

“Capacity Building and Strengthening Institutional Arrangement”

Workshop: “Best Available Techniques (BAT)”

BAT on Cement Industries

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APAT

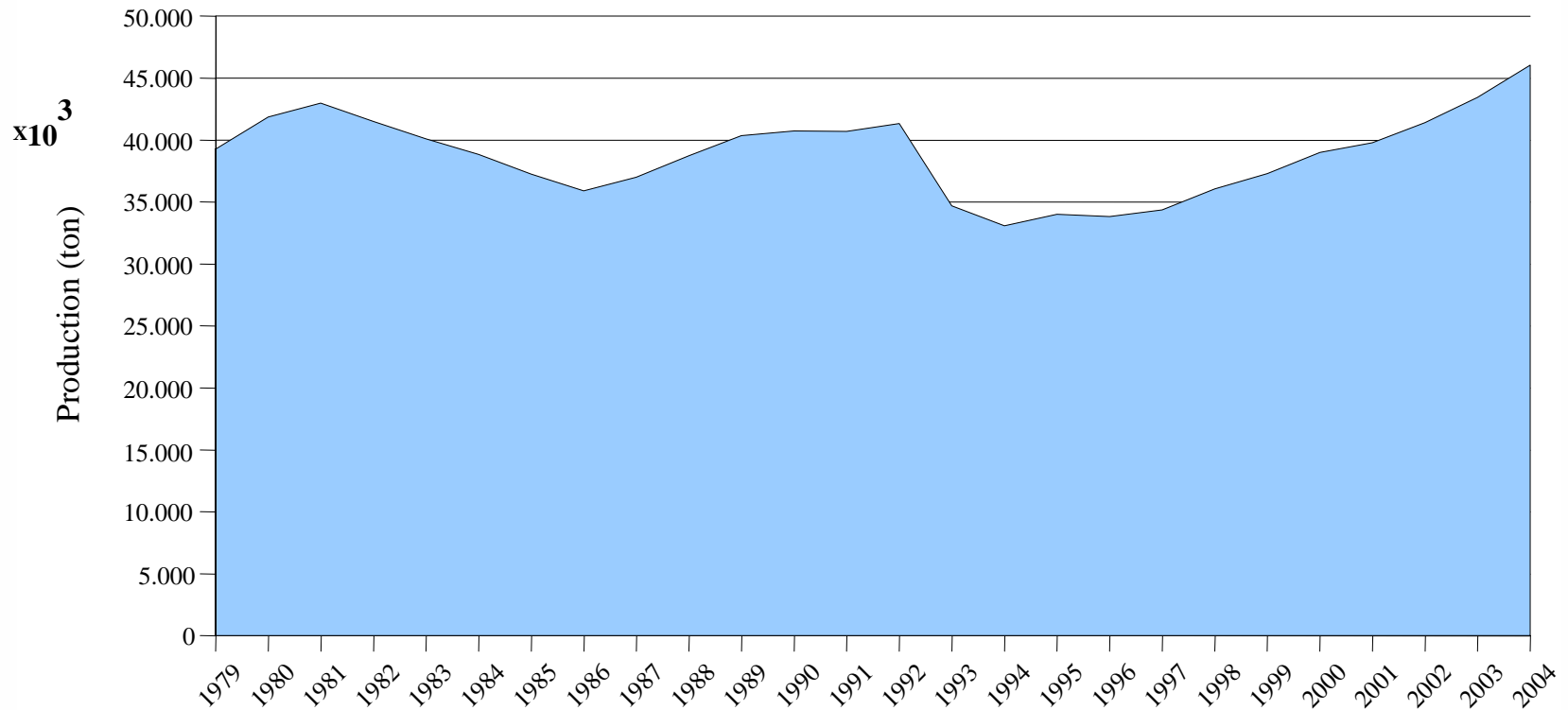
Agency for Environmental Protection and Technical Services

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2. Productive cycle
3. Emissions, pollutants and wastes
4. Consumption of water, energy and fuels
5. Consumption of raw materials
6. Storing of products
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1. Production framework

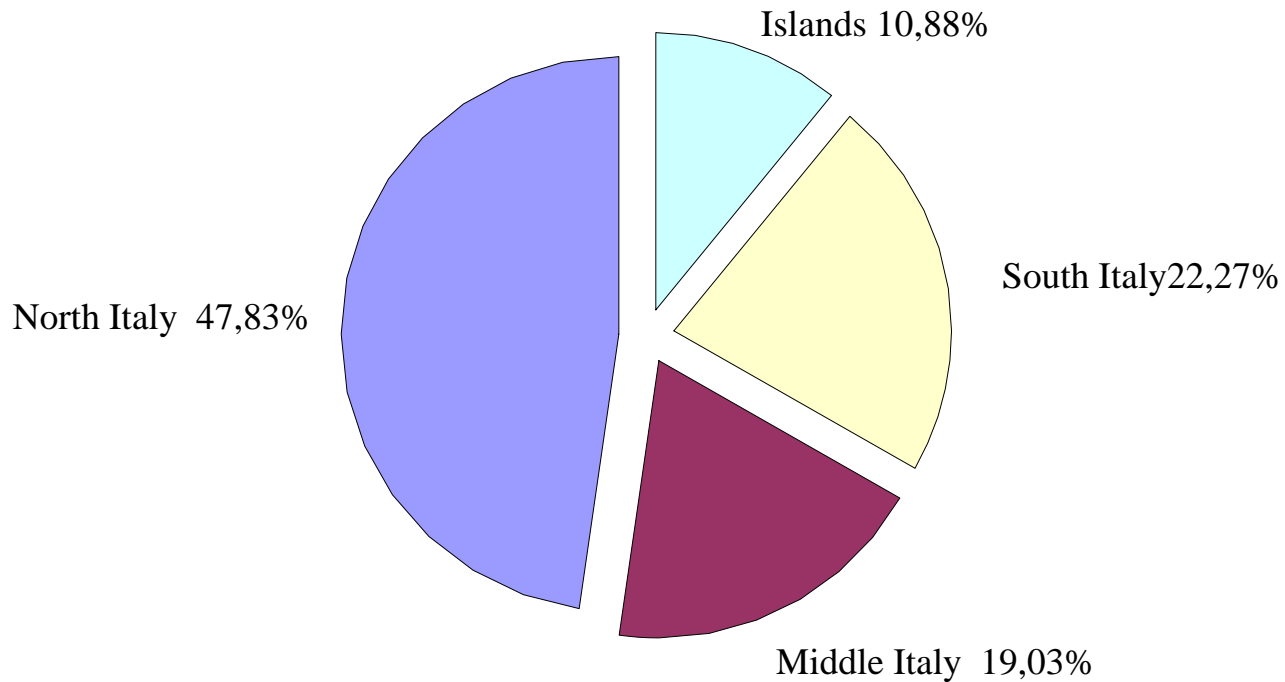
BAT - Cement Industries



Cement Production in Italy from 1979 to 2004 (A.I.T.E.C. 2004)

