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Industrial residuals and their use

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Outline

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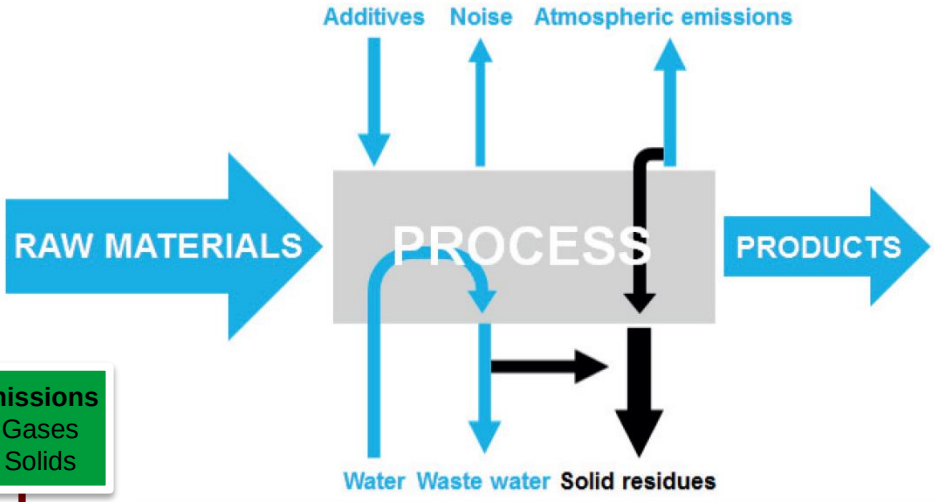
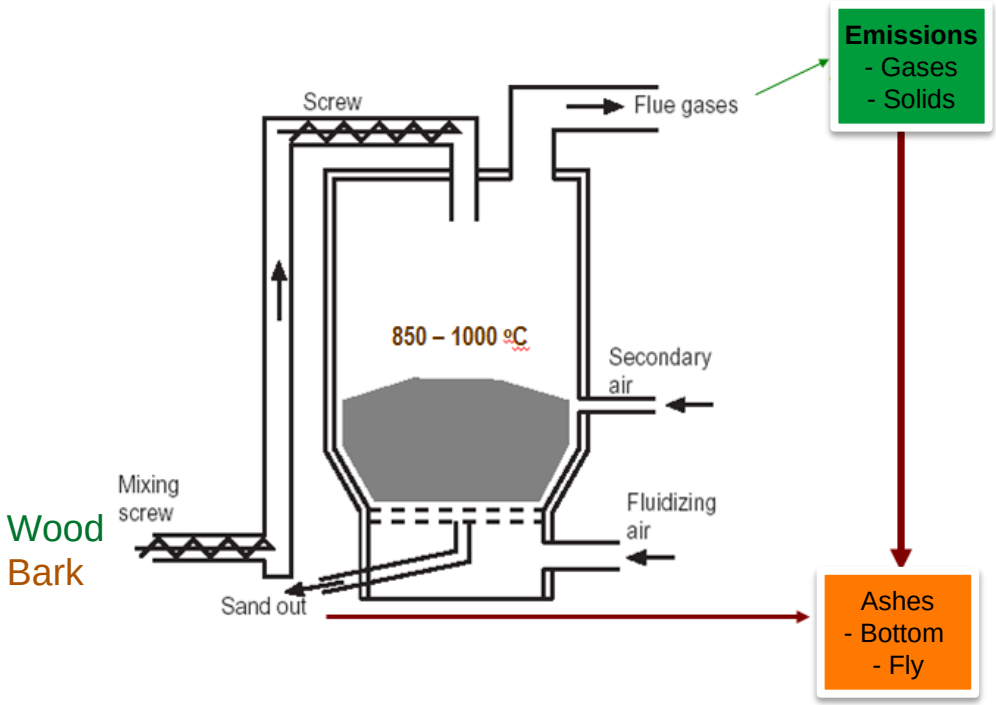
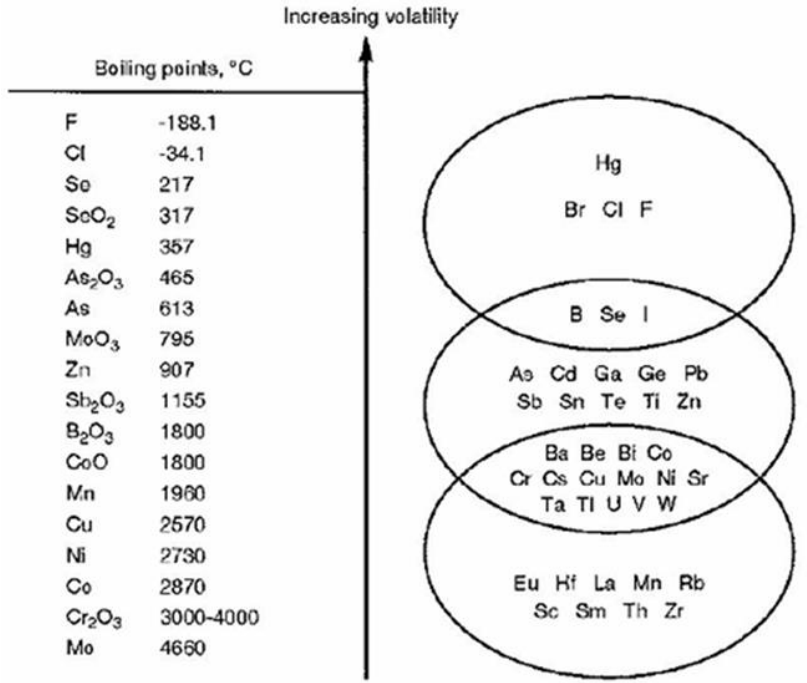
  - Quantities and origin of solid wastes in Finland
  - Factors that control the industry and the regulations that guide the utilization of solid residuals
- **Life Cycle Assessment as a part of the cross-utilization of industrial residuals**
  - The viewpoint of Industrial ecology and symbiosis:
  - What are symbiosis products?
  - Life cycle assessment example of symbiosis products
  - Recommendations on the basis of the calculation of LCA
- **Conclusions**

