

# Mixed Waste Plastics – an LCA<sub>4</sub>Waste Case Study from Czech Republic



Holcim

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Sustainable Development – Alternative Resources

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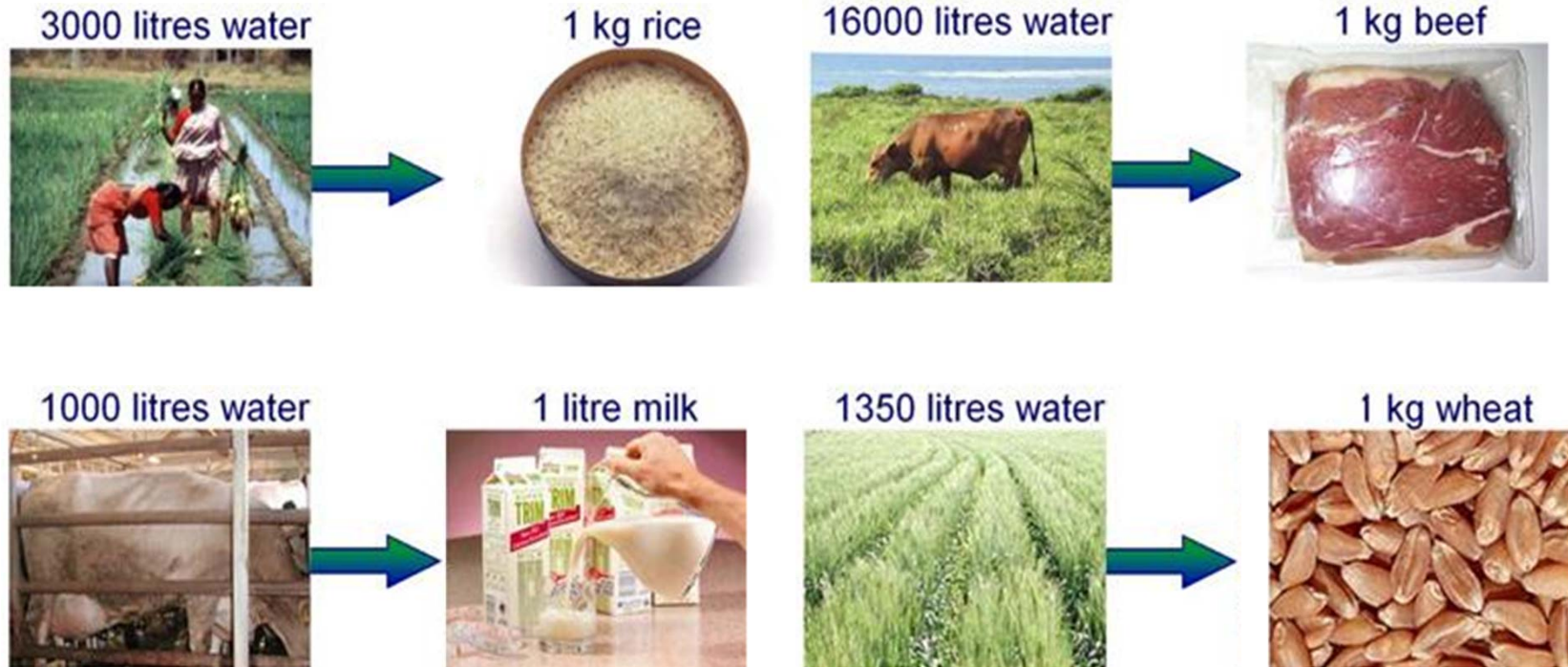
**1** Introduction: Why LCA?

2 The Holcim approach to LCA

3 Case study on mixed waste plastics Czech Republic

4 Conclusion

Life Cycle Assessment is a methodology to evaluate environmental burdens associated with a product or activity



## What LCA does

- It quantifies the environmental impact according to several Life Cycle Impact Assessment method
  - Global warming and CO<sub>2</sub> is only one of more than 200 Life Cycle Impact Assessment methods
  - It breaks down the magnitude of environmental impacts into various sub steps of the considered process



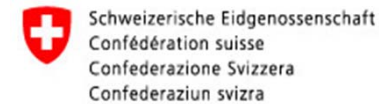
LCA takes into account the ecological impact along the whole value chain of a product or service from production to disposal

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- 2 The Holcim approach to LCA**
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# Holcim fosters the collaboration on LCA in an interdisciplinary manner

