Environmental impacts of using residues from food processing

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Introduction

- LCA identifies food waste as opportunity to reduce environmental impacts of food consumption
- Food waste has become important in political debates
- Many assume waste is free from upstream environmental burdens
- Focus solely on food system misses interlinks with other sectors

Examples of food processing residues

- Couple products:
  - Whey from cheese making
  - Soybean meal from oil pressing
  - Apple peels from making dried apples
- Food waste:
  - Unsold bread from supermarket
  - Used cooking oil sold by McDonalds

➢ Residues can be couple products or food waste

Competing usages of biomass residues

- Food (maybe upgraded)
- Fodder for animals and insects
- Fertilizer (compost)
- Biomaterials (e.g. leather from apple peels, glycerine, oils, ethanol)
- Processed materials (bioplastics, biochemicals)
- Energy carrier (biodiesel, biogas, ethanol)
- Energy (heat, electricity)
- Waste management with energy and substance recovery (MSWI, WWTP with sludge digestion, direct incineration, partly recovery e.g. of phosphorus)

➢ Often competing usages and many ideas to valorise residues

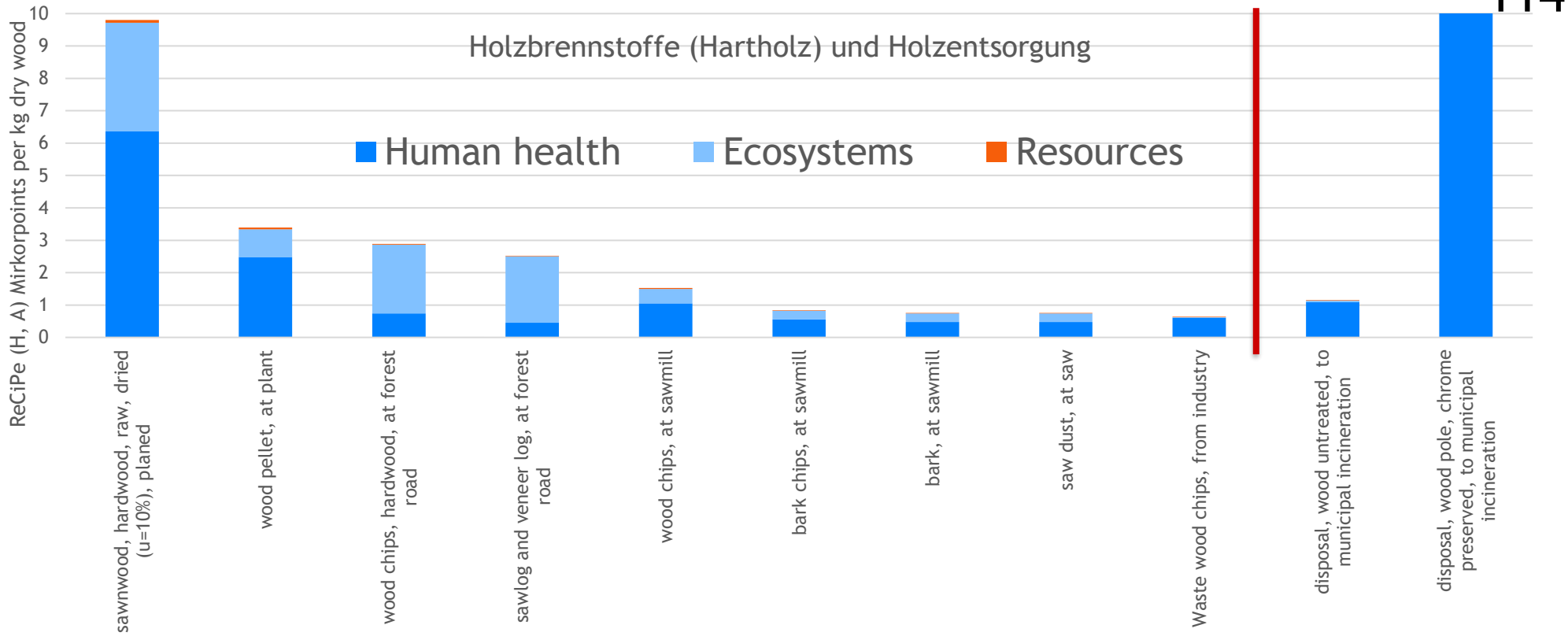
PPP broadly supported in the LCA community

- Allocation of environmental impacts in the production and treatment of residues is an allocation problem according to ISO 14040/44
- Specification PPP in EN 15804 to define end of waste
- Economic allocation is found in many datasets of background databases (e.g. wood products, biofuels and materials, animal feed, food processing)

Price of residues are influenced by

- Demand of the market and there for its usefulness (ideally)
- Prices of alternatives on the market (e.g. oil price)
- Subsidies and legal requirements in all forms
- LCA results for using residues (how beneficial for the environment)

Example wood qualities in ecoinvent



- Ecosystem (land use) = estimation of forestry load depends on economic value and further processing, minimum share of forest also in sawdust
- Waste wood only bears load from processing and chips

