

Environmental impact of vacuum coatings used in thermal collectors

Pierre D'Ans (), Cédric Boly (*),
Gilbert G. Descy (**), Marc Degrez (*)*

Congrès ACV - avniR

Lille, November 06th 2012

(*)Université Libre de Bruxelles (ULB)
pdans@ulb.ac.be, (**) European Sopro Energies



Context

Scope, functional unit & method

Process description & LCI

LCIA & discussion

Conclusions

SOLAUTARK project

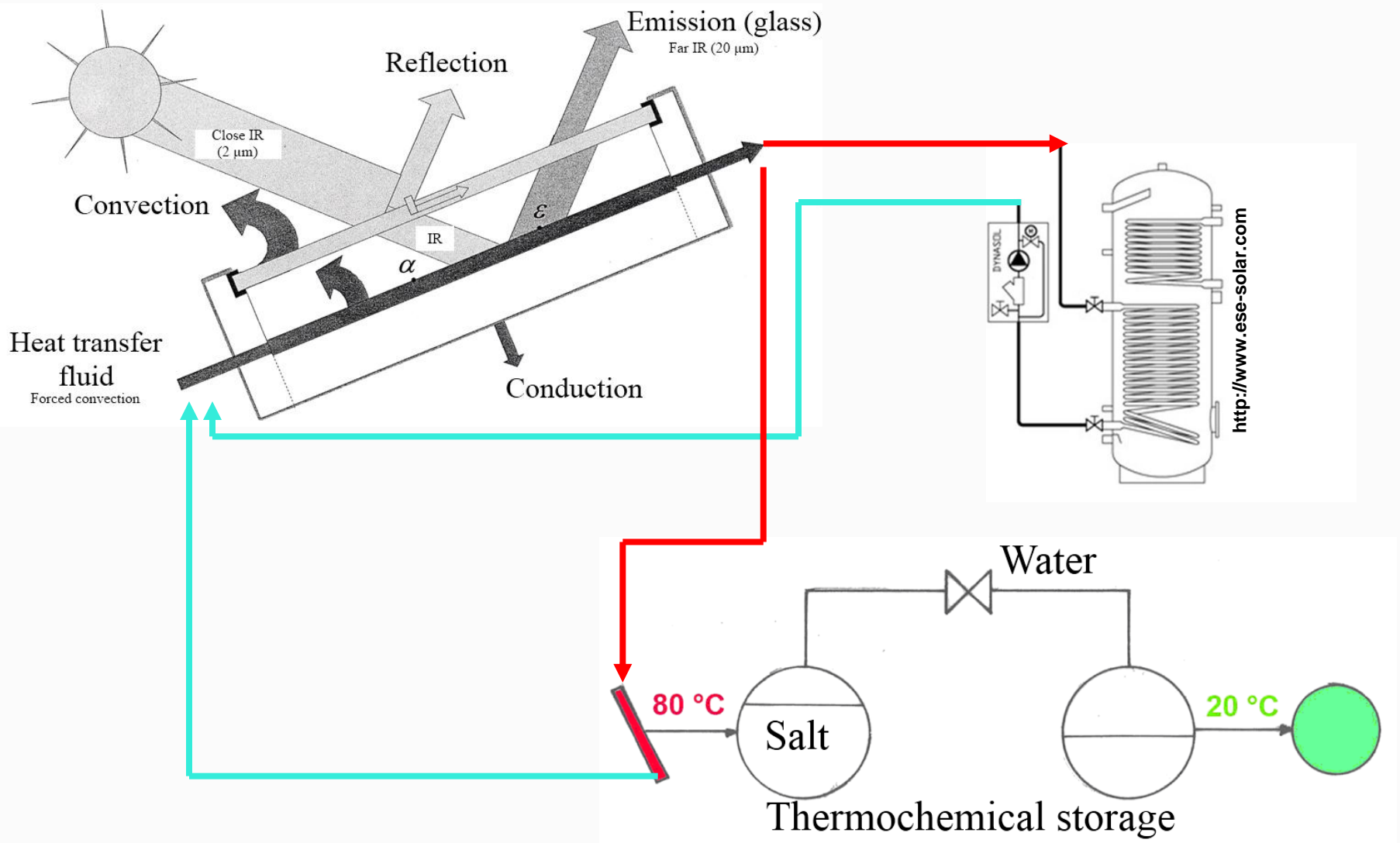
Solar heating for residential buildings:

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

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



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.es-solar.com>

LCA effort:

➤ Thermal collectors



➤ Individual components:
selective coating

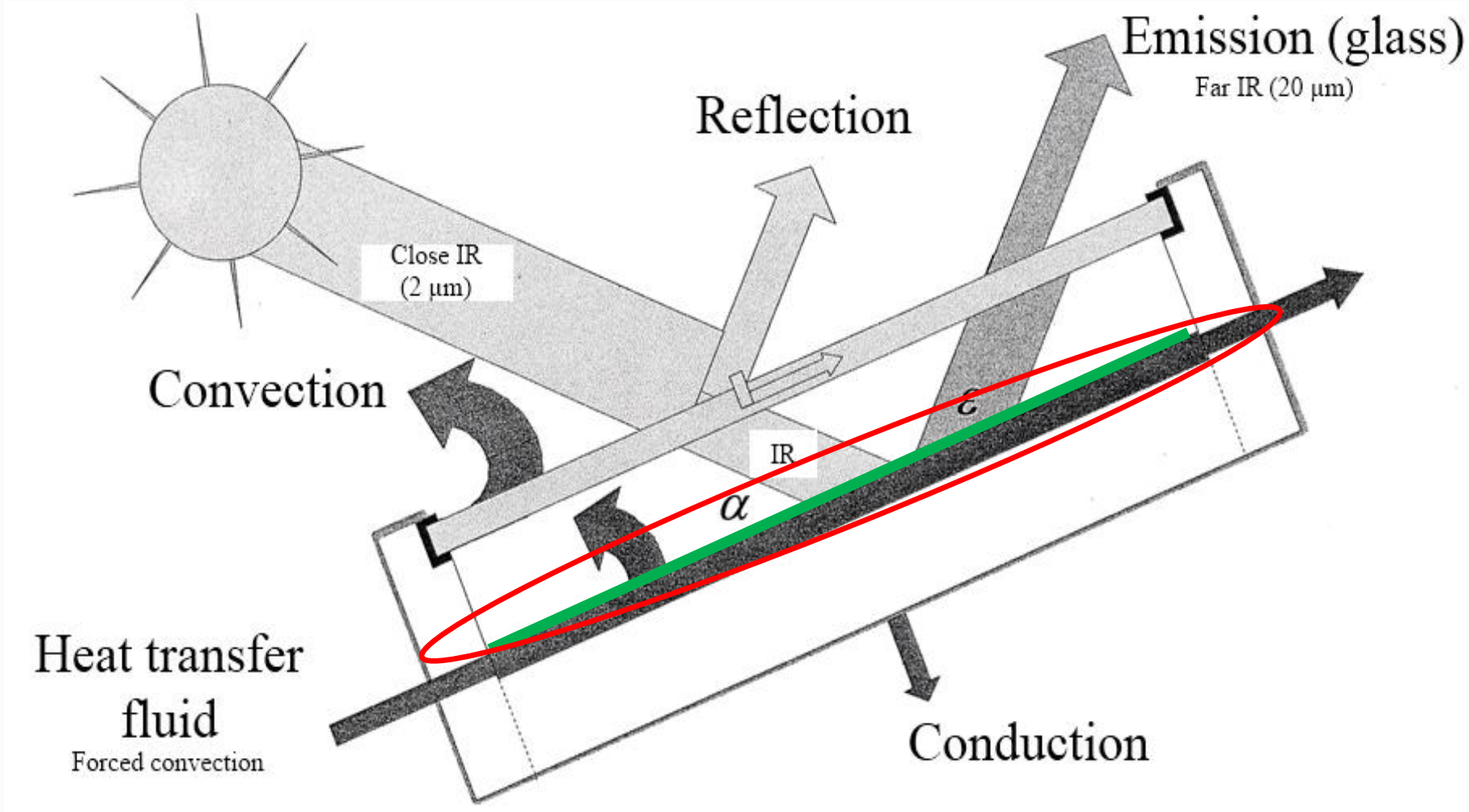
➔ Present paper