Formation of solid residuals ?

Ashes 1,6 milj. t/a
- Coal based 1,0 milj. t/a
- Wood based 0,6 milj. t/a







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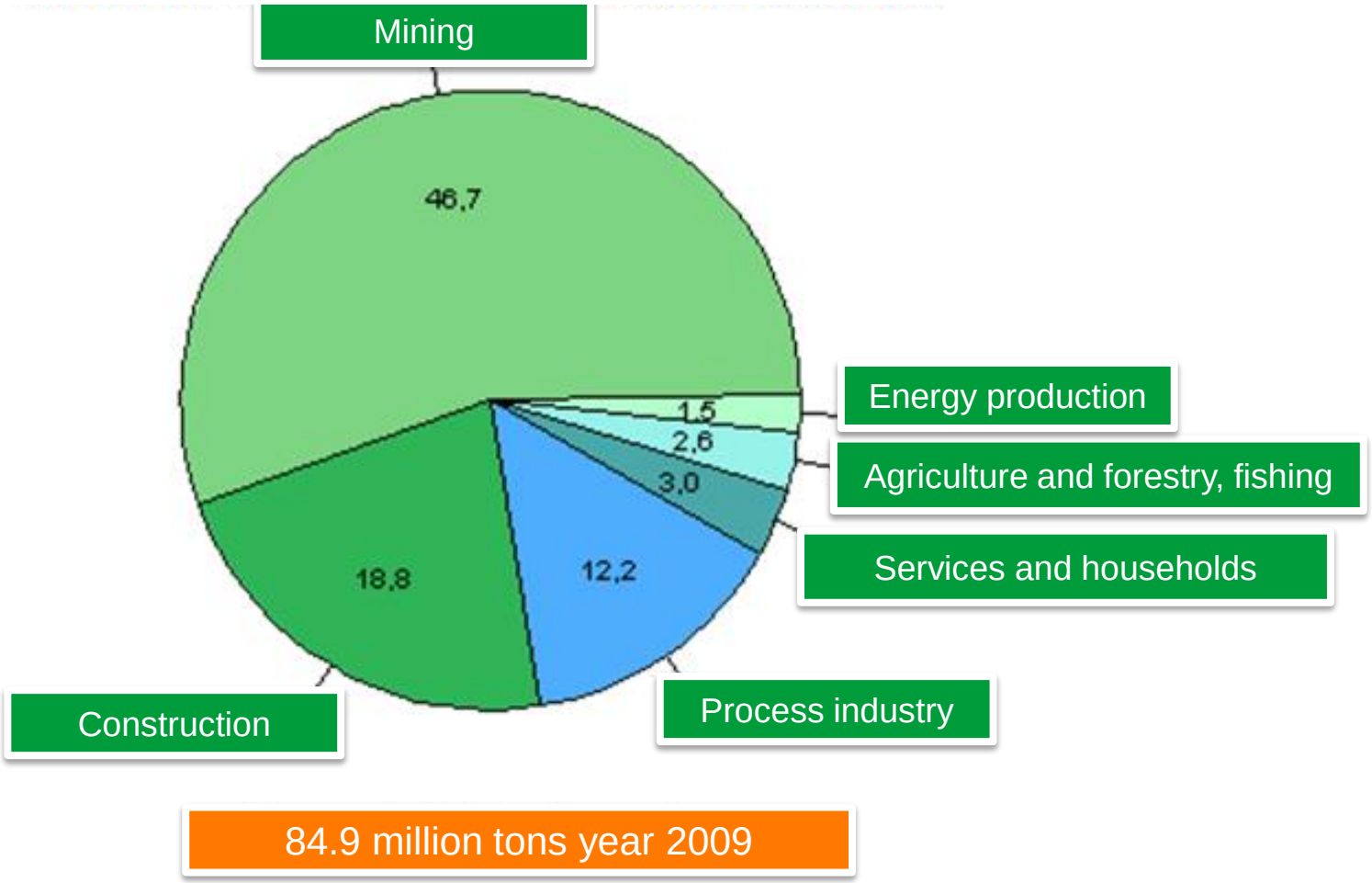
Quantities and origin of solid wastes in Finland