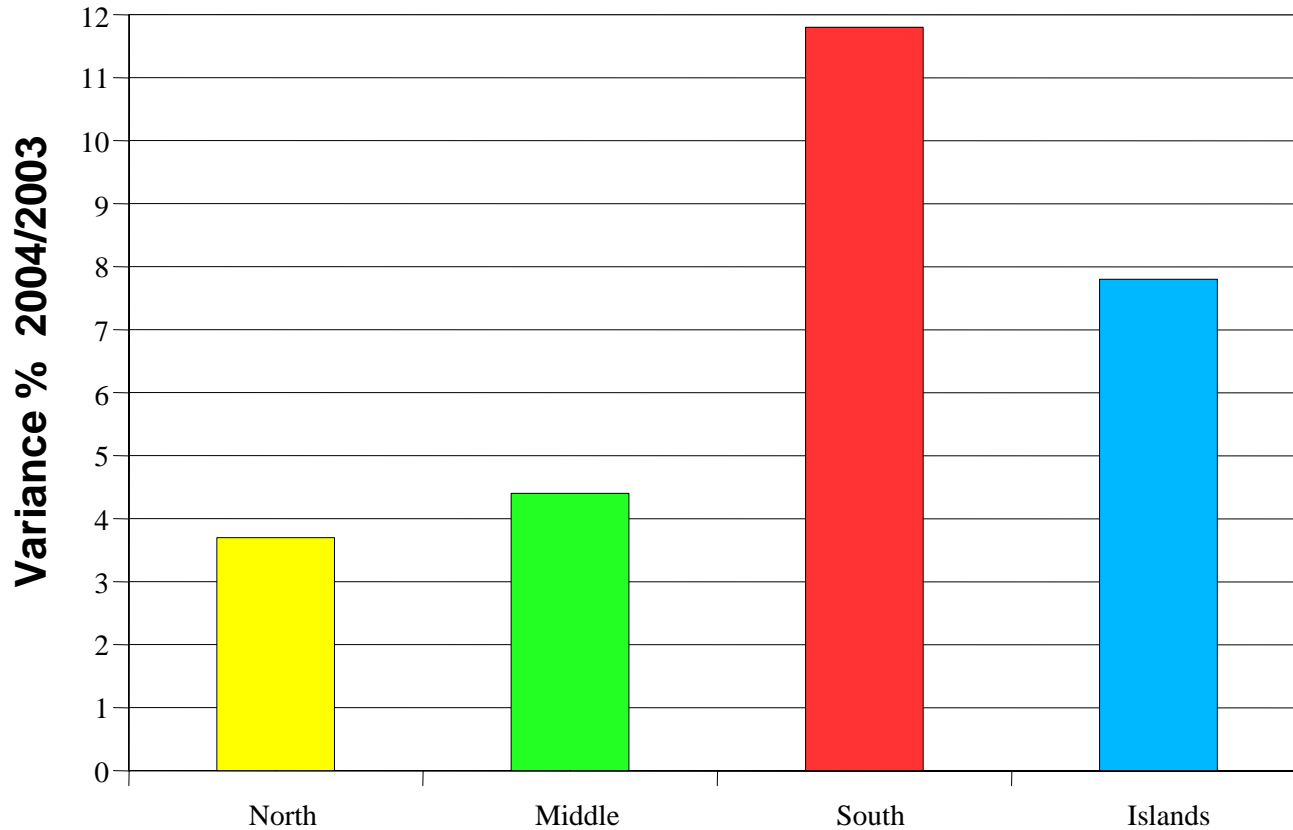
1. Production framework

BAT – Italy Production



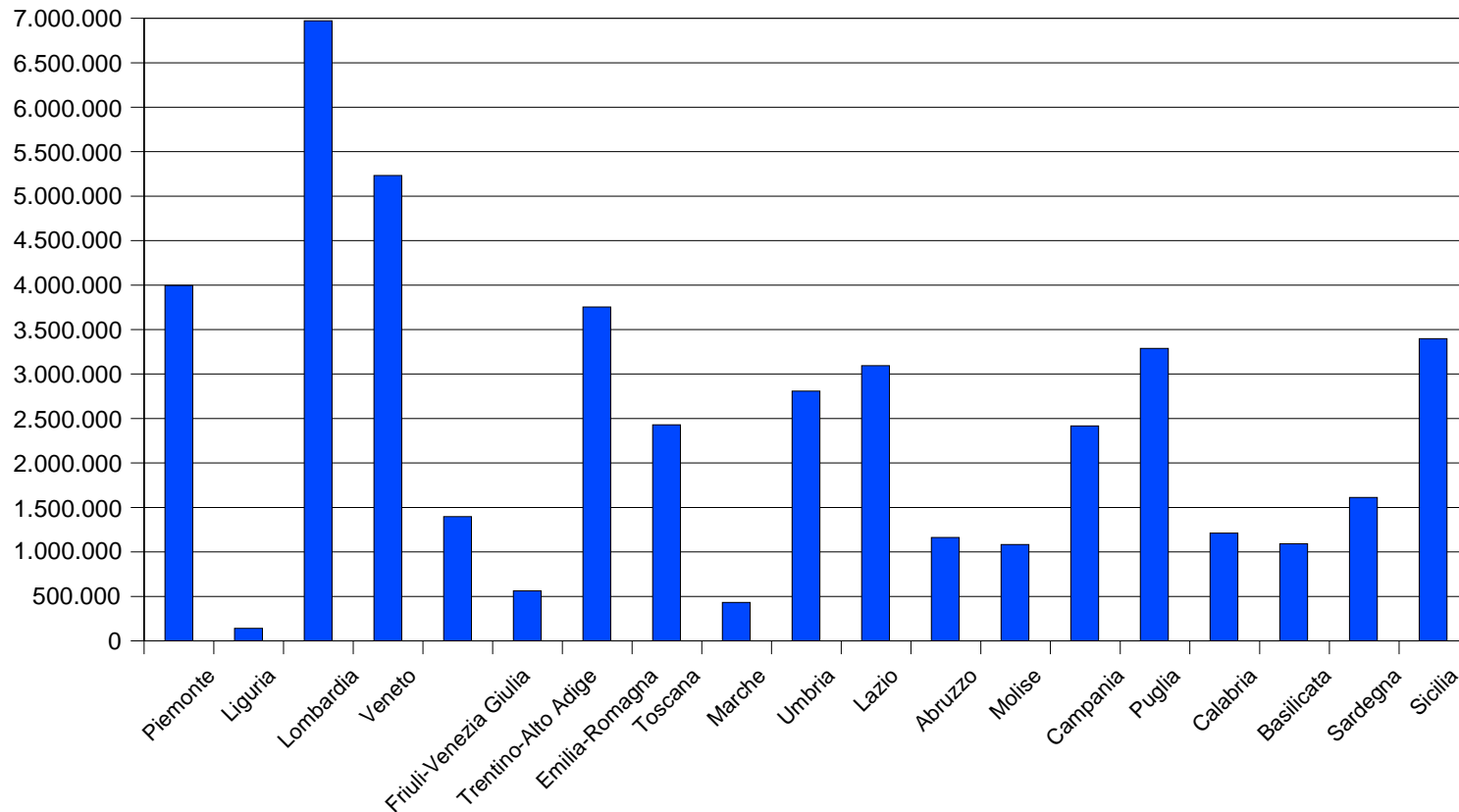
1. Production framework

BAT - Italy Production



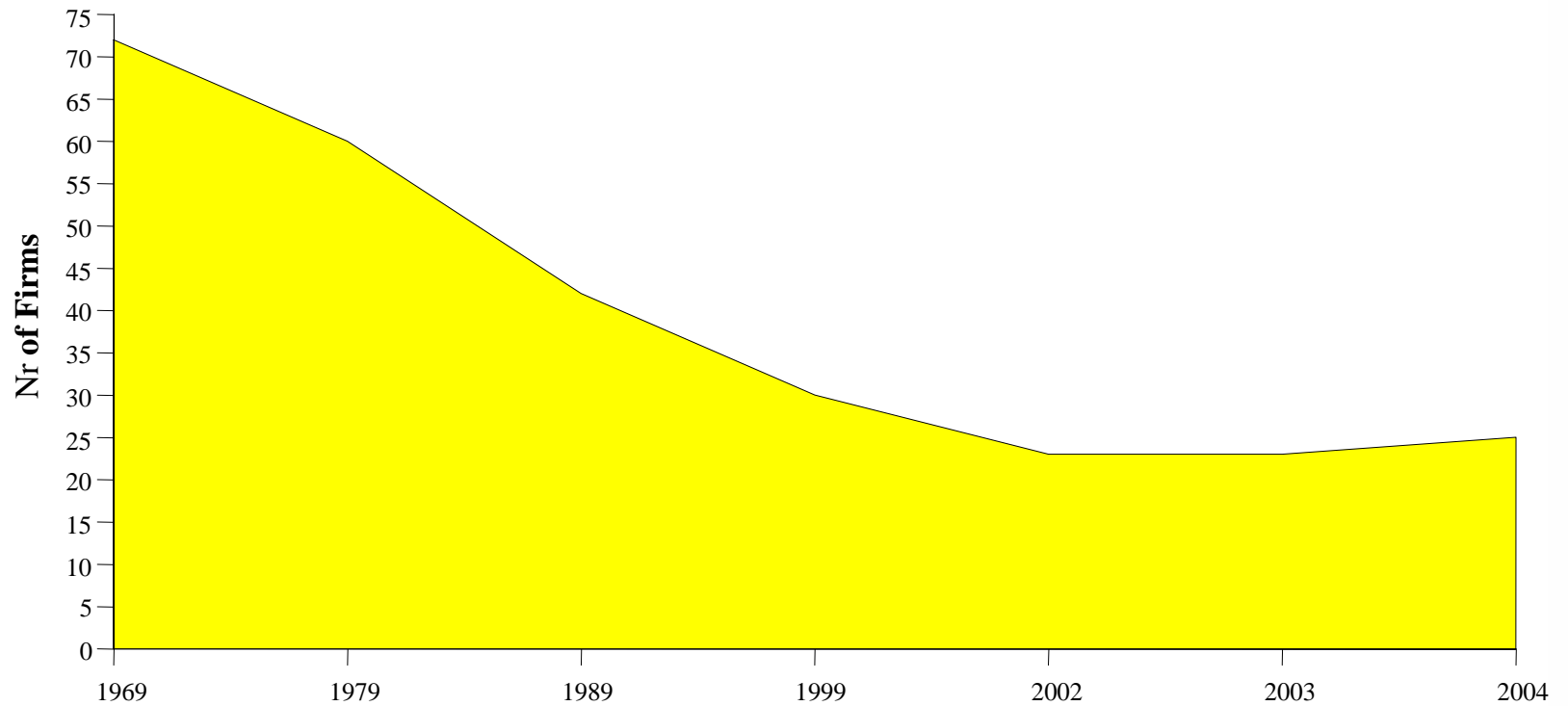
1. Production framework

BAT - Italy Production



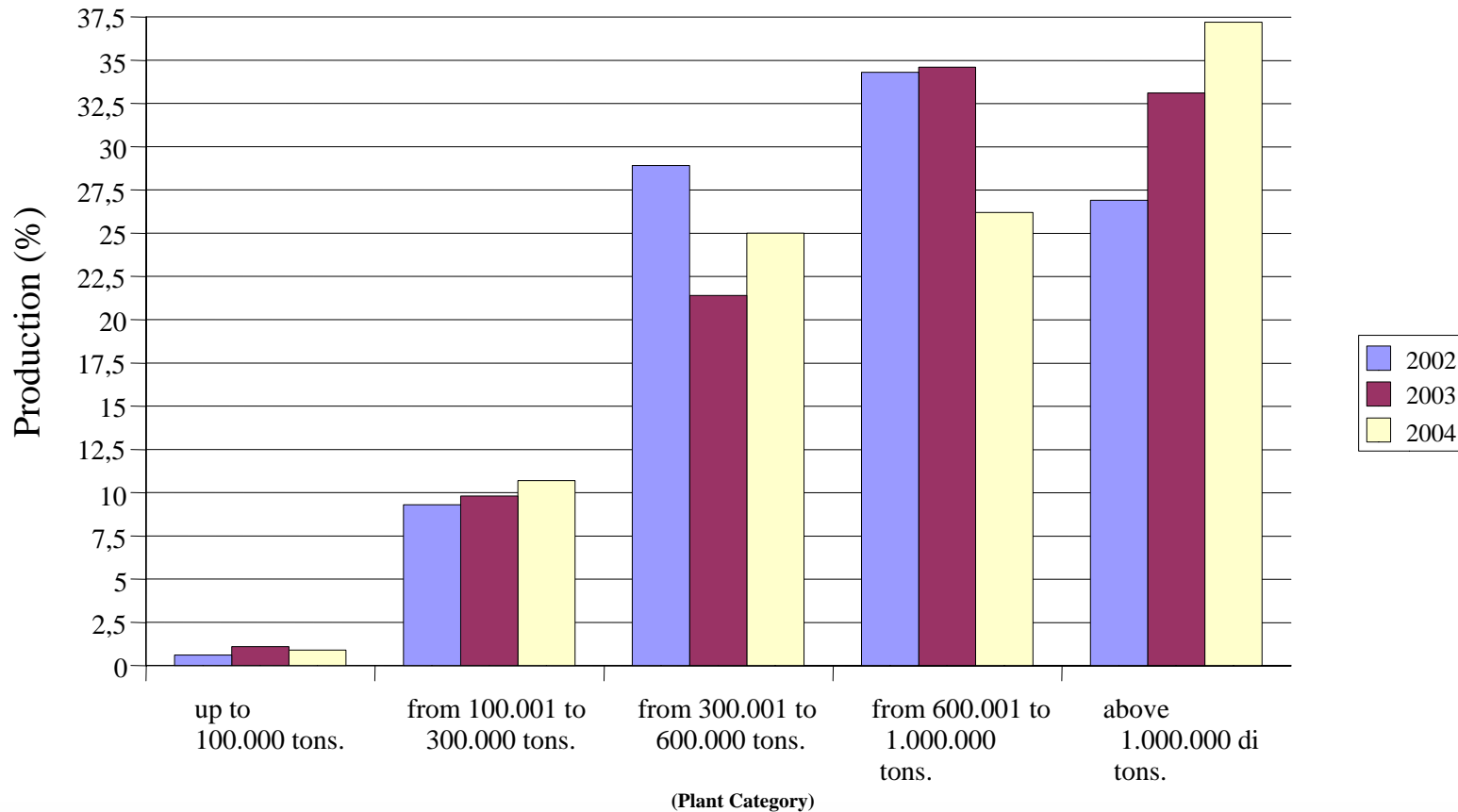
