Welcome
on

Iran Cement
Technical Forum & Exhibition

CEMAG GROUP

and to the presentation

CEMAG Beta Mill –
Energy Saving Grinding Technology
contributed by

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President CEMAG GROUP

CONTENT

- CEMAG GROUP – SHORT OVERVIEW
- MAIN CHALLENGES FOR BUILDING MATERIAL PRODUCERS
- SOLUTIONS FOR ENERGY EFFICIENT CEMENT PRODUCTION
- CEMAG BETA MILL







HOLDING Hameln	CEMAG Hameln	MEM-Bau Hameln	GFT mbH Hameln	FAF Brieselang	SBBZ Dessau	CPT Hameln
Administration	*Solutions for the building materials and ore processing industry* **Dessau** *Specialized in kiln and preheater technology*	*Structural & civil engineering for commercial and industrial solutions*	*Planning and manufacturing of plants and components for the stone and aggregates industry*	*Solutions for material handling and conveying*	*Steel- and sheet metal forming centre*	*Grinding & classifying technology, process engineering and R & D Center "Technikum"*

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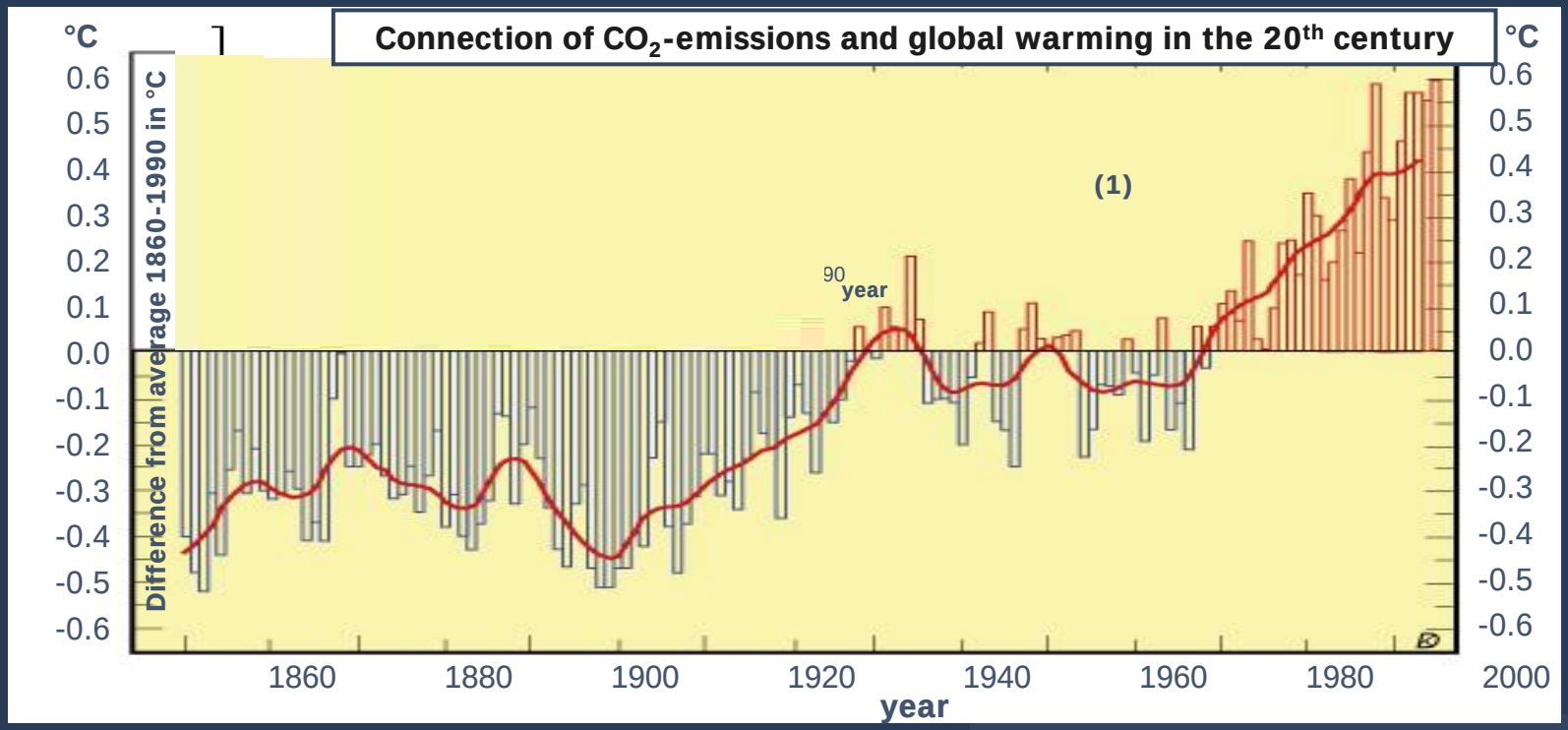
MAIN CHALLENGES FOR BUILDING MATERIAL PRODUCERS



Source: (1) Hamburger Bildungsserver (HBS)
(2) Berner & Streif, 2001

EMISSION CERTIFICATES

- The Kyoto protocol forces its ratification countries to reduce their CO_2-emissions and to buy emission certificates
- These certificates are e.g. traded at the European Energy Exchange (EEX) in Leipzig
- The CO_2-emissions of the cement industry are thermal, electric and raw material caused

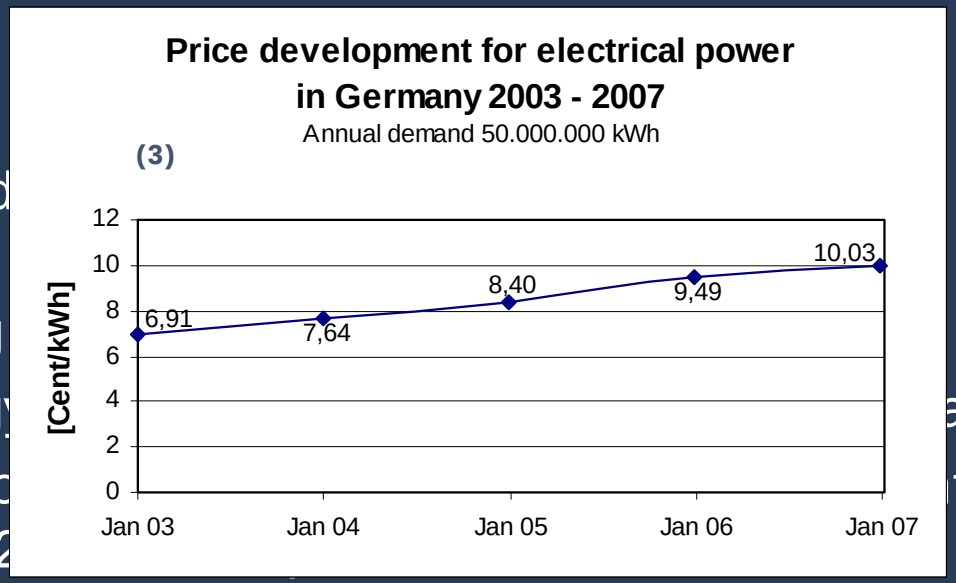
(2)	Absolute CO_2-emissions [10^6 t/a]				Specific CO_2-emissions [t CO_2/t cement]			
	2000	2001	2002	2003	2000	2001	2002	2003
Thermal caused	6,83	5,78	5,16	5,20	0,195	0,179	0,168	0,156
Electric caused	2,38	2,15	2,12	2,22	0,068	0,067	0,069	0,067
Raw material caused	15,10	13,37	12,70	13,37	0,431	0,415	0,413	0,401

