

# Prospective Assessment of Nanotechnology: Case Study on Nanosilver in Textiles

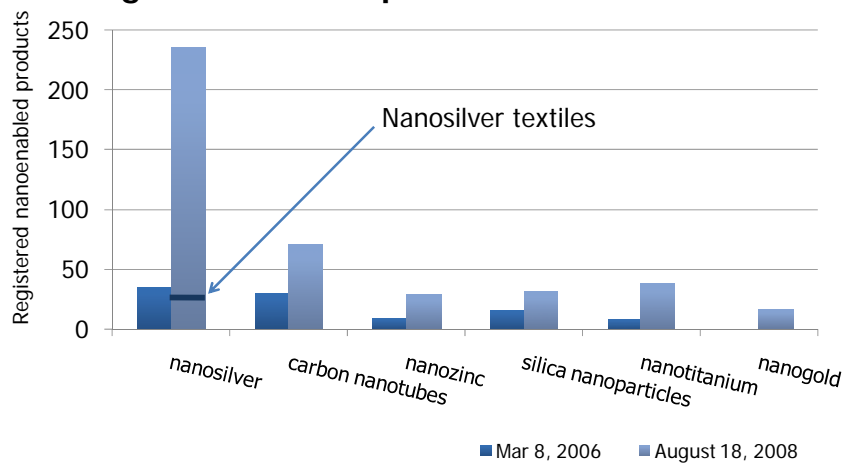
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Master Thesis, Presentation for DF38, June 19 2009



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## Increasing nano-enabled products



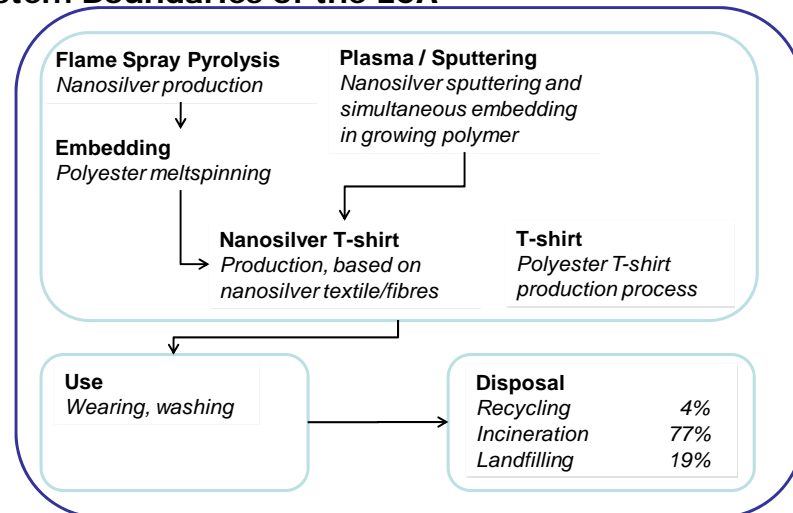
- nanosilver: 60m<sup>2</sup>/g, bacteriotoxic

Woodrow Wilson  
Institute (2009)

## Goal of the Study

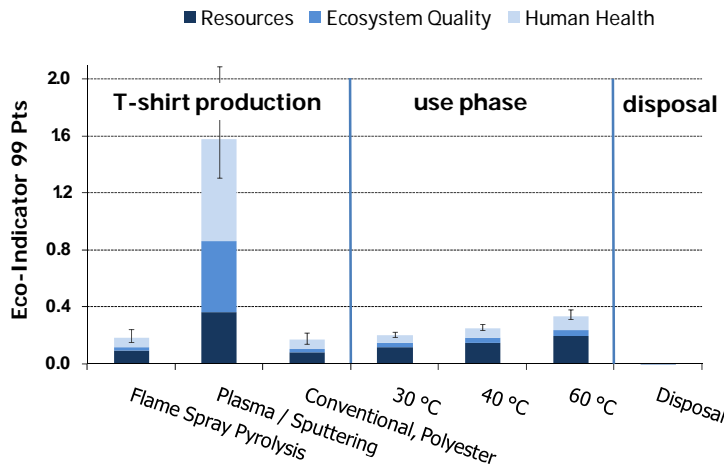
- **Cradle-to-grave environmental assessment** of nanosilver textile applications
- **Comparison of two nanosilver production technologies**, considering different development stages
- **Formative Scenario Analysis** (*Wiek et al. 2008*) for a prospective view, including future developments in society and nanotechnology industry: case Switzerland 2020