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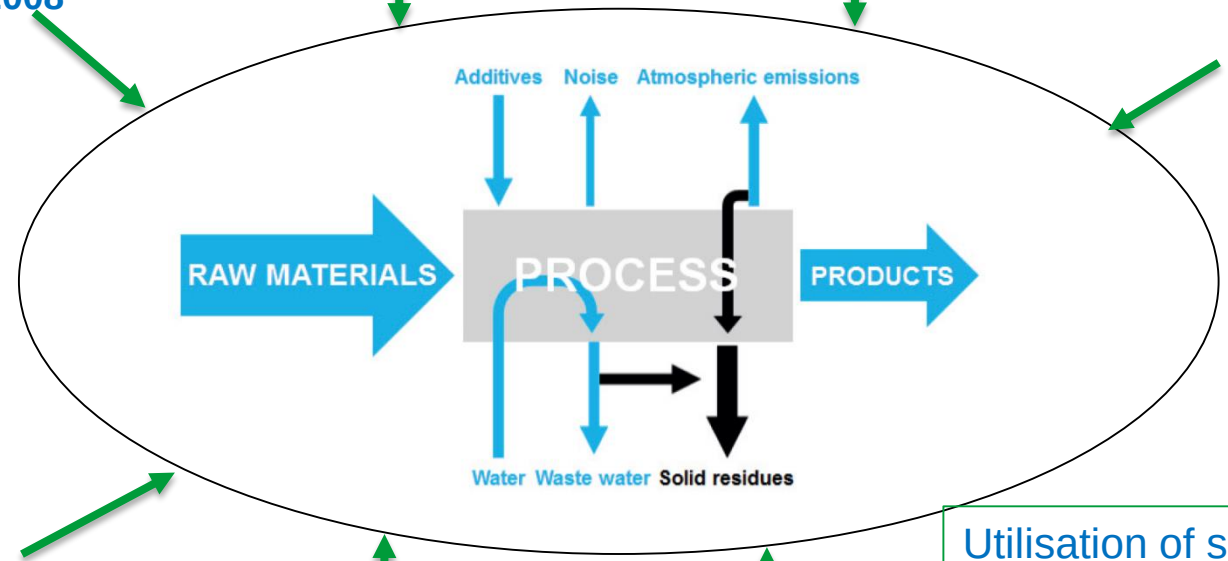
Source: tilastokeskus

Factors that control the industry and the regulations that guide the utilization of solid residuals



Waste directive 2008

IPPC directive 1996
IE directive 2011

BREF – documents
BAT

Environmental Regulations

IPP

Reach Act 2007

Revised Environmental Permits 2000-

Environmental Management Systems EMAS, ISO

Utilisation of solid residuals

- ✓ Waste legislation
  - ✓ Waste directive
- ✓ Chemicals legislation
  - ✓ REACH act
- ✓ Construction Products legislation
  - ✓ Construction products directive
- ✓ Fertilizer regulation

