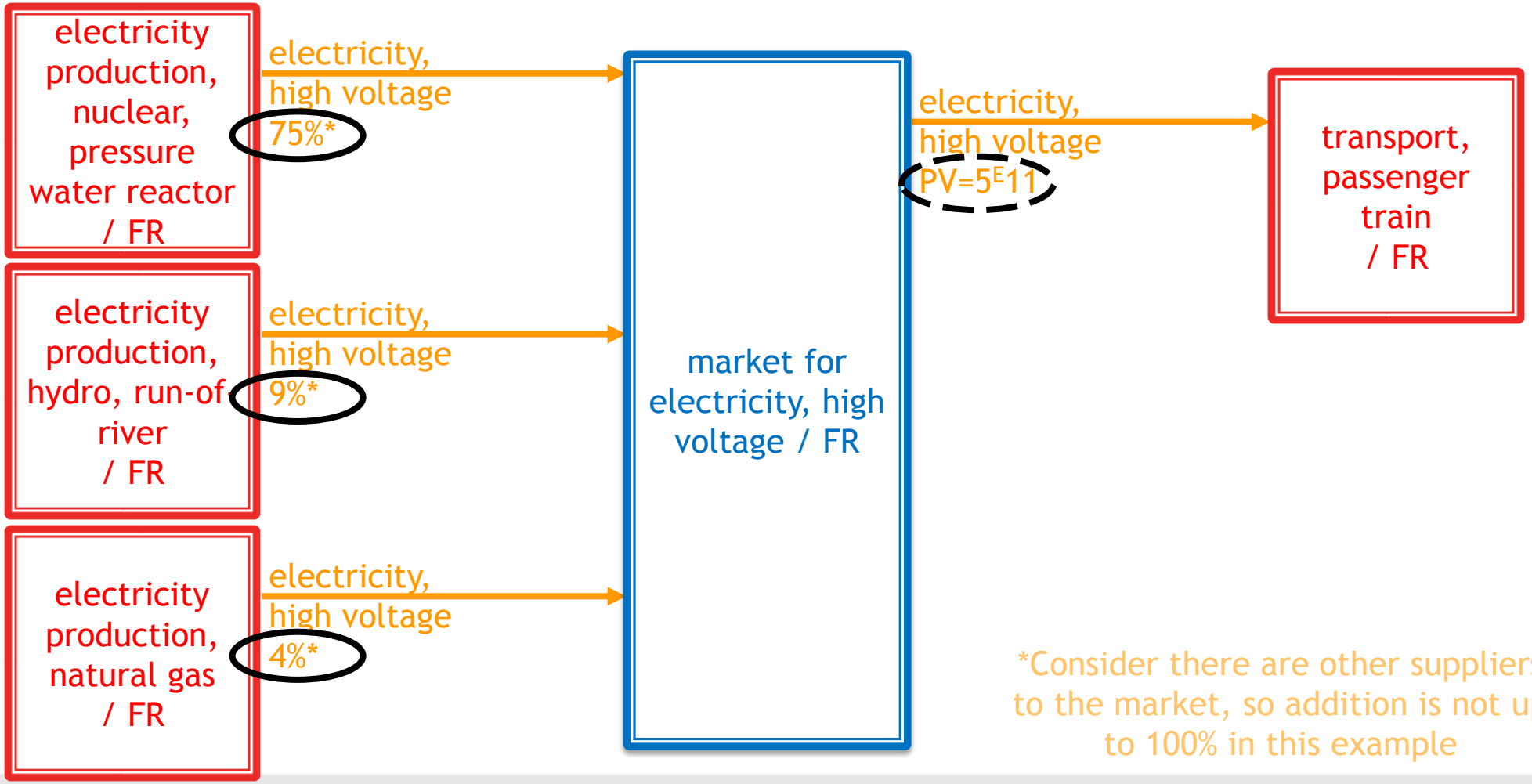
#		Name	Reference Product	Loc.	Time Period
6	☐	barley production	barley grain [kg]	DE	01.01.2000 - 31.12.2004
7	☐	barley production	barley grain [kg]	ES	01.01.2000 - 31.12.2004
8	☐	barley production	barley grain [kg]	FR	01.01.2000 - 31.12.2004
9	☐	barley production	barley grain [kg]	GLO	01.01.2000 -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

