Activity Browser Advanced Tutorial

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- Master of Industrial Ecology at Leiden U.
- Have been developing for AB since 2018
- PhD at Leiden U. since Oct 2020

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Researchgate: /marc-meide

Plan for today → Interactive tutorial

1. Making sure AB is working for all of you
2. Flow scenarios
3. Live demo
4. Break!
5. Uncertainty + Monte Carlo
6. Live demo
7. Break + Playing around
8. Reporting problems/asking for help & Wrapping up

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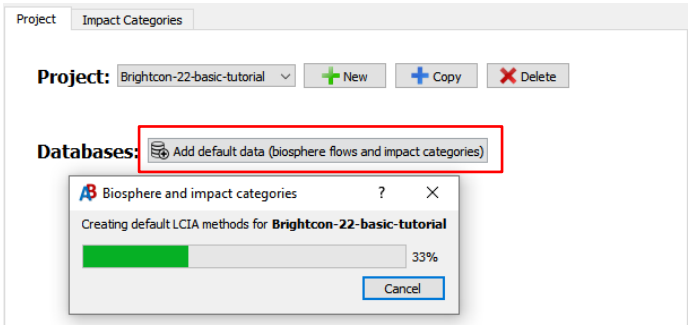
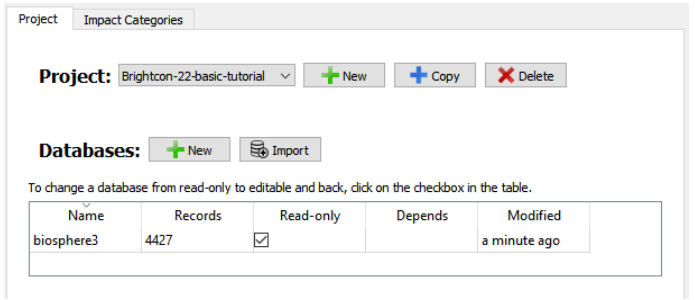
iceberg Circular Economy of Building Materials

Setting up

1. Installing Miniconda3
   https://docs.conda.io/en/latest/miniconda.html
2. Installing Activity Browser
   https://github.com/LCA-ActivityBrowser/activity-browser
   1. Most OS:
      ```
      conda create -n ab -c conda-forge -c cmutel -c bsteubing activity-browser
      conda activate ab
      activity-browser
      ```
   2. Apple M1 Mac
      ```
      conda create -n ab -c conda-forge -c cmutel -c bsteubing activity-browser-arm
      conda activate ab
      activity-browser
      ```
3. Add default data
   Do it now, this takes some time

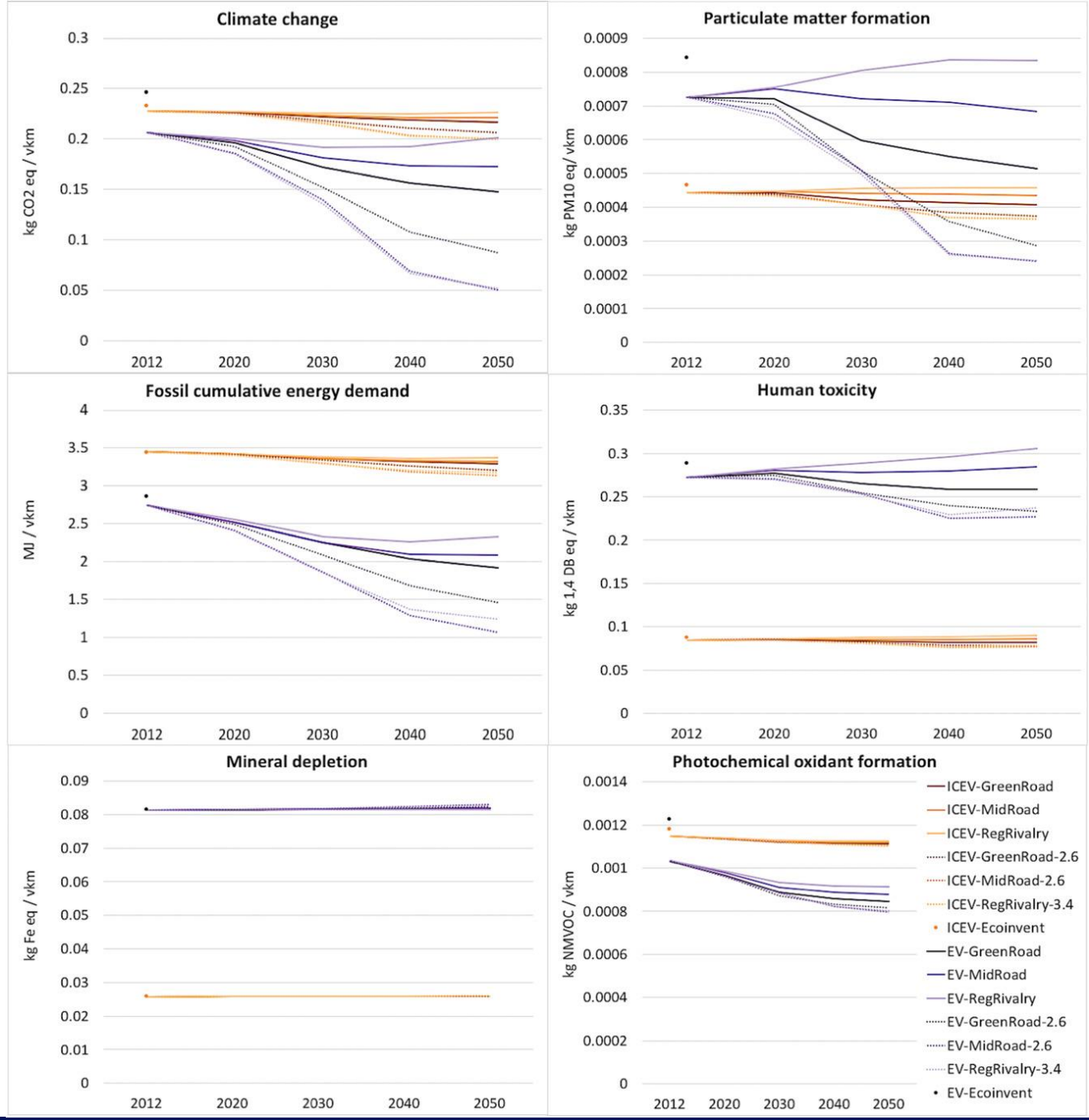




What scenarios are

- Very simply:
  - Different representations of (possible) reality
- Often used for exploration of future possible realities
- Can easily be used as ‘sensitivity analysis’

- Some further scenario reading:
  - A talk by Dr. Bernhard Steubing tonight (18:30-19:30 CEST) at the LCA network (free, requires sign-up)
  - Framework for scenario development in LCA (Pesonen et al. 2000)
  - When the background matters (Mendoza Beltran et al. 2018)



Flow scenarios & AB

- Flow scenarios represent changes in flows

Products:

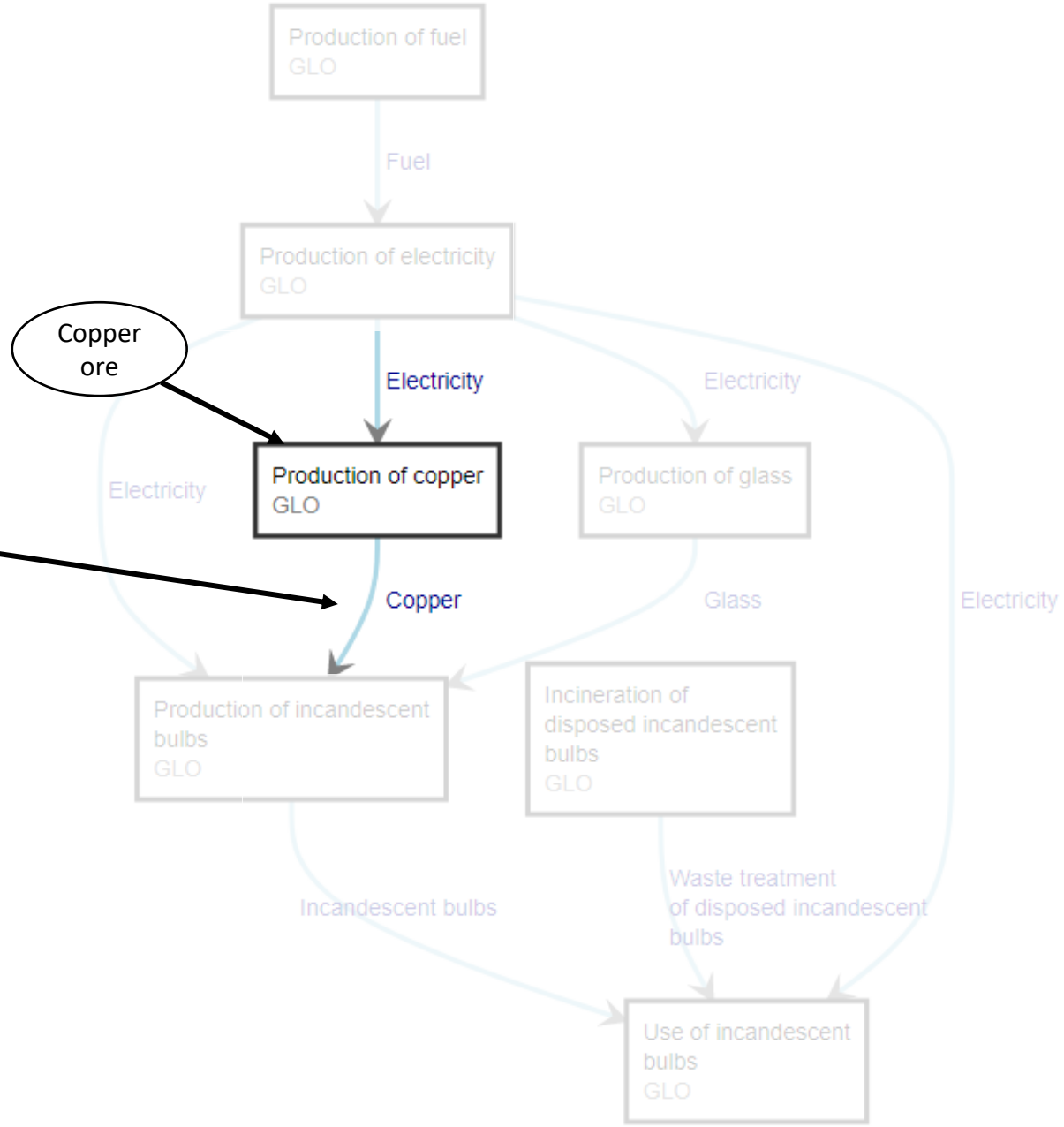
	Amount	Unit	Product	Formula
0	100	kilogram	Copper	

Technosphere Flows:

	Amount	Unit	Product	Activity	Location	Database
0	10000	megajoule	Electricity	Production of electricity	GLO	background_database

Biosphere Flows:

	Amount	Unit	Flow Name	Compartments	Database	Formula
0	1000	kilogram	Copper, in ground	natural resource - in ground	biosphere3	



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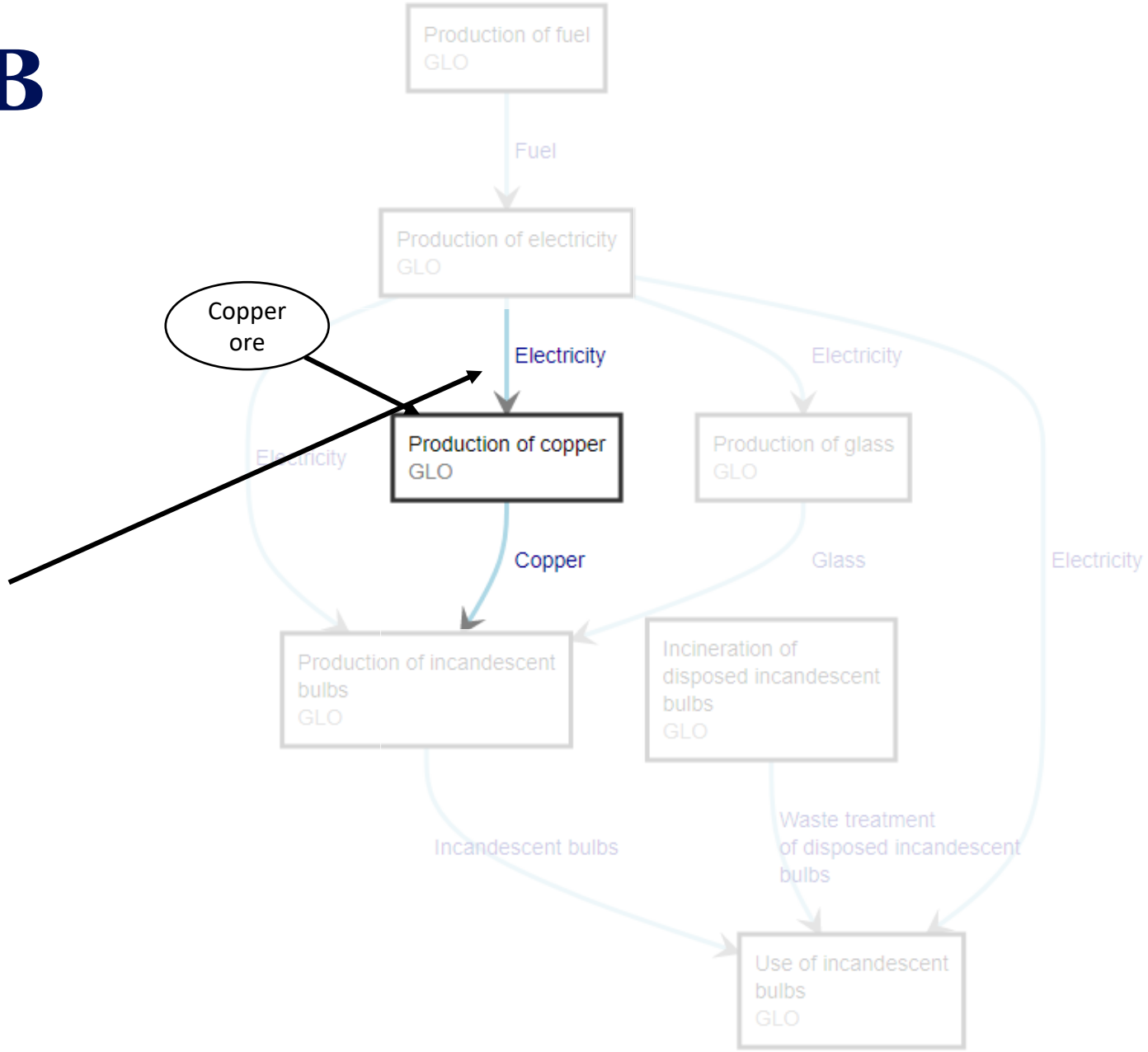

