Processed animal by-products in the cement industry: requirements for an advantageous use

How to generate and maintain a win-win situation
for rendering industry and cement plant

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- History from both sides of a medal
- How does the cement industry utilise MBM?
- Outlook
  - What is necessary to operate and sustain the cooperation
  - Expectations

We surely agree :

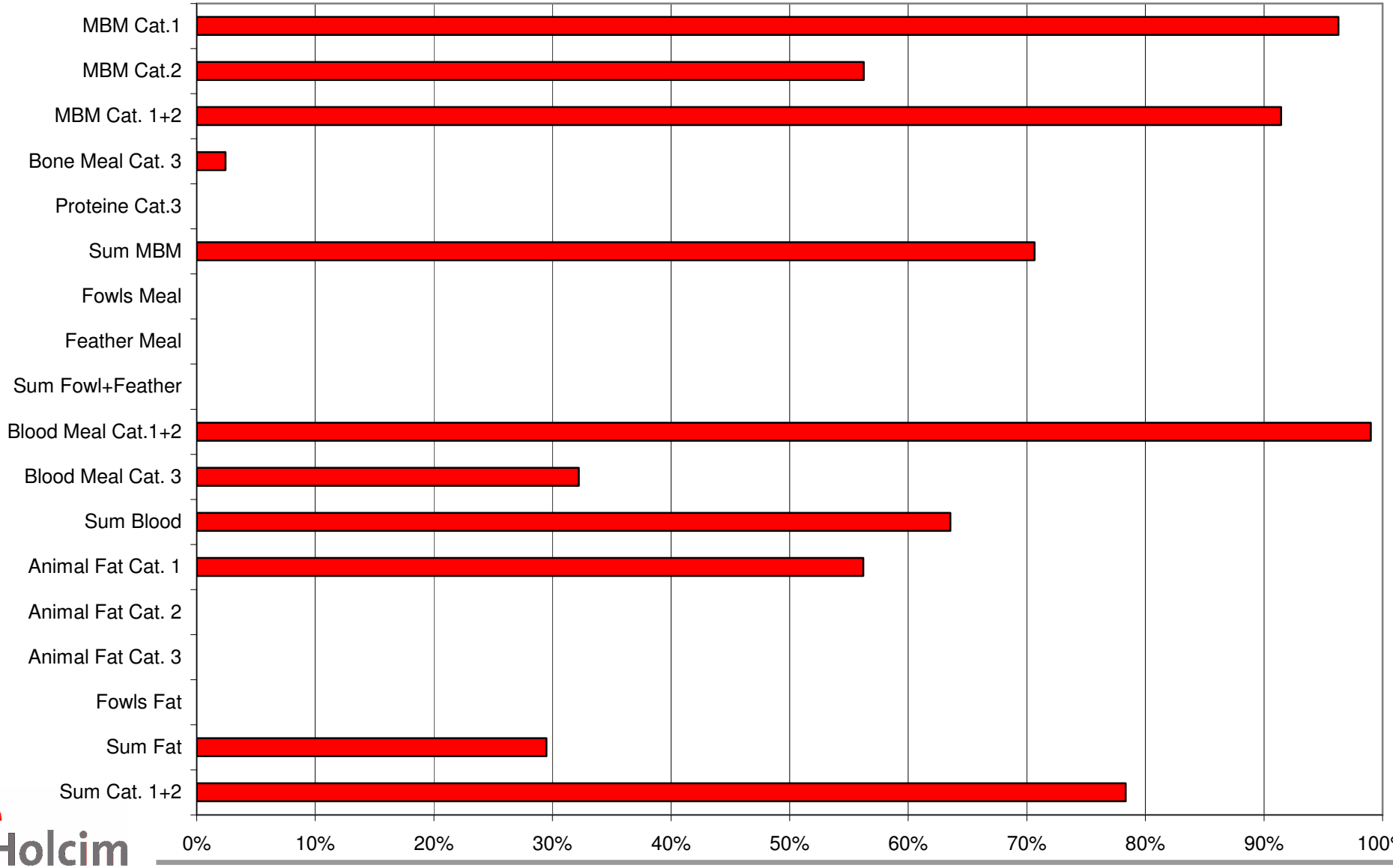
MBM is not made as a fuel nor is co-incineration the whole purpose. Incineration of High Risk Material is simply required legally and co-incineration helps to cut the costs.