➤ Energy storage unit

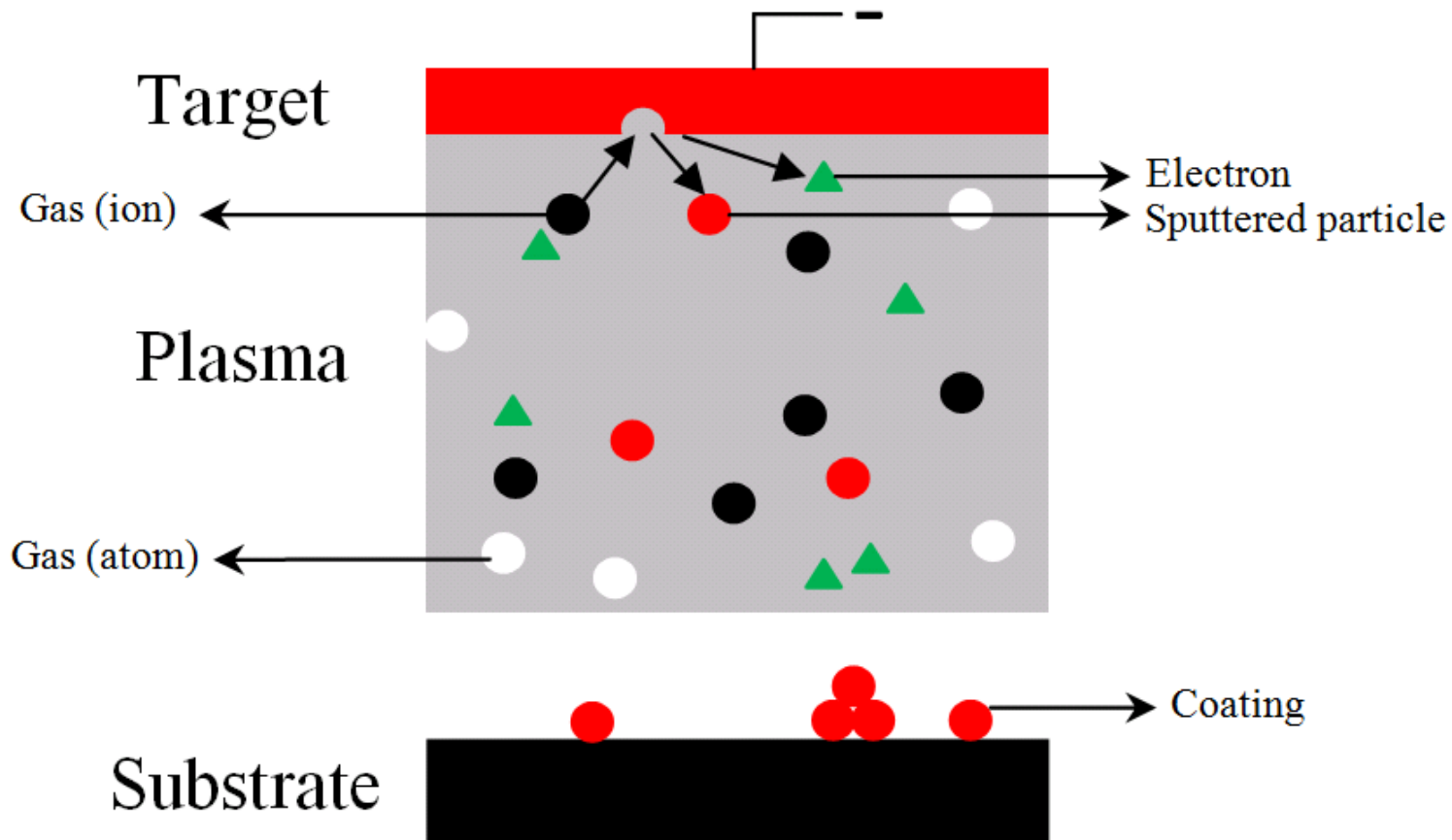
See our poster:

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

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



Physical vapour deposition (PVD): magnetron sputtering



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?

