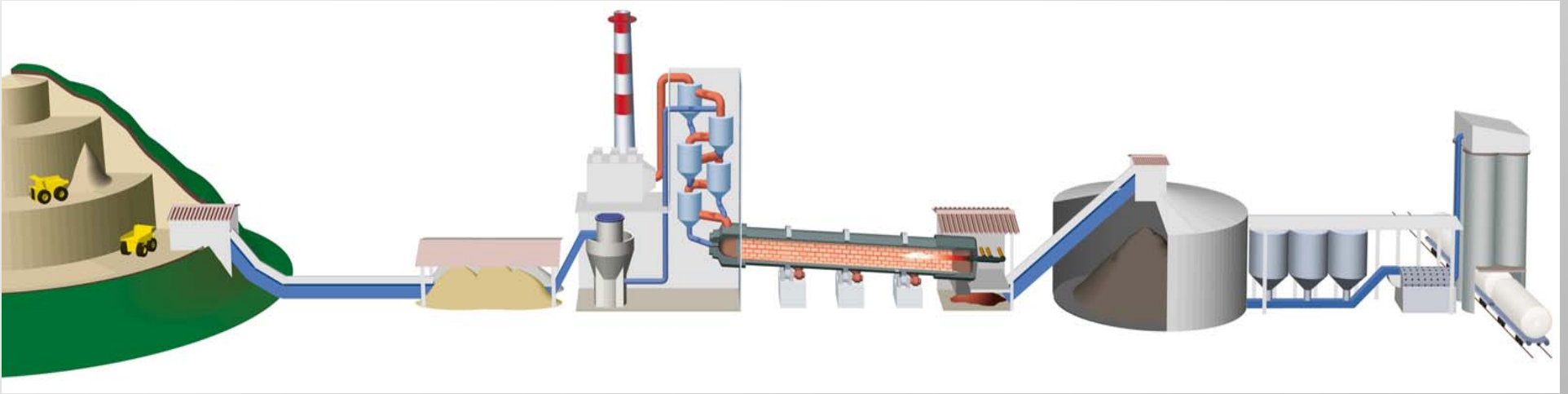


# WASTE CO-PROCESSING IN CEMENT PLANTS

## THE EUROPEAN EXPERIENCE

Dr Jean-Marie CHANDELLE – CEMBUREAU Chief Executive

# CEMENT MANUFACTURING – MAIN PHASES



- 1) Preparation of raw materials into raw meal (Extraction – Crushing – Pre-homogenisation - Dosing – Grinding – Homogenisation)
- 2) Clinker production – pyro-processing of raw materials (calcination of the raw meal into the rotary kiln – energy supplied by burning fuels)
- 3) Cement production - grinding of clinker and mineral components to obtain cement