Thermal without alternative fuels

Source: (1) http://www.eex.com
(2) VDZ e.V. (Verein deutscher Zementwerke)

SOME FACTS

- 6 – 10% of the worldwide prod
  reduction processes(1)
- About 90% of cement grinding
- Approx. 85 - 90% of the energy
- The average specific electric po
  industry is 101kWh/t cement (2
- The average price for 1kWh electrical power is today nearly
  10 Euro cent



Source: *(1) Taschenbuch der Verfahrenstechnik, K. Schwister*
(2) VDZ e.V. (Verein deutscher Zementwerke)
(3) http://www.bdi-online.de

FOR THIS REASON THE MAIN TASKS ARE:

- ⇨ Reduction of CO_2-emissions
- ⇨ Increase of energy efficiency

ACTUAL TRENDS & SOLUTIONS

Which are the possibilities to reduce CO_2-emissions?

1. Alternative raw materials as substitution for cement clinker
   - ⇨ Decrease of CO_2-emissions by less CO_2-discharge due to deacidification during the burning process
   - ⇨ Further advantages:
     - Protection of natural ressources
     - Saving of landfill space
     - Assistance to other industries in fulfilling their recycling needs
     - Secure disposal of wastes in the cement raw mill

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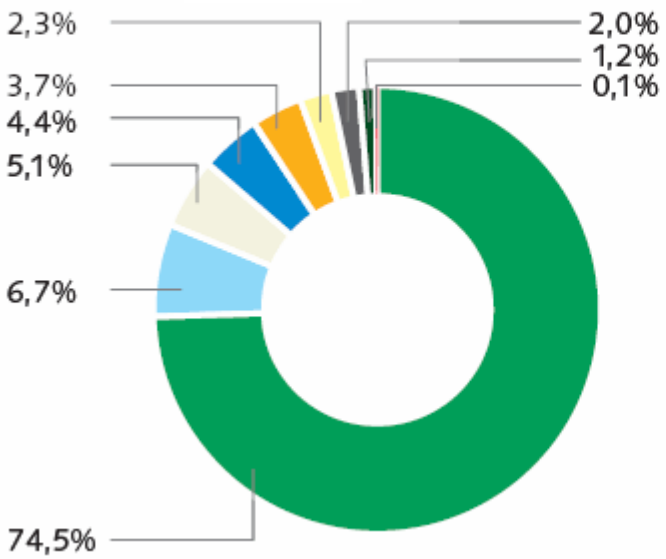
ALTERNATIVE RAW MATERIALS

Application in the German cement industry 2003

1.000 t/a



Granulated blast furnace slag	4.760
FGD gypsum	426
Fly ash	325
Lime slurrys and other residues of the lime industry	283
Other Si-Al-Ca-carrier (e.g. Ashes of combustion residues	234
Casting sands	148
Other charge materials of the iron and steel industry	131
Charge materials of the metal industry	76
Residues from coal processing	4

Source: VDZ

ACTUAL TRENDS & SOLUTIONS

Which are the possibilities to save electric energy?

2. Increase of energy efficiency by a new grinding technology

   ⇨ Decrease of CO_2-emissions by less power consumption due to lower specific energy consumption during the grinding process

   ⇨ Challenges to this system:

   - Energy-effective grinding of different materials
   - Constantly low specific energy consumption also for partial loads
   - Fast product change

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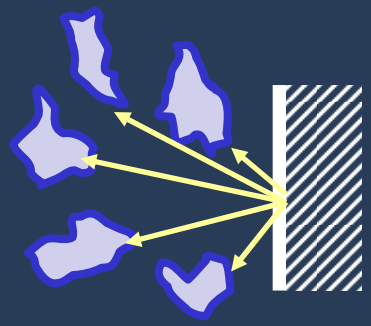
Technical possibility for bulk material grinding

1. IMPACTATION PROCESS

A.

UNCONTROLLED
FORCE TRANSMISSION

B.



I. MATERIAL HIGH SPEED
II. IMPACT PART HIGH SPEED

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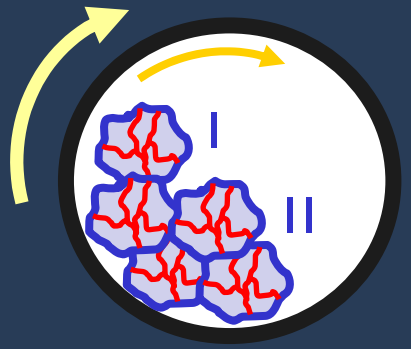
Technical possibility for bulk material grinding

2. SURGE GRINDING

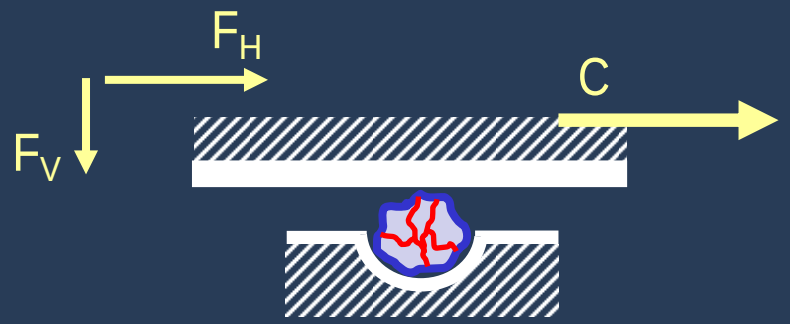
A. MATERIAL ON MATERIAL

$C_I \simeq C_{II}$



UNCONTROLLED FORCE TRANSMISSION

B. $F_H >> F_V$



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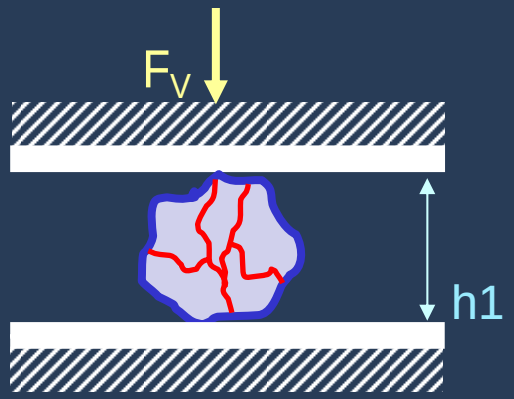
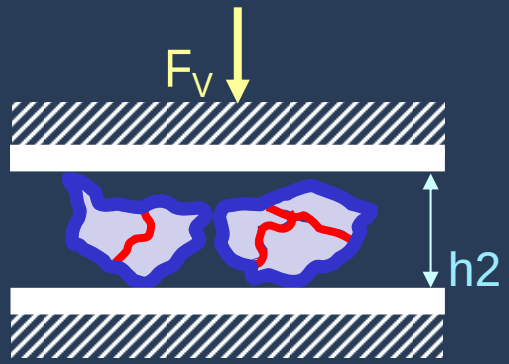
Technical possibility for bulk material grinding

3. .