Problem setting

- Whey is a by-product of cheese making
- So far often used as fodder
- Proteins would also be suitable for human consumption

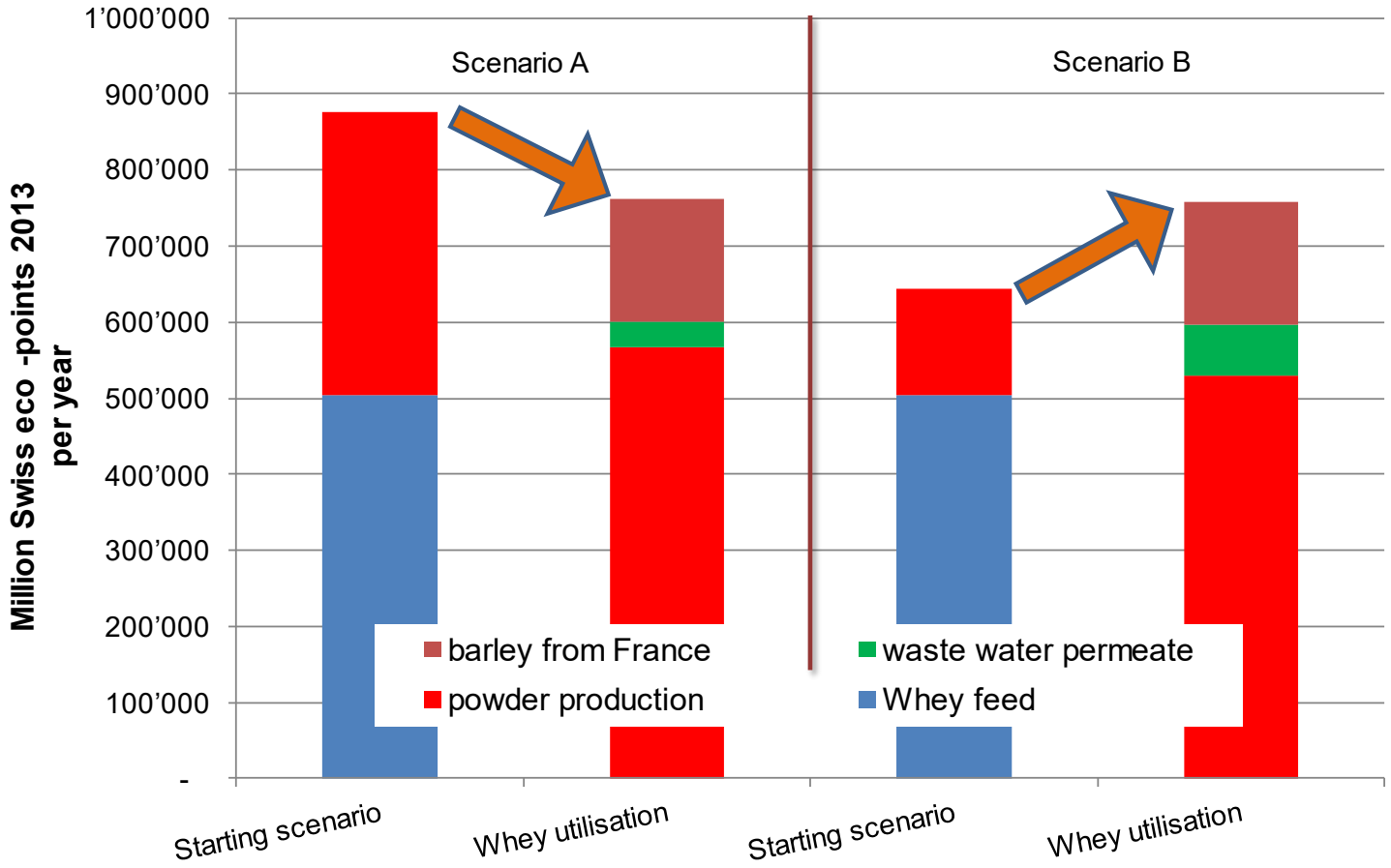
➢ Idea use whey proteins for human consumption

Szenarios

- Use of whey as pig feed and milk powder for human consumption (base case)
- A: Production of whey protein powder (WPC 35) and whey powder, import cereals for pigs
- B: Production of whey protein powder (WPC 65), import cereals for pigs

➢ Not covering direct replacement of animal proteins

Results


Million Swiss eco -points 2013 per year
1'000'000
900'000
800'000
700'000
600'000
500'000
400'000
300'000
200'000
100'000
-
Scenario A
Scenario B
barley from France
powder production
waste water permeate
Whey feed
Starting scenario
Whey utilisation
Starting scenario
Whey utilisation

Influencing factors for the LCA of using residue

- Allocation problems
  - Waste or residue?
  - Allocation of impacts from the 1st life cycle of food product to the 2nd usage
  - Avoided burden: Which alternatives are considered?
  - Apply PPP
- Efforts (and impacts) of upgrading and valorisation
- Functional unit: What do we compare with each other
- LCA results influence market and increasing prices rise impacts

➢ LCA studies cannot give a clear guidance for all possible cases

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