Use of Animal Meal

	Animal Feed	Technical Use	Energy Recovery	Internal Incineration	Waste Incineration	Stock	Sum	
MBM Cat.1			295018		10283	1125	306426	34%
MBM Cat.2	15	18362	23701				42129	5%
MBM Cat. 1+2	15	18362	318719				348555	39%
Bone Meal Cat. 3	20	191810	4816			1630	198276	22%
Proteine Cat.3	2747	10986					13733	2%
Sum MBM	2797	239520	642254	0	20668	3880	909119	102%
Fowls Meal	14477						14477	2%
Feather Meal	7845	5381					13226	1%
Sum Fowls and Feathers	22322	5381	0	0	0	0	27703	3%
Blood Meal Cat.1+2			7968			80	8048	1%
Blood Meal Cat. 3	5276	900	2936				9112	1%
Sum Blood	5276	900	10904	0	0	80	17160	2%
Animal Fat Cat. 1		3574	83817	61190		519	149100	17%
Animal Fat Cat. 2		18181		155			18336	2%
Animal Fat Cat. 3		102553		224		38	102815	12%
Fowls Fat	9106	4824					13930	2%
Sum Fat	9106	129132	83817	61569	0	557	284181	32%
all Cat. 1+2	15	40117	410504	61345	10334	1724	524039	59%
Sum	39486	356571	418256	61569	10334	3392	889608	
	4%	40%	47%	7%	1%	0%		

Capacity Ld Plant
~ 30.000 t = 9.4 %

Use of Animal Byproducts for External Energy Recovery



The start in Germany – November 2000

- Completely new situation for the rendering industry
  - The Mad Cow Disease (BSE) turns the image of MBM from a valuable product to a hazardous waste overnight
  - The market drops from demand and profits to a severe disposal problem and immense expenses for disposal
- Completely new situation for the cement plants
  - Co-processing capacity wanted by environmental and agricultural authorities to avoid costs for waste incineration
  - Strange requirements
    - Veterinarian inspection additionally to supervising authorities
    - Additional demands by trade union and workers´ council - incalculable threats, uncertainties in scientific assessment
    - Work hygiene like in the quarantine ward of a hospital
    - Pricing on daily basis is not feasible for a constant operation

Position at the start

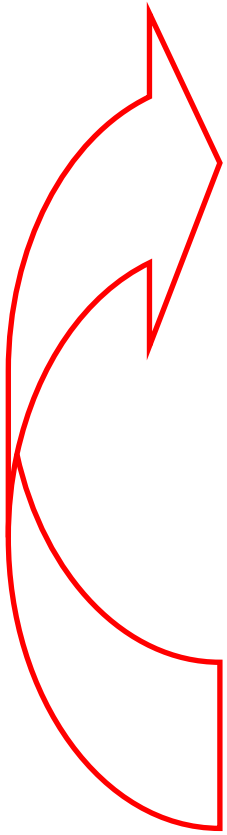
- Rendering industry
  - Our perfect product is infamised politically
  - At least it can be used as a fuel! Pricing similar to Brown Coal, please.
  - Incineration? – Disposal? – No, thanks!
  - Cement people try to rip off our emergency
- Cement industry
  - Stay away with all that interferes with our product quality
  - It will raise our profitability
  - Capital investment? Impacts on the process? – No, thanks!
  - They want us to pull their chestnuts out of the fire.
    => Waste incinerators´ conditions have to be met
- Disposal costs for MBM in waste incineration plants clearly went beyond the scope of the rendering plants