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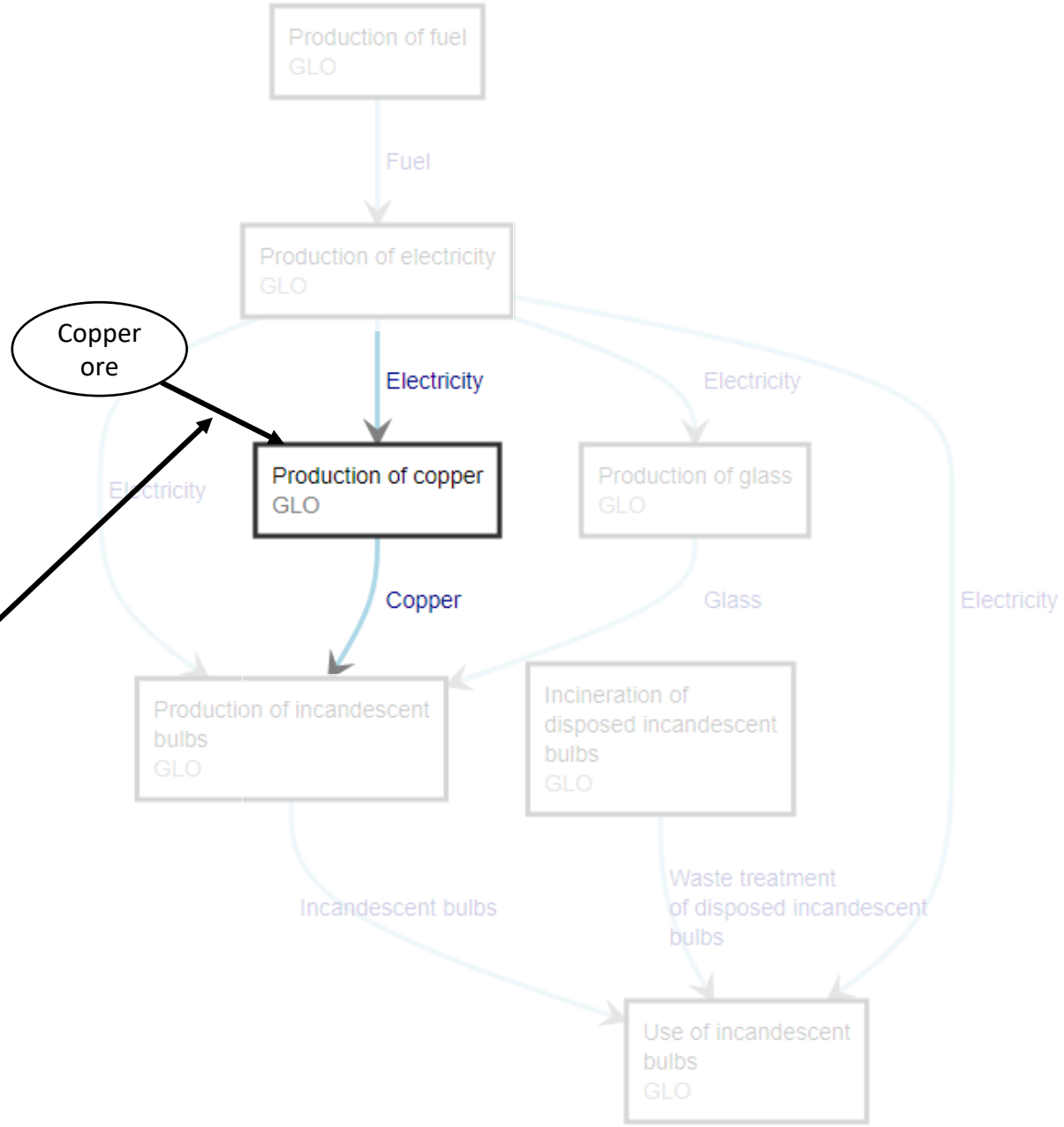

Flow scenarios & AB

- Flow scenarios represent changes in flows
- Flows are represented by a `*from*` and `*to*`

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	Amount	Unit	Product	Formula
0	100	kilogram	Copper	

Technosphere Flows:

	Amount	Unit	Product	Activity	Location	Database
0	10000	megajoule	Electricity	Production of electricity	GLO	background_database

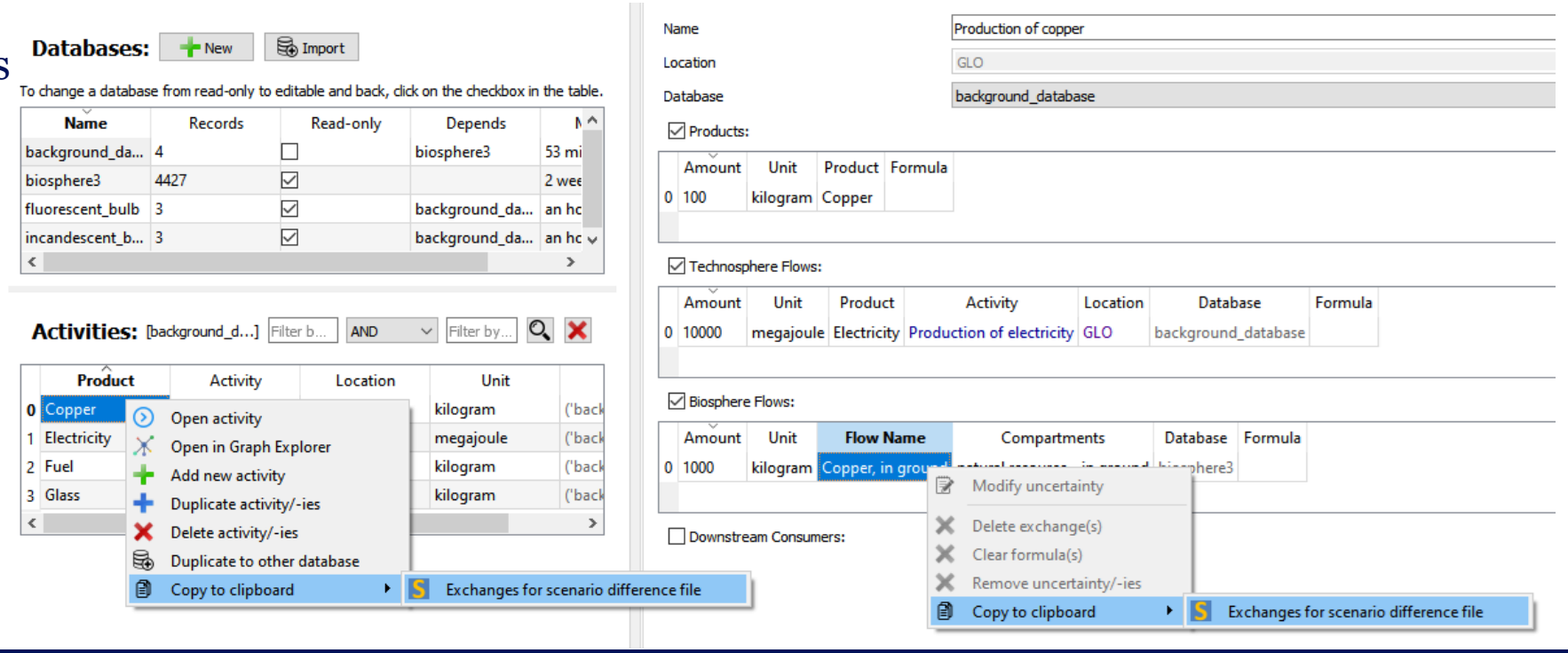
Biosphere Flows:

	Amount	Unit	Flow Name	Compartments	Database	Formula
0	1000	kilogram	Copper, in ground	natural resource - in ground	biosphere3	

from activity name	from reference product	from location	from categories	from database	from key	to activity name	to reference product	to location	to categories	to database	to key	flow type	amount
Copper, in ground			('natural resource	biosphere3	('biospher	Production of cop	Copper	GLO		background_	('backgr	biosphere	1000
Production of coppe	Copper	GLO		background_da	('backgrou	Production of cop	Copper	GLO		background_	('backgr	production	100
Production of electr	Electricity	GLO		background_da	('backgrou	Production of cop	Copper	GLO		background_	('backgr	technosphe	10000

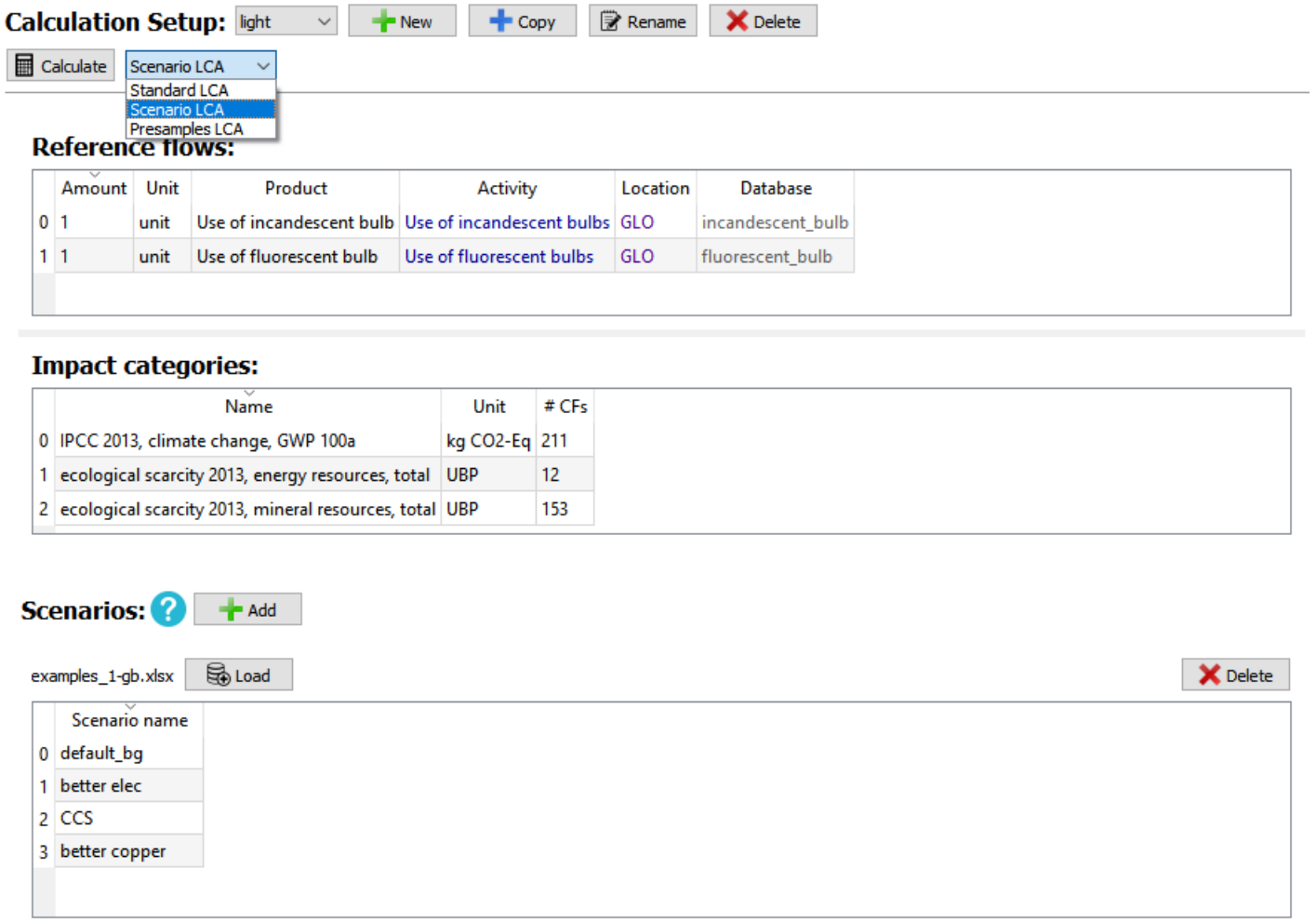
Working with flow data

- From Activities table to within an activity
- You can copy flow data from AB through right-click
  - Copies all related flows
  - You can also select multiple rows
- You can then paste to Excel
- Add columns for new scenarios



Calculating flow scenarios

- Choose the `Scenario LCA` option and load a file



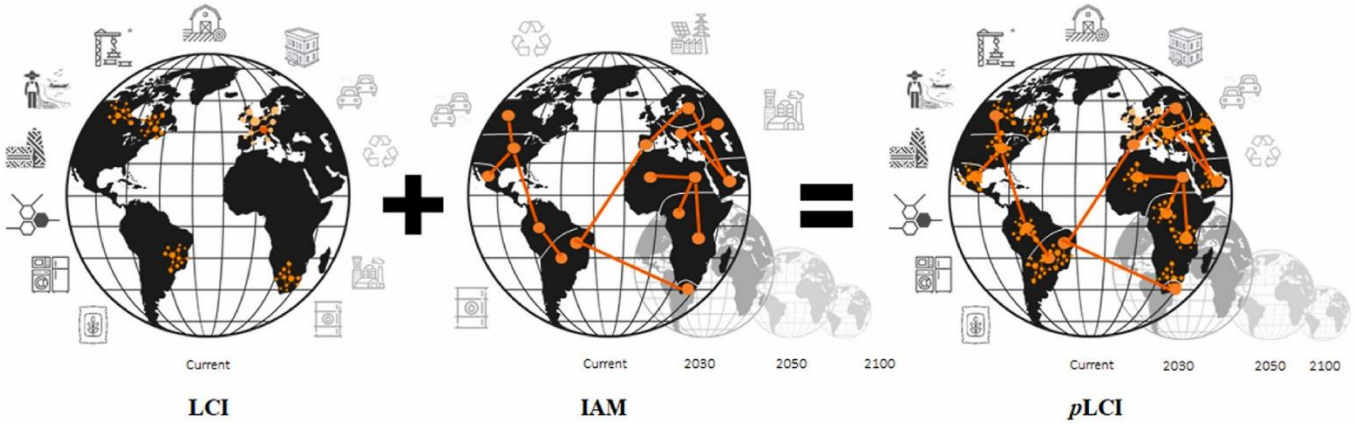
Flow scenarios, but cooler:

- Change *many* processes in ecoinvent background?
- Couple Integrated Assessment Models to ecoinvent?
- Generate files with >> 100'000 flows changed?
- Consider different scenarios into the deep future?

premise

- Premise (Sacchi et al. 2022)
- Superstructure (Steubing & de Koning 2021)

- More info? Come to the talk by Romain Sacchi tomorrow



Live demo

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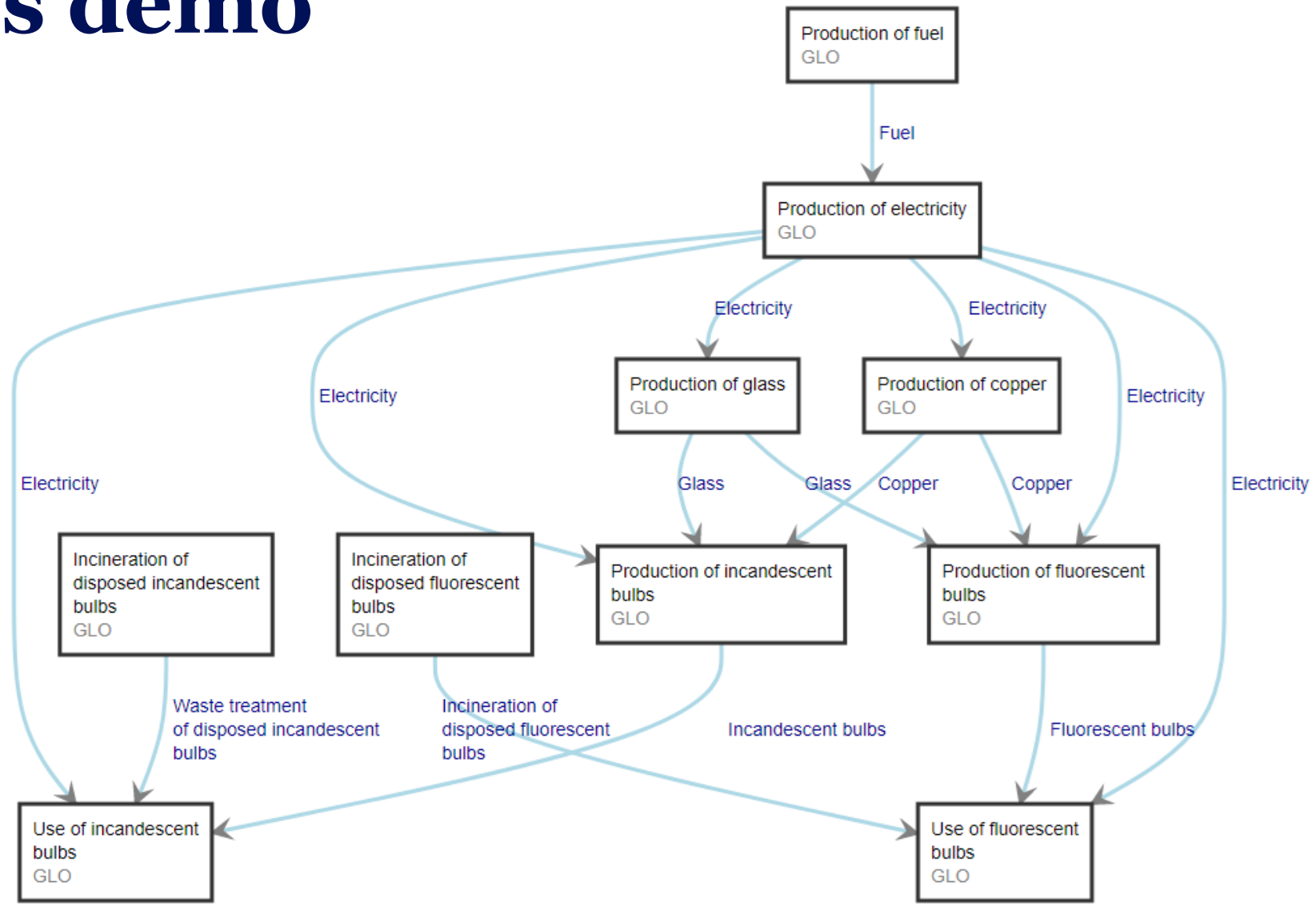
Flow scenarios demo

I will:

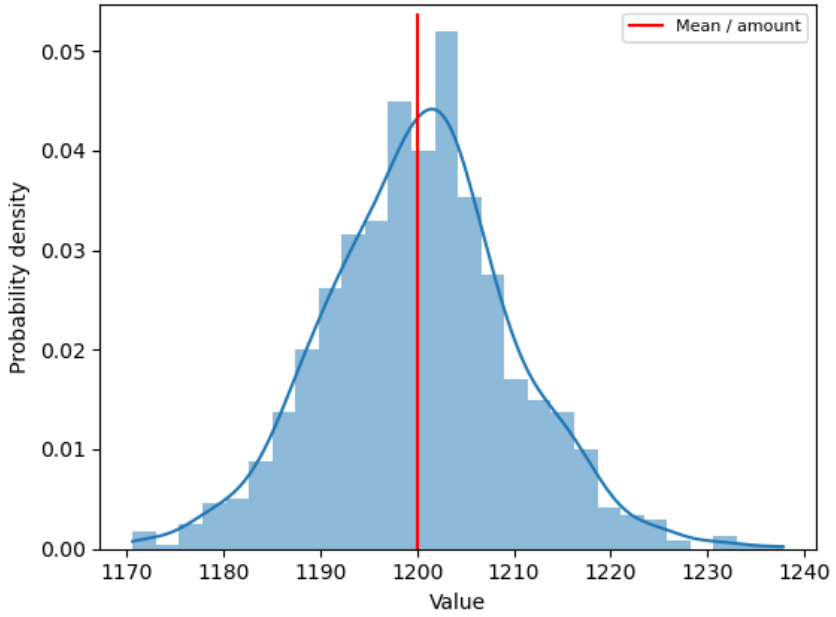
- Introduce the system
- Generate flow scenario file
- Run calculations
- Assess results
  - General results
  - Process contributions
- Use multiple flow scenarios



This example is based on Chapter 17A of Principles of Environmental Sciences (Heijungs; 2009).