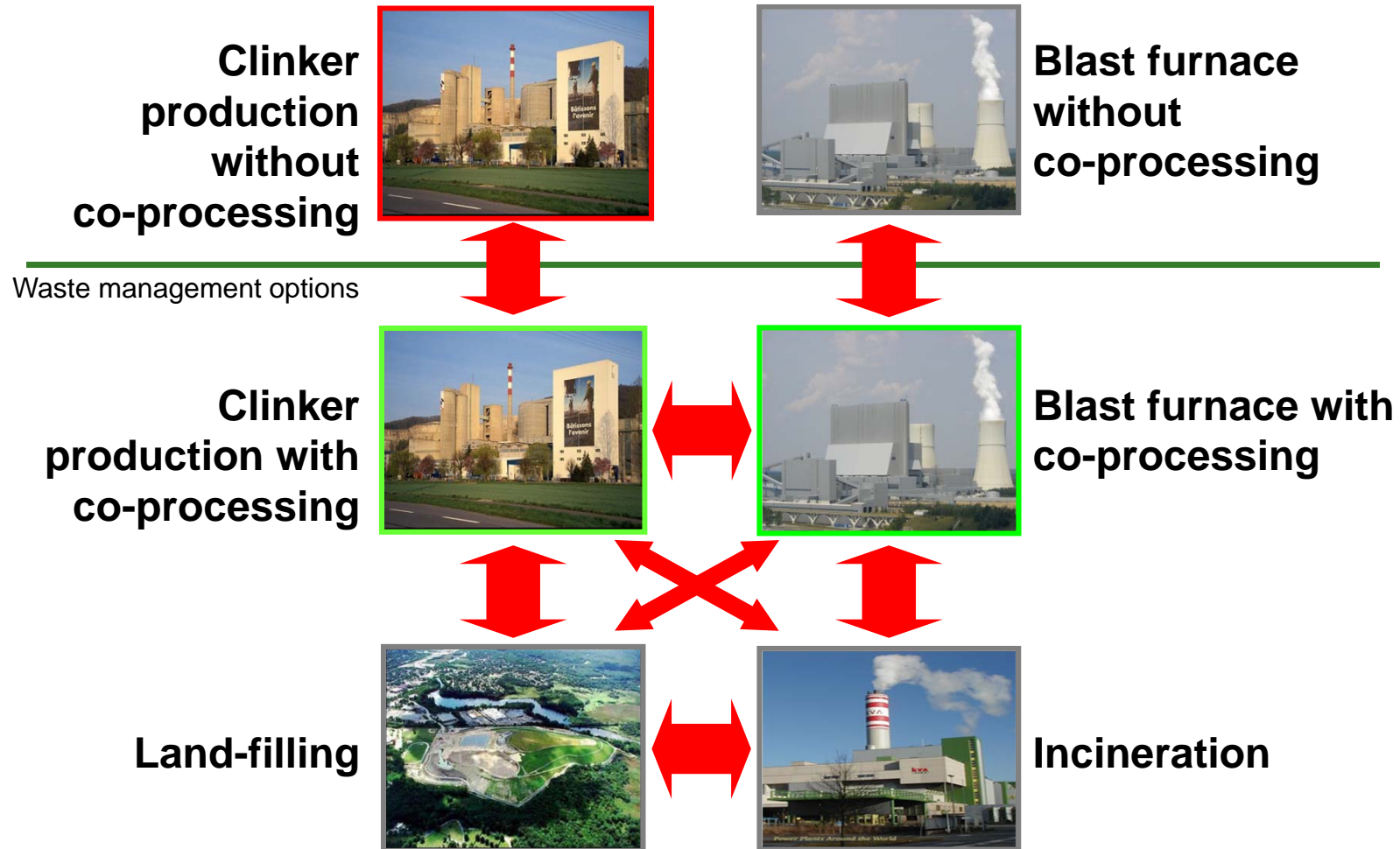


## ***Mission***

- ⇒ **Promote LCA for strategic decision making in waste and resource management**
- ⇒ **Provide adequate and comprehensive assessment tools**
- ⇒ **Implement the research results in industry**