1. Production framework

BAT - Cement Industries



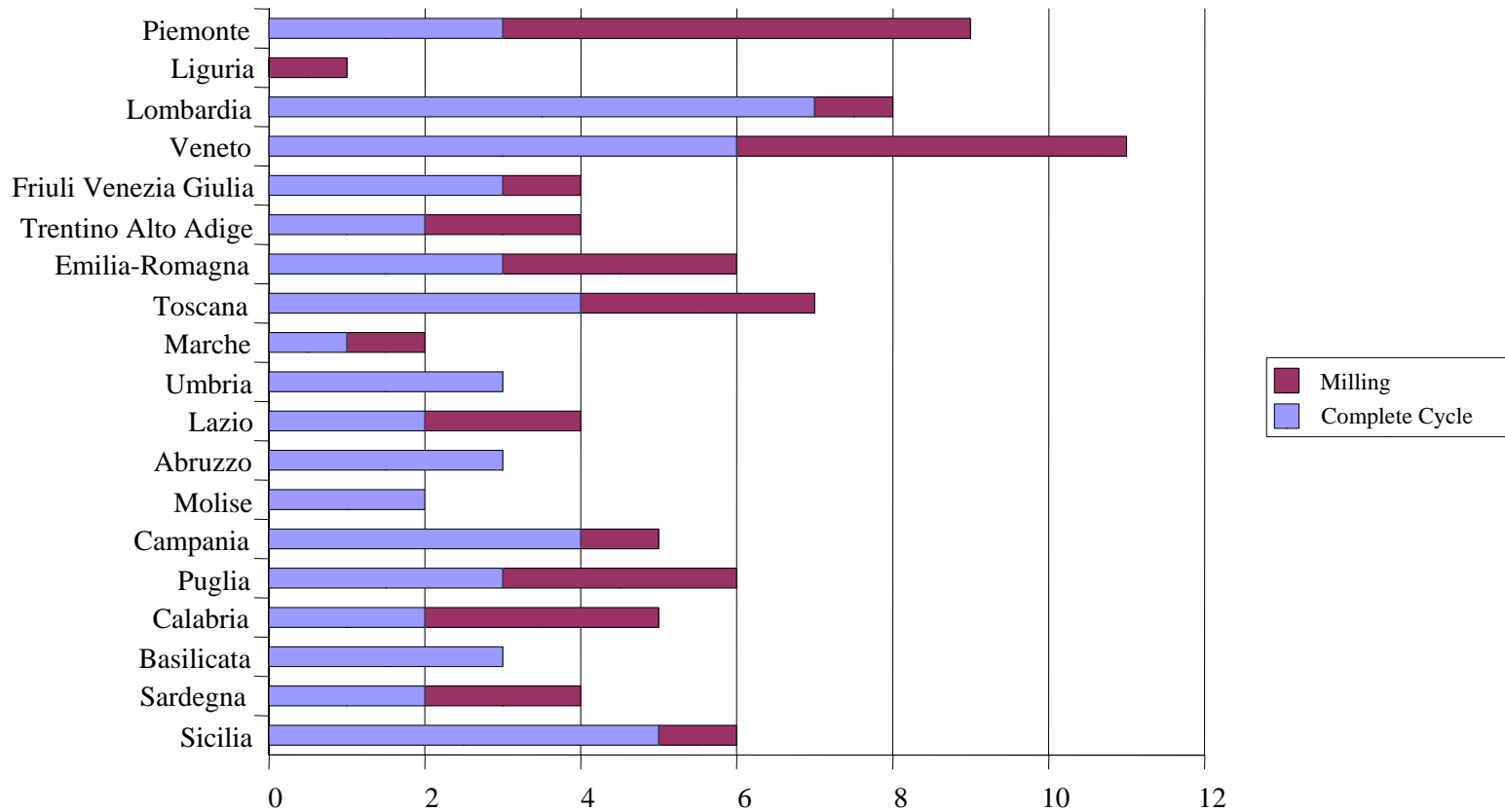
1. Production framework

BAT – Production vs. Plant Category



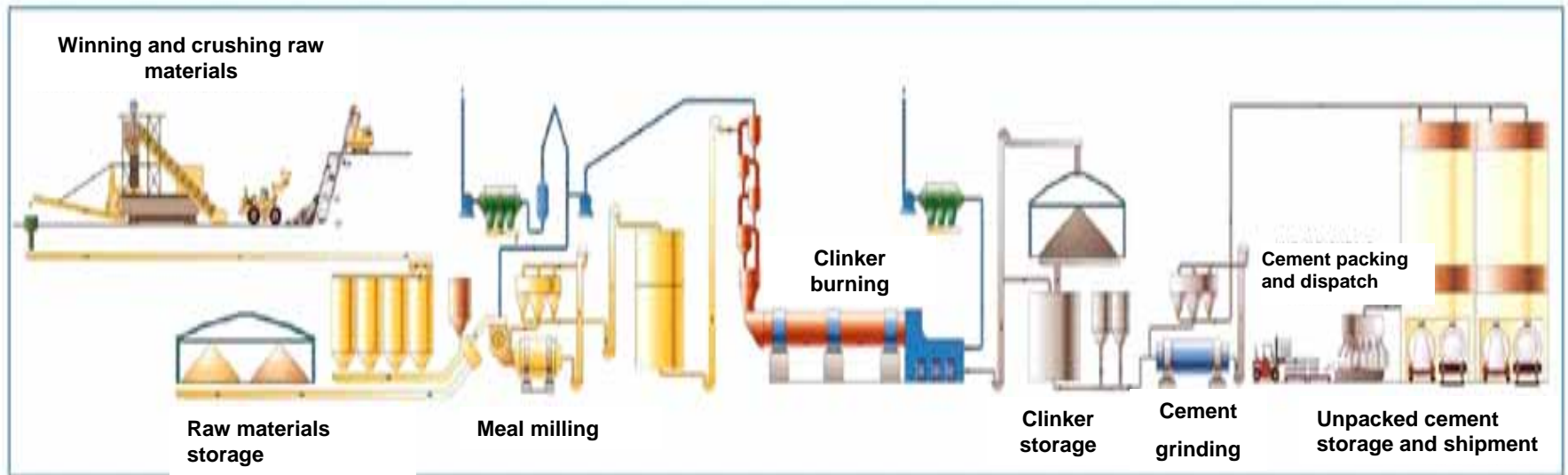
1. Production framework

BAT – Regional Cement Industries (milling/complete cycle)