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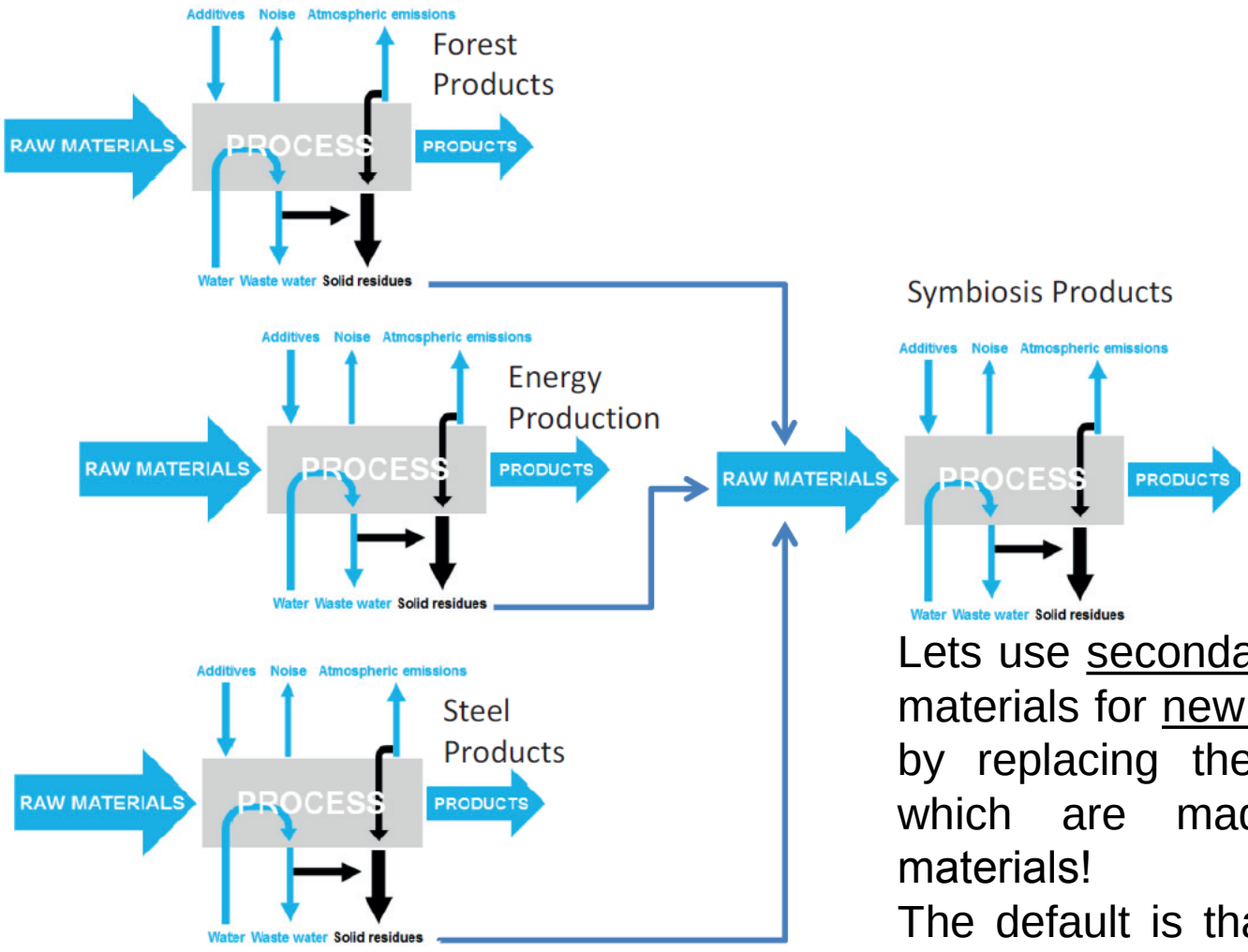
LCA as a part of the cross-utilization of industrial residuals – The viewpoint of Industrial ecology and symbiosis

- ✓ <u>The viewpoint of Industrial ecology and symbiosis:</u>
  - Industrial ecology is a broad, systemic and cross-industrial approach, it studies industrial systems as ecosystems which encompass a network of processes and flows, includes industry's wider links to society – Broad metaphor.