https://ecoquery.ecoinvent.org

Example: different technologies

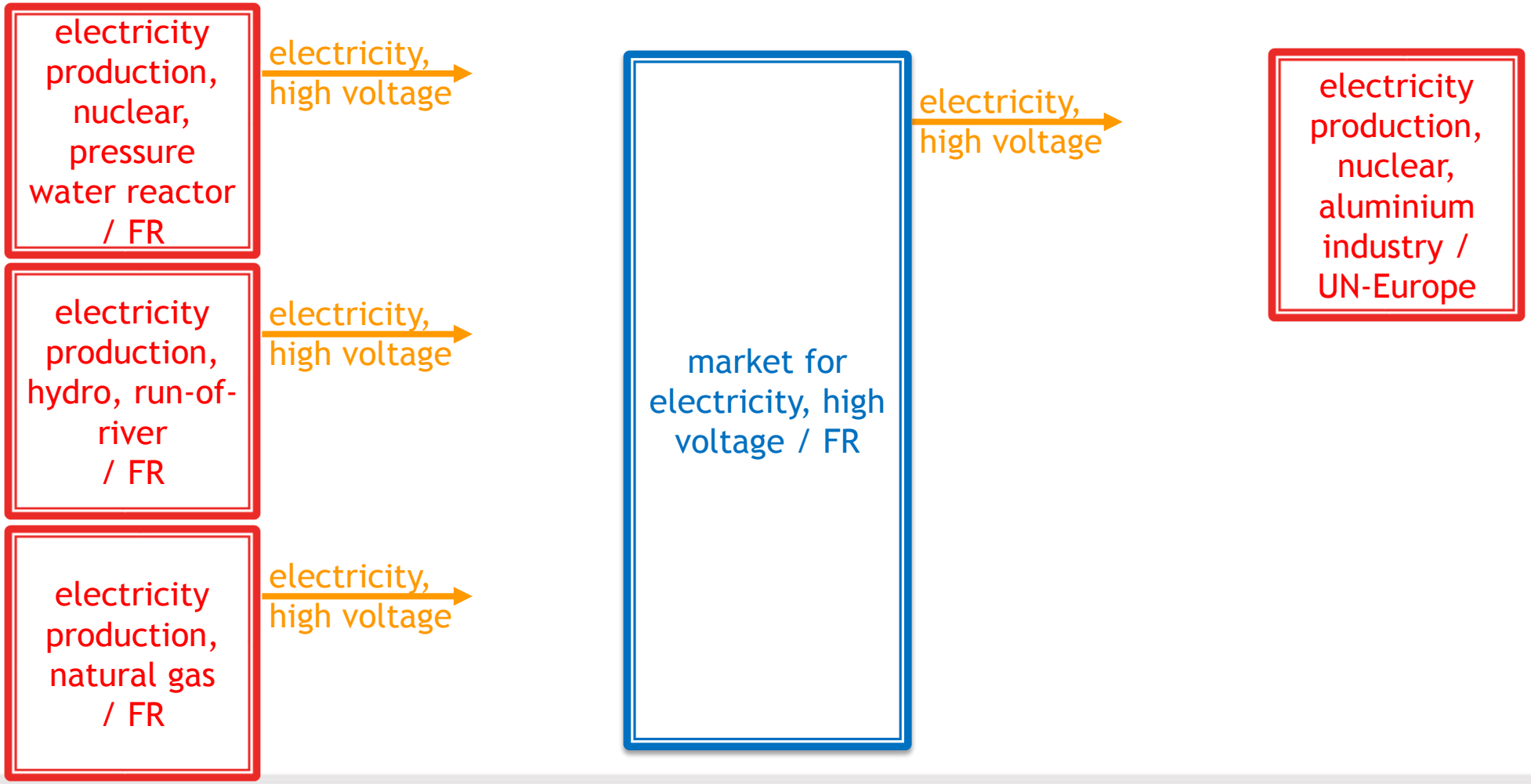


Example: different technologies