2. Productive cycle

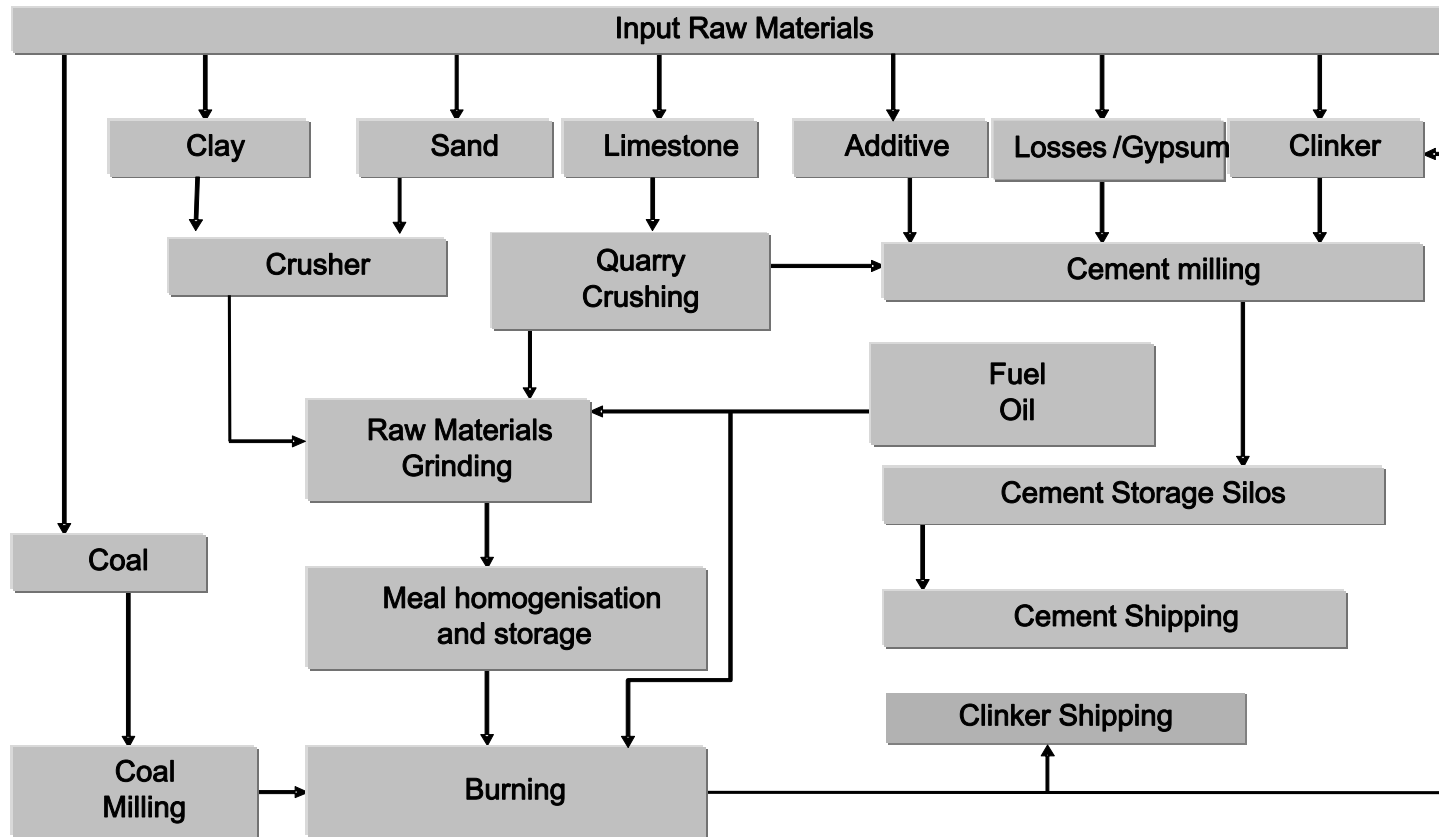
BAT - Cement Industries, Dry Process



2. Productive cycle

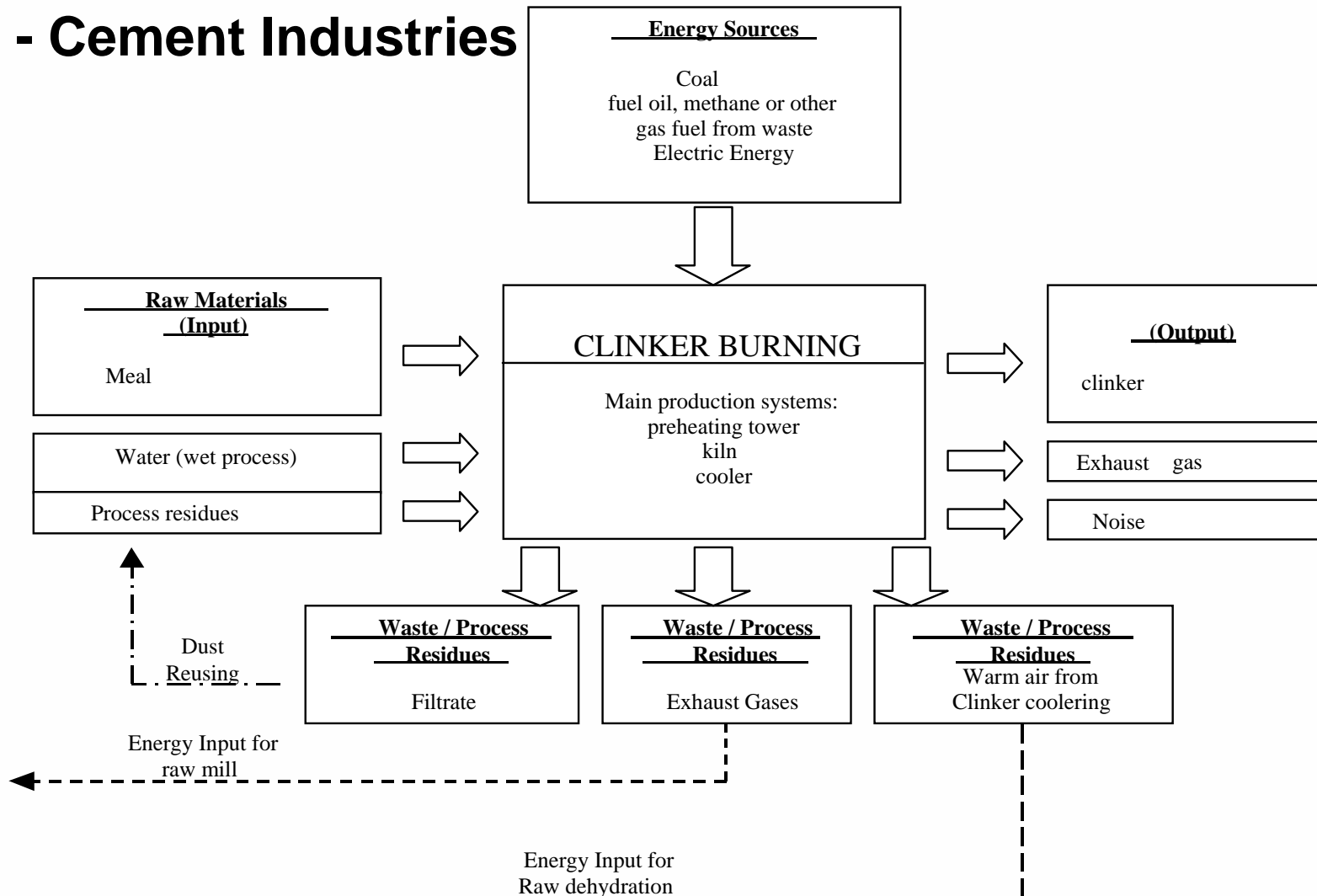
BAT – Flow Cycle

Cement production cycle - Flow Diagram



2. Productive cycle

BAT - Cement Industries



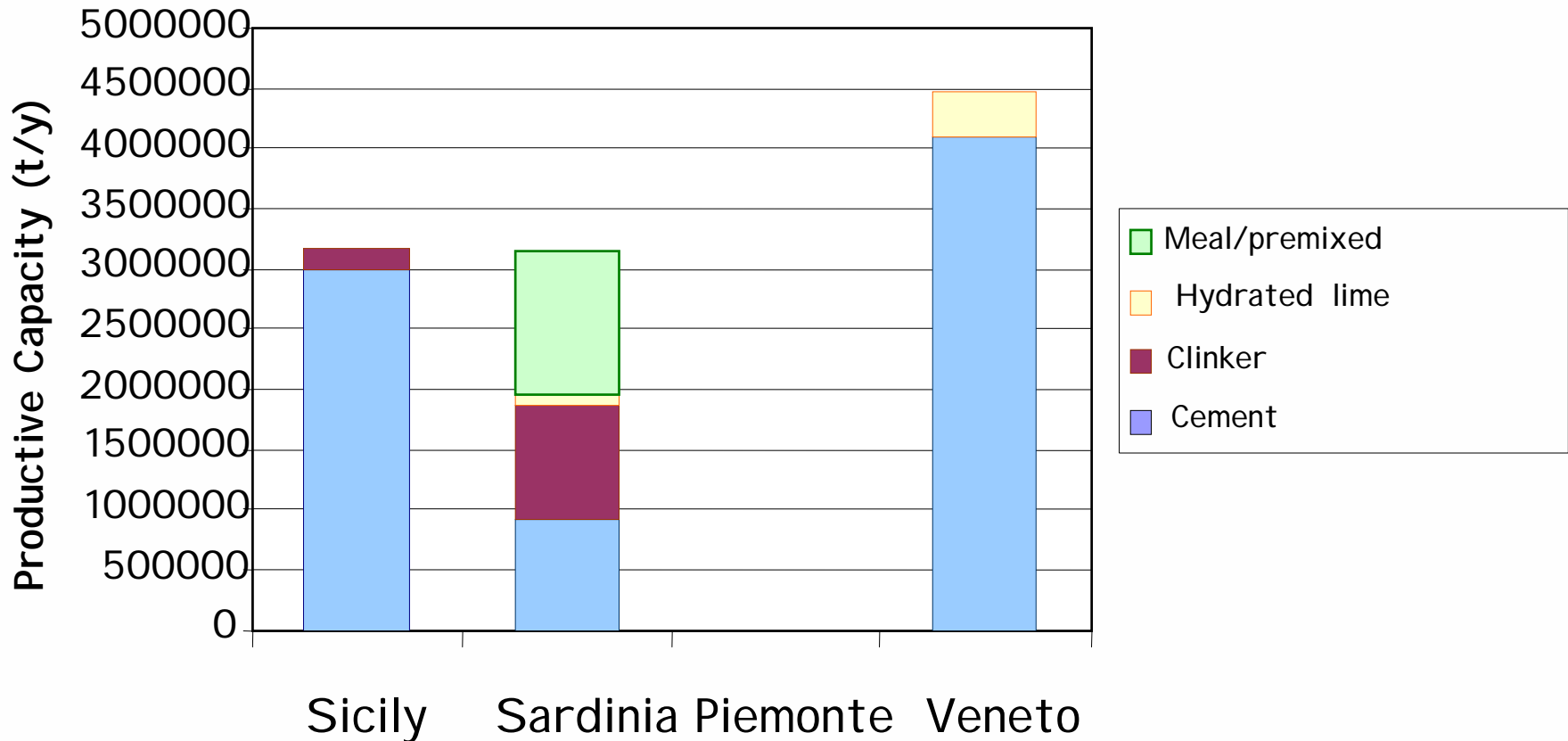
2. Productive cycle

BAT - Cement Industries, Data Plants

	Sicily	Sardinia	Piemonte	Veneto
Starting	1954 - 1969	1973 - 1997	1958 - 1979	1882 - 1965
Average area (ha)	132,18	28,54	30,39	10,34
Average covered area (ha)	18,67	3,21	8,04	3,14
Process Type	Dry/Semi-Dry	Dry/Semi-Dry	Dry	Dry/Semi-Dry
Certification	Quality management systems - ISO 9000 Environmental management standards ISO14000 Only a plant certified ISO9100:2000 (ex ISO 9002) UNI EN ISO 14001:1996 in progress	Quality management systems -ISO 9000 Environmental management standards ISO14000	Only a plant certified Quality management systems -ISO 9000	Quality management systems -ISO 9000 Environmental management standards ISO14000
Productive Capacity 2004 (t/y) (end products)	3.183.394	3.139.500	nd	4.480.657
Productive Capacity 2004 (t/y) (Clinker)	2.612.099	1.042.741	nd	3.183.498
Products	Cement Hydrated lime Only one Clinker	Clinker Cement Pre-mixed cement Hydrated lime Raw Meal	Pre-mixed cement	Cement Hydrated lime

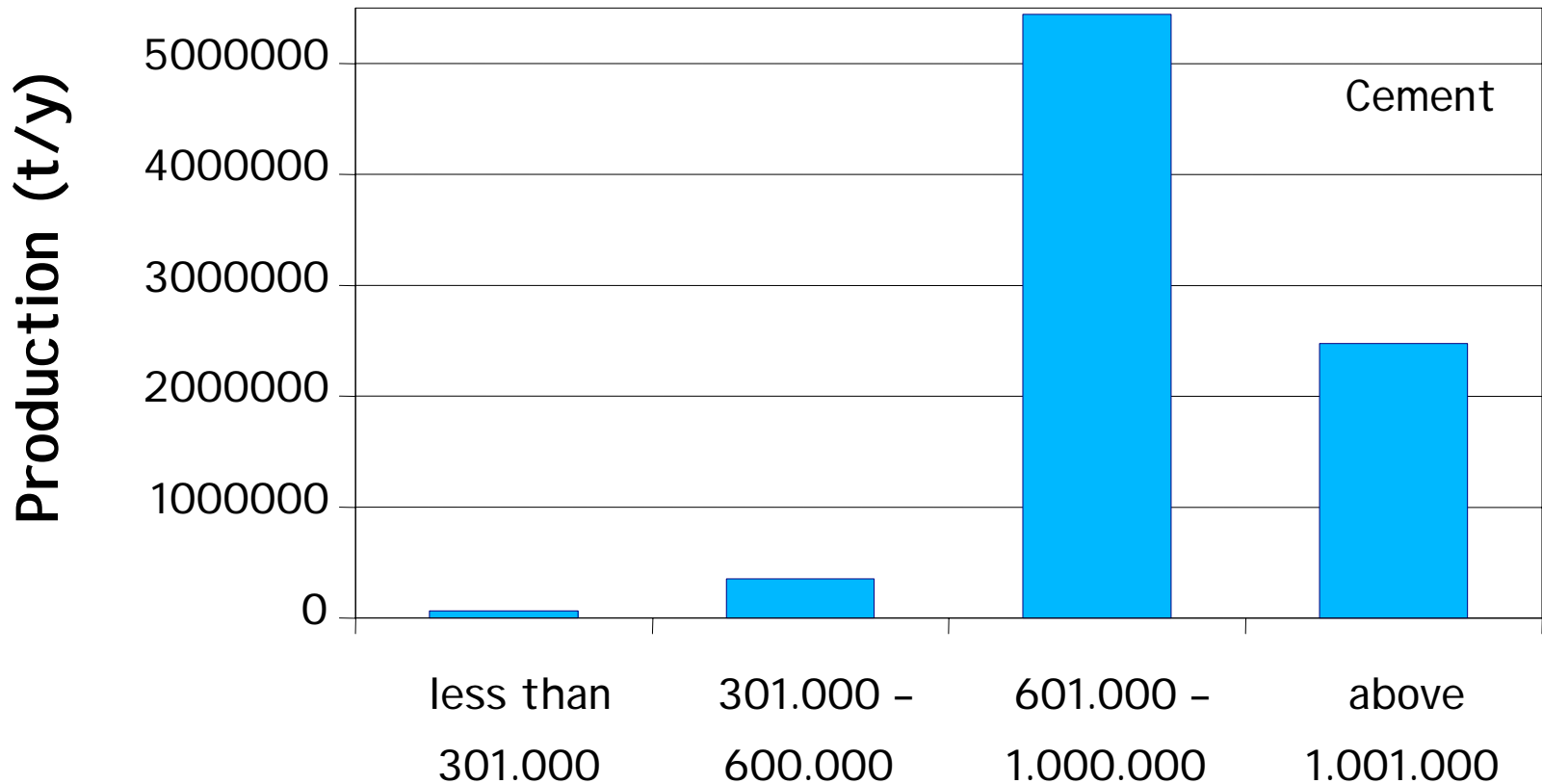
2. Productive cycle

BAT - Cement Industries



2. Productive cycle

BAT - Cement Industries



3. Emissions, pollutants and wastes

BAT - Cement Industries

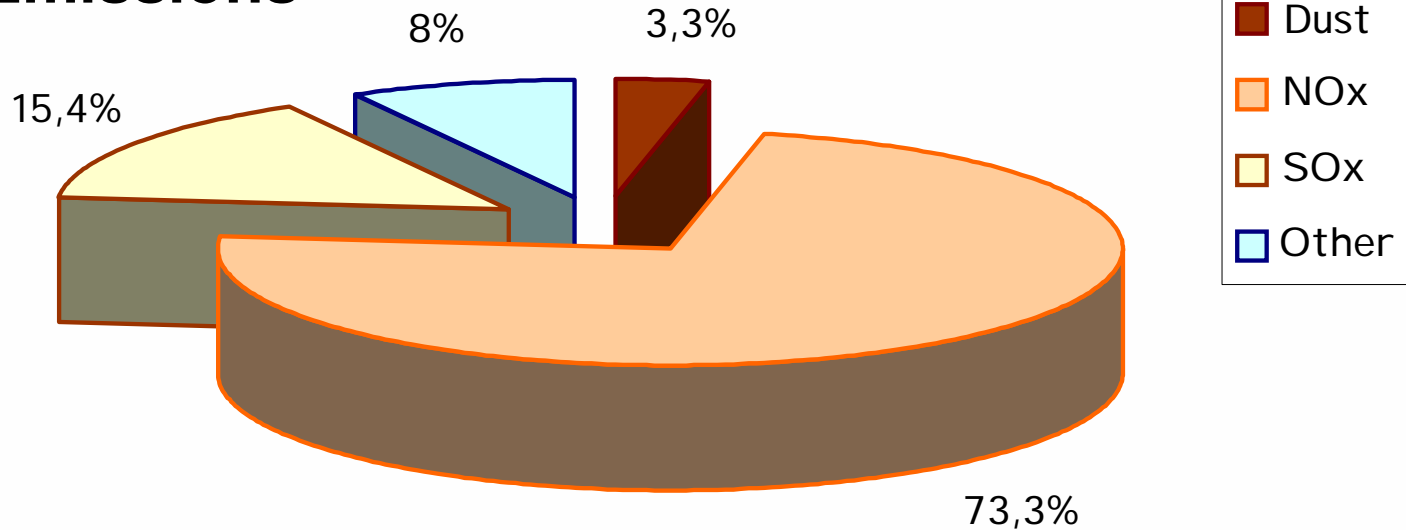
Emissions

	Sicily	Sardinia	Veneto
Dust (t/y)	702,0	149,6	354,7
NO_x (t/y)	17.025,6	3.027,1	6.906,9
SO_x (t/y)	4.443,5	329,3	910,8
Other (t/y)	0,1		2.943,0
Cement Productive Capacity 2004 (t/y)	3.183.394	3.139.500	4.480.657
Clinker Productive Capacity 2004 (t/y)	2.612.099	1.042.741	3.183.498