- ✓ <u>Industrial symbiosis is a part of industrial ecology:</u>
  - looking at the interaction and utilization of processes and flows within the industrial ecosystem such as recycling of residues for the development of new symbiosis products – A model.

LCA as a part of the cross-utilization of industrial residuals – What are the symbiosis products?



Lets use secondary raw materials as materials for new symbiosis products by replacing the existing products which are made using primary materials!

The default is that new products do not contain too many harmful substances - Does this make sense?

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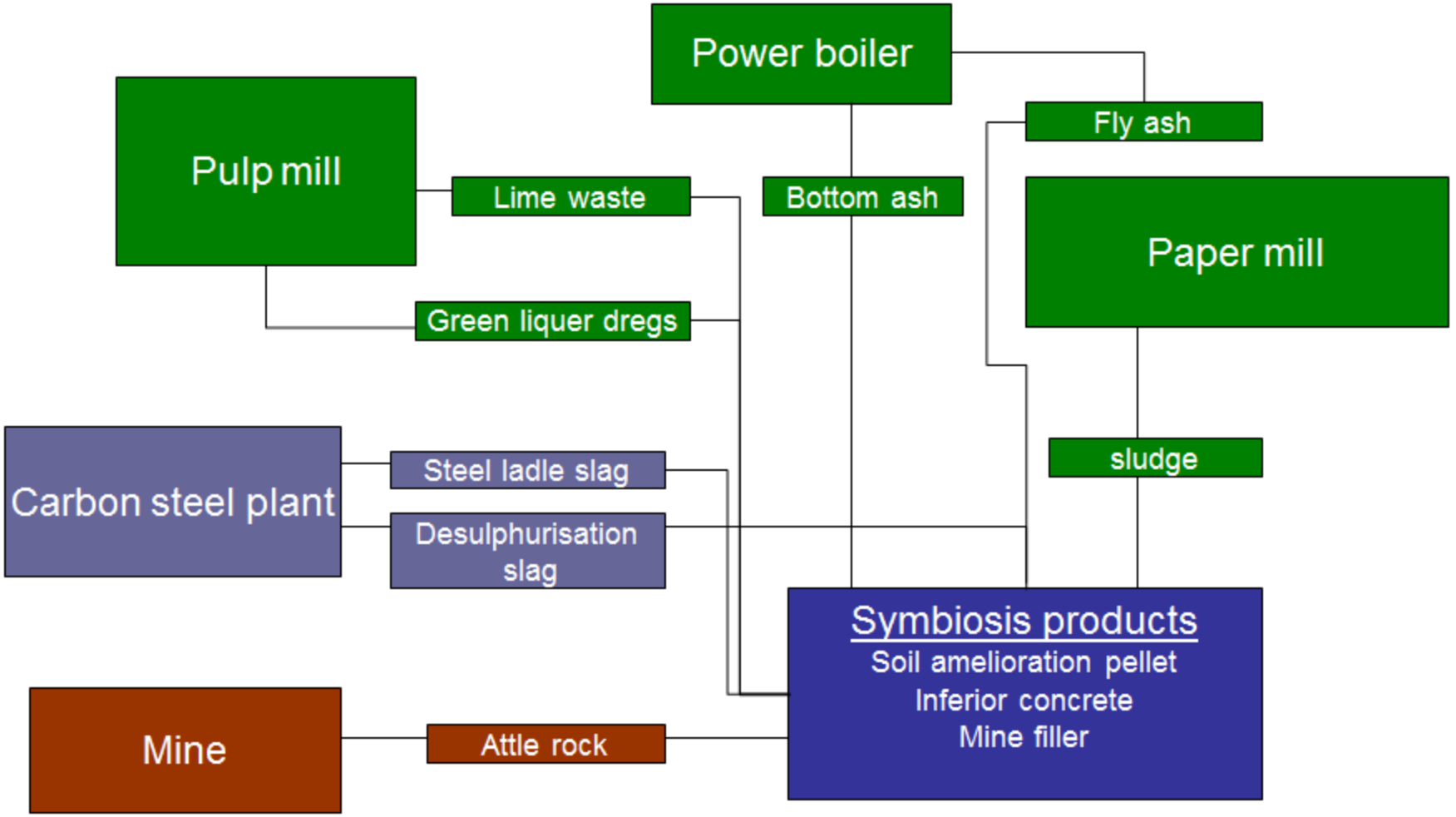
Life cycle assessment example of symbiosis products

- Life cycle assessment (LCA) of the recycling of residue flows from an integrated pulp and paper mill, a power boiler, a carbon steel plant and a mine into secondary raw materials for new symbiosis products.

