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Environmental impact of vacuum coatings used in thermal collectors

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Congrès ACV - avniR

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SOL autark .com

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Context

Scope, functional unit & method

Process description & LCI

LCIA & discussion

Conclusions

Context

SOLAUTARK project

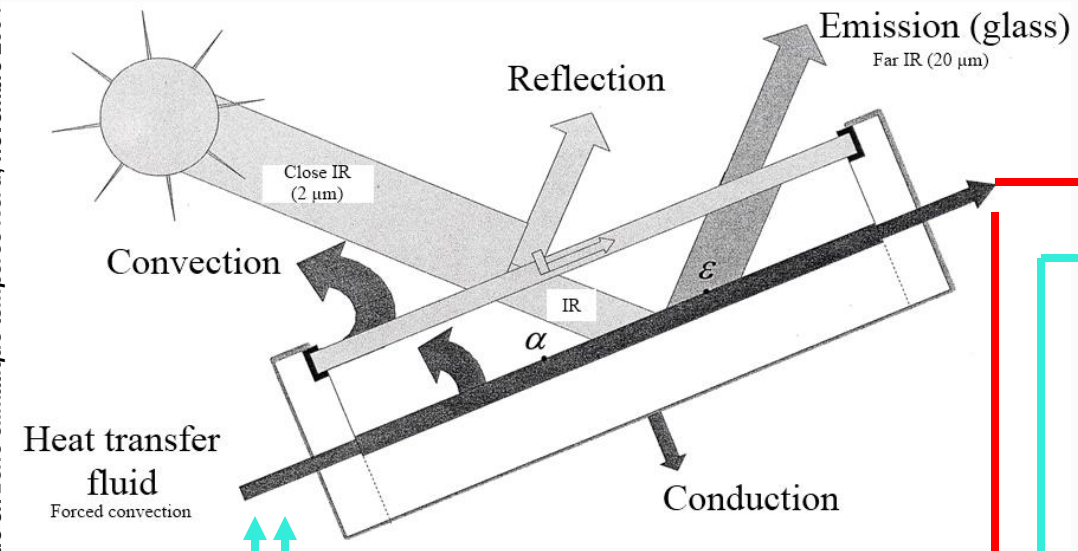
Solar heating for residential buildings:

- Improvement of current thermal collectors
- Inter-seasonal storage of heat using salts and a reversible reaction

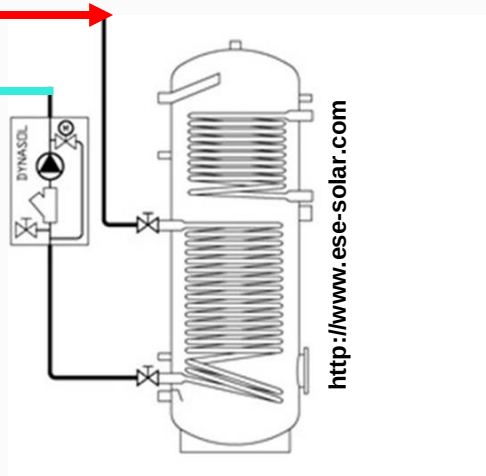
Funding: Walloon Region (B), « plan Marshall »