3. Emissions, pollutants and wastes

BAT - Cement Industries

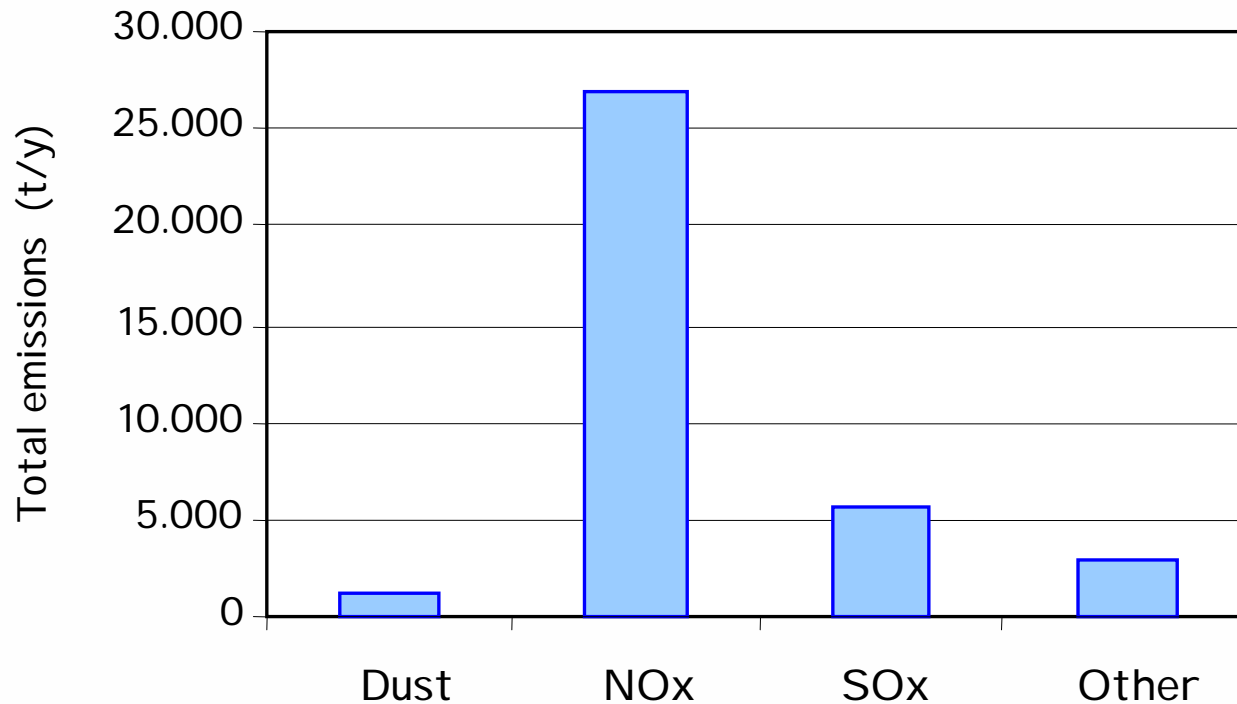
Emissions



3. Emissions, pollutants and wastes

BAT - Cement Industries

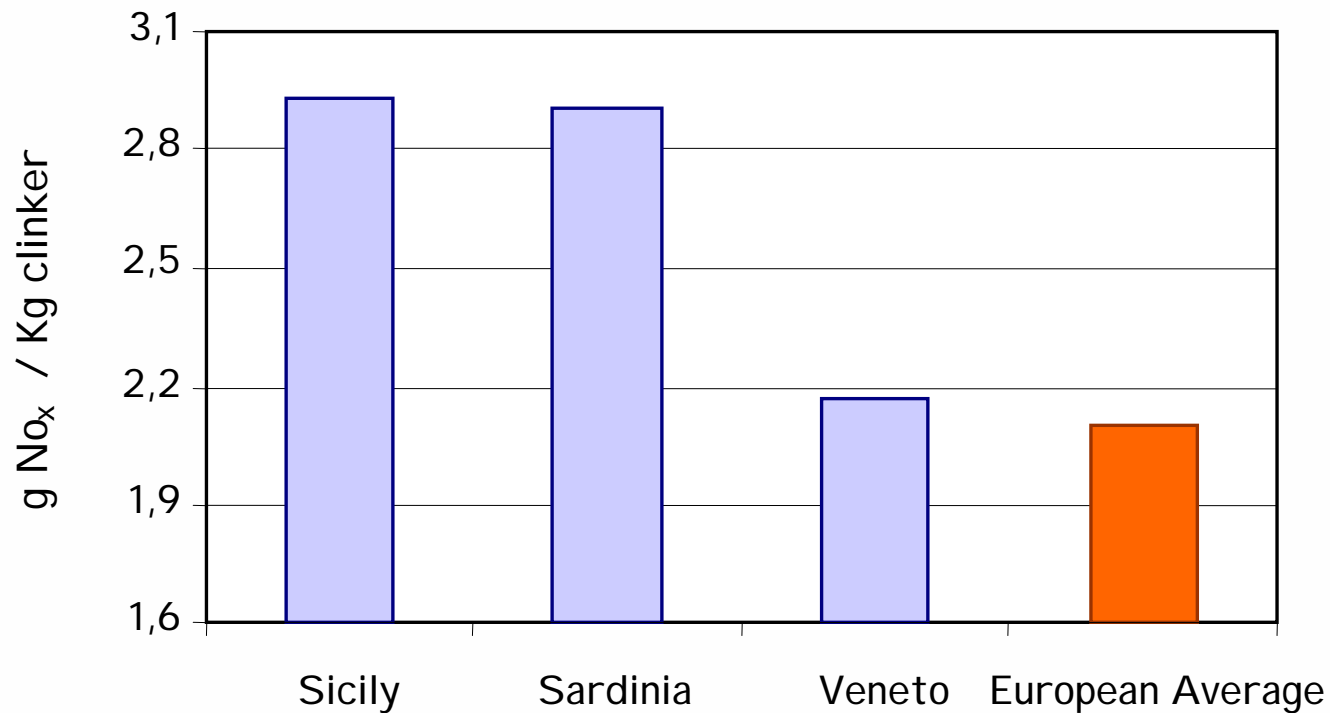
Emissions



3. Emissions, pollutants and wastes

BAT - Cement Industries

NO_x



3. Emissions, pollutants and wastes

BAT - Cement Industries

NOx

	Process Type	Emission control Techniques	NOx (mg/Ncm)
average values - Sicily kilns	Dry / Semi-dry	PE	885
average values-Sardinia kilns	Dry / Semi-dry	FT / PE	1513
average values - Veneto kilns	Dry / Semi-dry	FT / PE	1253
European values *			500 - 3000
average European kilns **			1300
BAT	Semi-dry	Flame cooling	700
		Low-NOx burners	
	Dry	SNCR	500 - 800
		Flame cooling	700
		Low-NOx burners	
		Staged combustion	700-1000
	SCR	100 - 200	

* Cembureau Report, 1997

** Okopol Report, 1998

3. Emissions, pollutants and wastes

BAT - Cement Industries SOx

	Process Type	Emission control Techniques	SOx (mg/Ncm)
average values - Sicily kilns	Dry / Semi-dry	<i>PE</i>	132,7
average values-Sardinia kilns	Semi-dry	<i>FT / PE</i>	164
average values - Veneto kilns	Dry	<i>FT / PE</i>	66,9
European values *			< 10 - 3500
BAT	Semi-dry	<i>Absorbent addition</i>	400
		<i>Wet scrubber</i>	< 200
	Dry	<i>Absorbent addition</i>	400
		<i>Wet scrubber</i>	< 200
		<i>Dry scrubber</i>	< 400
		<i>Activated carbon</i>	< 50

* Cembureau Report, 1997

3. Emissions, pollutants and wastes

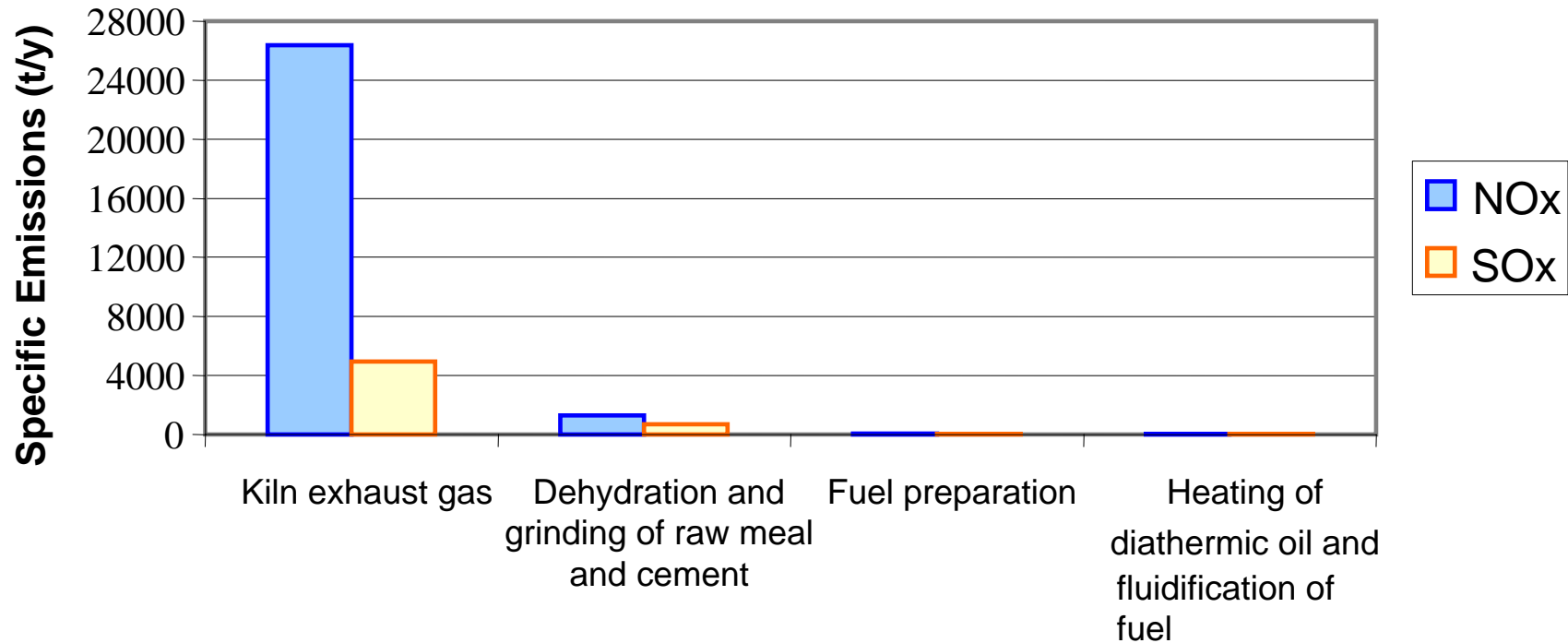
BAT - Cement Industries DUST

	Process Type	Emission control Techniques	Dust (mg/Ncm)
average values - Sicily kilns	Dust Emissions	<i>FT / PE</i>	18,27
	Fugitive dust	<i>FT</i>	14,41
average values-Sardinia kilns	Dust Emissions	<i>FT / PE</i>	47
	Fugitive dust	<i>FT</i>	27,74
average values - Veneto kilns	Dust Emissions	<i>FT / PE</i>	29,21
	Fugitive dust	<i>FT</i>	31,87
European values *			5 - 200
BAT	Dust Emissions	<i>Electrostatic Precipitators and Fabric Filters</i>	= 30
	Fugitive dust	<i>Local vacuum systems and Fabric Filters</i>	= 20

* Cembureau Report, 1997

3. Emissions, pollutants and wastes

BAT - Cement Industries



3. Emissions, pollutants and wastes

BAT - Cement Industries

Regional Specific NOx Emission

NOx (t/y)	Sicily	Sardinia	Veneto	TOTAL
Kilns exhaust gases	15.822,5	3.027	7.523	26.373
Raw meal and cement dehydration and milling	1188		105	1293
Fuel preparation			75	75
Heating of diathermic oil Fuel fluidification	15,15		24	38,93
<i>NOx da combustione</i>	<i>38,93</i>			

3. Emissions, pollutants and wastes

BAT - Cement Industries

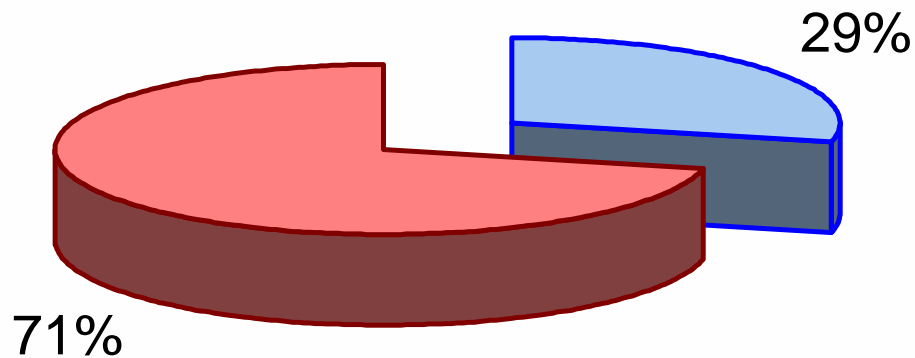
Regional Specific SO_x Emission

SO_x (t/y)	Sicily	Sardinia	Veneto	TOTAL
Kilns exhaust gases	4.221	329,3	401,4	4.952
Raw meal and cement dehydration and milling	218,7		451,1	669,8
Fuel preparation			26,8	26,8
Heating of diathermic oil Fuel fluidification	2,2		29,3	31,5
SO_x from fuel	31,5			