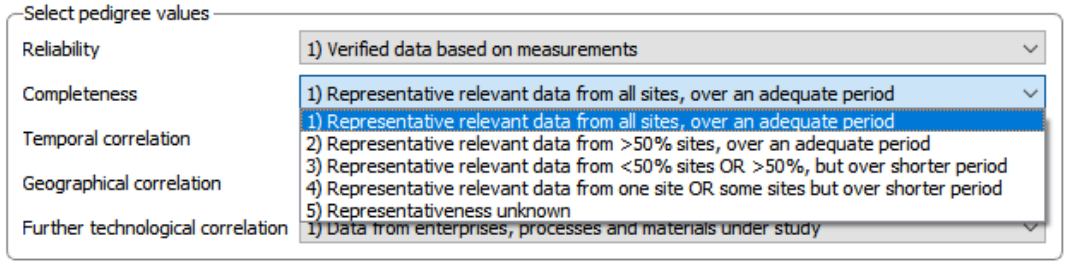
What are uncertainties in LCA

- We never know a number with perfect precision
- We can assume a distribution of results

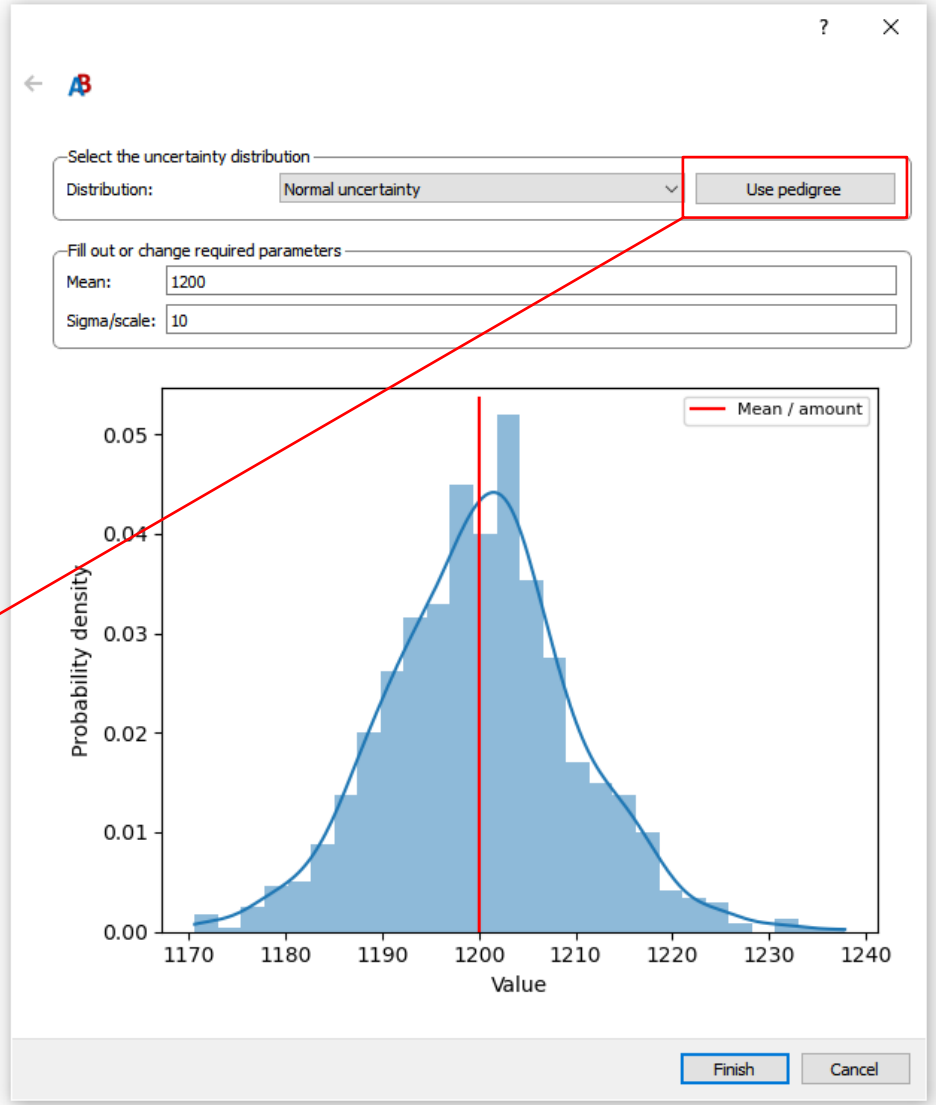


Uncertainties & AB

- You can set uncertainty distributions for every flow, parameter and characterization factor in AB
- Many different distributions can be set in AB (see statsarrays documentation)
- You can also use pedigree distributions (Ciroth et al. 2013)
  - 5 categories that get a score 1-5
- Ecoinvent also uses this for uncertainty data