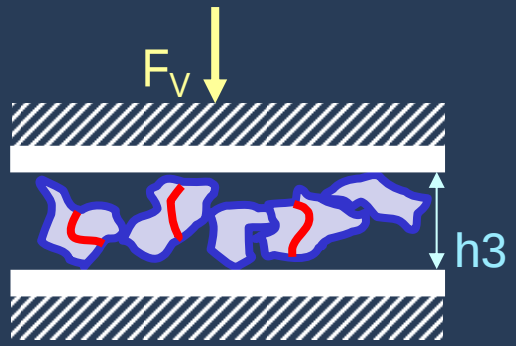
A.



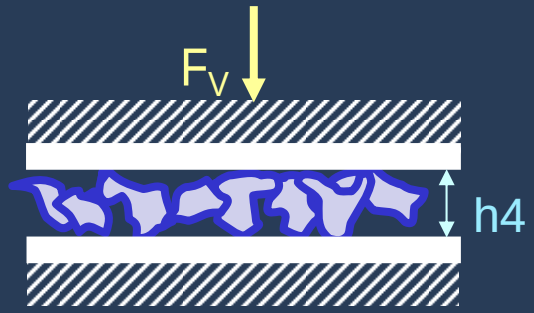
B.



C.



D.



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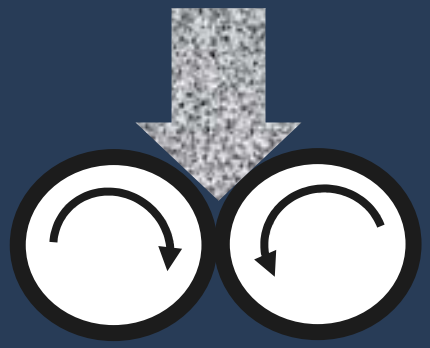
Comparison between the existing roller mills

1. ROLLER PRESS



- MATERIAL SPEED ≃ m/s
- MATERILAL BED : UNCONTROLLED
- PRESSURE : UNCONTROLLABLE
- HIGH WEAR RATE !

RESULT :

- HEAVY VIBRATION
- VERY HEAVY GEAR BOX !
- HIGH WEAR RATE
- HIGH MAINTENACE COST
- HIGH ENERGY CONSUMPTION

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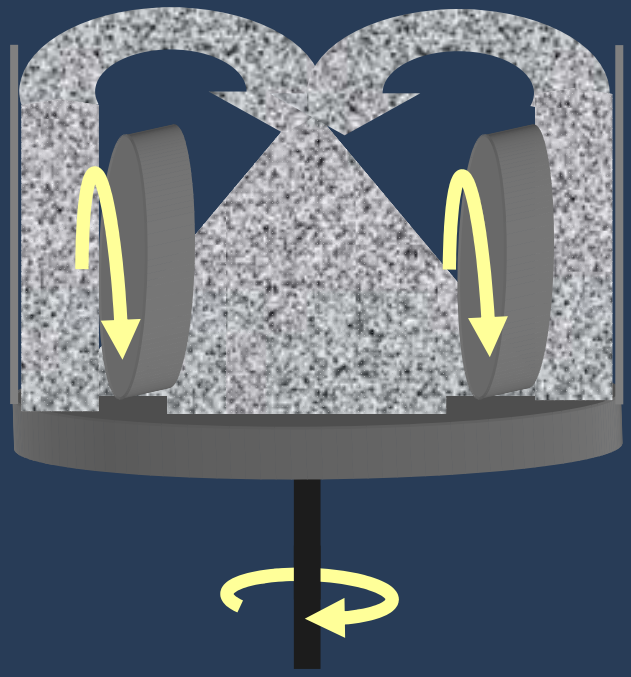
Comparison between the existing roller mills

2. VERTICAL ROLLER MILL



- MATERIAL DISTRIBUTION BY CENTRIPETAL FORCE
- MATERILAL BED : UNCONTROLLED
- PRESSURE : ONLY ONE WORKING POINT

RESULT :

- HEAVY EQUIPMENT
- VERY HEAVY GEAR BOX !
- HIGH WEAR RATE
- HIGH MAINTENACE COST
- HIGH ENERGY CONSUMPTION

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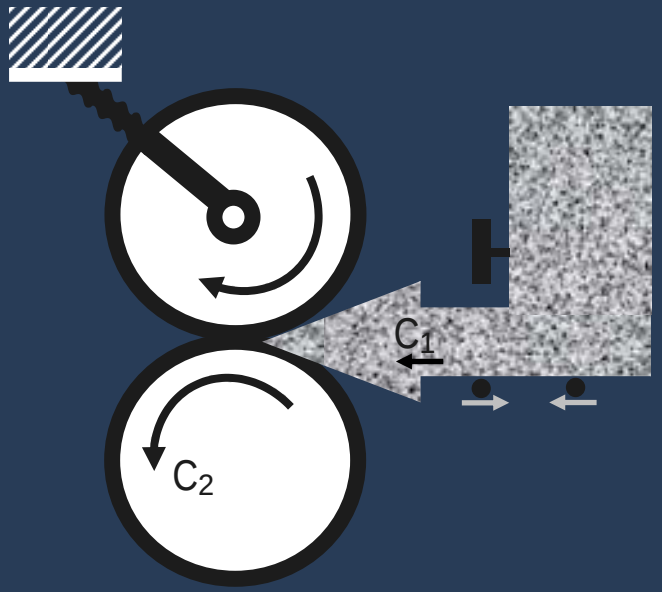
Comparison between the existing roller mills

3. BETA MILL



- MATERILAL BED : DEFINED
- $C_1 \simeq C_2$
- C_2 0 ... 4 m/s
- F 0 ... 8 KN/mm

RESULT :

- SMOOTH & VIBRATIONLESS SYSTEM !
- VARIABLE IN OUTPUT
- LOW MAINTENANCE COST & TIME (MAX 1 DAY !)
- VERY LOW WEIGHT EQUIPMENT 1/3 OF VERTICAL ROLLER MILL
- LOW INVESTMENT COST !

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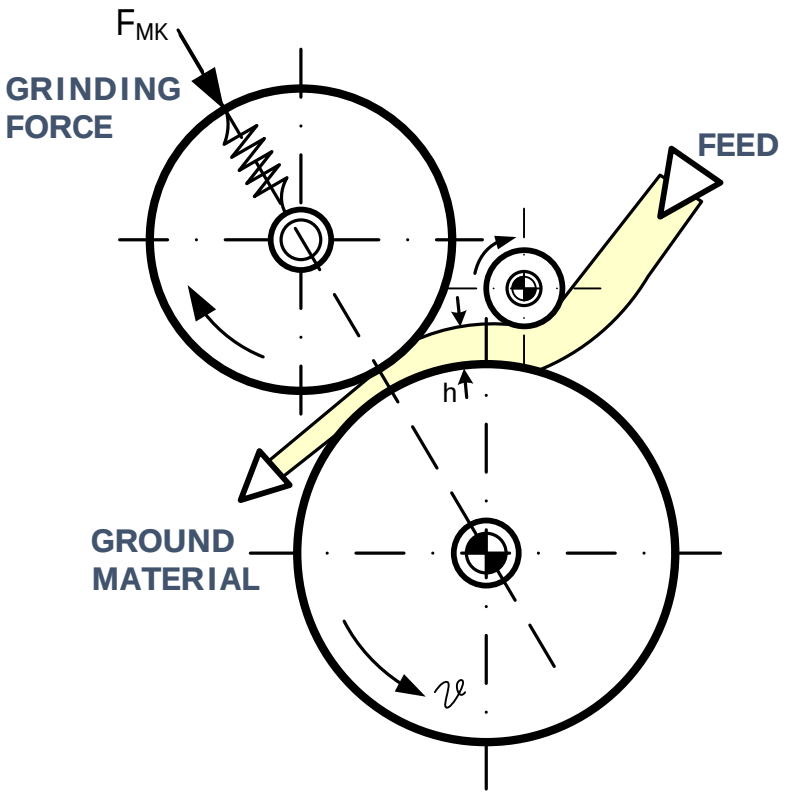
WORKING PRINCIPLE