## System Boundaries of the LCA



- inclusive raw material acquisition, energy and precursor production, and emissions

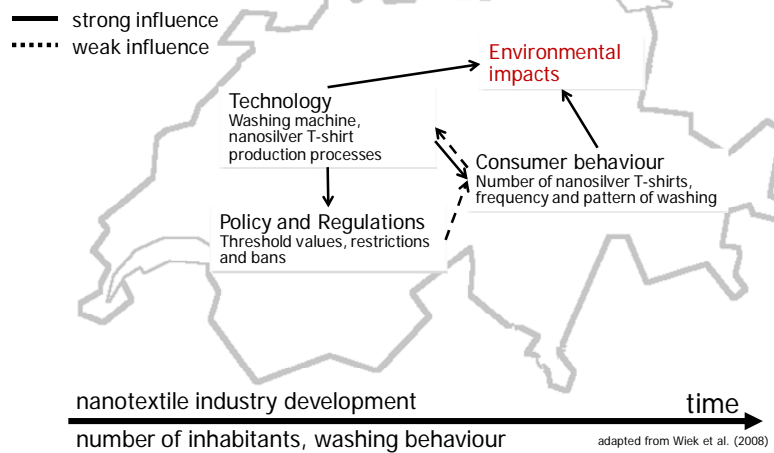
## Life cycle assessment of nanosilver T-shirts



- **Use phase:** 15 T-shirts/cycle, 100 washings/T-shirt
- **Uncertainty bars:** 95%-CI; **Electricity mix:** UCTE
- **No** nanospecific environmental impacts included

## Formative Scenario Analysis

- Possible future states of the analyzed system
- Groups of determining variables



## Scenarios: Environmental impacts (Switzerland, 2020)

### Estimated development

- foreseen technological development
- hesitating consumers

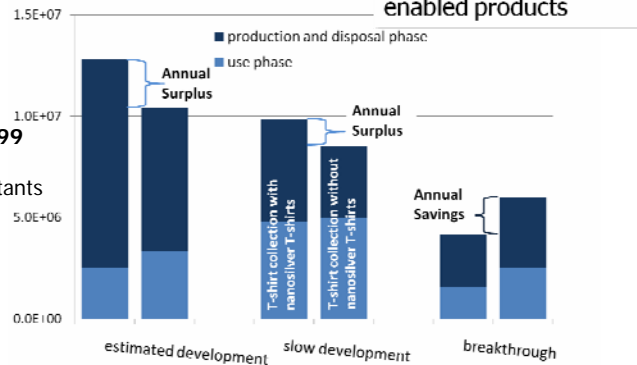
### Slow development

- slow development of nanotechnology
- strict regulations
- sceptic consumers

### Breakthrough

- enhanced efficiency of nanoparticle processes
- supportive regulations
- consumers use the full potential of nano-enabled products

Y-Axis:  
Annual Eco-Indicator 99  
Points for the T-shirt  
collection of Swiss inhabitants



## Summary/Conclusion

- Different nanosilver coating production technologies have significantly different environmental impacts
- The use phase of (nanosilver) T-shirts is sensitive to washing behaviour
- Nanosilver textiles may contribute to environmental benefits **IF** washing frequency is lowered
- Nanosilver emissions are not considered by current impact assessment methods

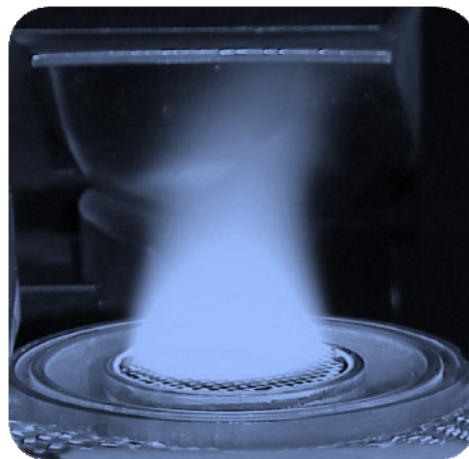
## Outlook

- Consideration of nanoparticle-related effects in LCA
- Measurement of release rates and effectiveness of nanosilver applications
- Performance based indicators for nanoenabled products – what are net environmental benefits or impacts?

## Questions?

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*Acknowledgements*  
Height, Murray (HeiQ)  
Körner, Enrico (EMPA)  
Luechinger, Norman (Nanograde LLC)



Pratsinis (2009)

**Thank you for your attention!**

## Key sources

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