Context

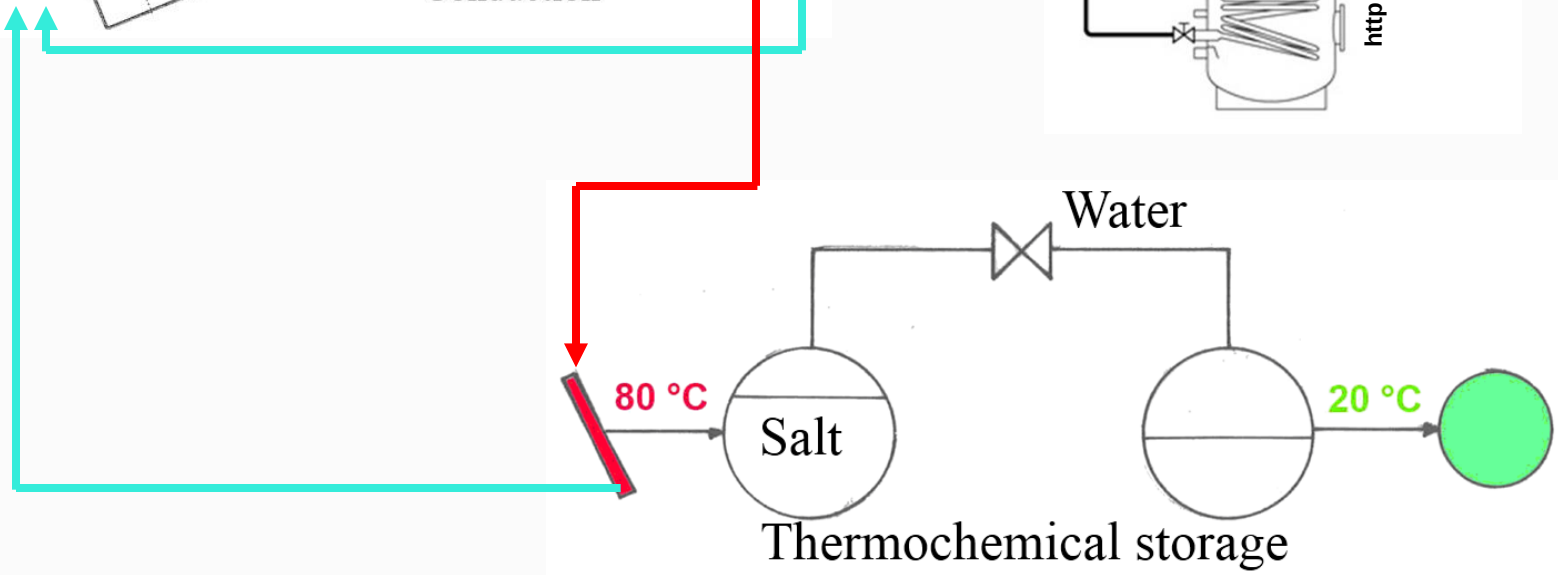
Collector for SHW or central heating



J. Bougard, *Panorama des techniques et applications du solaire thermique en zone climatique tempérée Nord*, novembre 2004



http://www.ese-solar.com



Scope

LCA effort:

- Thermal collectors

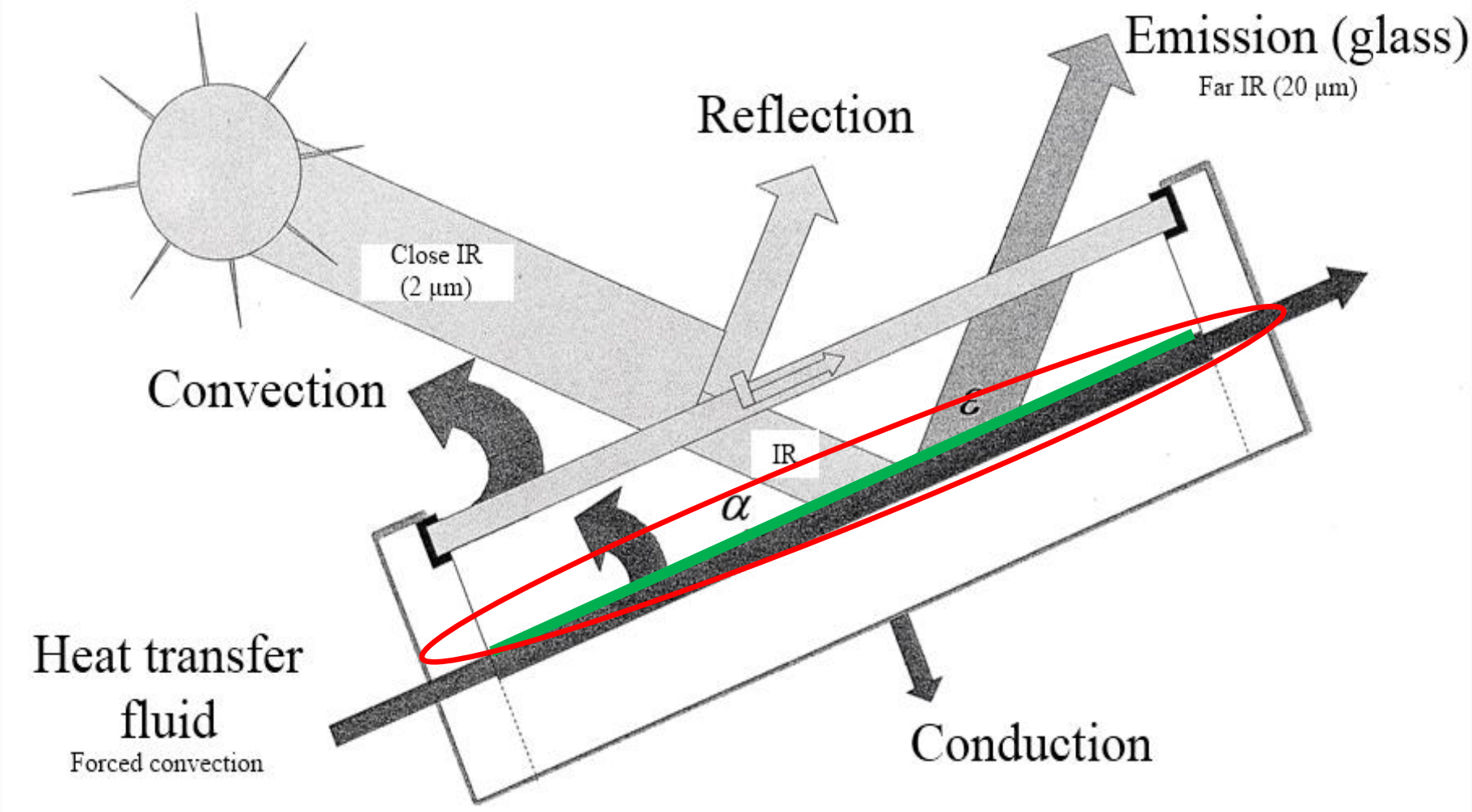
- Individual components: selective coating → **Present paper**