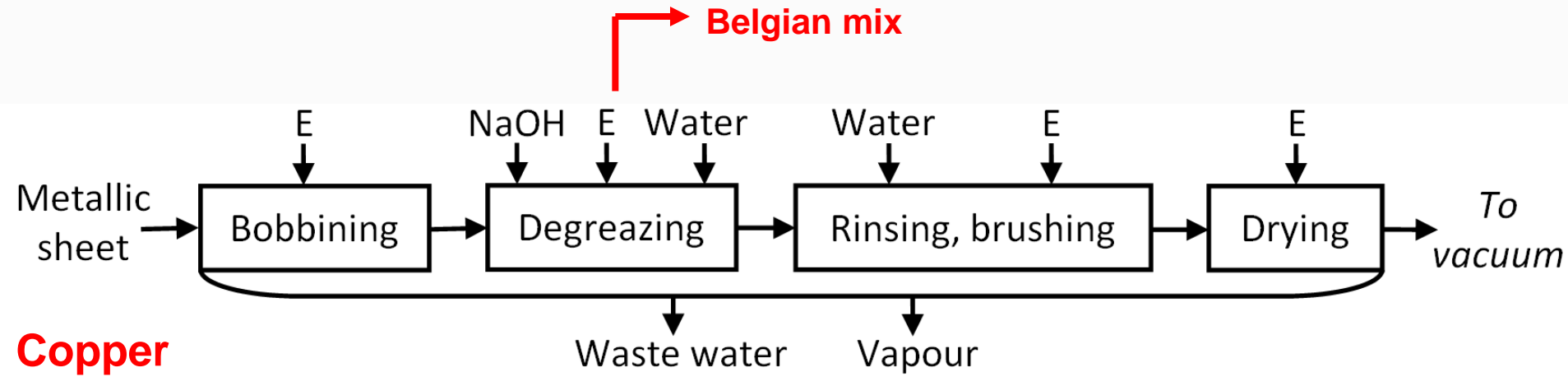
F.U.: m² of coated sheet

- Then, conversion per produced MJ

Impact 2002+ endpoint, EcoInvent database v2.2

Studied coating chain:

➤ Preparation zone:



Copper

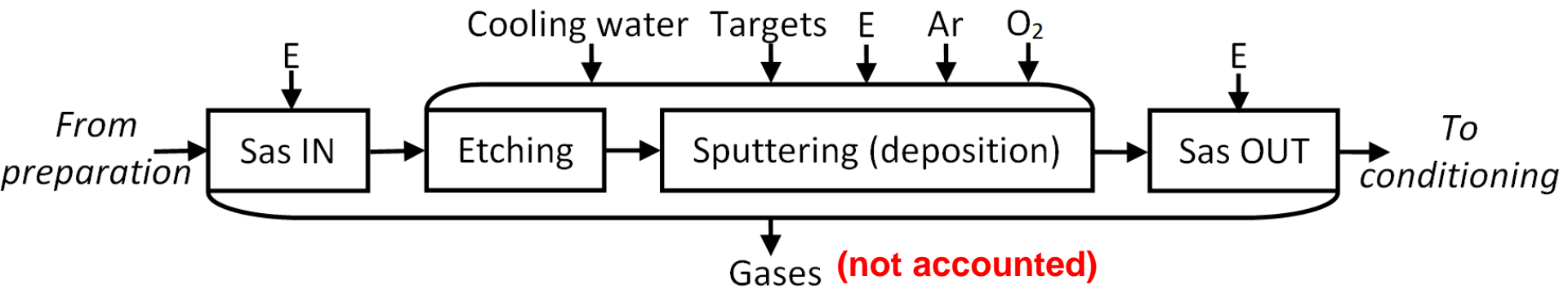
Out of the system boundary

Studied coating chain:

➤ Vacuum zone:

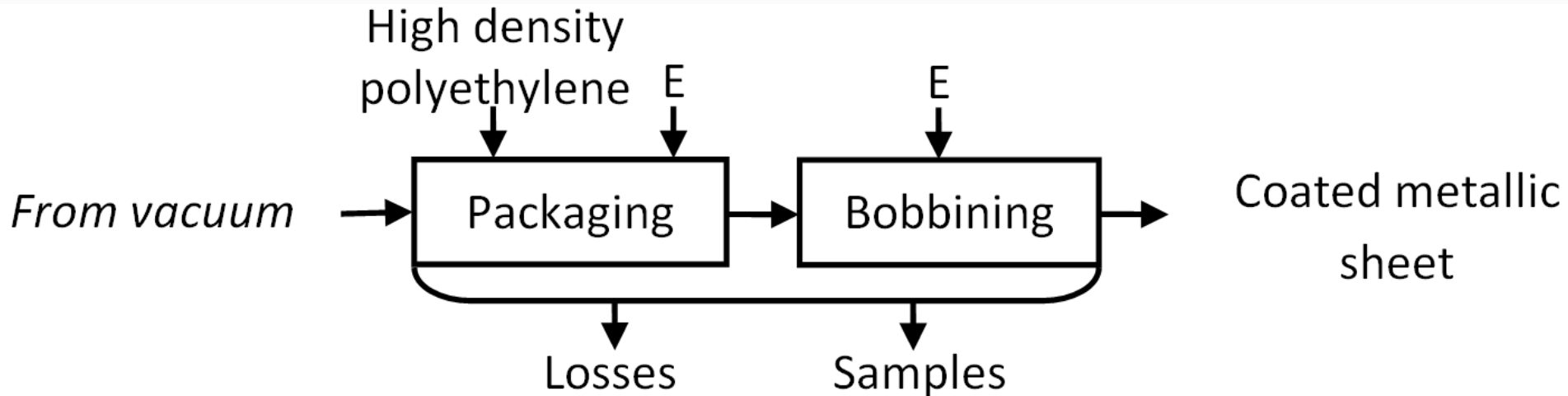
Assumptions:

- Useful fraction of the target
- Sputtering yield
- Composition



Studied coating chain:

➤ Conditioning zone:



Production steps:

Time →

= f(batch size)

Constant

<i>Zones:</i>	Setting the vacuum	Cleaning the targets	Parameterization	Production
Preparation	-	-		
Vacuum zone				
Conditioning	-	-		

