



Pastoor Consult

NETWERKBIJEENKOMST

Maritime Campus

07 Maart 2013

Aktivites

- **Consulting Activities**
 - Papermills
 - Cementindustry en Energy
- **Alternative Fuels**
 - Business Development
 - Projekts on fuels
- **Recycling for Cement**
 - Gypsum powder and - paper
 - Rotor Blades
- **Biomass**



Recycling of blades



at site

Rawmaterial and Fuel



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Challenge and Difficulty

A practicable disposal solution for used rotor blades has to overcome the challenges of the material properties,

- the high abrasive wear,
- the endangerment of the occupational
- health and safety



A flawless disposal of rotor blades requires an extraordinary "Know How" of waste management



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The Green Solution

Pre-preparation takes place in four steps:

1. First size reduction on site

- first step takes place at the wind power plant
- for this mobile saws are used
- minimal number of slices for a transport without special permit
- installed water nozzles for dust reduction
- collection of the saw dust by filter clothes
- transport to the pre-preparation platform



The Green Solution

2. Further size reduction in an encapsulated system with automatic saws for two cuts simultaneously
- Separation of different components (metals, blade hubs, etc.)
- Recycling of ferrous and non-ferrous metals
- Dust attachment



The Green Solution

3. Final size reduction
 - pre-cut blades are sent to the encapsulated preparation plant
 - automatically working saws and the cross-flow shredder crushing the blades to a max size of < 50 mm.
 - separation of different components (metals, blade hubs etc.)
 - recycling of ferrous and non-ferrous metals



The Green Solution

4. Homogenization

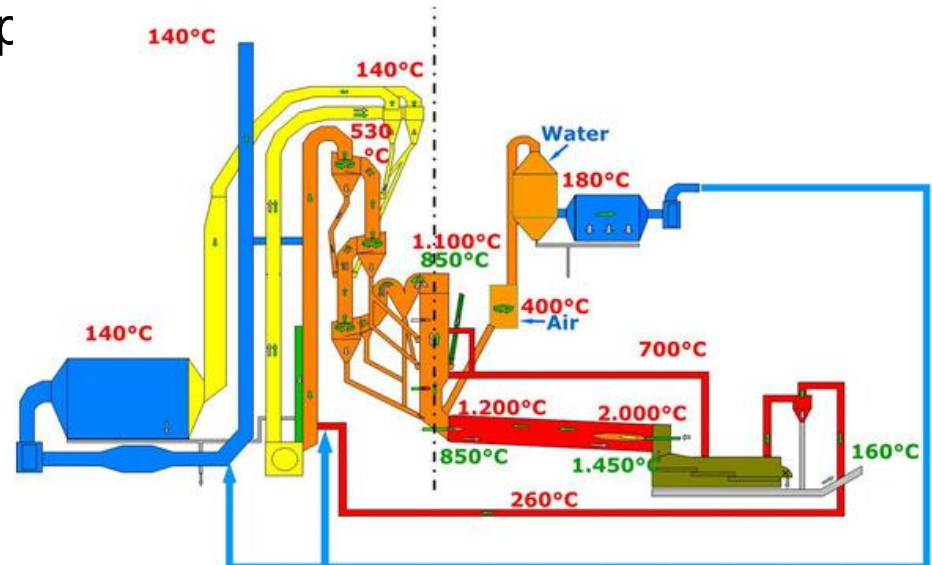
- Homogenization of the shredded rotor blade with a second, wet material to an alternative fuel and raw material for the cement process
- calorific value ~ 15 MJ/Kg
- The mixture contains also the collected dust



A Thermal and Material Recycling

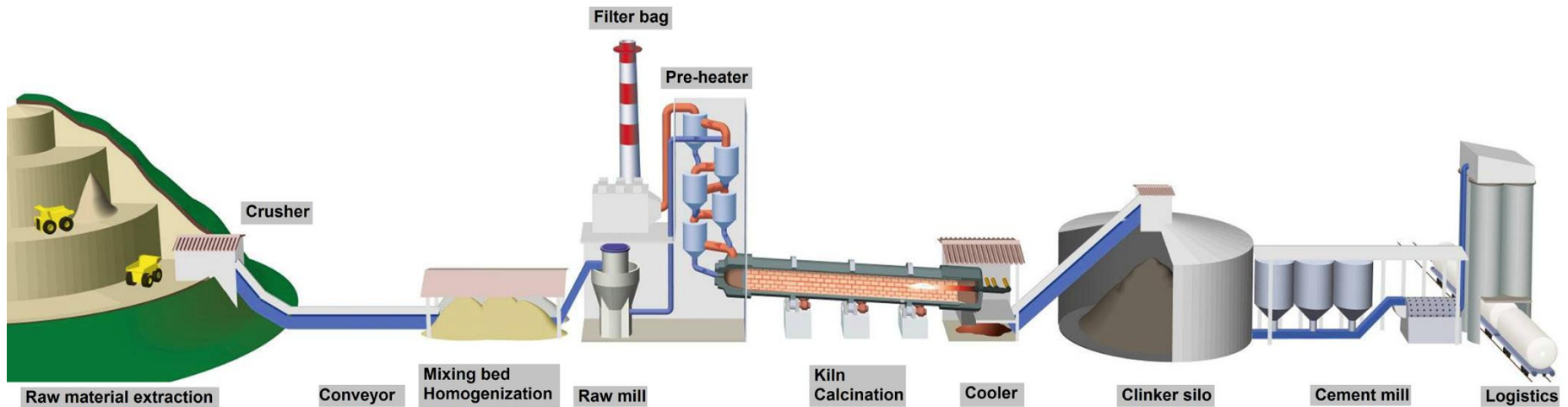
Use of thermal energy content for cement clinker production