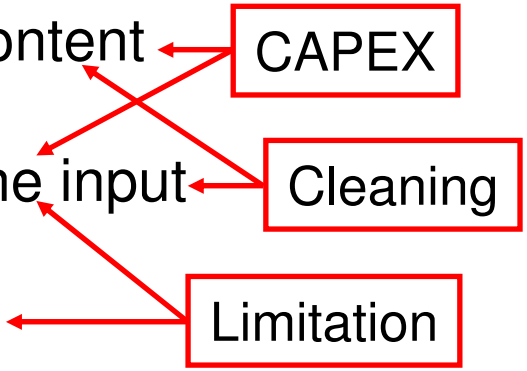
Impacts of MBM use for the cement plant

- Substantial CAPEX needed for additional installations
  - Little time for depreciation and amortisation expected
- In many cases: strip down concepts for the use of existing installations w./wo. modification (silos, dosing equipment)
  - … in many cases misleading
- Cost reduction in cooperation with rendering plants
  - use of chips instead of meal (win-win-situation)
  - only applicable in very particular cases

Impacts of MBM use for the cement plant

- Learning process: operation of a cement plant and it´s product are influenced by the use of MBM
  - Handling / Storage / Dosing
    Plugging due to fluctuating fat/moisture content
  - Kiln operation
    Build ups in the kiln system due to Chlorine input
  - Product quality
    Delayed setting due to Phosphorus input





- Anyhow the use of MBM is sensitive in standard systems
  - Unsteady fat content results in blockages of pipes and silos
  - Coarse material and impurities may block pipes and nozzles
  - Seasonal variations influence handling and dosage
  - The more MBM is used the more sensitive is the process

Holcim: “Strength Performance Passion”-worldwide

Colleagues worldwide

1990 ↗ 2000 ↗ 2005
29.500 ↗ 41.100 ↗ 60.000

Laegerdorf plant 272 (+35)
Hoever plant 198 (+3)
Corporate 80
Holcim (Deutschland) 588

Net sales worldwide
2004
13.2 Billion CHF

Important Properties of the Kiln Process

Rotary kiln (primary firing)

- gas temperatures at least 2000 °C,
- residence time of the gases 3 to 8 seconds
- oxidising atmosphere in the whole rotary kiln
- complete use of the main ash compontents as raw material
- material temperature 1.450 °C
- chemical-mineral bonding of heavy metals

Calciner (secondary firing)

- gas temperatures at least 850 °C
- residence time of the gases clearly over 2 seconds
- material temperature at least 850 °C

Preheater / Gas Filter

- adsorption of gaseous components like HCI, HF or $S0_2$ by basic Alkali-compounds
- high adsorption capacity for particle bound heavy metals

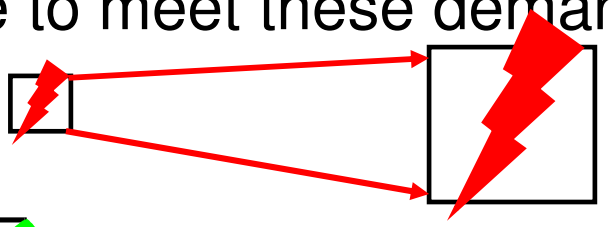
Complete decoposition of organic components due to high temperature, oxidising atmosphere and sufficient residence time

Summary - Assessment

- Cement plants are generally well qualified for the recovery of waste
  - rotary kilns are equipped with dust firing and operated at very constant conditions
  - process temperature, residence time, and kiln atmosphere assure complete incineration and environmentally safe recovery
  - incomplete incineration can be safely precluded
  - there is no change of the emissions with the use of AFR
  - complete material recovery for all Ca-, Si-, Fe- or Al-rich ashes - no waste to be disposed off
  - due to the high standards for health and safety and environmental protection additional investment for the extension of waste usage is comparably low
  - cement plants are available for cooperation almost everywhere
- The eco-balance of waste recovery in cement plants is positive
- Successful cooperation with authorities in several cases qualified especially Holcim plants for further projects of waste recovery