3. Emissions, pollutants and wastes

BAT - Cement Industries

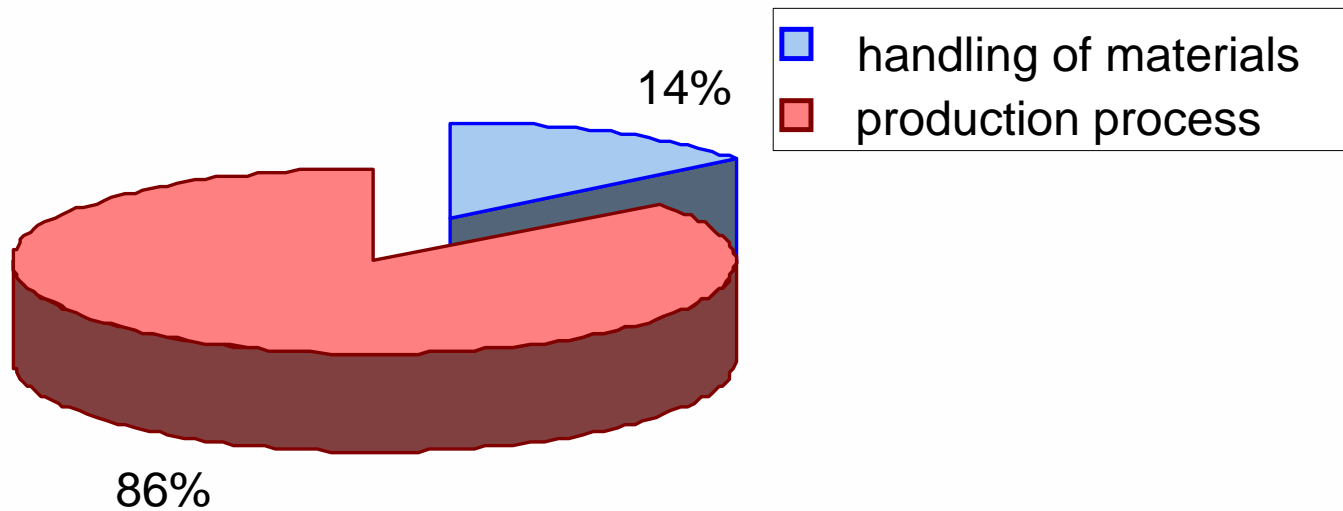
DUST



3. Emissions, pollutants and wastes

BAT - Cement Industries

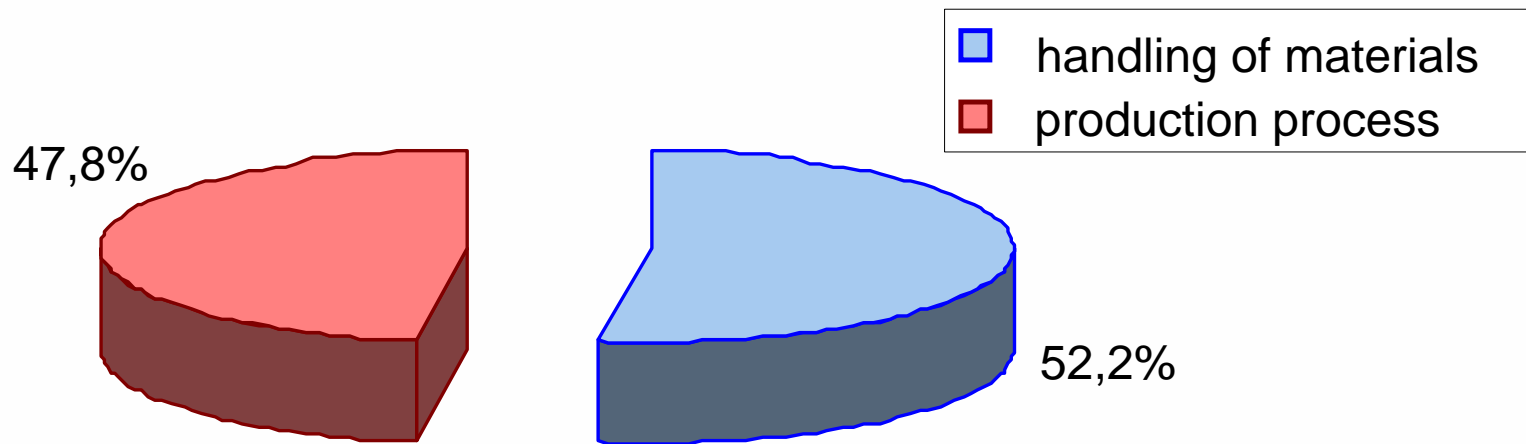
TOTAL DUST - SICILY



3. Emissions, pollutants and wastes

BAT - Cement Industries

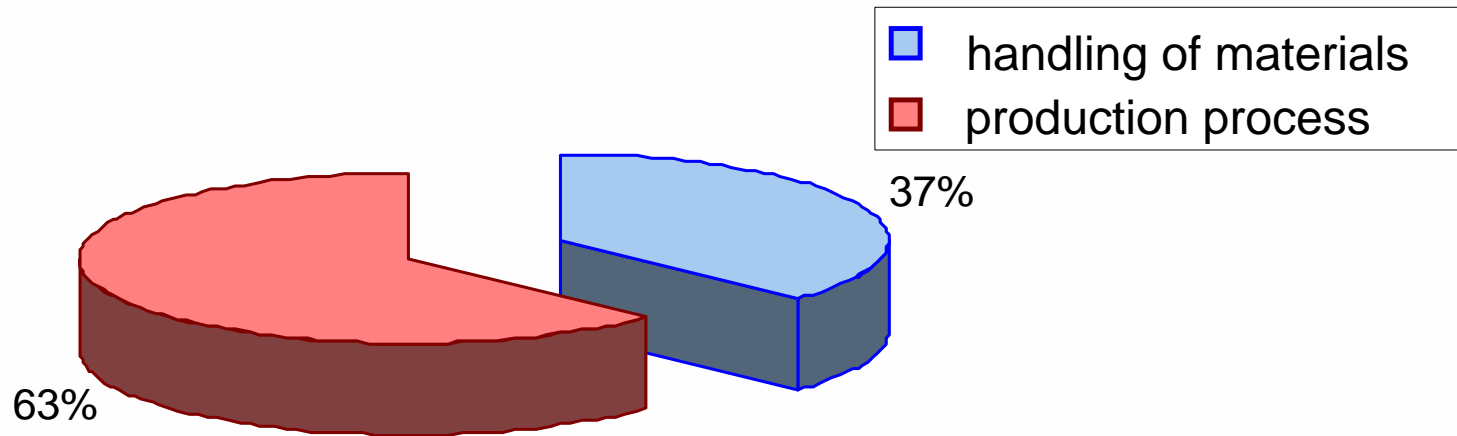
TOTAL DUST - VENETO



3. Emissions, pollutants and wastes

BAT - Cement Industries

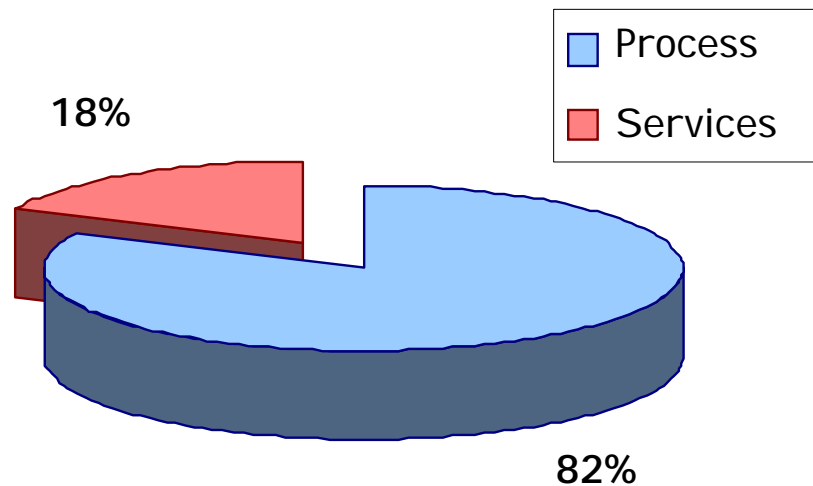
TOTAL DUST SARDINIA



4. Consumption of water, energy and fuels

BAT - Cement Industries

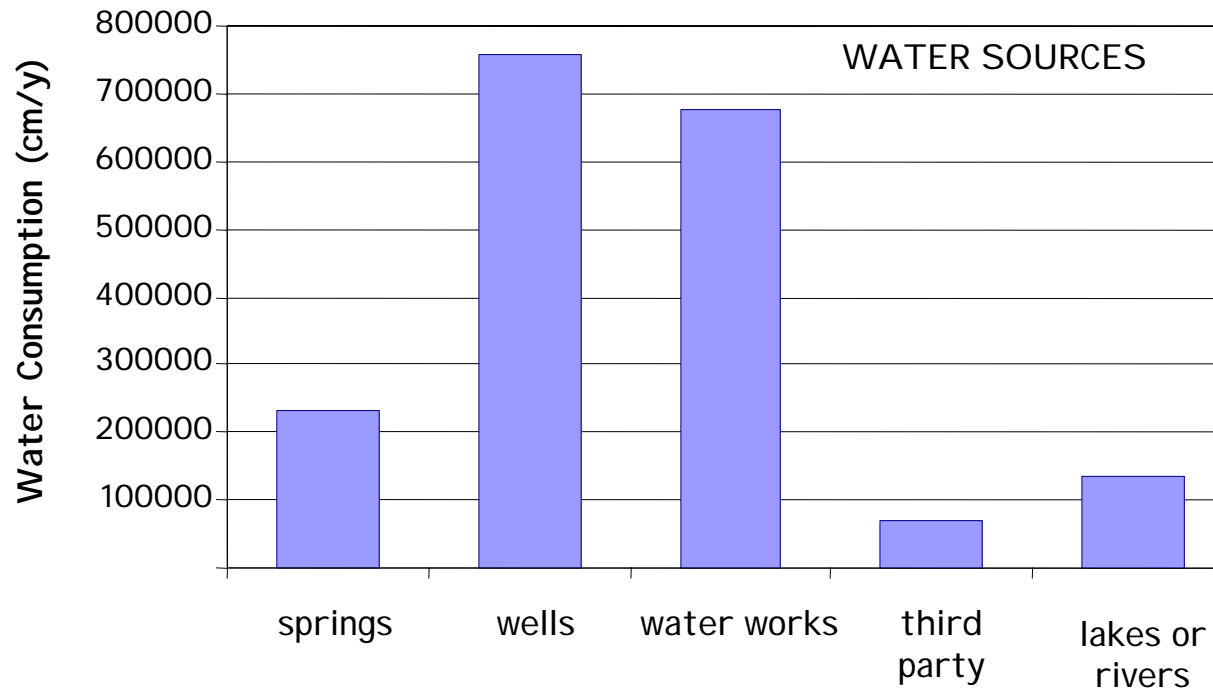
Water Consumption



4. Consumption of water, energy and fuels

BAT - Cement Industries

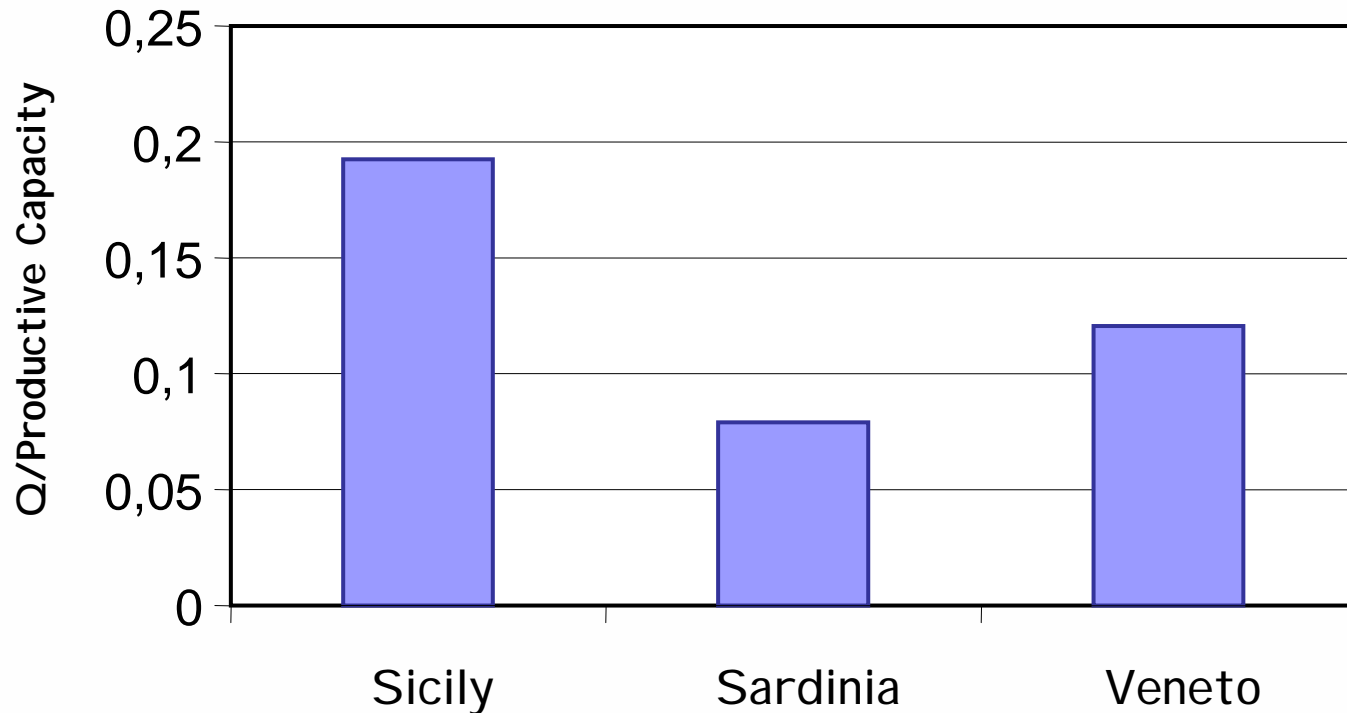
Water Consumption



4. Consumption of water, energy and fuels

BAT - Cement Industries

Water Consumption Indicator: QW/P (m³/t)