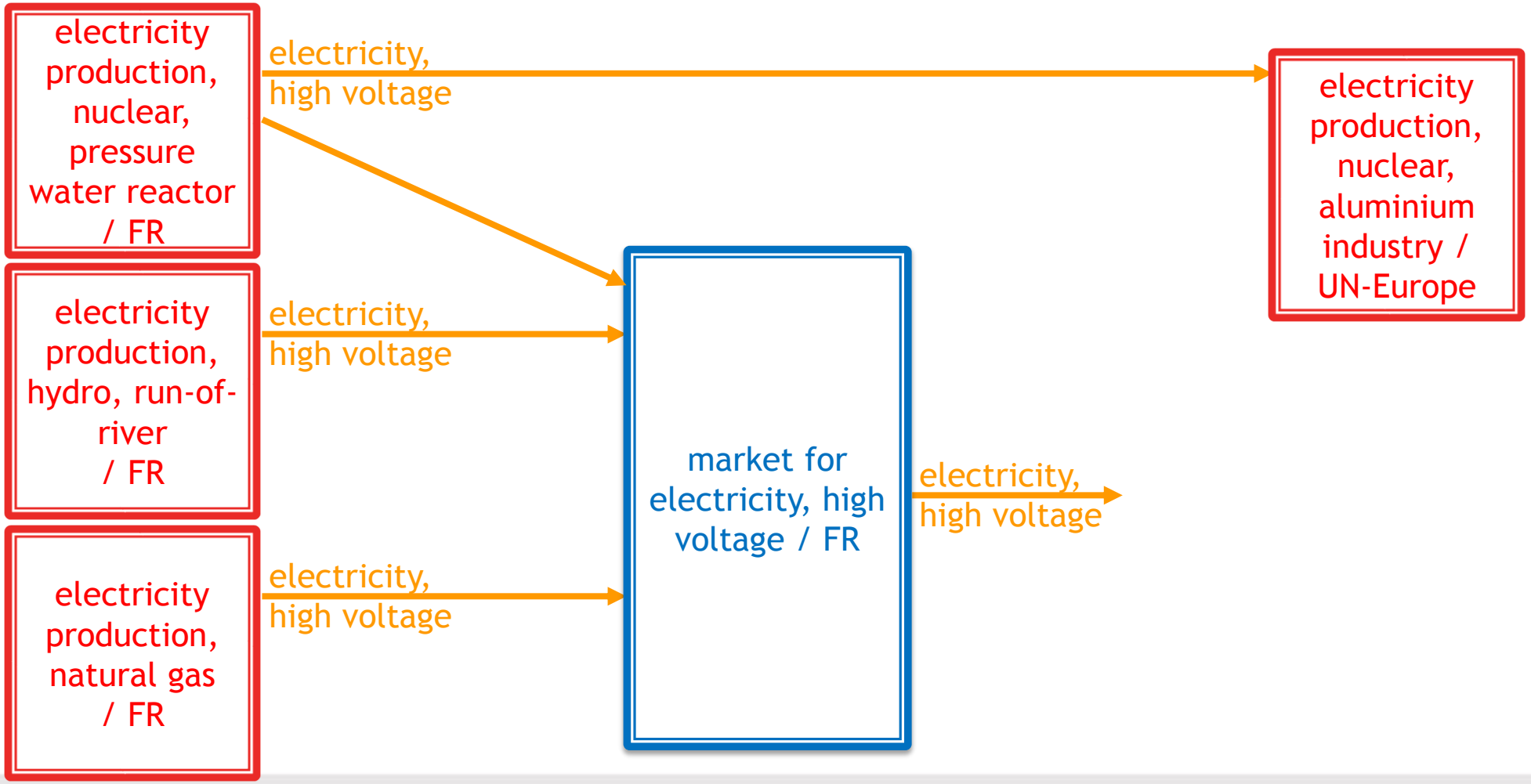


*Consider there are other suppliers to the market, so addition is not up to 100% in this example