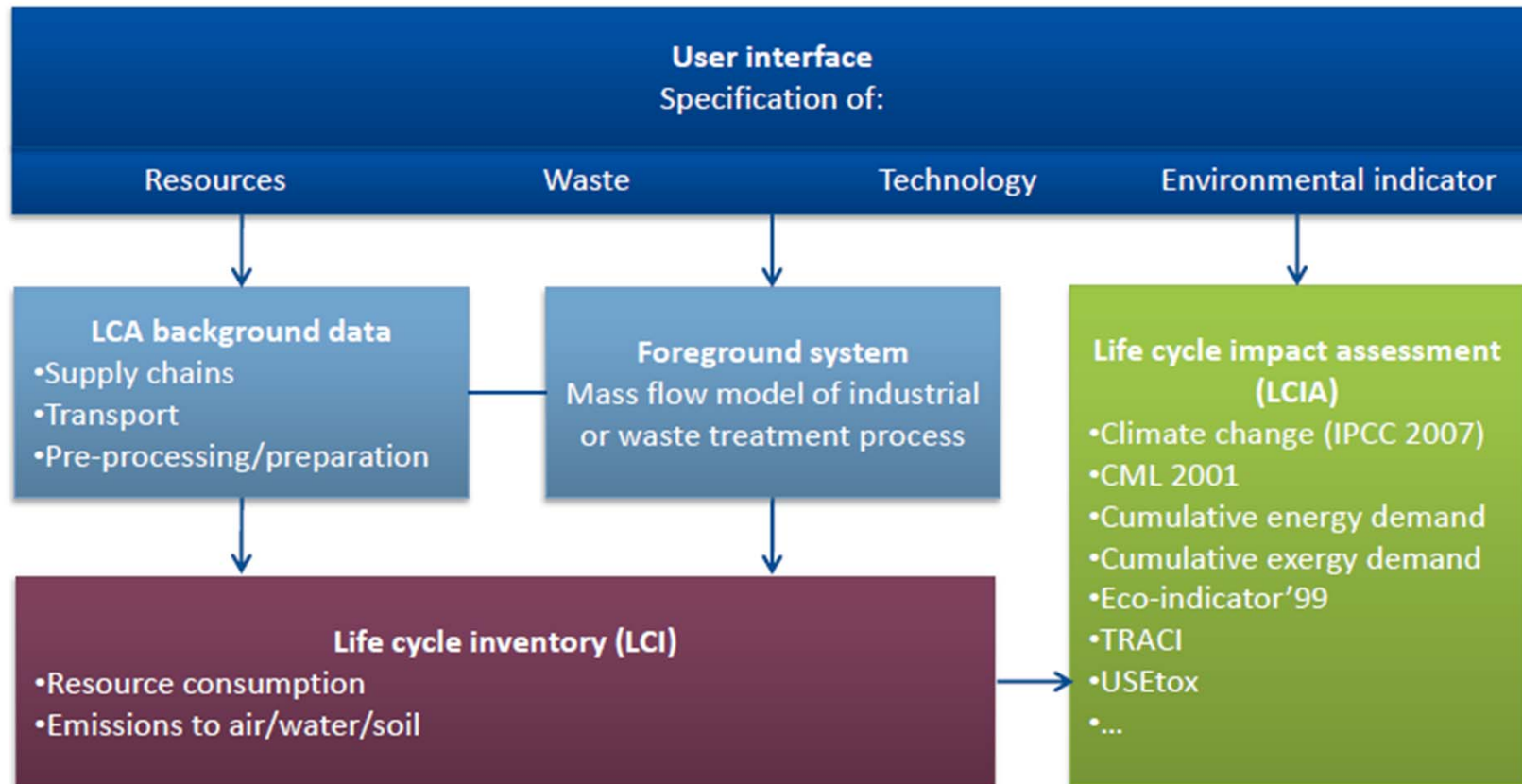


A set of tools allows the comparison of ecological impacts of various waste management options



# Method and tool development: highly customizable and linked to ecoinvent for background data

## Cradle-to-gate LCA model





The tools are complete production process models which are customizable to mirror single, specific plants

Production technology	Base case	Alternative case
<i>Kiln &amp; operation</i>		
Kiln type	Precalciner	Precalciner
Compound operation rate (%)	0%	0%
<i>Raw gas &amp; flue gas treatment</i>		
NOx emissions (mg/Nm3)	500	400
DeNO <sub>x</sub> installation	No DeNO <sub>x</sub>	No DeNO <sub>x</sub>
DeSO <sub>x</sub> installation	No DeSO <sub>x</sub>	No DeSO <sub>x</sub>
DeDust installation	Fabric filter	Fabric filter
<i>Clinker kiln dust (CKD)</i>		
Gross CKD production (%)	10%	10%
<i>Clinker kiln dust (CKD) extraction to:</i>		
Cement mill (% of CKD gross)	0%	0%
Landfill (% of CKD gross)	0%	0%
Back to Silo/Kiln (% of CKD gross)	100.0%	100.0%
<i>Bypass and Bypass dust (BPD):</i>		
Bypass rate (for Cl-removal)	No bypass	No bypass
Bypass dust (BPD) extraction	n.a.	n.a.
<i>Clinker cooler</i>		
	Grate	Grate

Long dry  
 Precalciner  
 Susp. Preheater  
 Lepol  
 Long dry  
 Long wet

No DeSO<sub>x</sub>  
 No DeSO<sub>x</sub>  
 Dry absorption  
 Wet scrubber

No bypass  
 3%  
 5%  
 8%

Satellite / Tube  
 Satellite / Tube  
 Grate

LCA<sub>4</sub>Waste is a decision support tool for industries and authorities likewise.