- Prepared and defined material layer fed to the grinding zone
- The grinding force is applied by pressing on the upper roller
- Lower roller with frequency controlled drive system
- Material accelerated to working speed before entering the grinding zone
- Material layer thickness is a result of different grinding parameters like material, moisture, fineness & throughput



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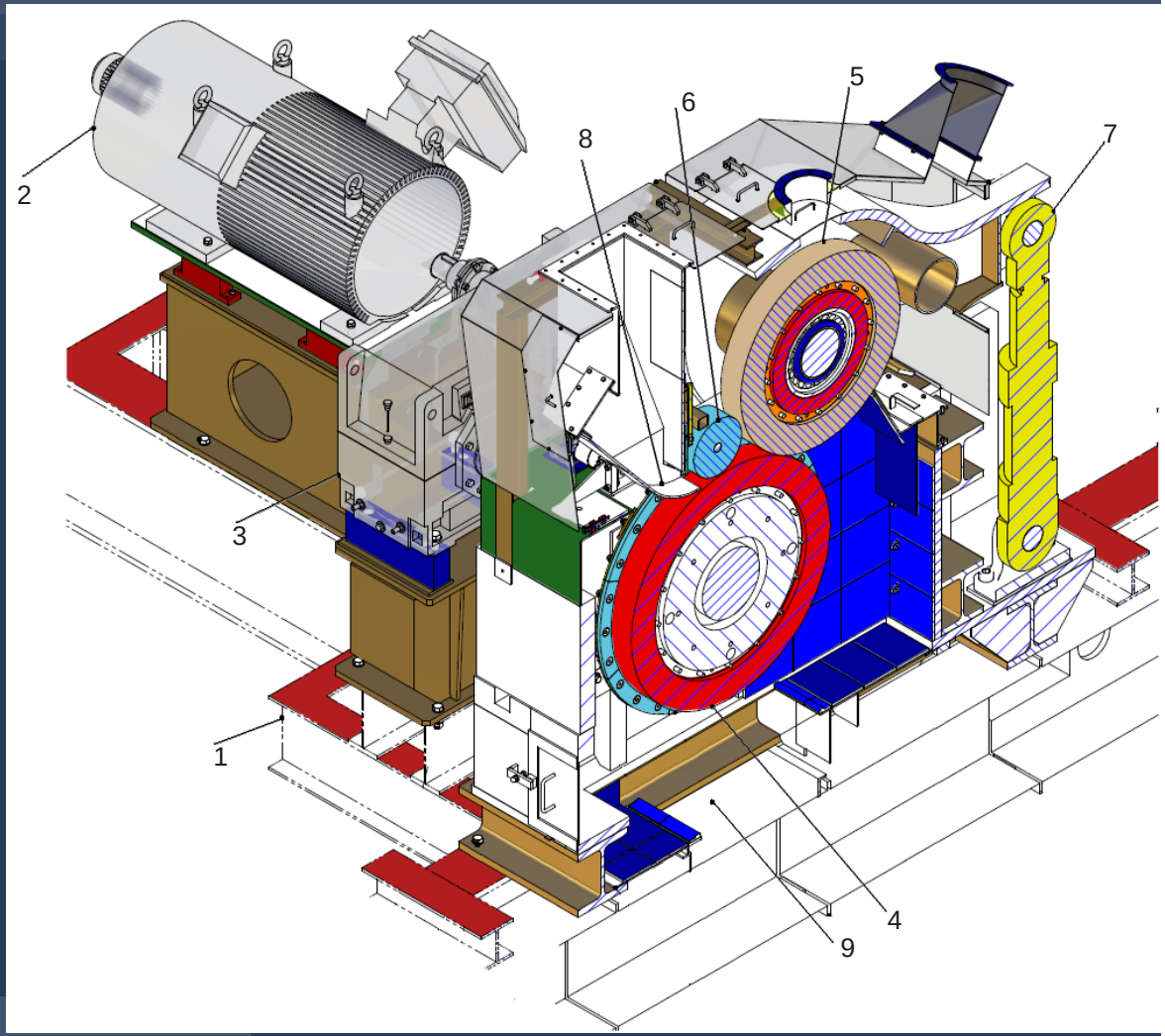
BASIC DESIGN

1 Base frame
2 Motor
3 Standard gear box
4 Lower roller
5 Grinding roller
6 Acceleration roller
7 Hydraulic cylinder
8 Material feed
9 Material outlet