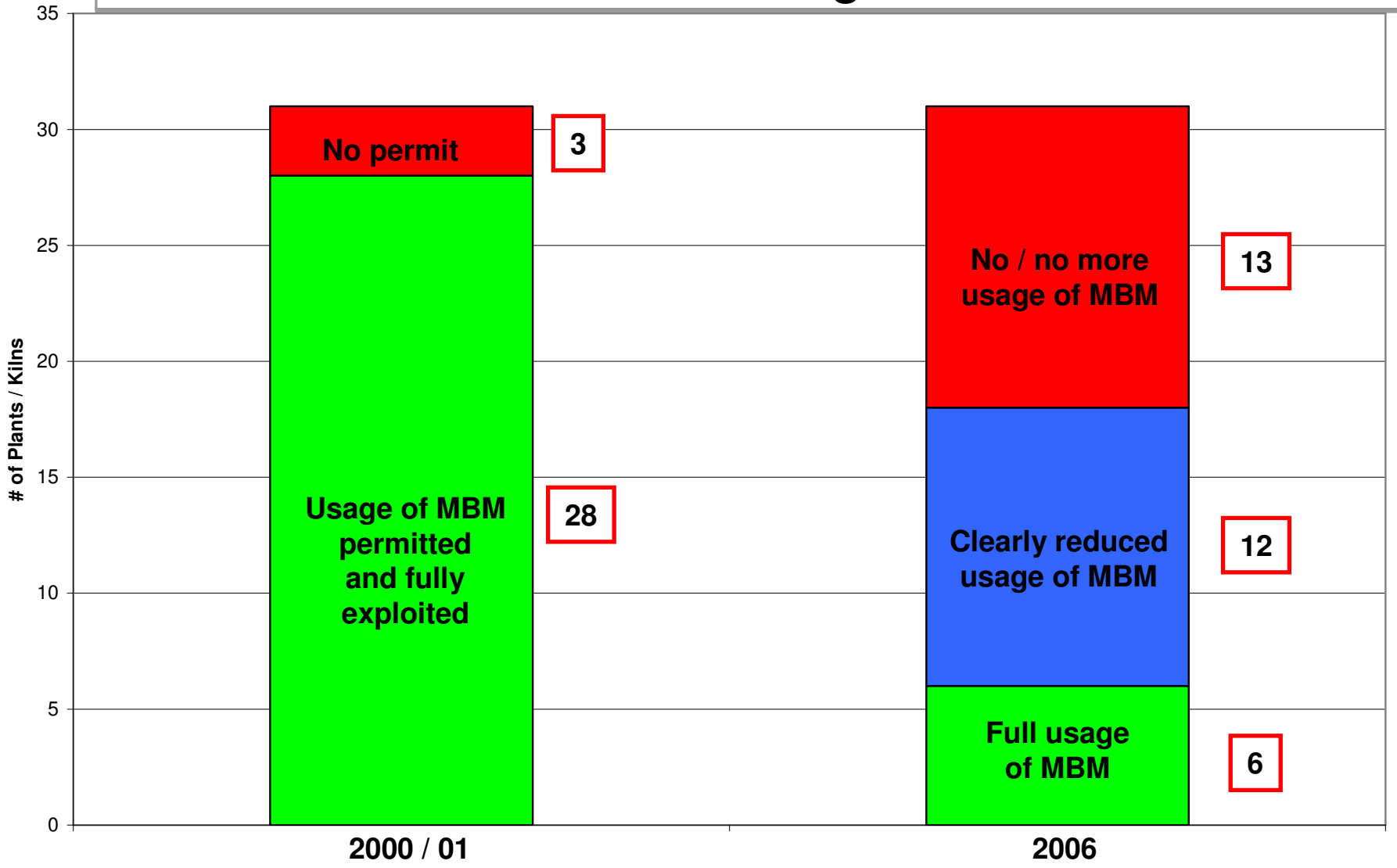
Demands to AFR (= Alternative Fuels and Raw Materials)

- Adjusting constant parameters is essential for the clinker burning process
  - Material feeding ☑
  - Material composition ☑
  - Temperature profile ☑
  - Kiln atmosphere ☑
- All input materials have to meet these demands
  - Continuity of Sourcing ☐
  - Doseability ☑ → ☑
  - Composition ☑ → ☑