Strengthen and foster internal and external co-processing acceptance through the development of ecological arguments

- Catalyze dialogue and support co-processing lobbying and advocacy with key external stakeholders to reinforce your local network
  - ▶ Authorities
  - ▶ Academics
  - ▶ Other Energy Intensive Industries (EII)
- Enter in a trustworthy dialogue with your customers based on ecological benefits of co-processing and strengthen relationships
- Support capacity building on co-processing with well founded scientific ecological arguments

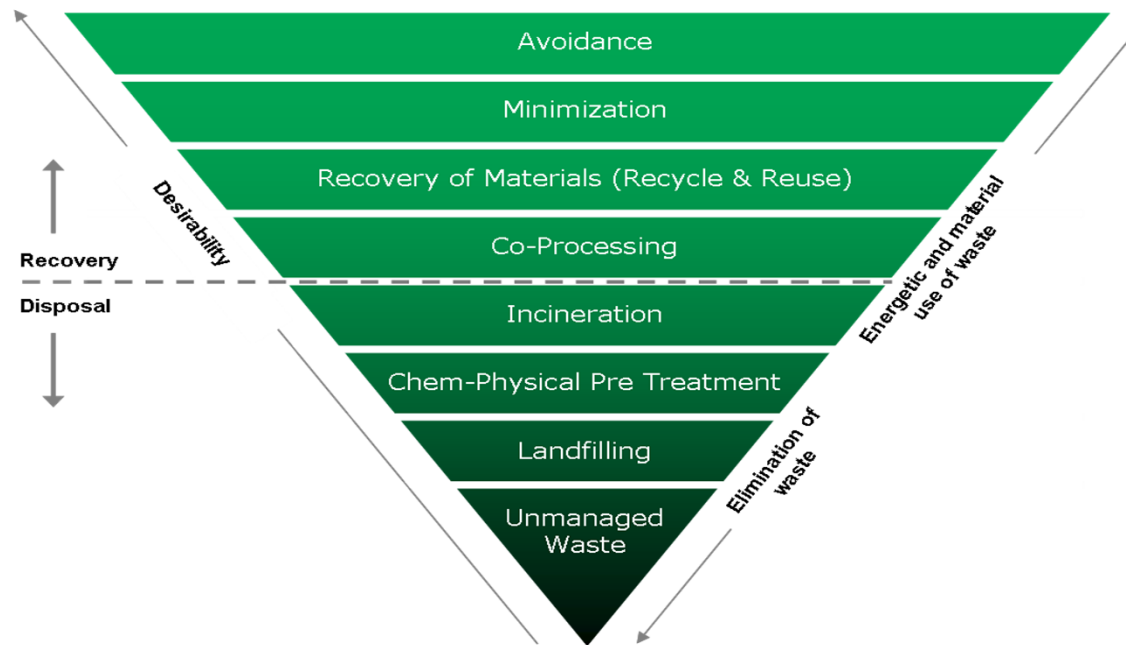
## LCA<sub>4</sub>Waste helps Holcim to prove adherence to the Holcim AFR Policy and the Holcim/GTZ Guidelines

Holcim AFR policy principle II a)

- “When using AFR our goal is to contribute to the preservation of natural resources or to the reduction of the global environmental impact”

Holcim – GTZ guideline principle I)

- “Co-processing does not hamper waste reduction efforts, and waste shall not be use in cement kilns if ecologically and economically better ways of recovery are available”



## What do you need to keep in mind to realize the benefits of Life Cycle Assessments – minimum requirements!

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- Build up a network with local accredited and trustworthy partners from the academic sector
  - ▶ Students and external partners
  - ▶ Other Energy Intensive Industries
- LCA case studies need to fulfill minimum requirements
  - ▶ High quality data about the clinker production process
  - ▶ External review of the case studies and their results for external communication
- Tool users need to understand
  - ▶ the Life Cycle Assessment methodology
  - ▶ the cement production process
  - ▶ competing waste management processes