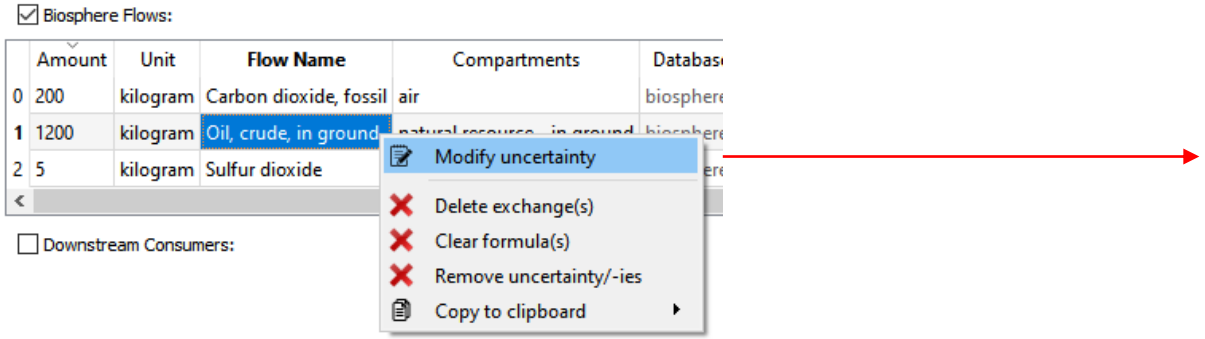


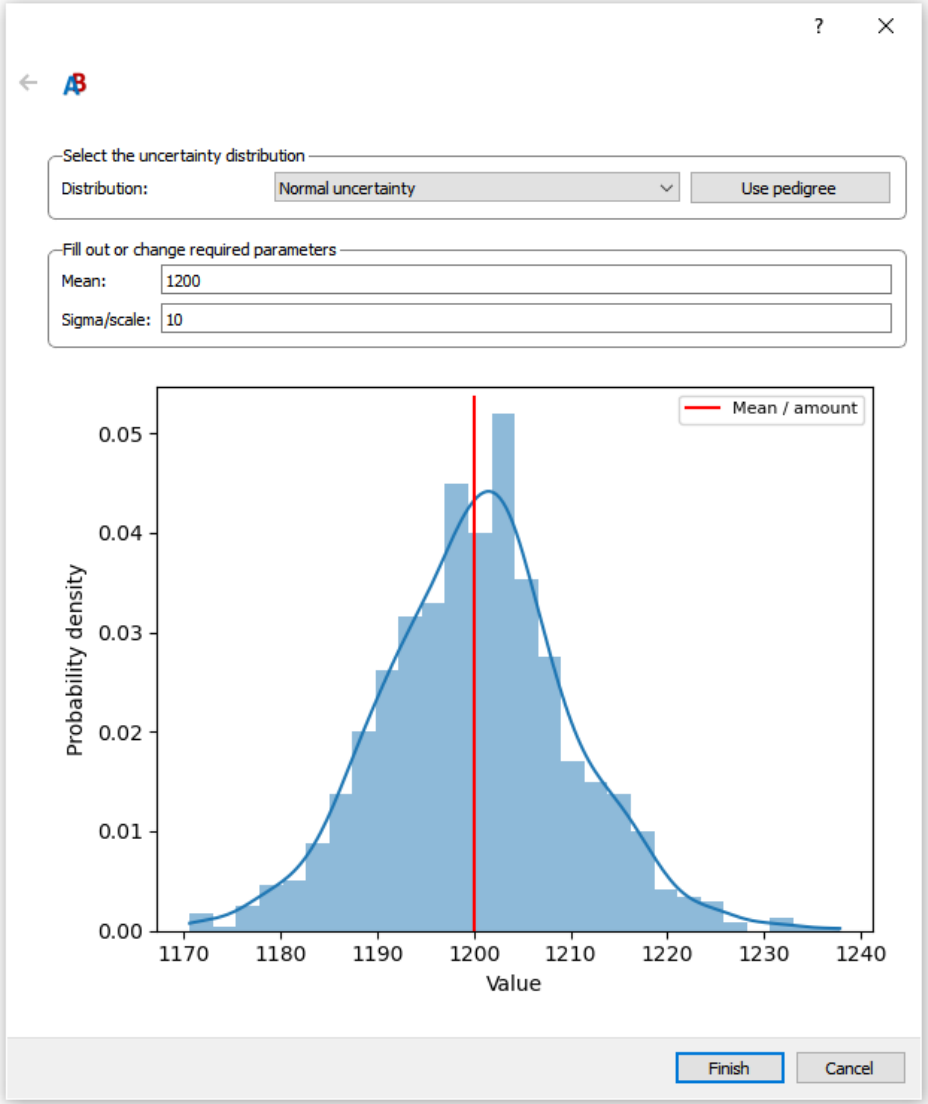
- Though not without criticism (Heijungs 2020)



Setting uncertainty in AB

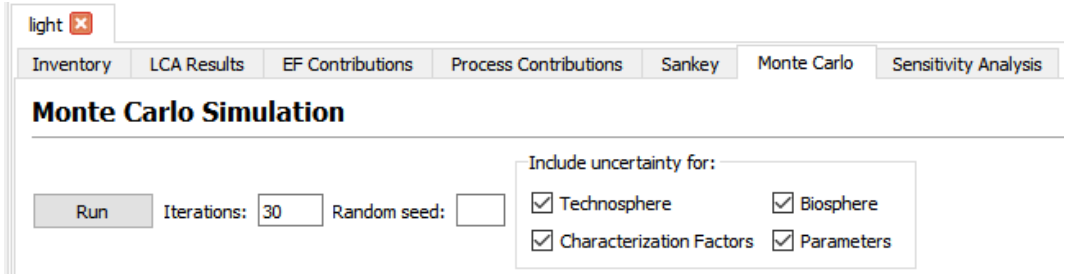
- Right-click a flow and choose Modify uncertainty