- Calcination of raw material
- Calorific value ~ 15 MJ/kg
- Complete incorporation of the rotor blade ashes into the clinker matrix (e.g. silica component)
- Ash content ~ 50 %
- No negative environmental impact
- No negative impact on the cement quality



A Thermal and Materiel Recycling

Cement Proces



A Thermal and Material Recycling



Environmental friendly preparation



Re-use for new
fundaments and towers



The Green Solution

Conclusion

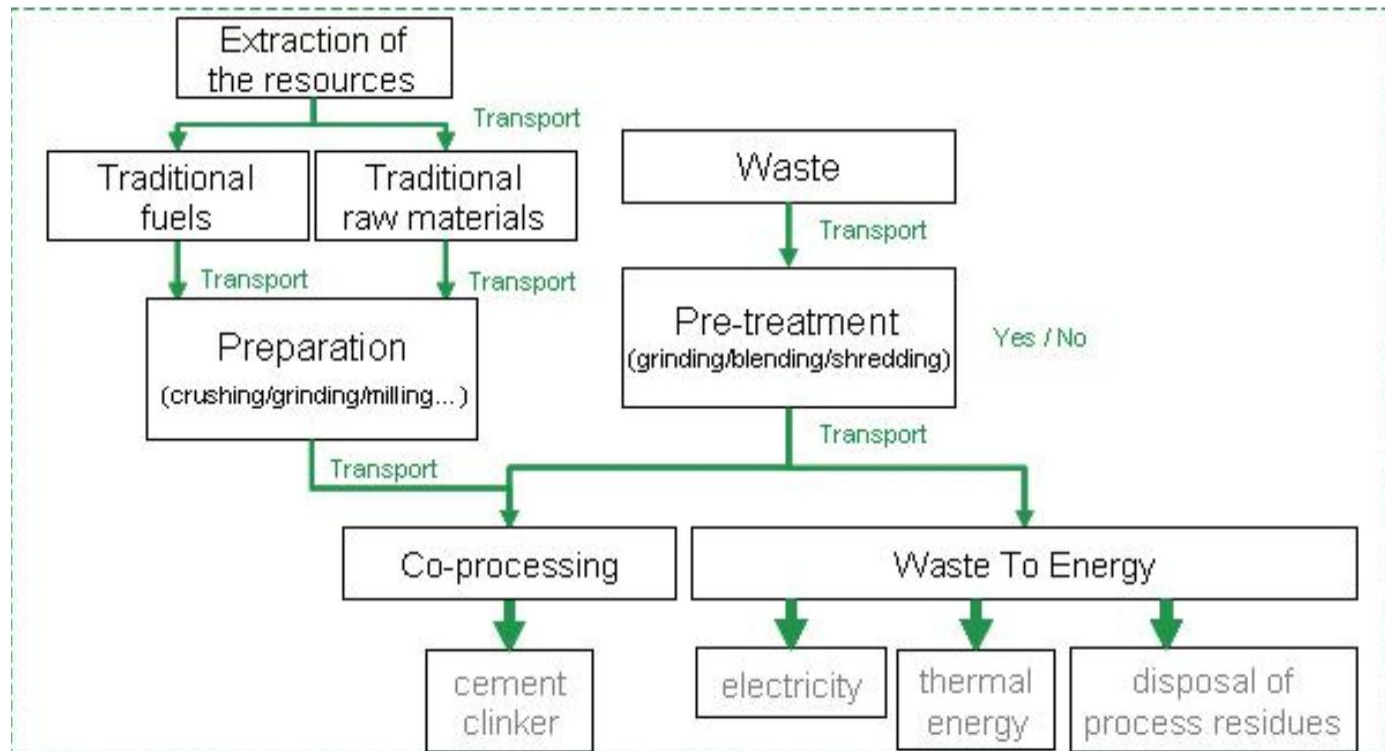
- Crushed and mixed FRP chips can be used as AFR cement process without any negative influence on cement quality
- The co-processing ensures a complete thermal and
- mineral recovery of the blade components
- No negotiation impact on the environment
- The process guarantees a secure handling of the FRP dust
- No remaining waste like ash or slag
- Considerable reduction of CO₂-Emissions

Co-processing of FRP in the cement production is a complete thermal and material recycling



LCA₄Waste

Co processing



LCA₄Waste

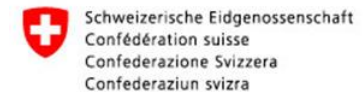
- Sharp increase of disused rotor blades within the next years
- Sustainable solution for disused rotor blades is available
- Zajons and Holcim have realized and implement a sustainable solution for disused rotor blades
- The LCA has proved the adherence of the process to our Directives and Policies and improved our knowledge on the environmental impacts

Requirements by ISO 14040 and 14044 are fulfilled

EuCIA, EuPC and ECRC evaluate the cement route as the currently best recycling option for glass-fibre reinforced plastics

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LCA₄Waste



A Green Solution



Taking over and cutting at site



Rawmaterial and Fuel





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THANK YOU FOR YOUR ATTENTION



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