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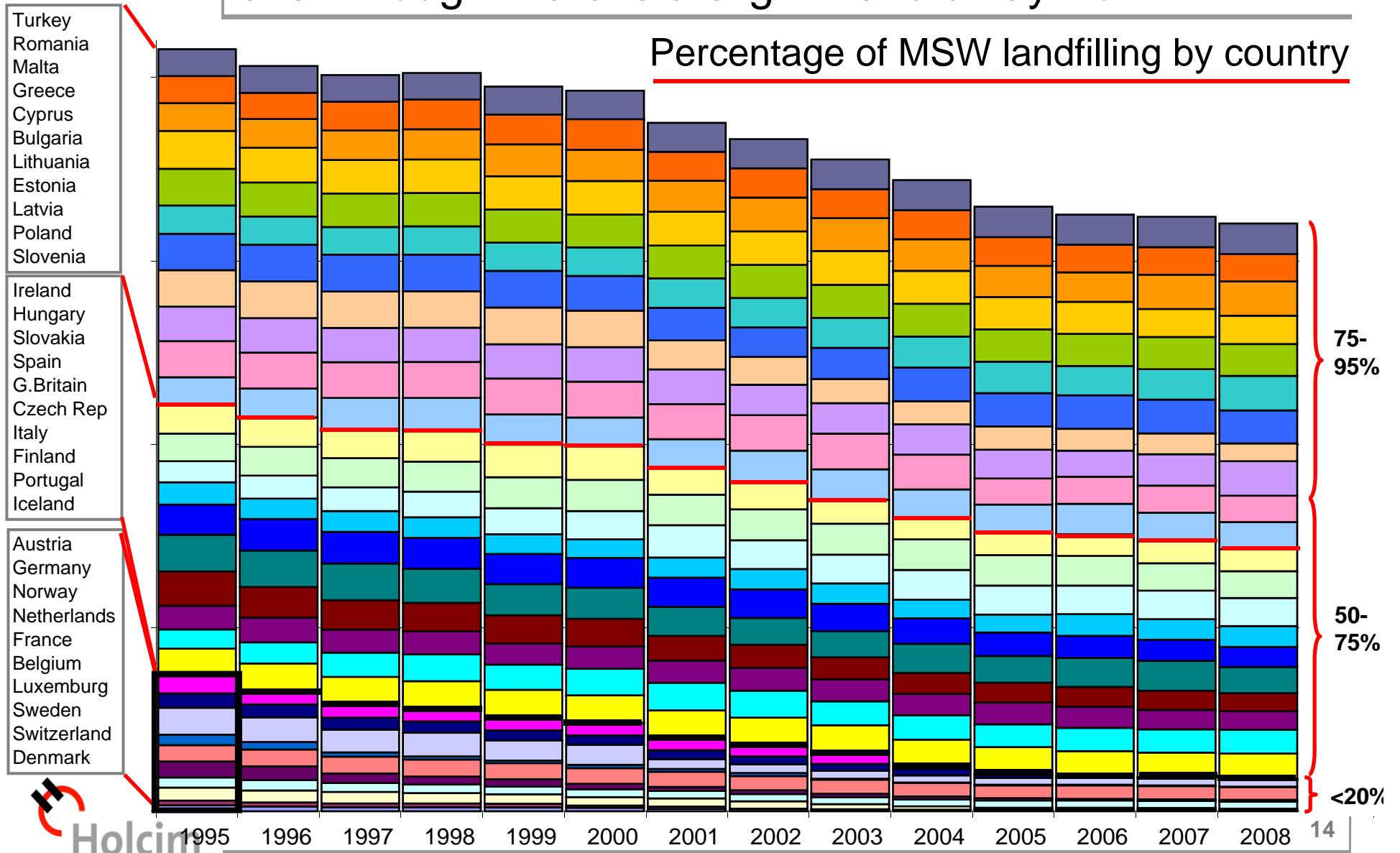
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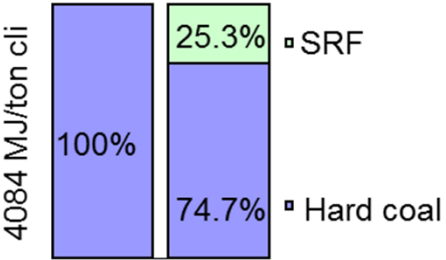



4 Conclusion

Most of the MSW is still landfilled in Czech Republic, even though there is a slight trend away from it.