- LCA based on the ISO 14040 and 14044 standards.

Life cycle assessment example of symbiosis products

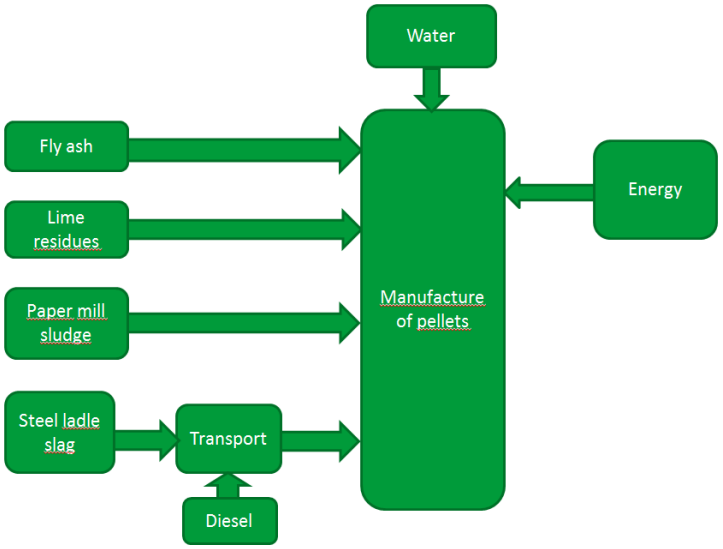


Life cycle assessment example of symbiosis products

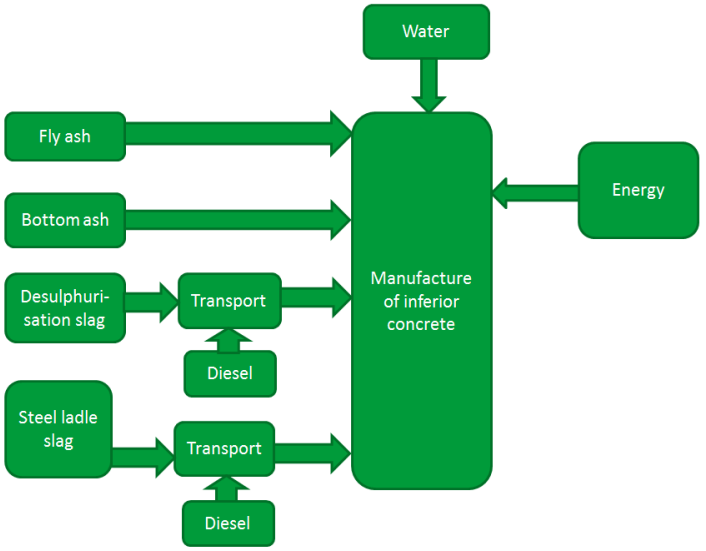
- **Assessed secondary products:**
  - 1) soil amelioration pellet,
  - 2) inferior concrete
  - 3) mine filler

- **Compared primary products:**
  - 1) commercial limestone product,
  - 2) commercial concrete element (OPC)
  - 3) commercial mine filler
  - 4) NPK 15-15-15 fertilizer,
  - 5) landfill construction (slag compartment and waste)