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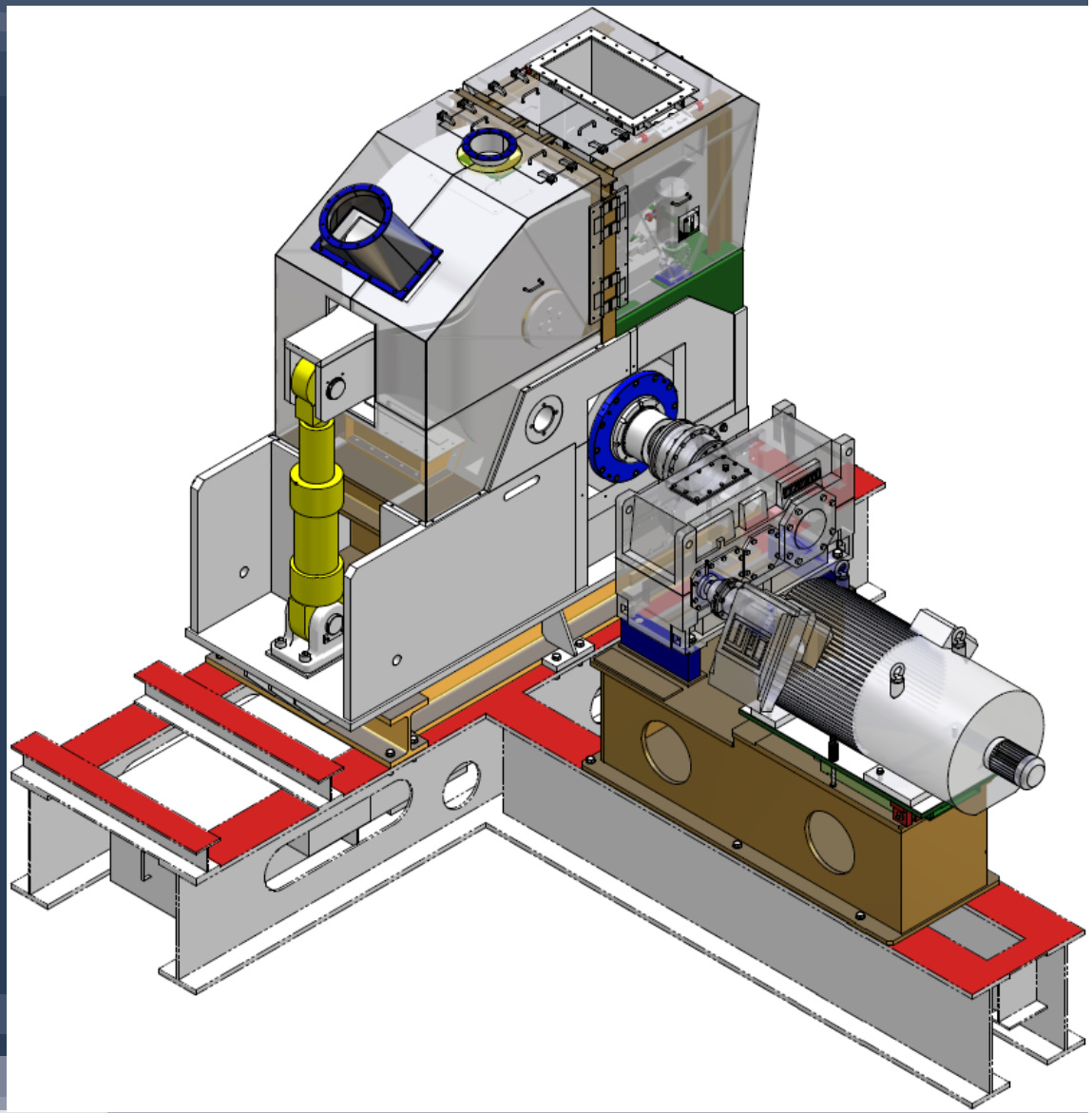
THE CEMAG ANSWER:

THE BETA MILL



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DEVELOPMENT MILESTONES

- Patent idea in the late nineties
- ⇨ *Patent No. WO 99/54044*
  International reference number PCT/EP99/02606
- First tests together with well-known German institute (IBU-tec, Weimar)
- Since 2003 further development at CEMAG headquarters
- 2005 startup of the pilot plant in the CEMAG “Technikum”
- ⇨ *Funded by the “European fund for regional development” (EFRE)*
- Semi-industrial circuit grinding tests under realistic conditions
- First industrial application (BM 25) in 2007 in a German cement plant

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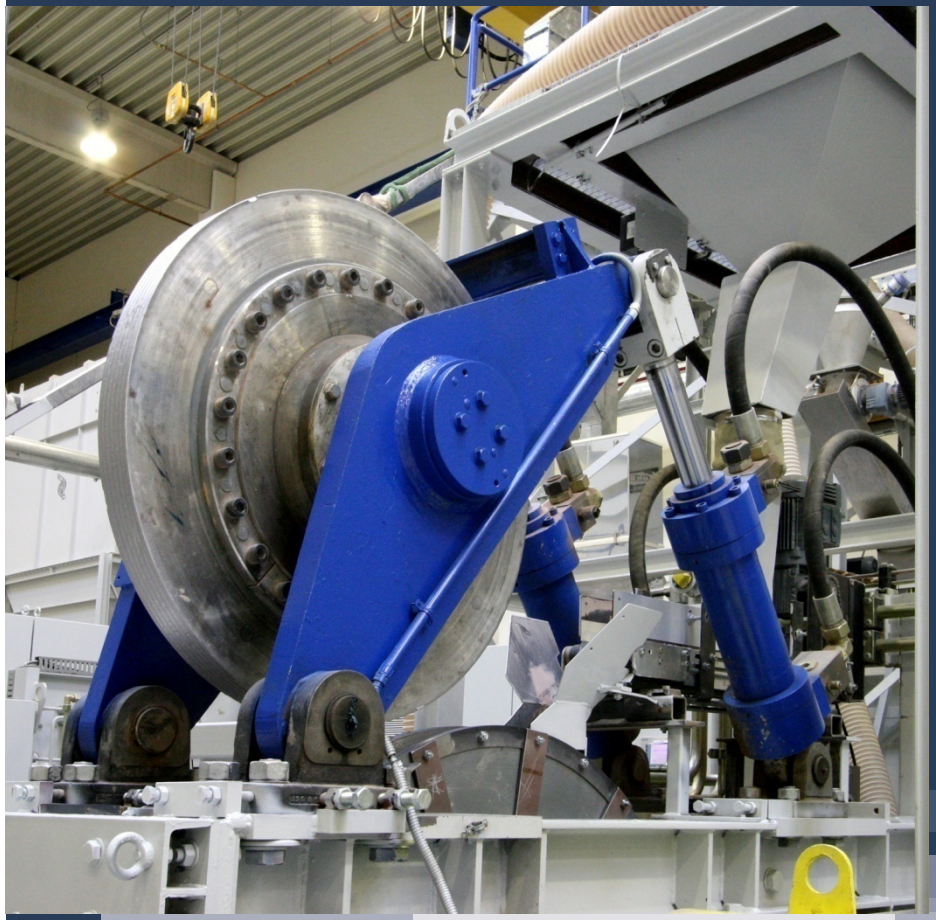
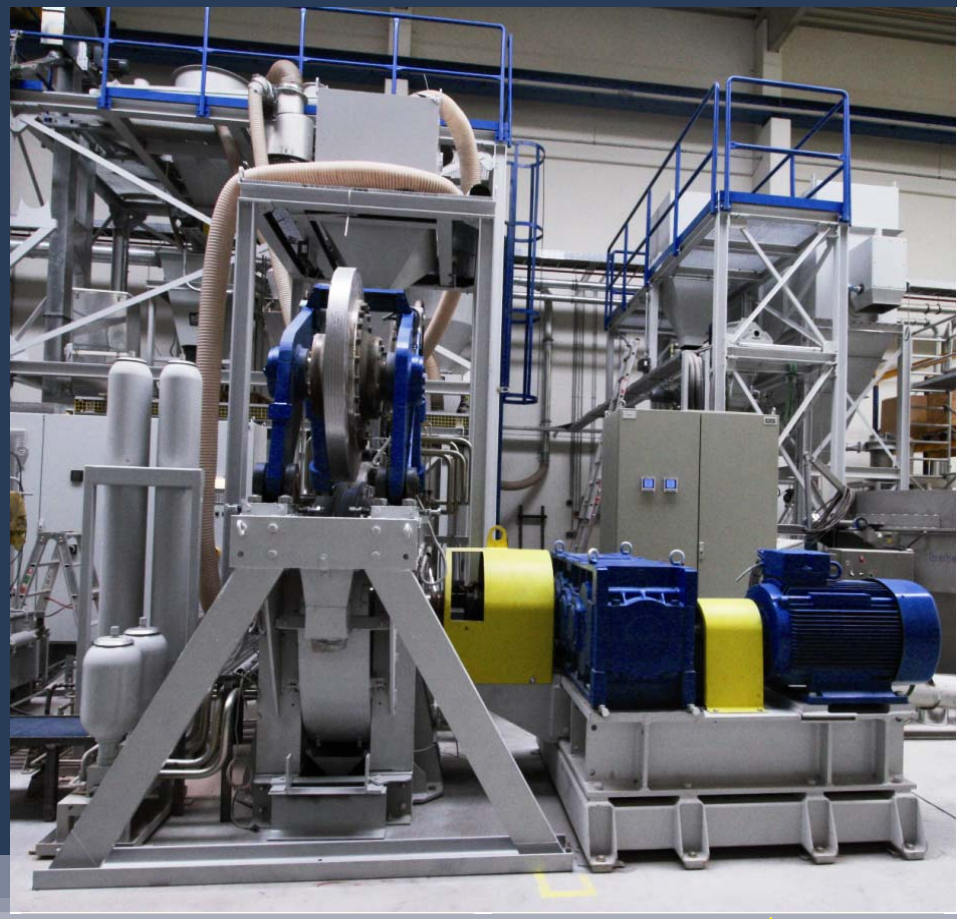
THE BETA MILL PILOT PLANT IN THE CEMAG TECHNIKUM