4. Consumption of water, energy and fuels

BAT - Cement Industries

Energy Balance Indicator

	Heat Energy	Electric Power
GJ/t	3,36	0,089

4. Consumption of water, energy and fuels

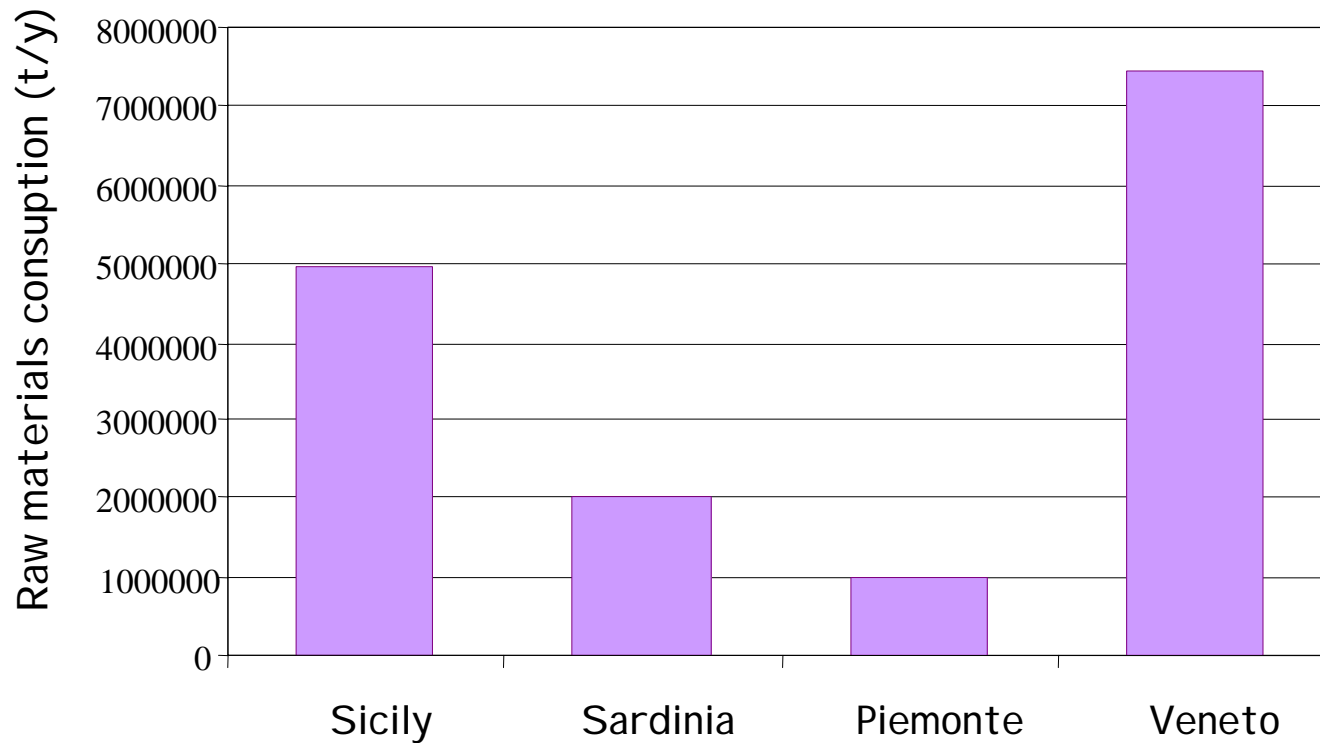
BAT - Cement Industries

Energy Consumptions - Buzzi Unicem Augusta Plant 2003

Phase		Heat Consumption (MWh)	Power Consumption (MWh)	Main product	Specific heat consumption (kWh/t)	Specific power consumption (kWh/t)
Raw meal production	Crusher and mill	0	23.972	Raw meal	/	18,40
Burning	Clinker kilns	794.145	21.212	Clinker	965,796 (*)	25,80
Cement production	Cement mill	0	40.667	Cement	/	40,40
Shipment activity	Packing and dispatch	0	2.826	Cement	/	/
Polverised coal production	N.2 coal mill	0	3.481	Polverised coal	/	42,10
Services	Office activity, Heating, etc.	462	7.809		/	/
TOTALE		794.607	99.967	* 3.477 MJ/t clinker		

5. Consumption of raw materials

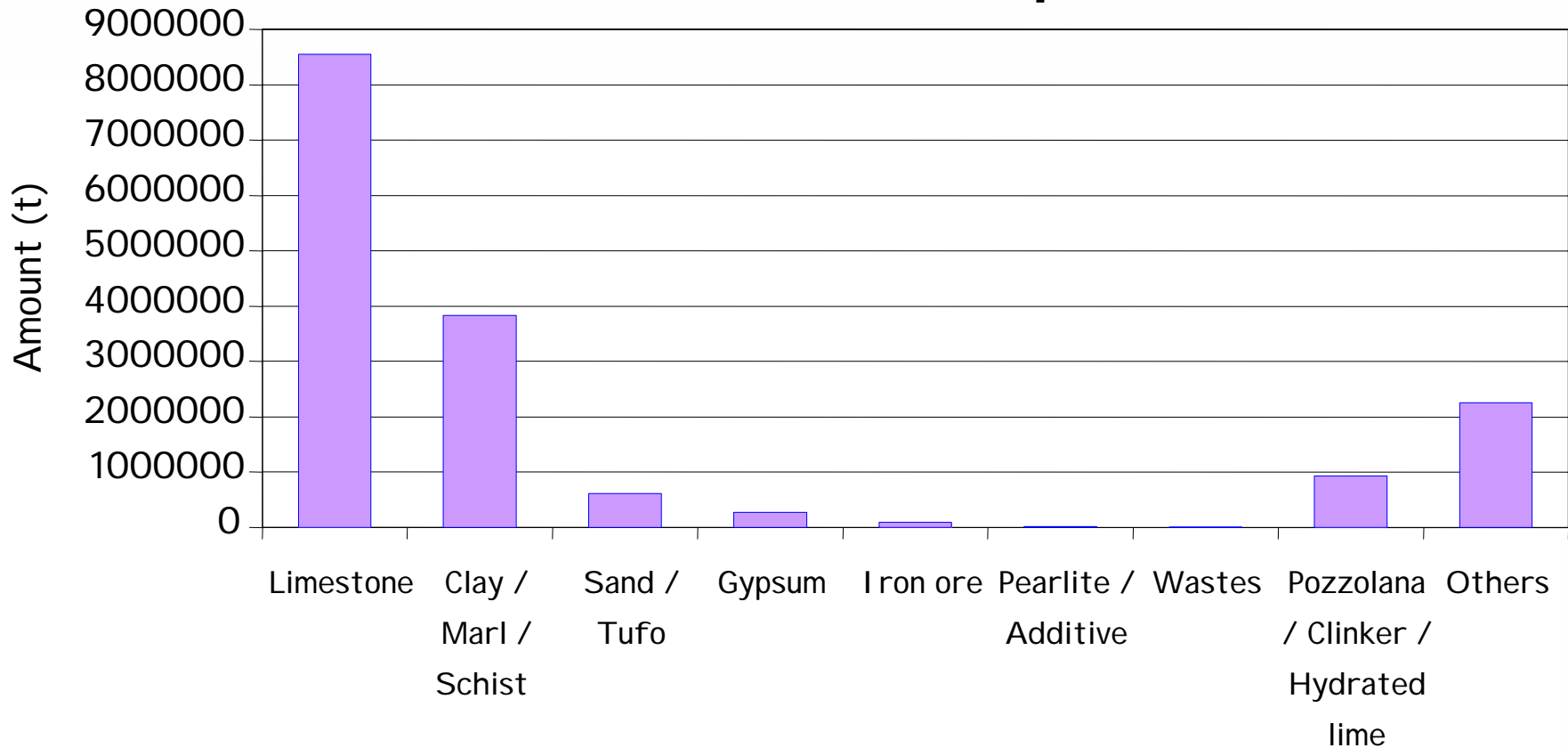
BAT - Cement Industries



5. Consumption of raw materials

BAT - Cement Industries

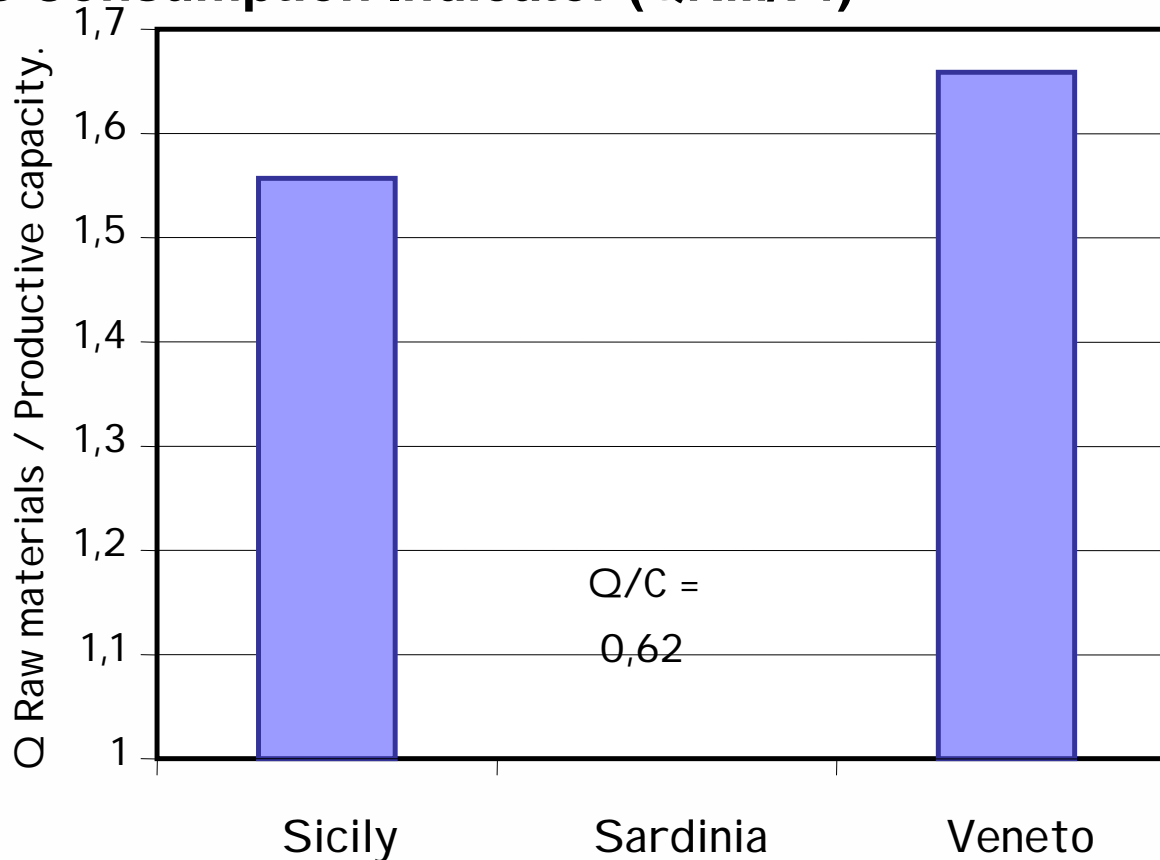
Raw Materials Consumption



5. Consumption of raw materials

BAT - Cement Industries

Raw Materials Consumption Indicator (QRM/Pf)