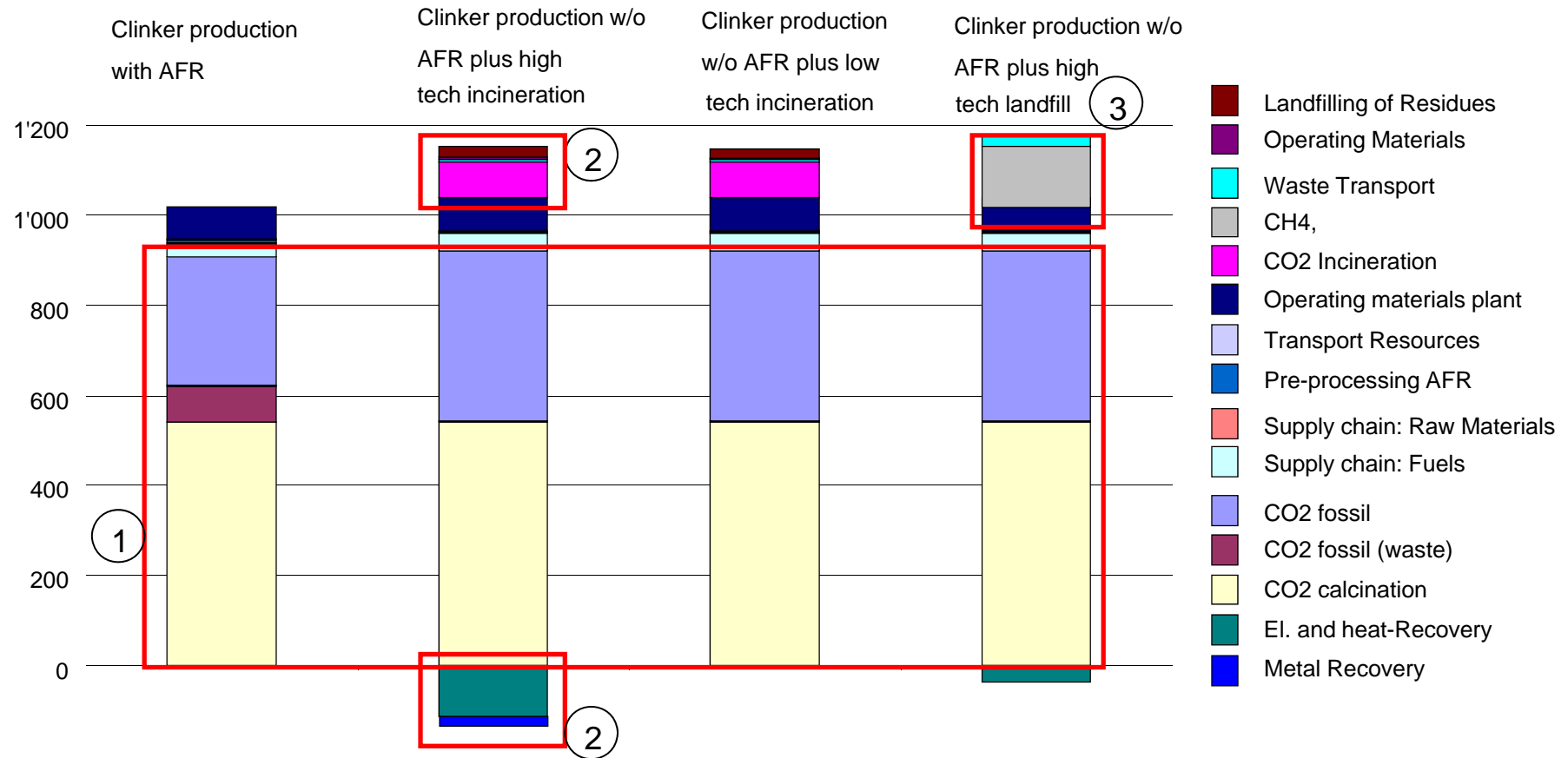
Percentage of MSW landfilling by country