- The plant has to be suitably prepared for waste recovery
  - Storage areas suitable for homogenising ☑
  - Dosage facilities for constant feeding ☑ → ☑

Decline of Animal Meal Usage in Cement Plants



Source:situation poll 5/06, feedback from ~ 50 % of all plants

Special case - Chips at Lägerdorf plant

- In contrast to all other cement plants in Germany coarse (unground) material is burnt
  = chips, dry, after cooking line, before final grinding
- Material feeding and transport had to be adapted to the material characteristics
- Even sticky material (high fat content) can be handled
- Dosing has to be optimised taking into consideration material characteristics
- Cleaning of preheater and kiln inlet is increased to prevent build ups (due to additional Cl input)
- Increased AFR quantities require constant AFR characteristics and supply !

Special case - Chips at Lägerdorf plant

- Advantage for the rendering plants
  - Complete meal grinding is omitted
  - Energy and maintenance costs are reduced
  - Reduction of transport costs, queue time for silo evacuation
  - All in all considerable cost reduction
- Advantage for the cement plant
  - No pneumatic transport ⇒ No build-ups in the pipes
  - No dust formation - no explosible dust-air mixtures
  - Less problems with odour
- Win – win - situation
  - Saved costs can be shared
  - Long term contracts secure both constant removal and supply
  - Long term contract advantageous for both parties

Recent Development

- Categorisation of different MBM-types facilitates use in pet food, fertiliser, animal feed under certain restrictions - the need for (co-) incineration capacity drops
- Still newcomers try to turn energy recovery of MBM into an economic advantage - increased demand cuts the disposal costs for the rendering industry
- … but effort and expenses for the energy recovery of MBM are completely underestimated
- Adventurers and temporisers step off as soon as the they do not just make a quick win
- Supply becomes uncertain for the cement plants - they start to opt out

Recent Development

- Effort and expenses for the handling of MBM in a cement plant exceed the disposal fee by far
  - in some cases they even come up to the benefit of the calorific value
- Economical advantage is only achieveable for plants with a significant throughput.
- As long as there is no economical competition for the incineration capacity little throughput may be accepted
  - if it is constantly secured and well maintained.
    - Fluctuating feed rates are fatal for cement production
    - Uncertain deliveries spoil a constant operation
- It is impossible to run a cement kiln under consistently changing conditions

Expectations

- Most rendering plants will not commit themselves to an enduring cooperation with a cement plant but will try to optimise costs on short term basis
- Due to decreasing certainty of MBM supply more and more cement plants will opt for other alternative fuels
- The alternative to co-incineration is
  - Uncertain – little industrial firings or powerplants
  - Expensive – waste incineration

- Sustainability calls for long term cooperation quick wins include a significant risk
- We recommend cooperation with cement plants
  - Keep in mind the repair downtimes
  - Keep in mind the problems with pneumatic dosing

Expectations

- The alternative to co-incineration is
  - Uncertain – little industrial firings or powerplants
  - Expensive – waste incineration

- Sustainability calls for long term cooperation quick wins include a significant risk

- We recommend contracts with flexible reliable partners
  - Keep in mind the repair downtimes
  - Keep in mind the problems with pneumatic dosing