- Energy storage unit → **See our poster:**

P. D'Ans, G.G. Descy and M. Degrez

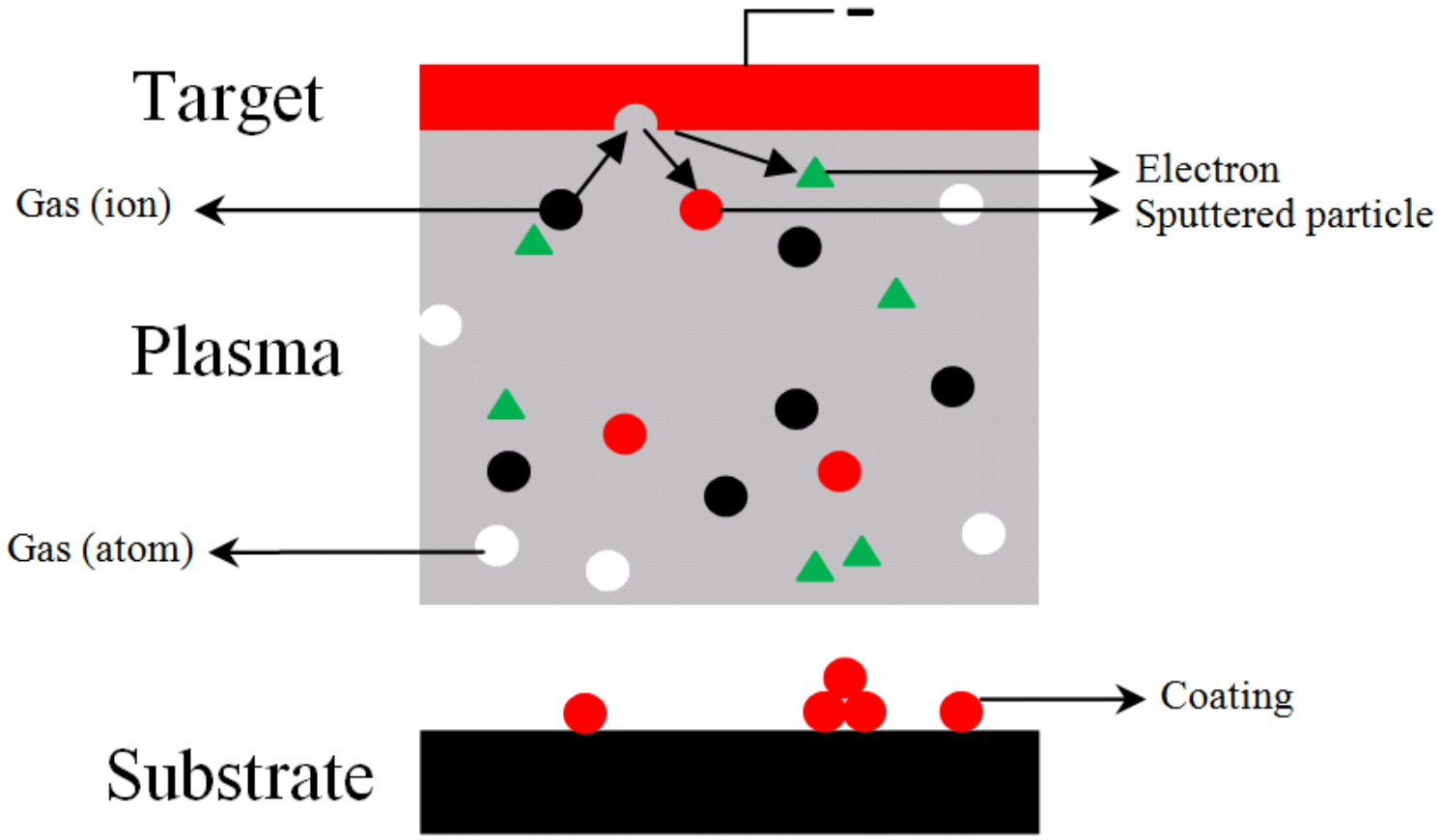
Preliminary LCA study of an inter-seasonal heat storage reactor for residential central heating

Scope


Emission (glass)
Far IR (20 µm)
Reflection
Close IR
(2 µm)
Convection
IR
ε
α
Heat transfer
fluid
Forced convection
Conduction

Scope

Physical vapour deposition (PVD): magnetron sputtering



Scope, FU, method

Studied system: semi-continuous process, 2011, Belgium

Goals:

- Data for the solar central heating system
- Coating improvement
- Influence of the batch size?
- Is the coating a major contribution in a collector?