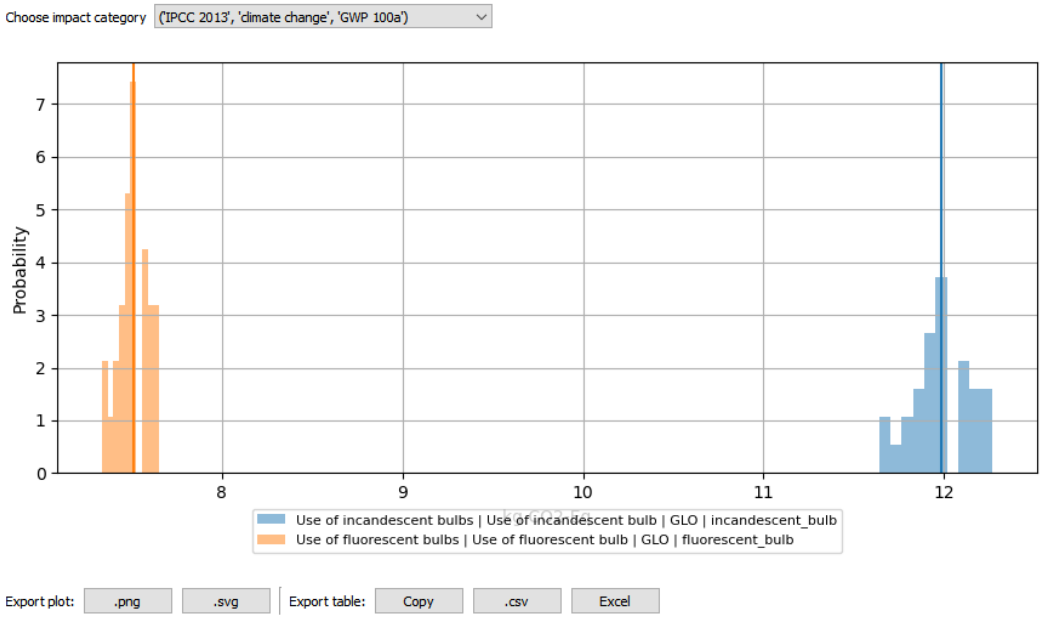


Calculating with uncertainty in AB

- Do a normal calculation



- Then go to Monte Carlo and run



Live demo

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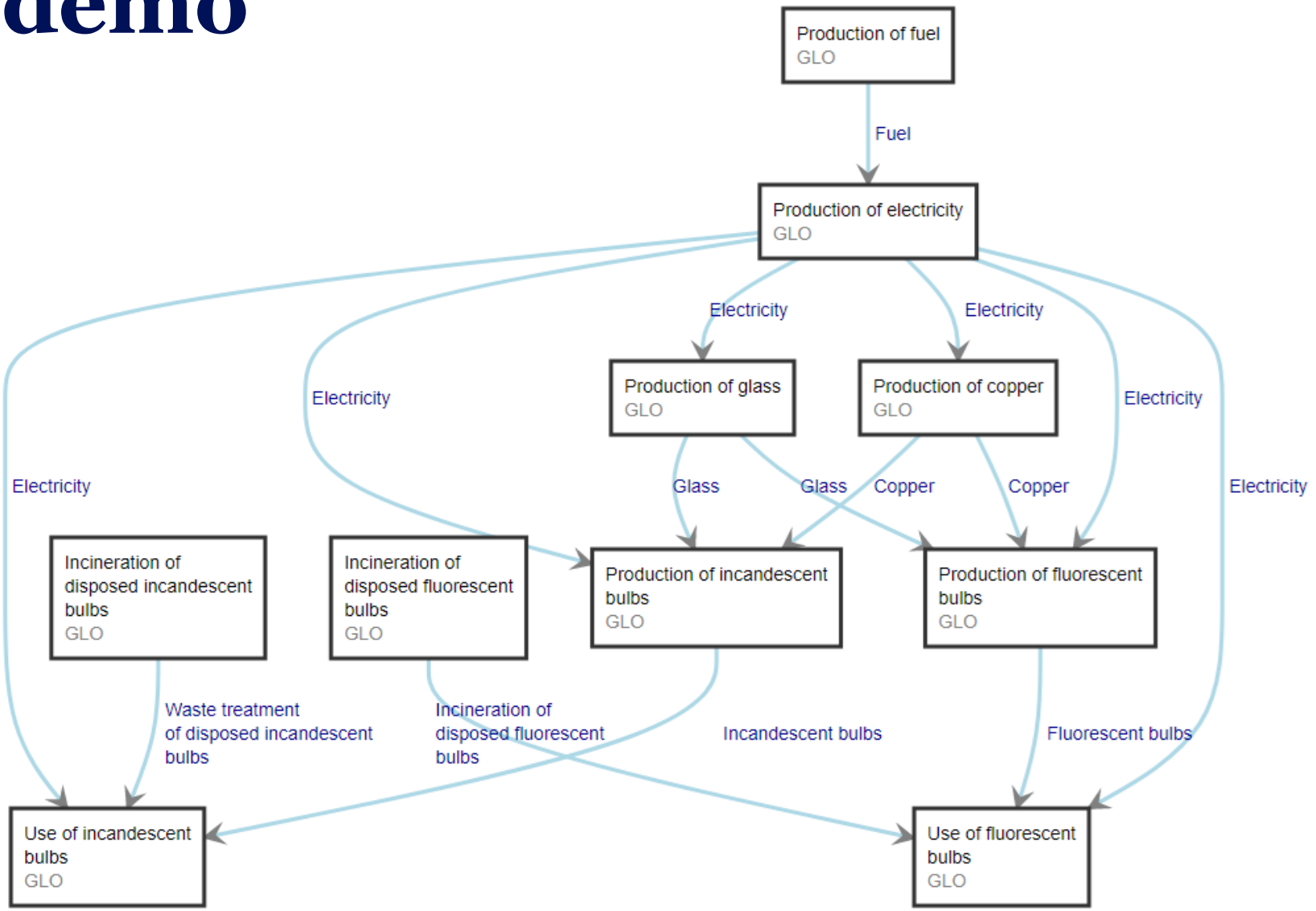
Uncertainties demo

I will:

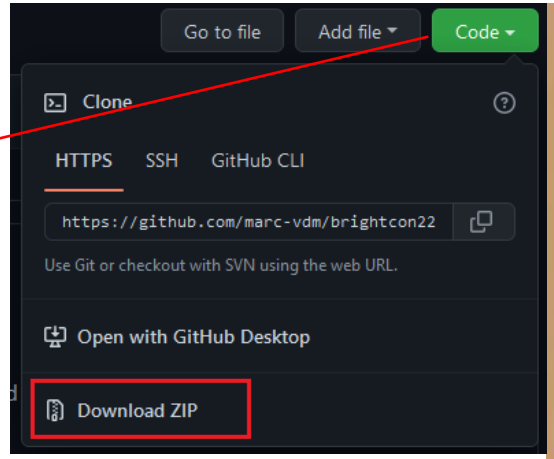
- Use the same system
- Demonstrate some uncertainties
- Calculate results



This example is based on Chapter 17A of Principles of Environmental Sciences (Heijungs; 2009).

Playing around

1. Take a break, grab a drink
2. Go to:
   tinyurl.com/bcon22-AB102
3. Download all files
   - Optional: Import the databases
4. Use the slides as a guide to play around
   - Create some flow scenarios
   - And/or add uncertainty data
5. Either use the provided databases
   or your own system to try things out



Ready to continue?

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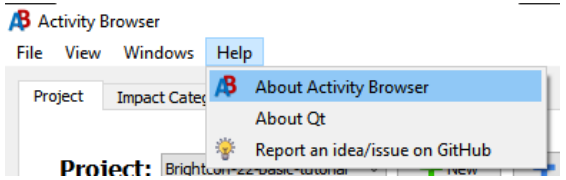
Reporting problems and asking for help

- Are you having problems or did you find a bug?
- Don't know how to do something?
- Do you have ideas for improvements or totally new features?

Report it on our [github-issues page]

- Reporting a problem? Provide the following for quicker help:
  - What were you trying to do/expecting?
  - What did happen?
  - If relevant share extra information:
    - Screenshots
    - Error messages from the terminal
  - The version of your Activity Browser →

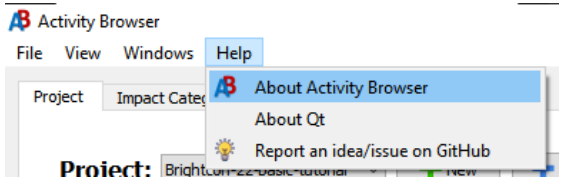


Wrapping up

1. You can now develop your own flow scenarios and assess results
2. You can now add uncertainty data and use Monte Carlo simulations

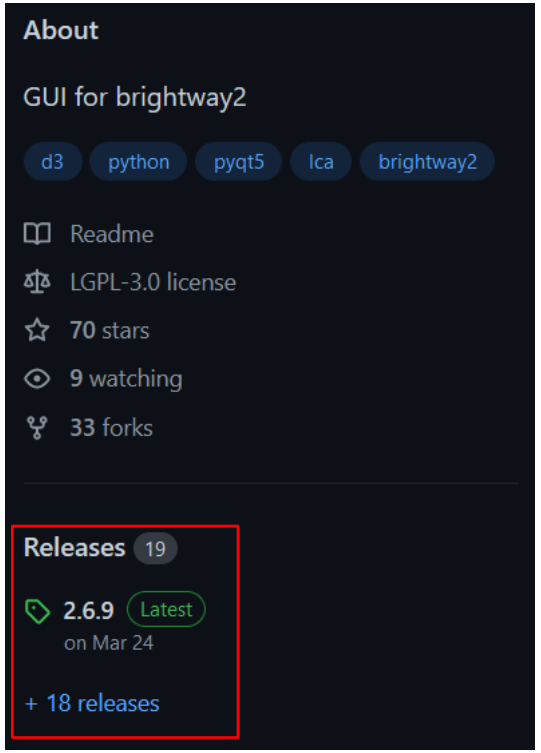
Updating AB

- Updating will never remove data in your projects/databases
- You can check what version of AB you're on under: Help → About Activity Browser



- You can see what version is the latest release on our github under releases
- You can update activity browser with:

```
conda activate ab
conda update activity-browser
```



- Want to be on the cutting edge?
  - You can download the development version here
  - You can have both versions side-by-side and both will have access to the same projects/databases etc
  - The development version gets more updates, but things may break more often

General tips

- **Tooltips:** Hover over a button/slider/item with your mouse to get a popup for more information.
- **Excel format:** While AB supports the excel format, please don't make databases in excel, only edit them there, it's *very* easy to make mistakes and break your file.
- **Modeling waste treatment:** Be aware that ecoinvent considers waste treatment a service that an activity needs as 'input', not as an output product. This is modeled by having a negative value for production and the input into a process.

Q&A

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