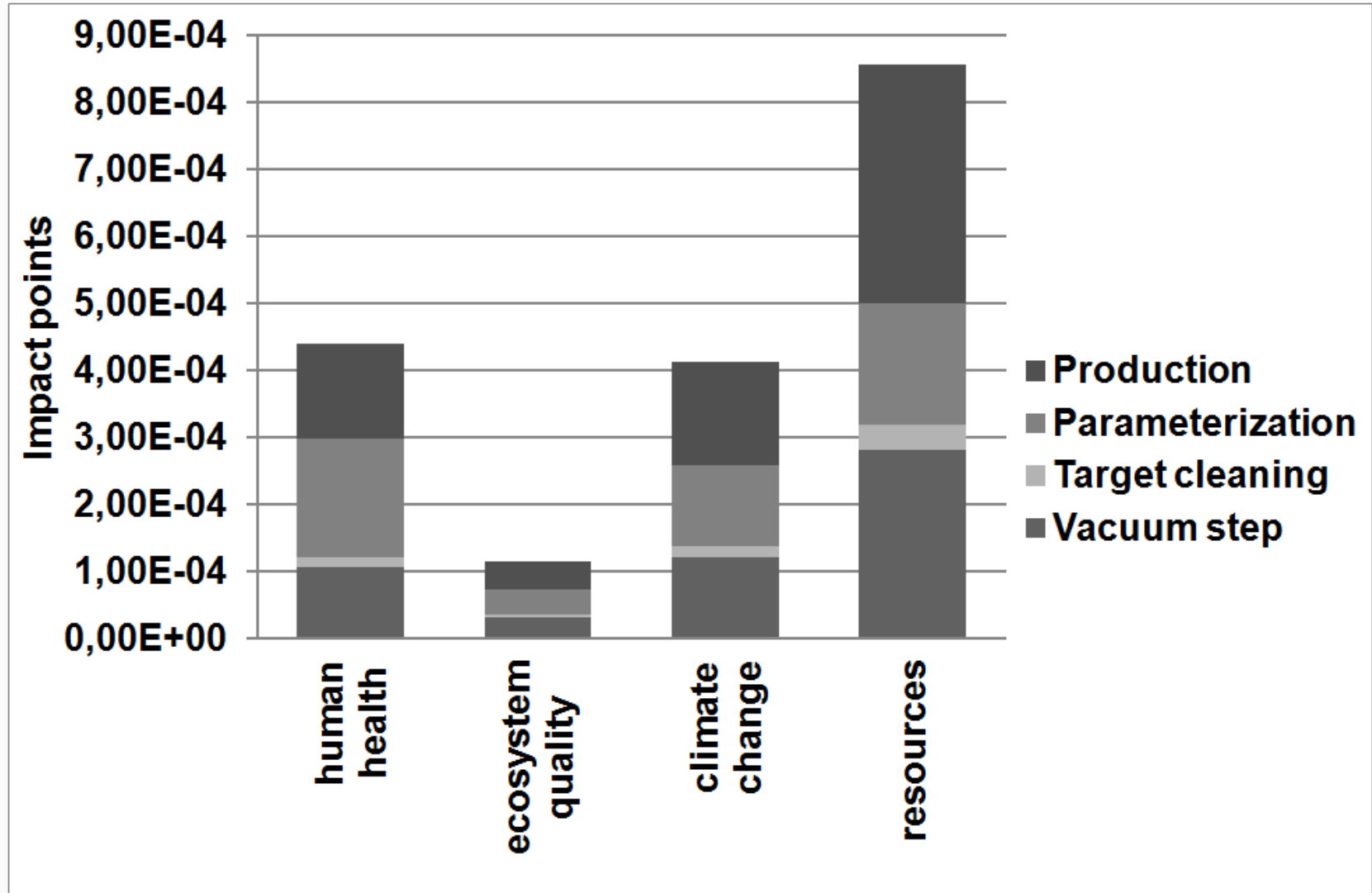


Steel sheet

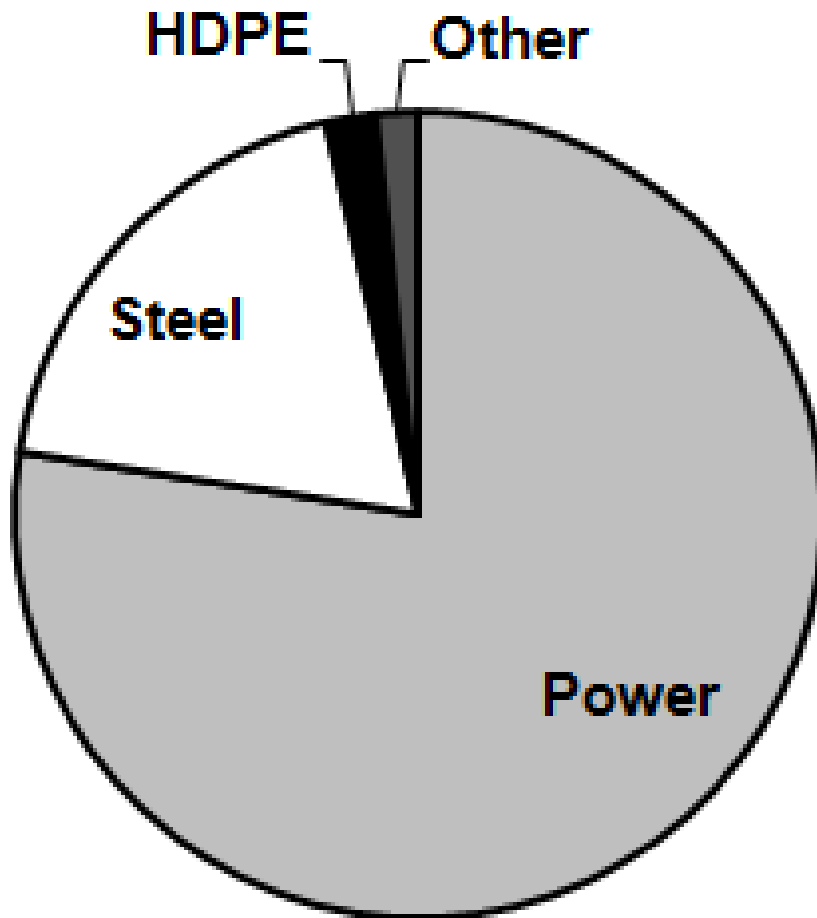
Copper sheet

Recycled