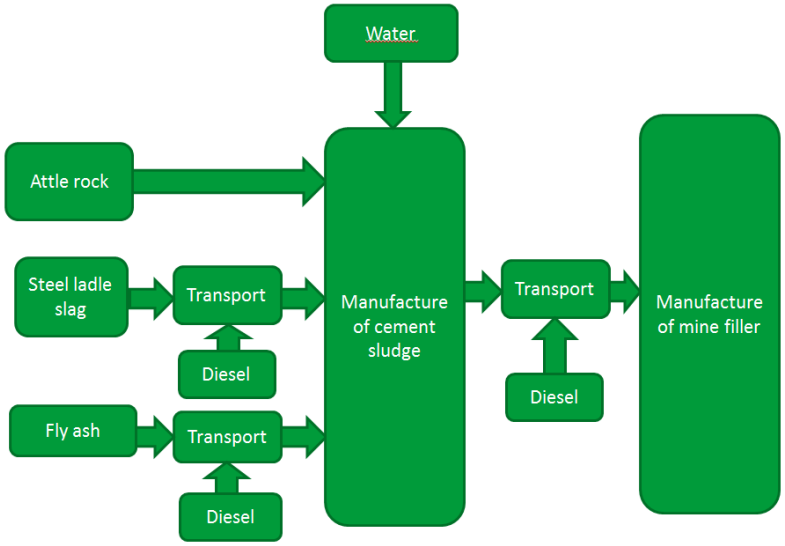
Soil amelioration pellet



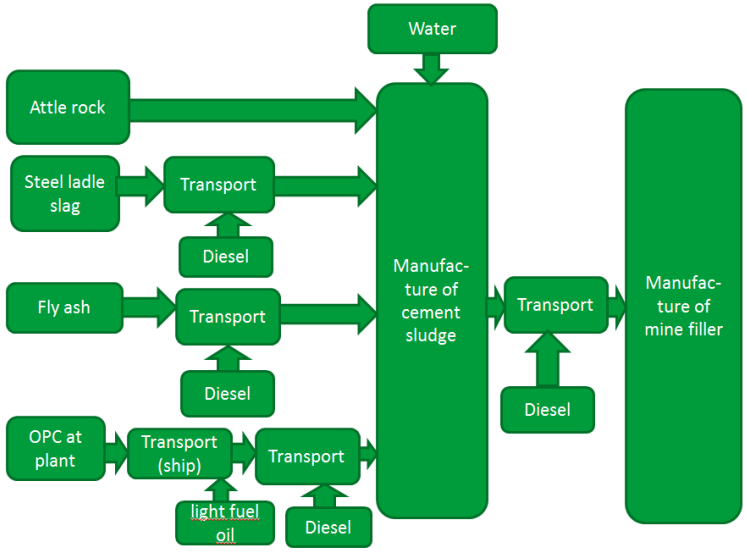
Inferior concrete



Mine filler no OPC



Mine filler with OPC



Material and methods

- GaBi 4.4 – software and its databases (e.g. primary products, transport and energy).
- Data on the production processes of the secondary products was gathered directly from industry.
- LCA and comparison of the environmental burden associated with the production of secondary and primary products with a focus on global warming and climate change aspects.
- Global Warming Potential (GWP) was used as a measure of the burden contributing to global warming.
- Functional unit is 1000 kg of finished end-product.

LCA –results, 1000 kg end product

Case		GWP (kg, CO_2-Ekviv.)	CO_2 (kg)
Secondary products	Soil amelioration pellet	1.6	1.6
	Inferior concrete	2.0	1.9
	Mine filler	0.13	0.12
Primary products	Limestone product	12.2	11.4
	NPK 15-15-15 fertilizer	1497	845
	Concrete element	124	119
	Portland Cement	899	885
	Mine filler (Portland cement)	1.5	1.4
Landfilling	Slag compartment	5.6	5.0
	Landfilling (Municipal waste)	6.9	6.2

Recommendations on the basis of the calculation of LCA

- Process industry should identify and assess the local potential for industrial ecology and symbiosis, particularly opportunities for material efficiency and minimization of energy consumption.
- Life cycle thinking should be integrated into strategic and environmental management.
- Development of new symbiosis products should encompass strong focus on the physical, chemical, biological and technical properties of of new products and secondary raw materials.
- Public authorities and their steering work will play a major role in the approval and utilization of symbiosis products, therefore active dissemination of information on their benefits and associated best practices should be widely promoted.
  - Please note! If there is no justification for the utilization of symbiosis products or various fractions based on holistic environmental protection reasons, removal of waste status should be considered or at least removal of waste tax on those fractions.

Conclusions

- ✓ Our focus on the utilization of residue flows / wastes should move from research and reporting to practical action
  - ✓ Quality systems as a part of the productization of residue flows
  - ✓ More “agile” legislation – currently too bureaucratic
- ✓ Holistic thinking should be promoted to advance the identification of most environmentally friendly utilization practices and routes.
- ✓ Production of symbiosis products should be developed and supported in locations where they have clear potential – LCA thinking supports utilization

Thank you !

”We do not inherit the Earth from our Ancestors, we borrow it from our Children”

Antoine de Saint-Exupéry

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