F.U.: m^2 of coated sheet

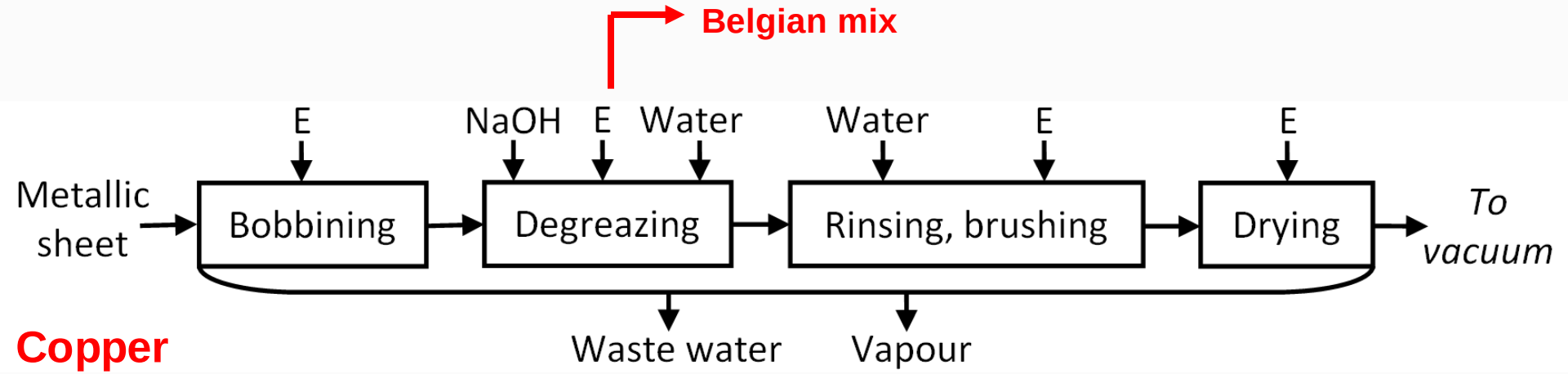
- Then, conversion per produced MJ

Impact 2002+ endpoint, EcoInvent database v2.2

LCI

Studied coating chain:

- Preparation zone:



Out of the system boundary

LCI

Studied coating chain:

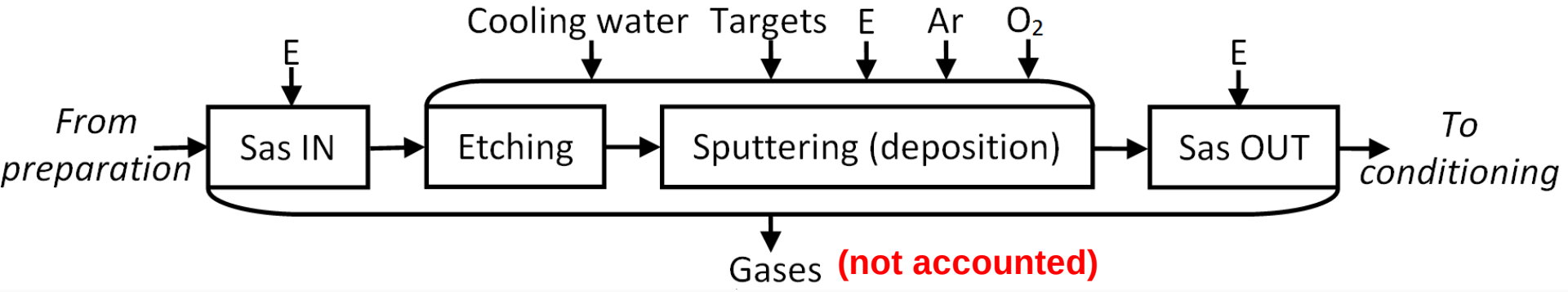
- Vacuum zone:

Assumptions:

-Useful fraction of the target

-Sputtering yield

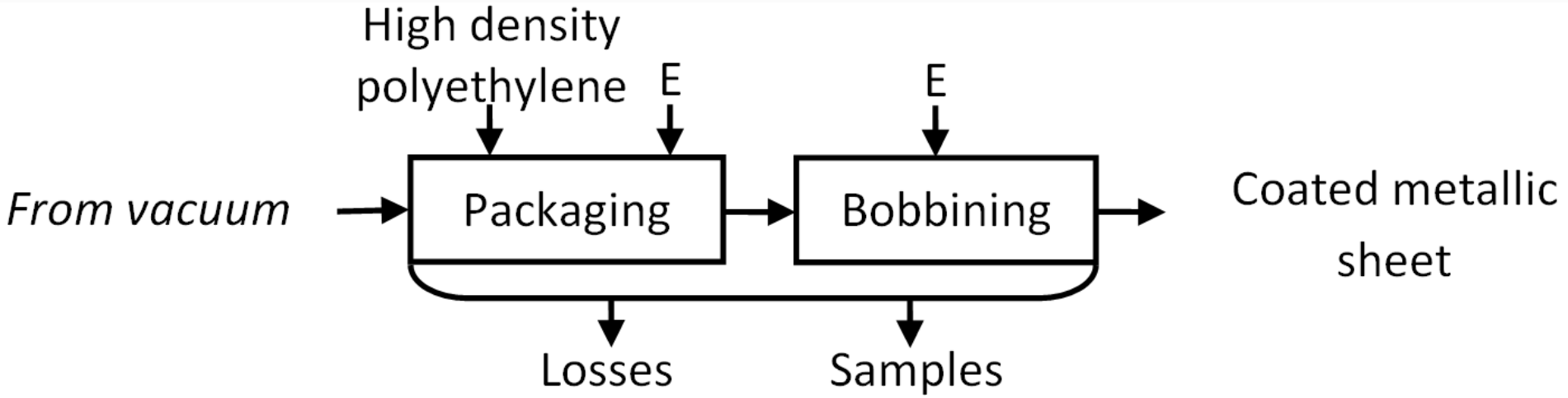
-Composition



LCI

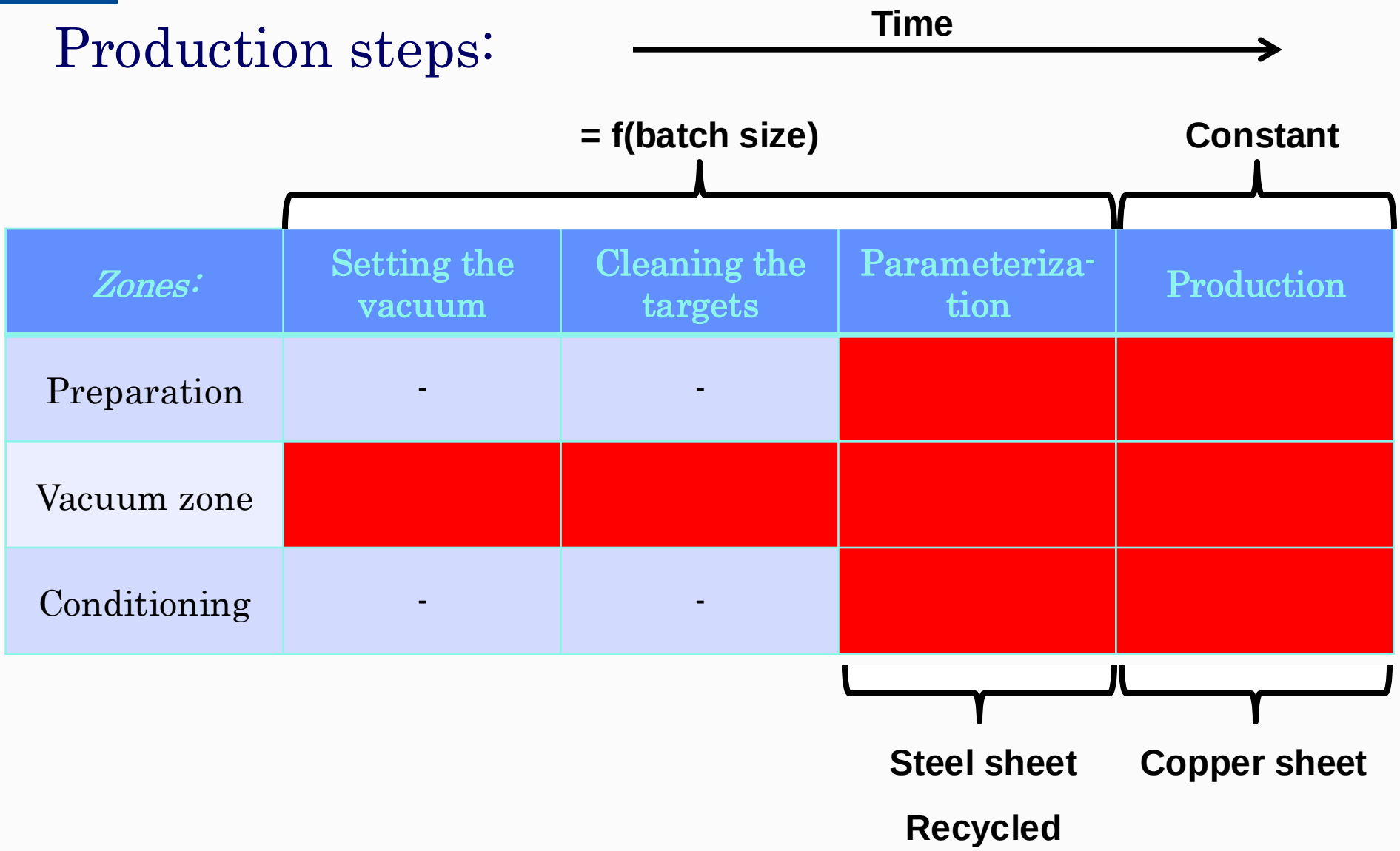
Studied coating chain:

- Conditioning zone:



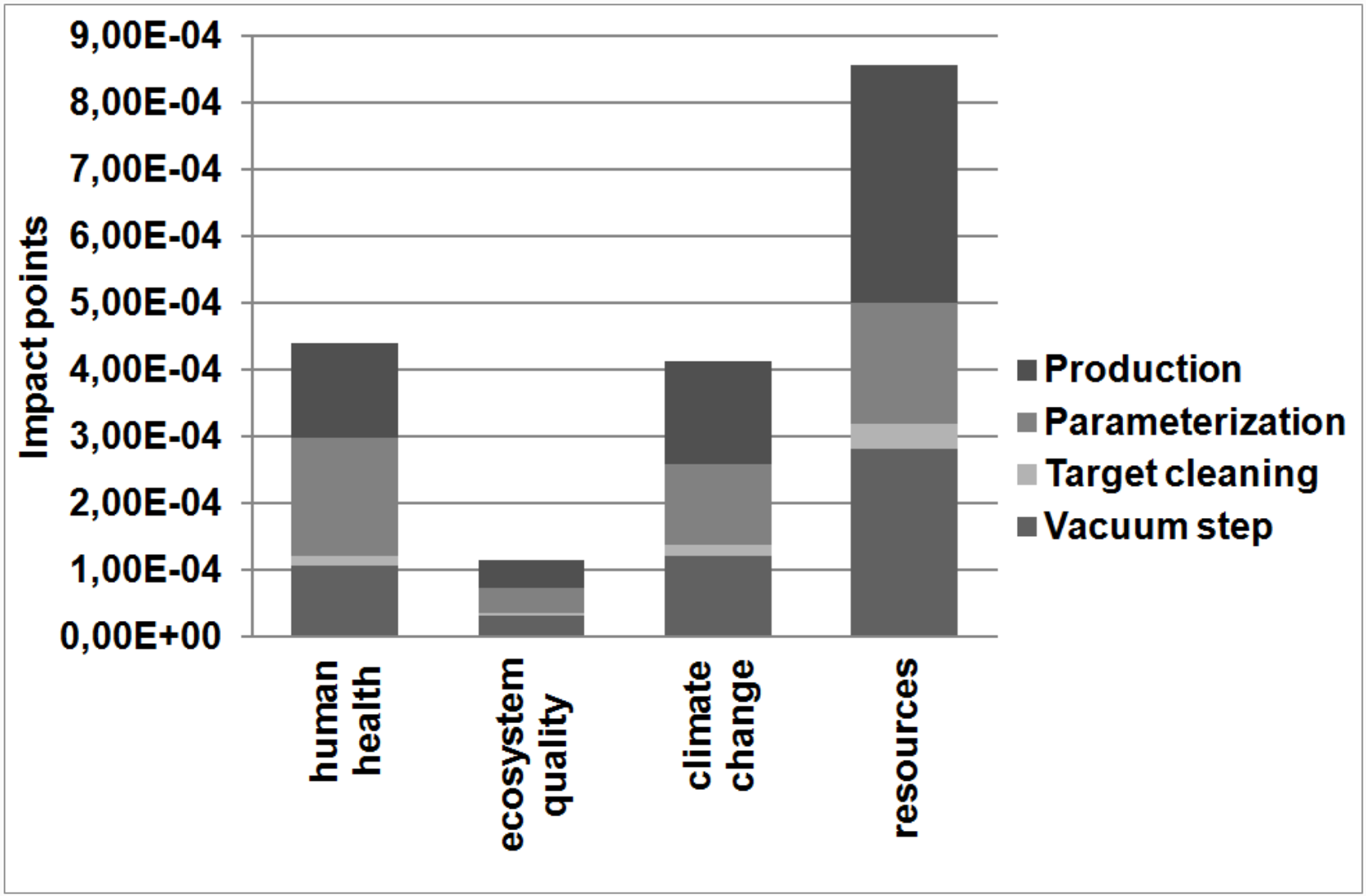
LCI

Production steps:



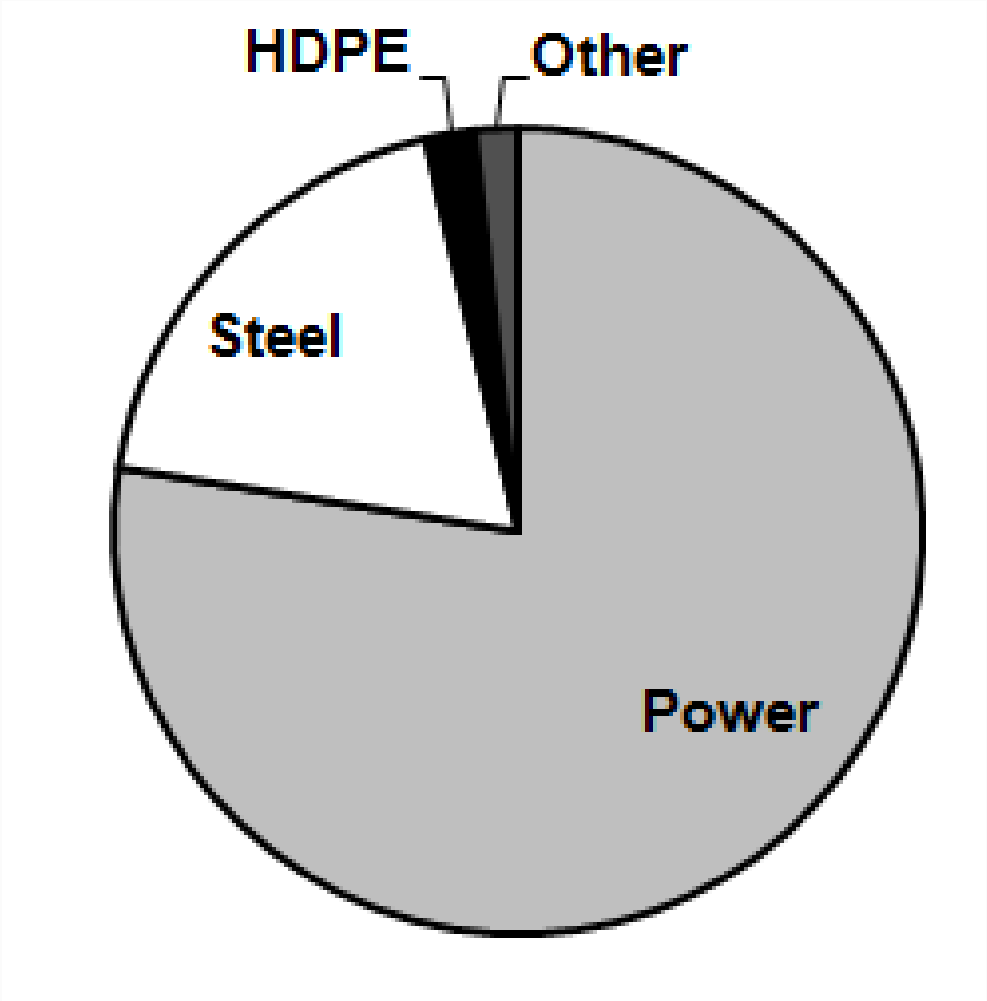
LCIA

Contributions per process step



LCIA

Contributions per commodity (climate change)