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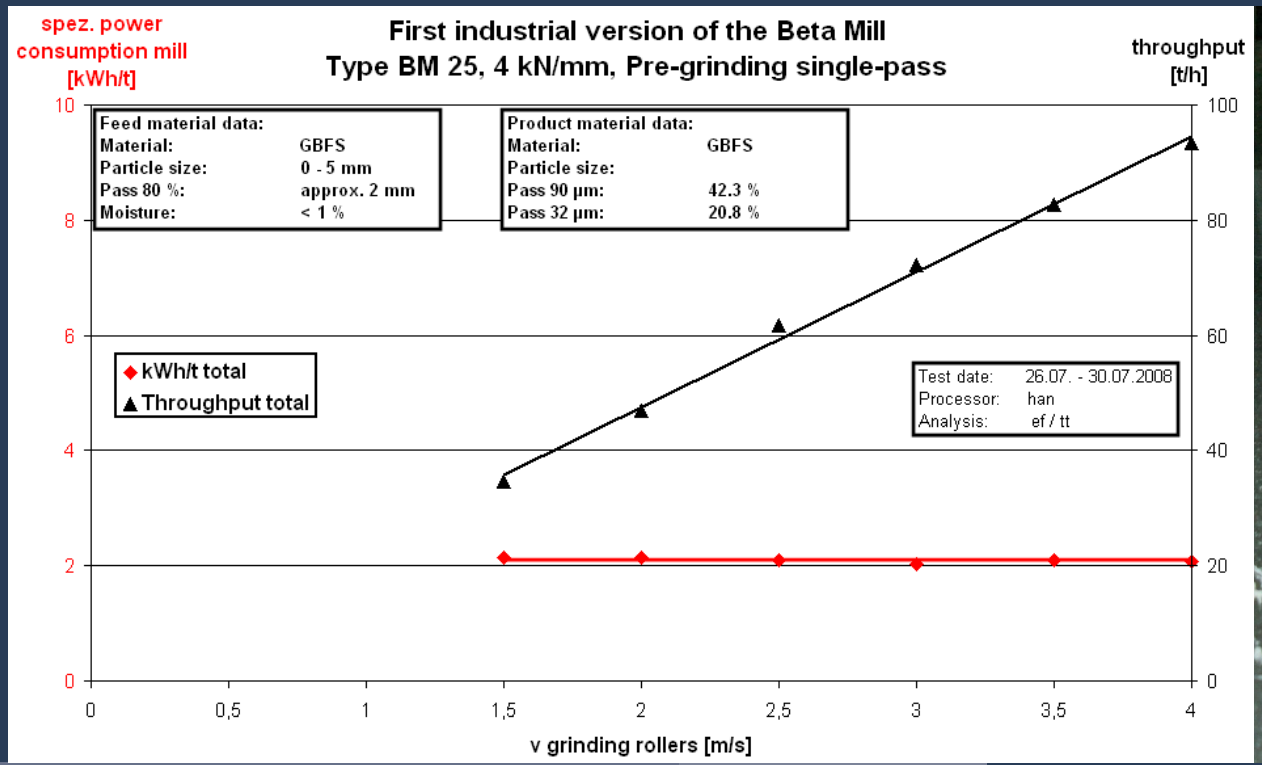
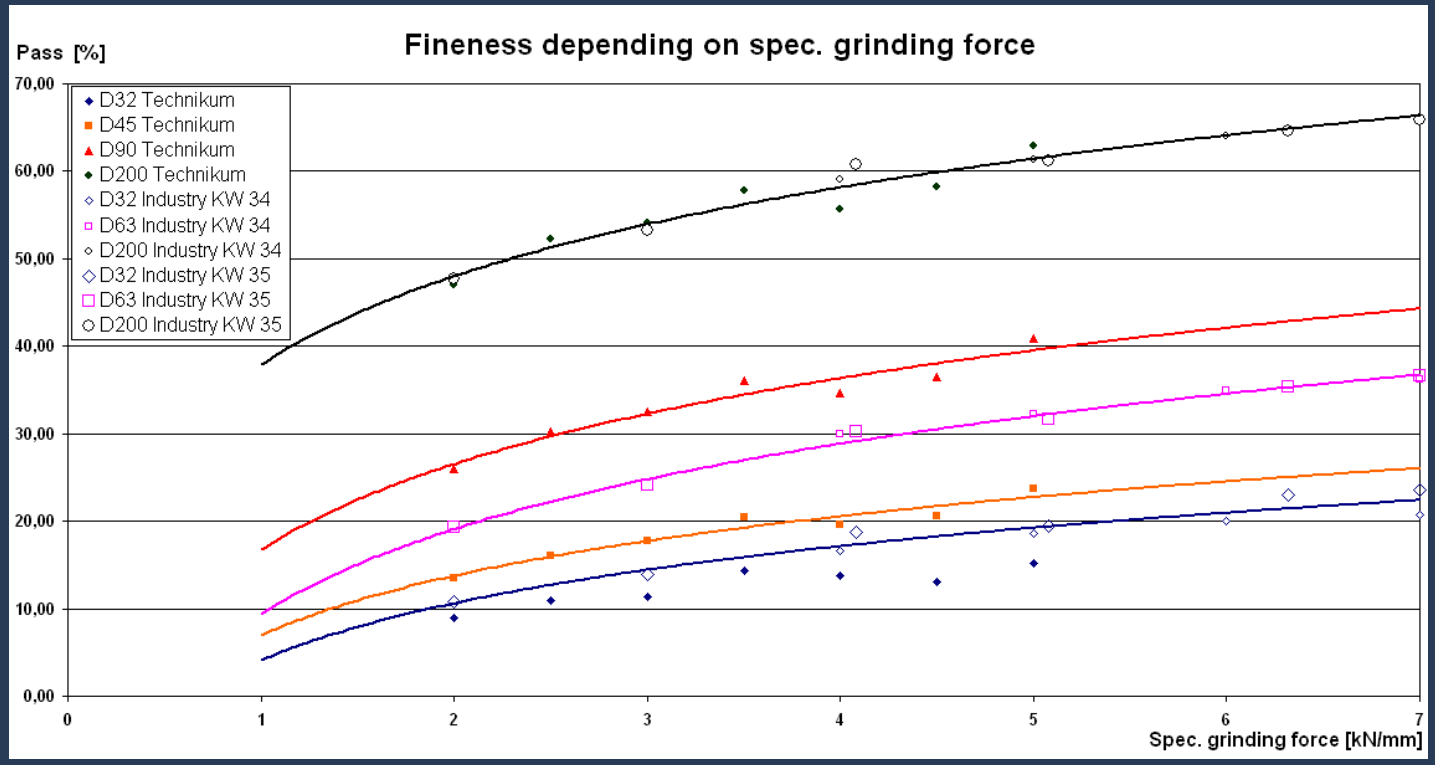
RESULTS FOR GBFS GRINDING