Contributions per process step



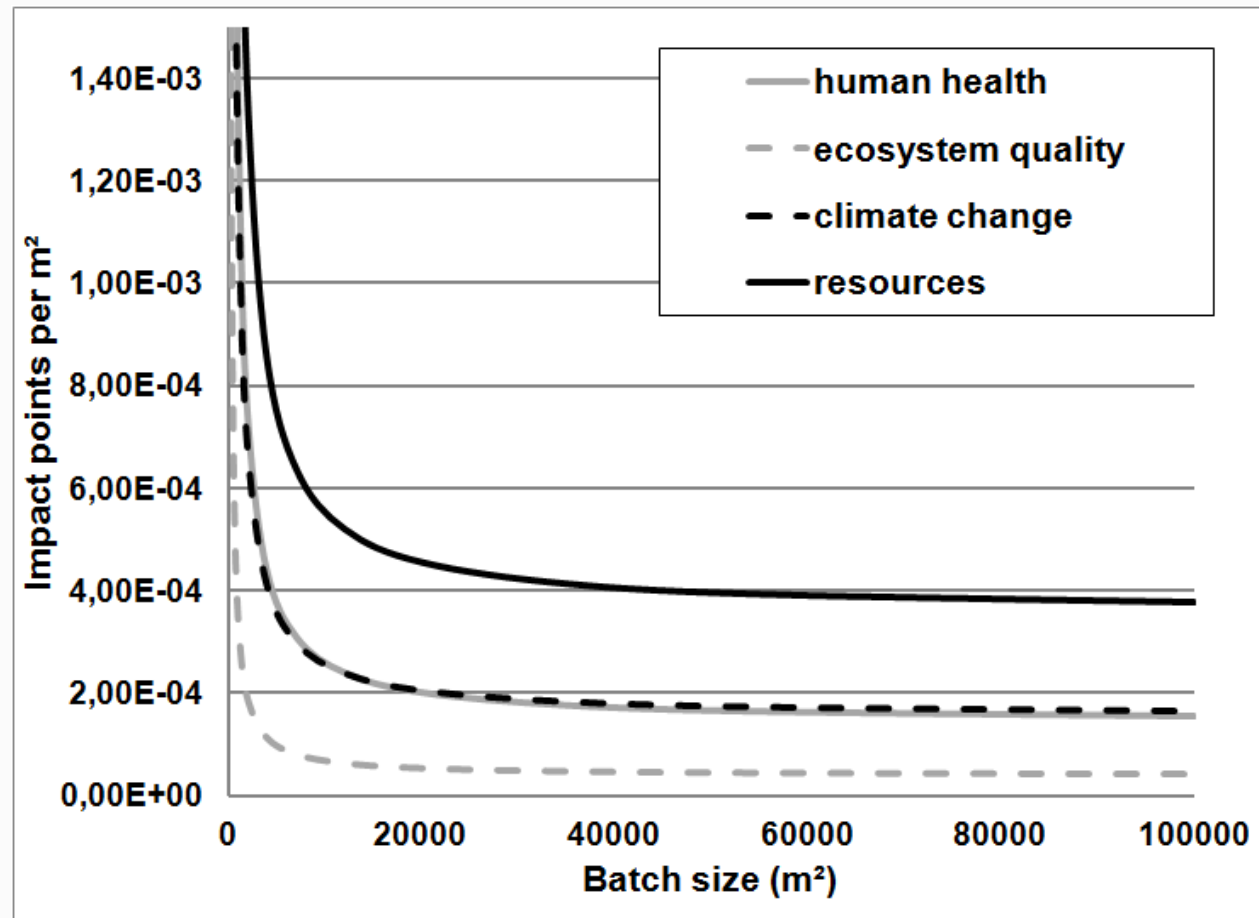
Contributions per commodity (climate change)