# Modeling of the case studies and important assumptions for the different treatment options

Clinker Production	Incineration	Landfilling
<p data-bbox="499 400 902 480"><b>Only coal compared to SRF use as AFR</b></p>  <p data-bbox="517 820 797 852">Prachovice Plant</p> <ul data-bbox="517 911 943 1350" style="list-style-type: none"> <li>• Customization of fuel specifications</li> <li>• 4084 MJ / ton of clinker</li> <li>• 50 kg of SRF = 25 % TSR</li> <li>• Transport of 250 km for SRF</li> <li>• No DeNox</li> <li>• No DeSox</li> <li>• Bypass</li> </ul>	 <p data-bbox="1249 416 1440 448"><b>Hight tech</b></p> <ul data-bbox="1025 552 1462 847" style="list-style-type: none"> <li>• SNCR</li> <li>• Wet Scrubber</li> <li>• Fabric Filter</li> <li>• Residues landfilled</li> <li>• Energy recovery* (30%)</li> <li>• Heat (40%) recovery</li> <li>• Ferrous metal recovery</li> </ul>  <p data-bbox="1249 895 1417 927"><b>Low tech</b></p> <ul data-bbox="1025 1046 1395 1350" style="list-style-type: none"> <li>• No SNCR</li> <li>• No Wet Scrubber</li> <li>• Bag Filter</li> <li>• Residues landfilled</li> <li>• No energy recovery</li> <li>• No heat recovery</li> <li>• No metal recovery</li> </ul>	 <p data-bbox="1798 440 1989 472"><b>Hight tech</b></p> <ul data-bbox="1559 616 1955 871" style="list-style-type: none"> <li>• Sanitary landfill</li> <li>• Capture of landfill gas</li> <li>• Leachate treatment</li> <li>• Electricity recovery (30%)</li> <li>• Heat Recovery (45%)</li> </ul>

# Example: Drill down of Results for IPCC Climate Change 2001 [kg CO2 eq]

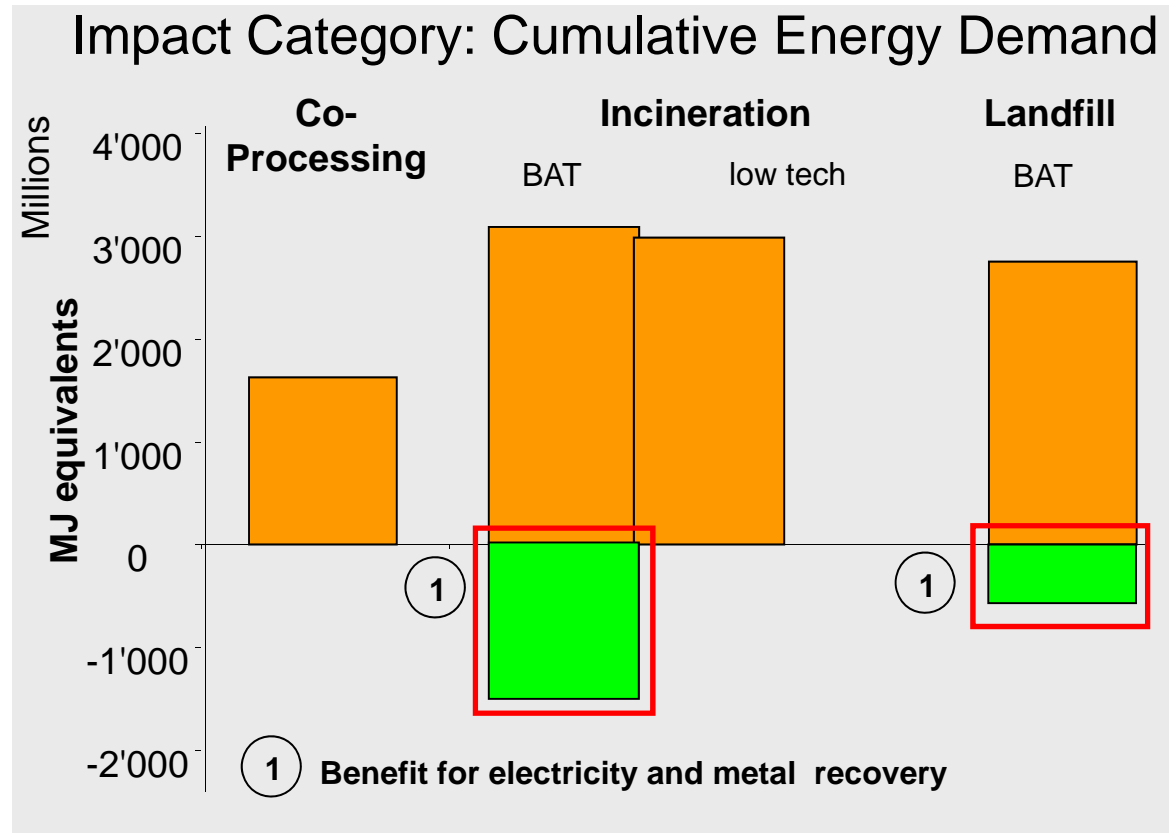


- ① CO2 Emissions from kiln operations are the same in all 4 cases
- ② Benefit for Electricity and heat recovery but additional burden through CO2 of Incineration
- ③ Important emissions of CH4 through landfill have high impact