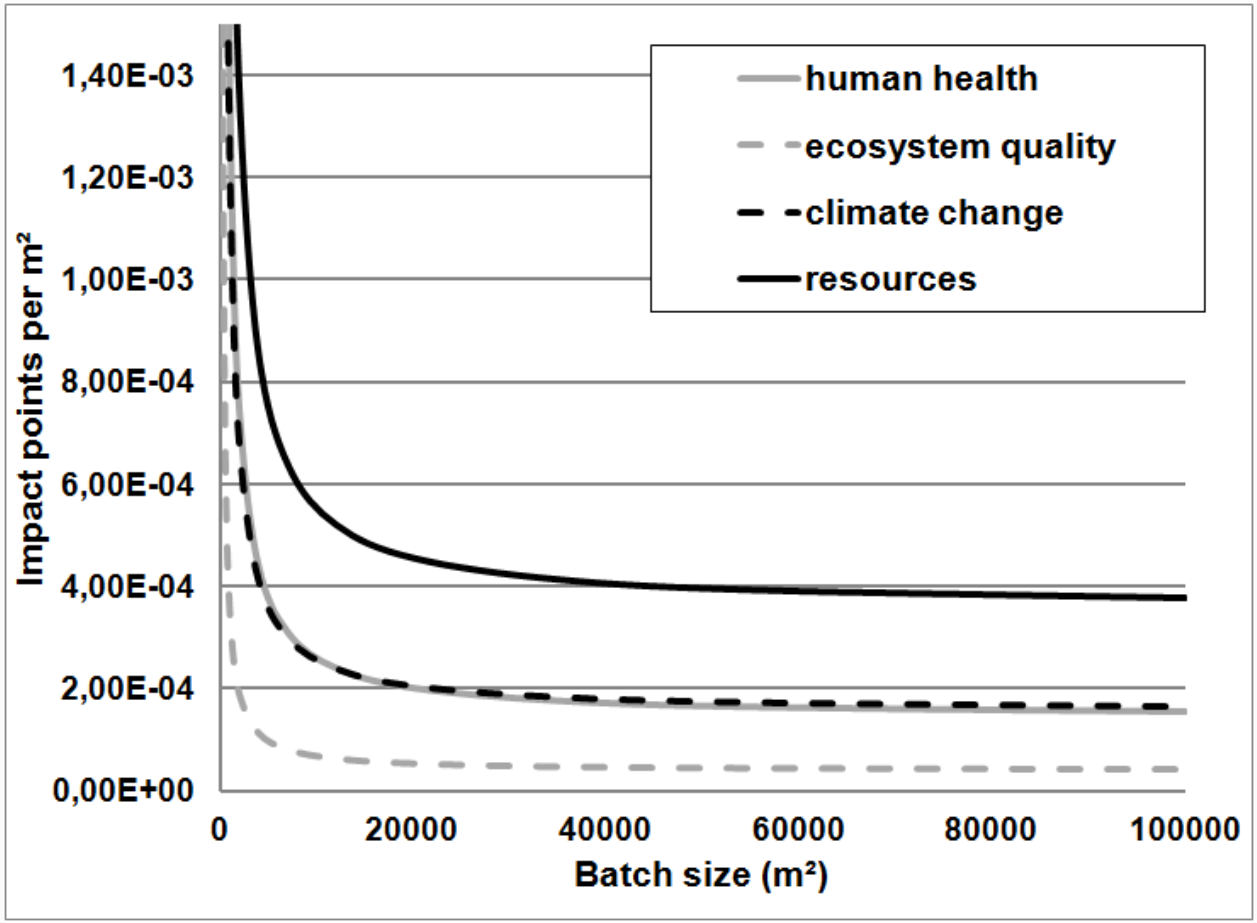


Importance of the vacuum step

LCIA

Sensivity analysis:

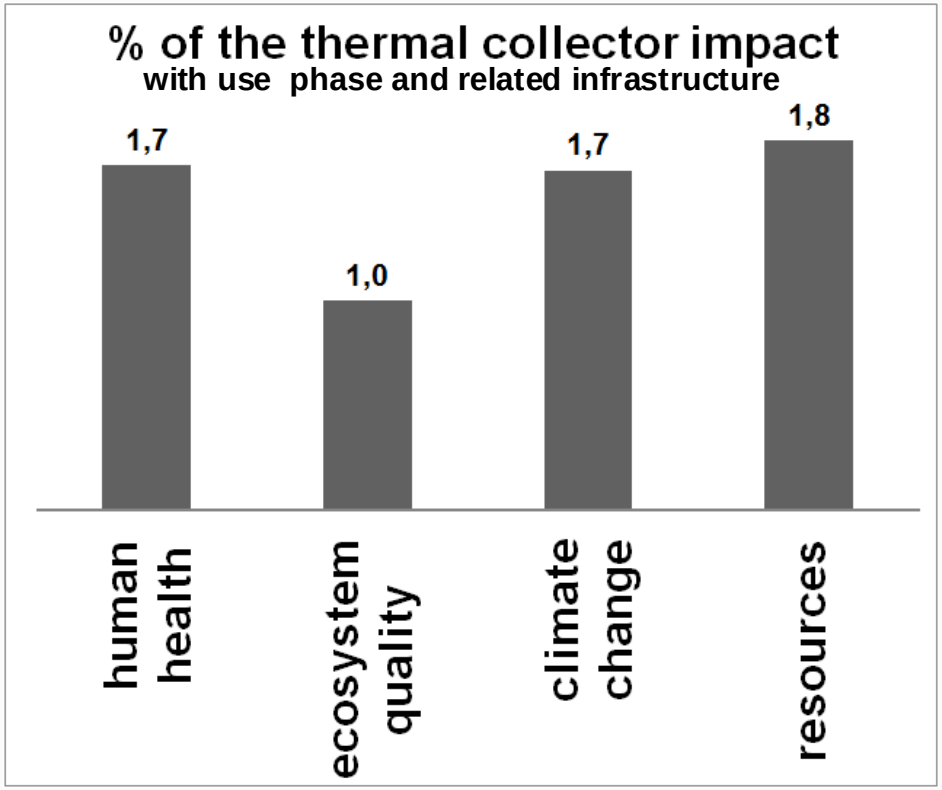
- HDPE film
- Dummy steel
- Batch size:



LCIA

Major contribution?

- Coating: 300 MJ NR energy/collector
- Collector itself: 1600 MJ/collector
- Annual production: 3700 MJ



More important on the collector scale:

-Collector frame

-Pumping system

-Holders

Conclusions

Impacts mainly originate from sputtering, vacuum and steel sheet

Represents < 2% of the impacts but cannot be recovered

Most important parameter: batch size

Modelling economies of scale in LCA

Thank you for your attention

Our posters:

P. D'Ans, G.G. Descy and M. Degrez, *Preliminary LCA study of an inter-seasonal heat storage reactor for central heating*

V. Zeller, L. De Boever, A. Richard, P. D'Ans, I. Wuijtens, M. Degrez, *LCA of wood building products on a regional scale: conceptual and methodological considerations*