Importance of the vacuum step

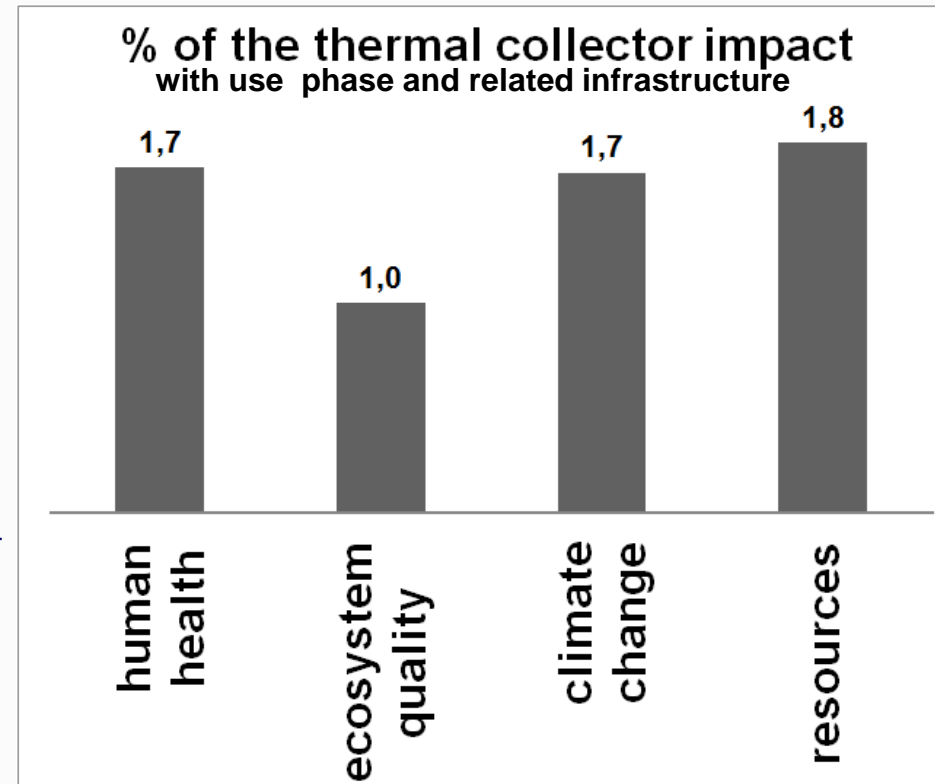
Sensitivity analysis:

- HDPE film
- Dummy steel
- Batch size:



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**

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. Wuijens, M. Degrez, *LCA of wood building products on a regional scale: conceptual and methodological considerations*