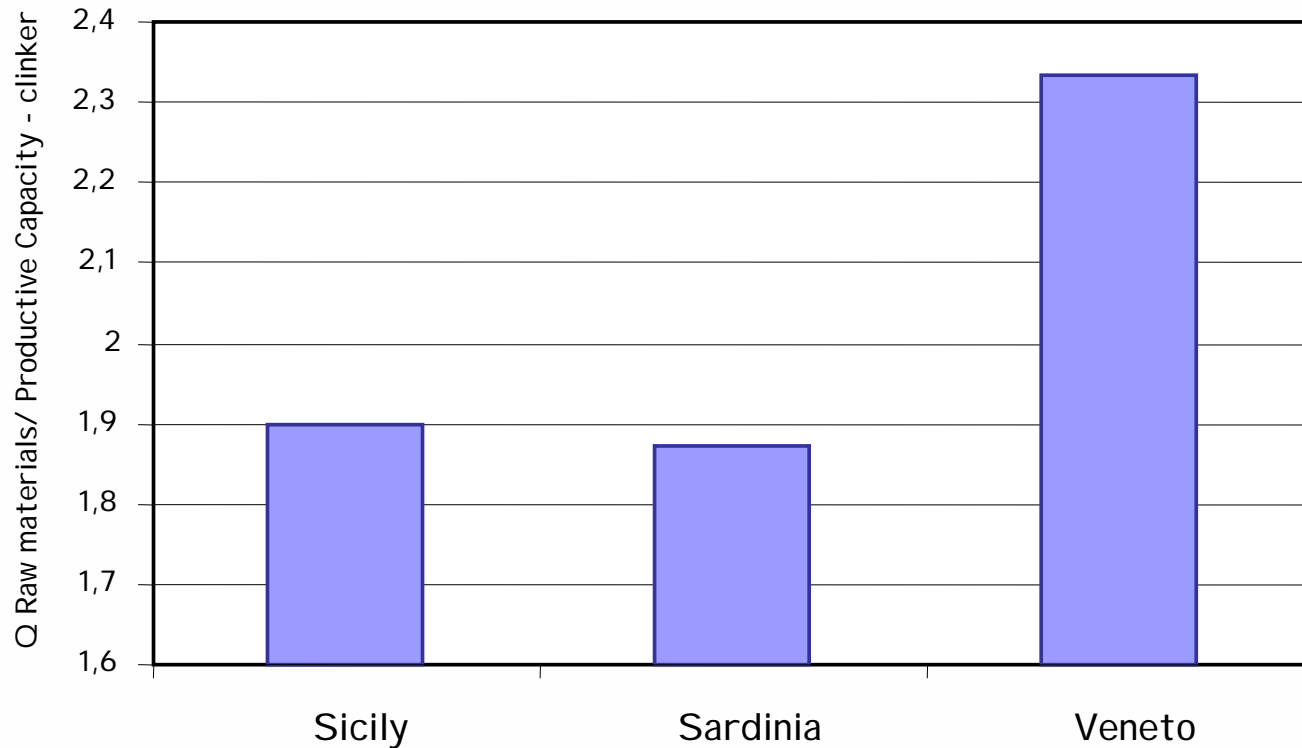
Sardinia: $Q_{RM}/P_f = 0.62 < 1$;

Sicily and Veneto: $Q_{RM}/P_f > 1$

5. Consumption of raw materials

BAT - Cement Industries

Raw Materials Consumption Indicator: QRM/Pinterm.



5. Consumption of raw materials

BAT - Cement Industries Indicators

	Sicily	Sardinia	Piemonte	Veneto
TOTAL raw materials recycled	13,45	48.724	641	918,473
Productive Capacity (t/y)-Clinker (2004)	2.612.099	1.042.741	nd	3.183.498
Productive Capacity (t/y)-end products (2004)	3.183.394	3.139.500	nd	4.480.657
Recycled Waste /ProductiveCapacity (end products)	0,004	0,016	nd	0,205
Recycled Waste/ Productive Capacity (Clinker)	0,005	0,047	nd	0,289

•Re-cycled waste/end products

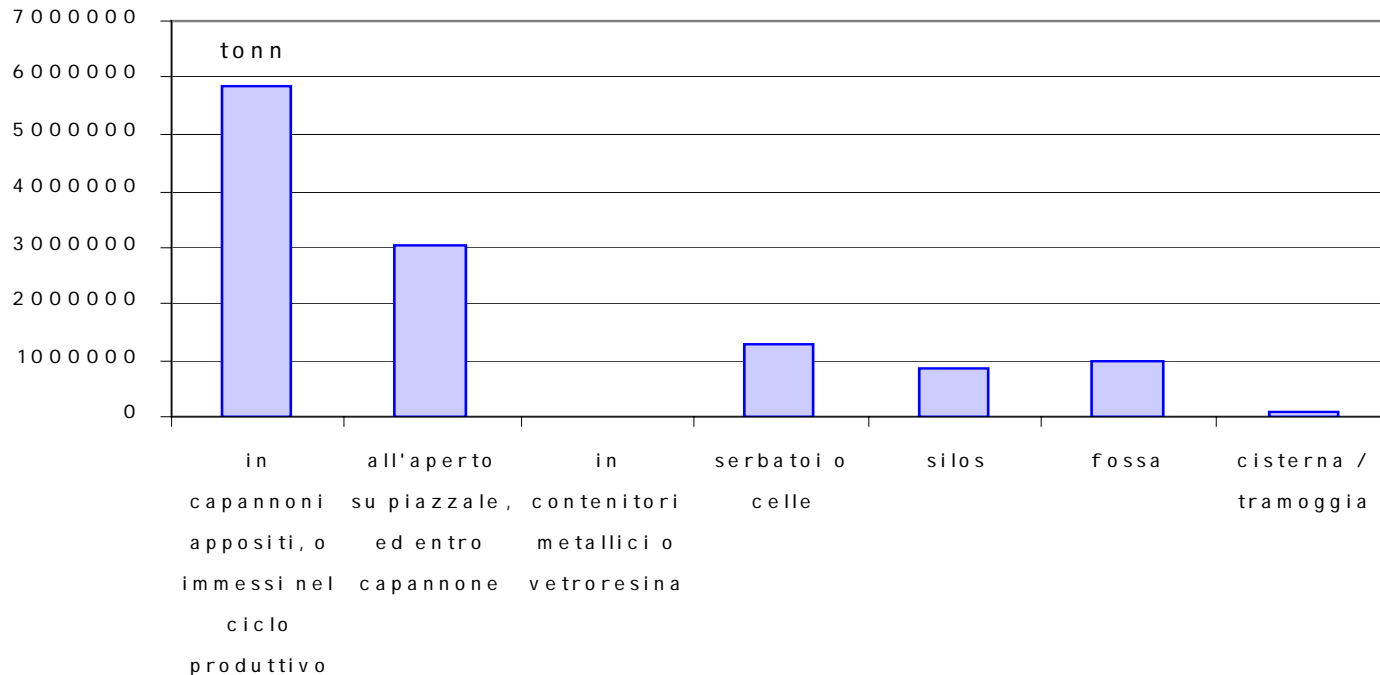
I_{fp} : 0.004 0.016 - 0.205

•Re-cycled waste/intermediate products (clinker)

I_{ip} : 0.005 0.047 - 0.289

6. Storing of products

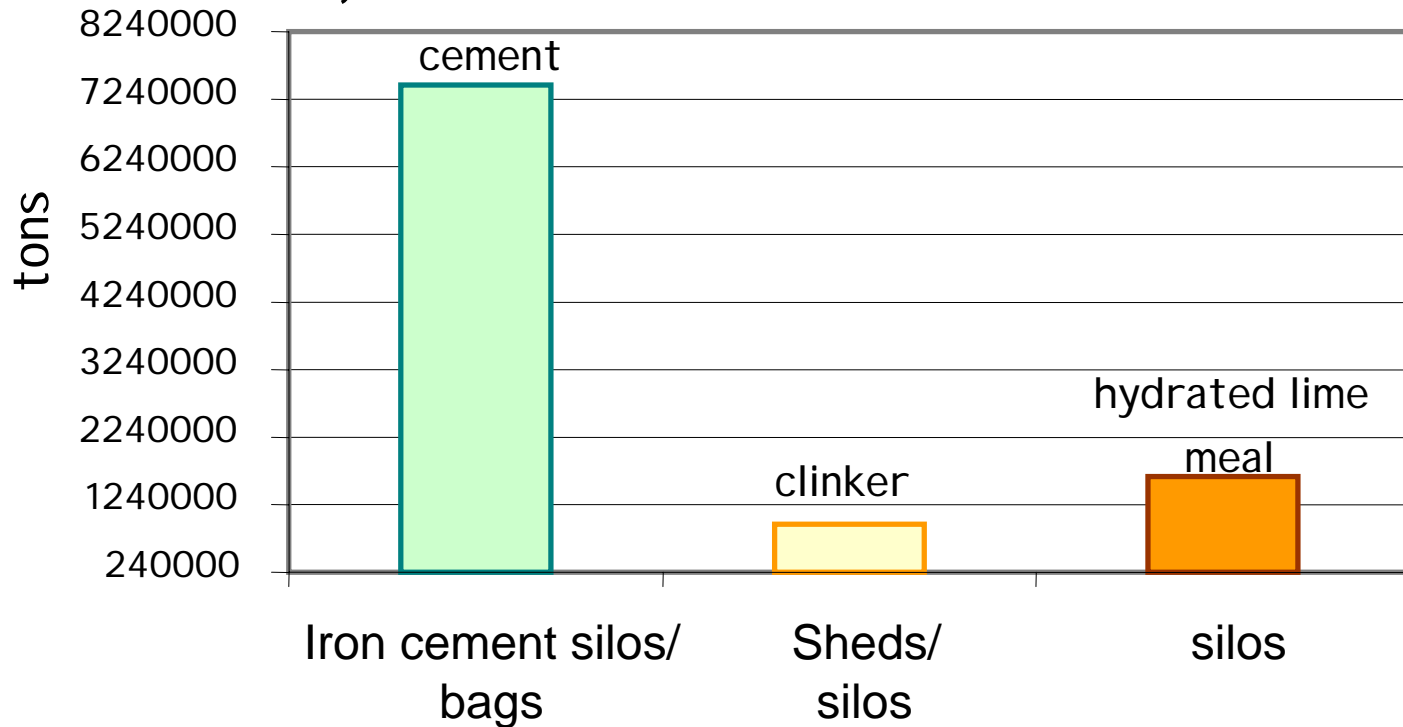
BAT - Cement Industries, Raw Materials Stock



- **48% raw materials stocked in sheds or in cycle directly;**
- **25% raw materials stocked on plant square or general shed;**
- **11% raw materials stocked in cells or vessels;**
- **7% raw materials stocked in silos.**

6. Storing of products

BAT - Cement Industries, Final and Intermediate Materials Stock



6. Storing of products

BAT - Cement Industries

Involved Area

	Total Area (Ha)	Covered Area (Ha)	Waterproof Area (Ha)	No-Waterproof Area (Ha)
Sicily	51,51	5,67	3,89	34,41
Sardinia	28,54	3,20	6,185	19,15
Veneto	10,35	3,14	5,66	2,7
Piemonte	30,39	8,035	9,78	12,57

7. Conclusions

BAT – Critical Issues

- Principal pollutant factor: ***NOx***
- Water consumptions: ***limited***
(using dry and semi-dry technologies)
- Raw materials consumptions: ***elevated***
- Attitude to raw materials re-cycle: ***insufficient***
- Dusts recovery by filters: ***insufficient***
- In progress improvements : ***raw materials re-cycle***
and ***dusts recovery***

8. References

<http://eippcb.jrc.es/pages/Fmembers.htm>