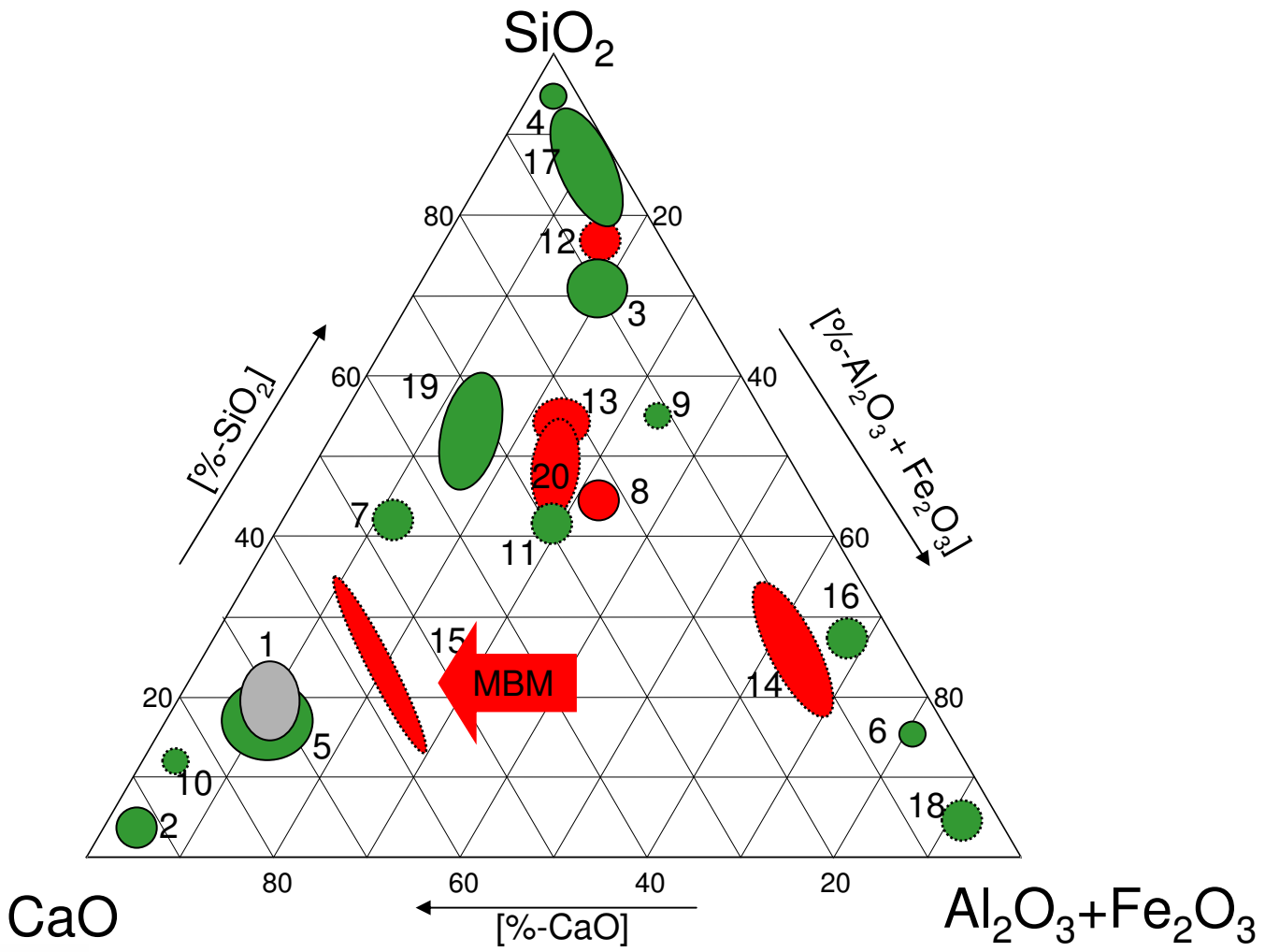
Thank you for listening !

- A WEED IS A FLOWER, SIMPLY GROWING IN THE WRONG PLACE.
  - Sir Edmund Salisbury, Weeds and Aliens

- WASTE IS A RESOURCE, SIMPLY LOOKED AT FROM THE WRONG PROCESS.
  - Holcim (Germany) AG, Common Position since 29. 3. 2000

Illustrations and Charts

CAS System for AFR



1 **Clinker**
2 **Chalk, Limestone**
3 Clay
4 Sand
5 Marl
6 Bauxite
7 (G)BFS
8 Coal
9 Flyash
10 Sludge from processing-
of drinking water
11 Papersludge
12 Diatomeous Earth
13 Rubber, Plastics
14 Tires, ~chips
15 MBM
16 Al-Slag
17 Foundry Sand
18 Pyrite Cinder
19 Sewage Sludge
20 RDF (FLUFF)