Use of direct links to overcome markets



Use of direct links to overcome markets

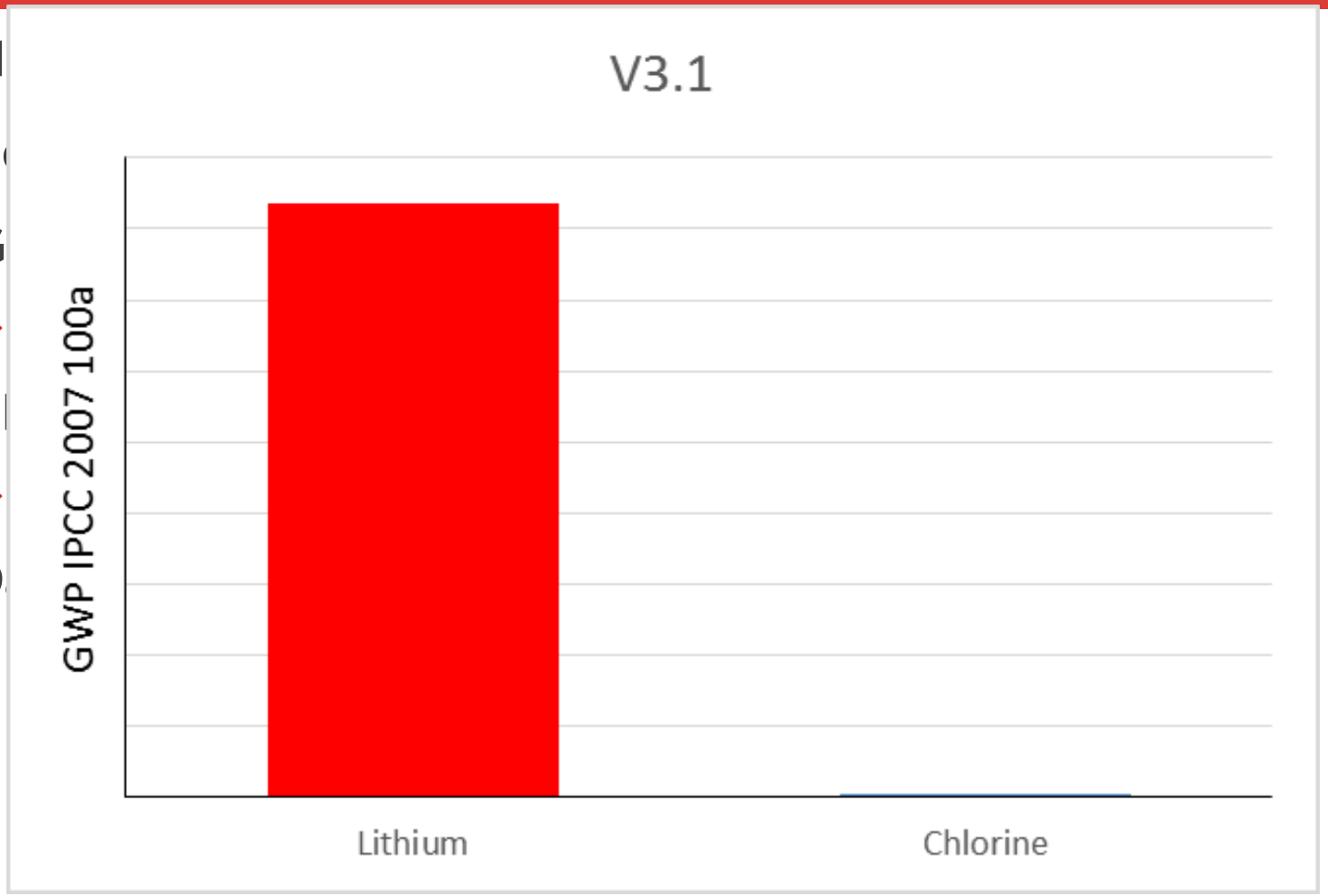


Global supply chains

- In v2.2, **local** datasets served as **placeholders** for global activities
- All processes now have a **global** counterpart
  - Often extrapolated from regional data
  - Uncertainties increased
  - Distributes supply chains and impacts for regionalized LCIA
  - Serves as a foundation for regional data projects
- Global update of **freight transport data**
  - Based on better data, sector-specific values

Why are v3 results different then?

- N
- C
- G
  -
- C
  -
- D



The world's most consistent and transparent Life Cycle Inventory database

Thank you for your attention!

Gregor Wernet

Executive Manager

wernet@ecoinvent.org

www.ecoinvent.org

Agroscope EMPA EPFL ETH PSI