Throughput and specific energy consumption




Fineness depending on spec. grinding force
Pass [%]
70,00
60,00
50,00
40,00
30,00
20,00
10,00
0,00
D32 Technikum
D45 Technikum
D90 Technikum
D200 Technikum
D32 Industry KW 34
D63 Industry KW 34
D200 Industry KW 34
D32 Industry KW 35
D63 Industry KW 35
D200 Industry KW 35
0
1
2
3
4
5
6
7
Spec. grinding force [kN/mm]

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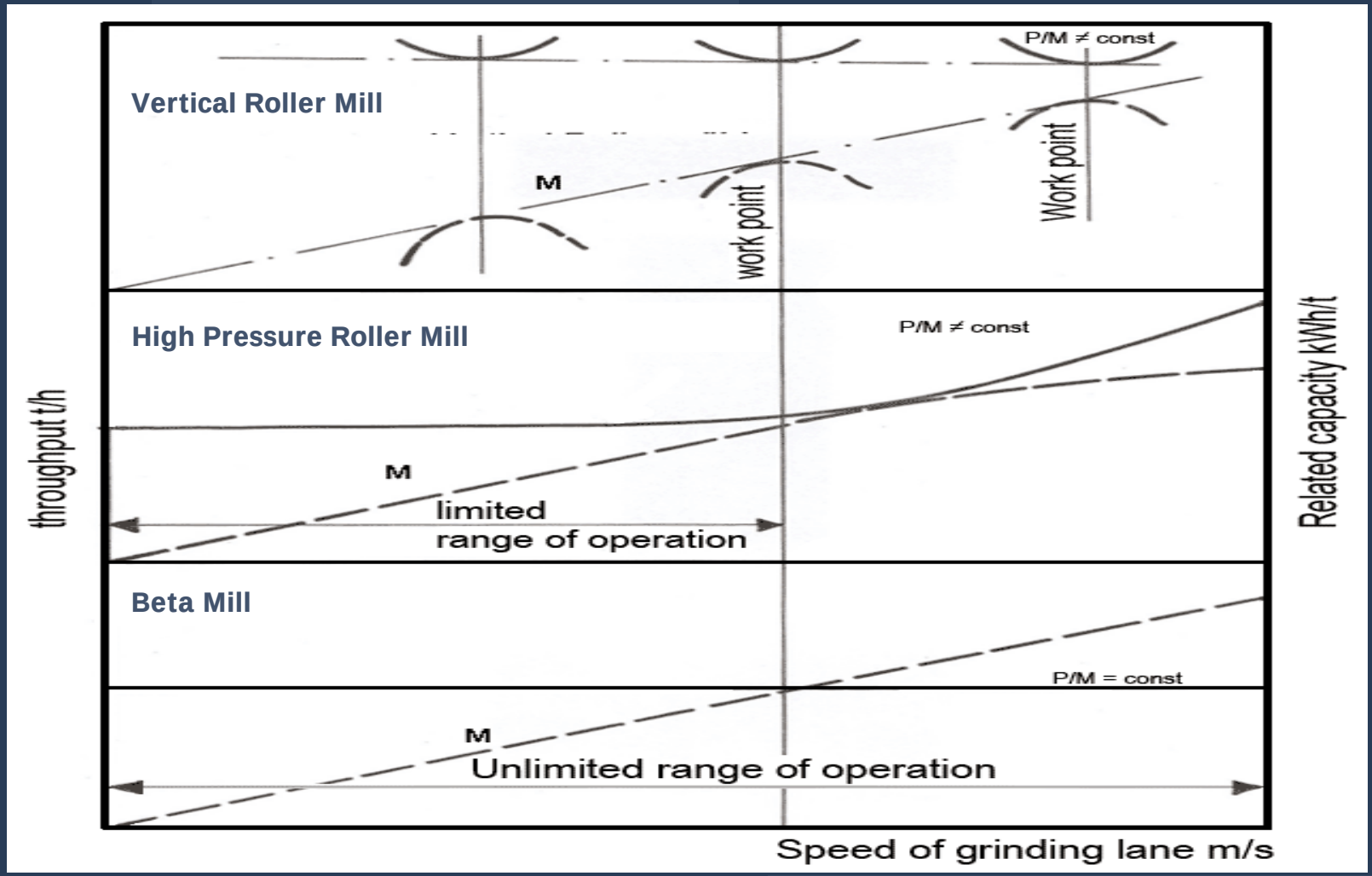
Vertical Roller Mill
P/M ≠ const
M
work point
Work point
High Pressure Roller Mill
P/M ≠ const
M
limited
range of operation
Beta Mill
P/M = const
M
Unlimited range of operation
throughput t/h
Related capacity kWh/t
Speed of grinding lane m/s

RESULTS FOR GBFS GRINDING

Performance data BM 25 compared to other common mill types

Mill type	Pre-grinding, single-pass		Finish grinding		Energy savings compared with BM 25	
	Spec. energy consumption [kWh/t]	Fineness [Pass 90 µm]	Spec. energy consumption [kWh/t]	Fineness [cm²/g]	*BM grinding circuit calculated with 22 kWh/t* [kWh/t]	[%]
Beta mill 25	**1.8 - 2.6**	**37 - 45 %**			-	**0**
only mill	-	-	**14 - 20**	**4.000**	-	**0**
grinding circuit	-	-	**≈ 18 - 24**	**4.000**	-	**0**
High pressure roller mill	3.0 - 3.5	max. 40 %			0.9 - 1.2	30 - 35
[2]	-	-	46	4.090	24	52
[1]	-	-	58	4.100	36	62
Vertical roller mill [3]	-	-	34	4.000	12	35
[4]	-	-	36	4.000	14	39
Ball mill [1]	-	-	76	4.100	54	71
industrial test	-	-	64	4.000	42	66

Source:

[1] Mathiak, H.. Die neuen Mahlanlagen zur Herstellung von Zement-Halbprodukten und Hüttenzementen im Readymix-Zementwerk Dortmund, Firmenbroschüre, Dortmund, 1992

[2] Patzelt, N.: Moderne Systeme für die Hüttensandmahlung, Zement-Kalk-Gips 45 (1992) Heft 7, S. 342-347

[3] Schäfer, H.-U.: Wälzmühlen für die Mahlung von Klinker und Hüttensand und die Her-stellung von Zementen mit Zumahlstoffen, Zement-Kalk-Gips 54 (2001) Heft 1, S. 20-30