# Case study in Prachovice compares mixed waste plastics co-processing to land-filling and incineration (1/2)

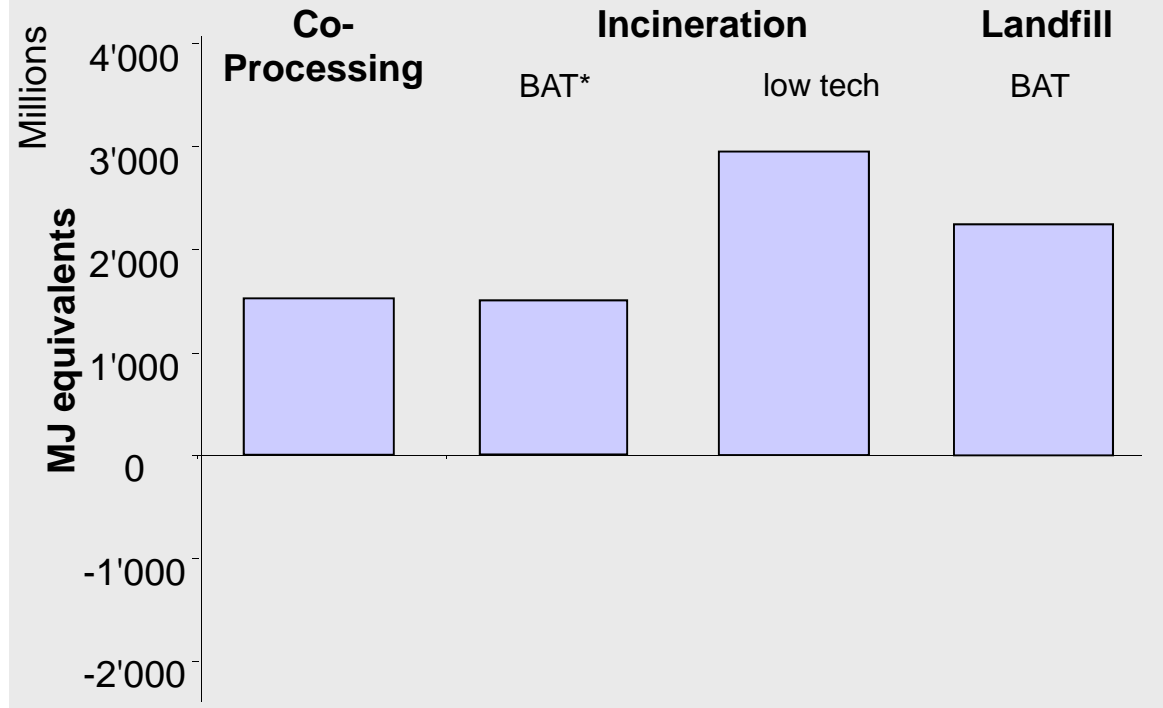
Orange square: Cumulated burden  
Green square: Cumulated benefit



# Case study in Prachovice compares mixed waste plastics co-processing to land-filling and incineration (2/2)

Impact Category: Cumulative Energy Demand

Net burden



**Results for one impact category only!**  
**→ 200 more are available!**

- ➡ BAT incinerators reach co-processing performance by leveling out burdens / benefits
- ➡ Landfill BAT exceeds low tech incinerator performance

## Case study in Czech Republic shows that co-processing is a competitive waste management option

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- Co-processing is ecologically more beneficial than landfilling and low technology incineration according to Climate Change, Acidification and Cumulative Energy Demand
  - ▶ Avoidance of CO<sub>2</sub> emissions and methane emissions from incineration and landfilling
  - ▶ Reduced NO<sub>x</sub> emission when using mixed waste plastics clinker production
  - ▶ Avoidance of supply chain burden
- BAT incinerators and co-processing are comparable options to the above mentioned impact assessment methods
  - ▶ Burden reduction through abatement technology
  - ▶ Energy recovery in a largely coal fired electricity grid

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Conclusion: LCA<sub>4</sub>Waste fully supports LCT and will be further promoted externally and internally

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- Supports the implementation of LCT and can complement the waste management hierarchy
- Decision support tool at various levels
  - ▶ Externally
  - ▶ Internally
- Main advantages of the LCA<sub>4</sub>Waste tool
  - ▶ Interdisciplinary development with key stakeholders
  - ▶ Highly flexible tool instead of static report
- Contact persons @ Holcim Group Support:
  - ▶ Amélie Orthlieb ([amelie.orthlieb@holcim.com](mailto:amelie.orthlieb@holcim.com))
  - ▶ Bruno Fux ([bruno.fux@holcim.com](mailto:bruno.fux@holcim.com))

# Thank you!!



*Because tomorrow matters*