[4] Kobe Steel Ltd. (Hrsg.): Roller mills for cement clinker and slag, Tokyo

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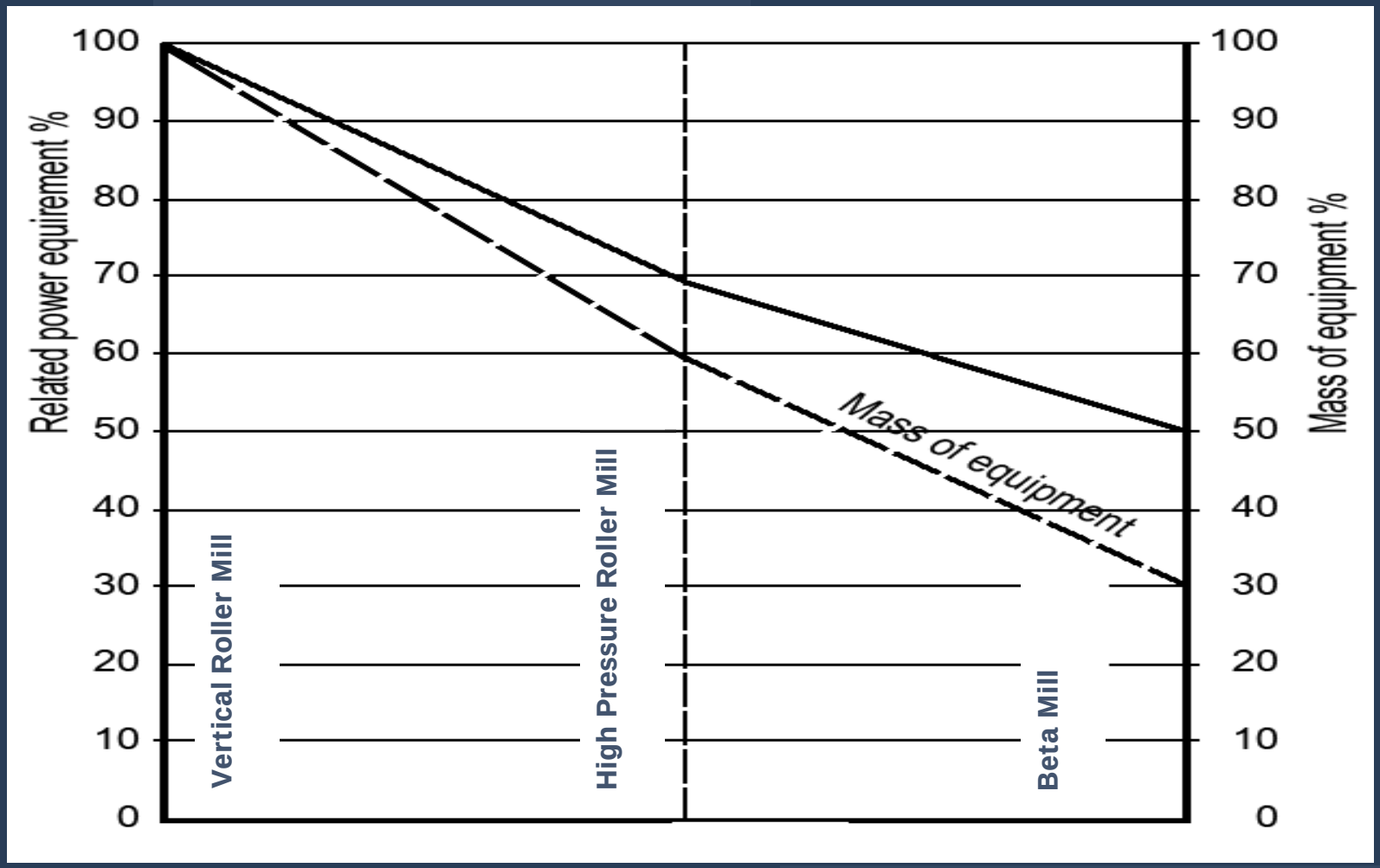
Related power equirement %
Mass of equipment %
100
90
80
70
60
50
40
30
20
10
0
Mass of equipment
Vertical Roller Mill
High Pressure Roller Mill
Beta Mill

ENERGY COST SAVINGS WITH CEMAG BETA MILL

One example compared to ball mills

Preconditions:

- GBFS finish grinding
- Product fineness 4.000cm²/g acc. Blaine
- Annual operating hours: 8000h/a
- Production capacity: 70t/h
- Ball mill 70kWh/t (mill, classifier, fans)
- Beta mill 22kWh/t (mill, classifier, fans)

Beta Mill 22kWh/t * 70t/h * 0,10 €/kWh * 8000h/a = 1.232.000 €/a

Ball Mill 70kWh/t * 70t/h * 0,10 €/kWh * 8000h/a = 3.920.000 €/a

Annual possible electrical energy cost savings with Beta Mill:

2.688.000 €/a

MILL TYPES FOR CEMENT GRINDING (OPC)

Mill size	Grinding roller width [mm]	Production finish grinding [t/h]	Remarks
BM 8 Pilot Plant in the Technikum	80	~4	permanent running tests with various materials
BM 25 1st Industrial Prototype	250	~40	Pre.grinding tests completed, finish grinding and wear rate tests ongoing
BM 50	500	~80	design process finished, under construction
BM 75	750	~120	design process
BM 100	1000	~160	design process

- Modular concept for higher product capacities
  - ⇨ parallel or face to face line-up
  - ⇨ closed grinding with one or two CEMAG HQ classifiers

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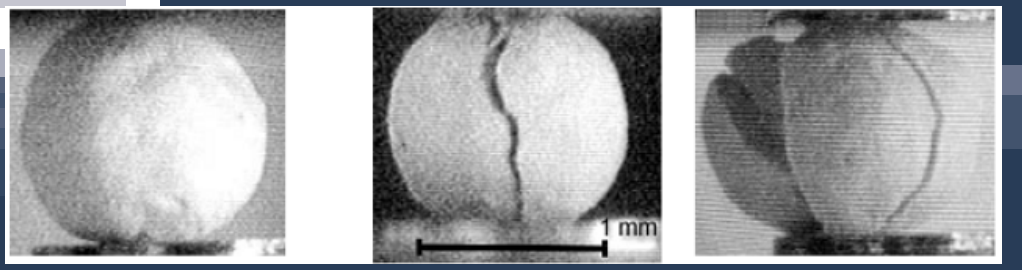

MAIN FACTS

- Pressure grinding mill
  - ⇨ most energy efficient grinding principle (1)
- Determined and stable grinding conditions
  - ⇨ smooth running behaviour
- Minimized speed differences and friction
  - ⇨ low wear rate
- Free adjustable working speed
  - ⇨ perfect for partial load operation with constant specific energy consumption
- Free adjustable grinding force
  - ⇨ ideal stressing conditions for each material
  - ⇨ minimized stressing conditions for machine parts
- Standard drive and hydraulic components
  - ⇨ cost reduced maintenance & easy spare-parts handling
- Low Civil And Erection Cost
- Short Return On Investment

Source: (1) http://www.uni-magdeburg.de

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FIRST AWARD FOR CEMAG BETA-MILL

We are proud to announce the winning of

Global Slag Award 2008
“ Innovation of the year”

Strasbourg, 10.11.2008

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THANK YOU FOR YOUR ATTENTION

MERCI POUR BIEN VOTRE INTERET

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