# AN ENERGY INTENSIVE INDUSTRY

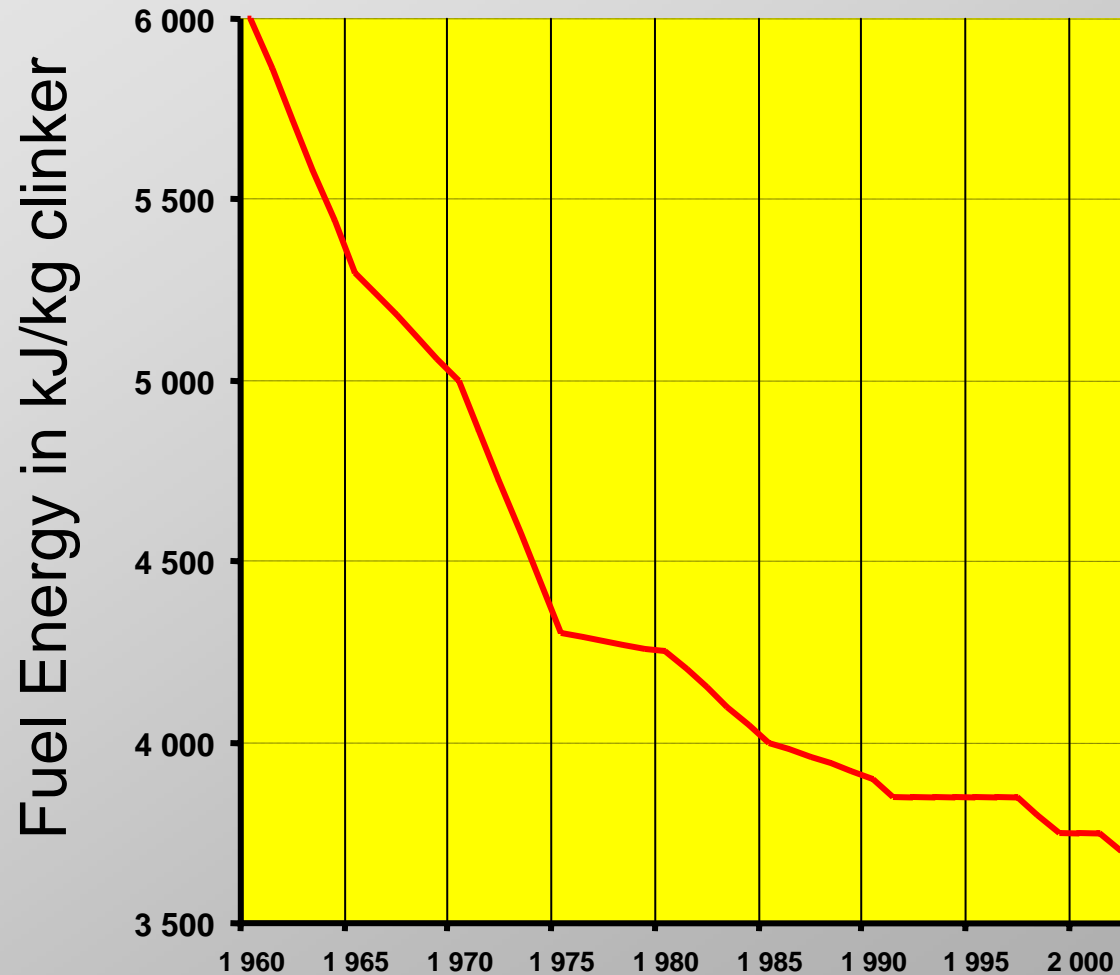
## One metric tonne of cement

- 60 - 130 Kg of fuel oil (or equivalent fuelling amount)
- The world has only limited amount of fossil based fuels
- Sustainable development: “To meet the needs of the present without compromising the ability of the future generation to meet their own needs”
- Take measures in order to save “some” resources for the future generation



# REDUCTION OF SPECIFIC ENERGY

Development of the specific fuel energy consumption in CEMBUREAU countries since 1960



Source: CEMBUREAU EL October 2004

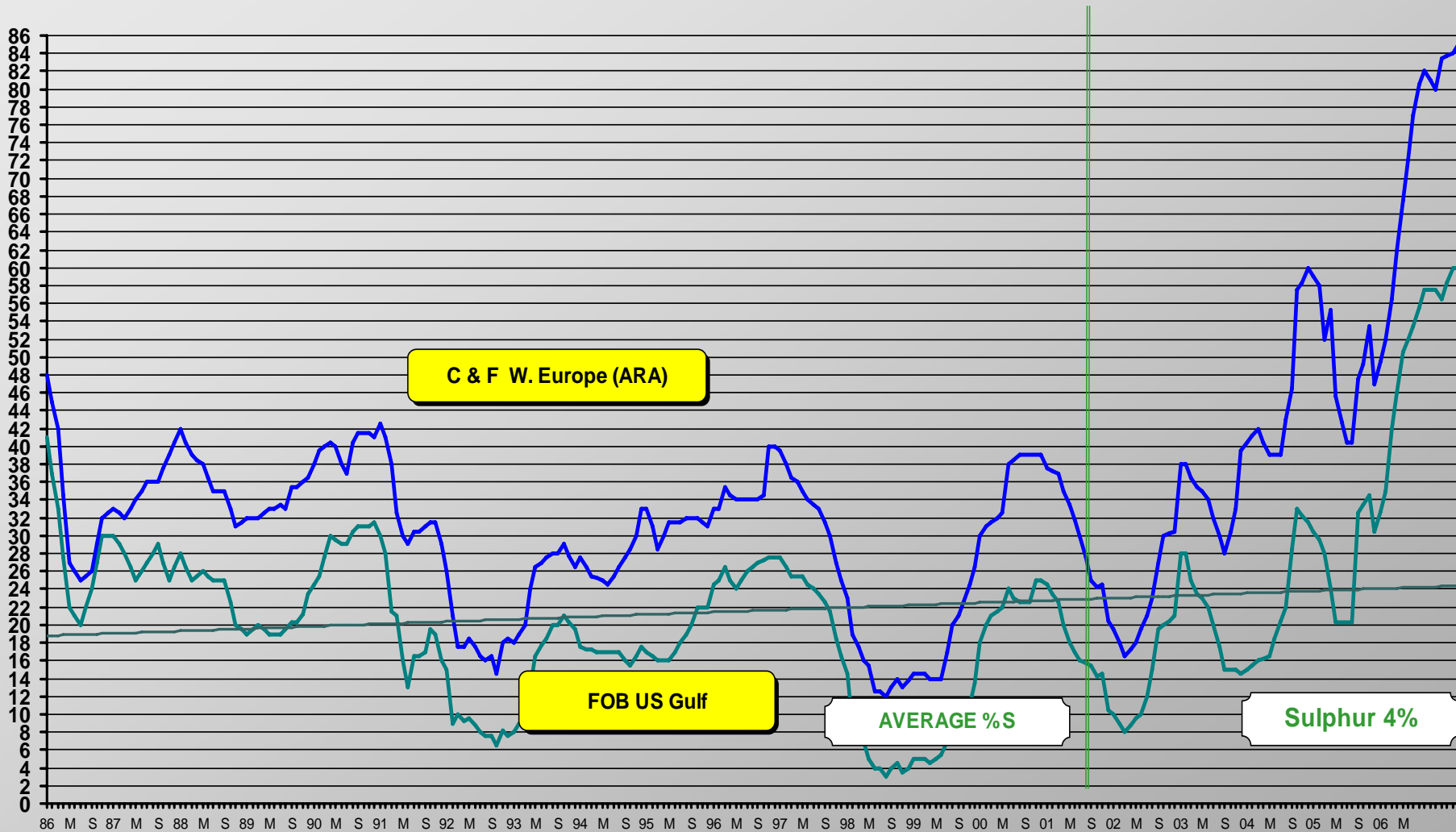
Remaining potential for reducing specific energy consumption through classical means (technological innovation and improvement)

**= LESS THAN 2 %**

# PETCOKE PRICE

## January 1986 - End March 2007

US\$



© Cimeurope EL - End March 2007



# COULD WASTE BE THE SOLUTION?

Homogeneous waste can be effectively recovered energetically and/or materially by co-processing in the cement - making process

- as alternative fuels (co-processing of waste)
- as alternative raw materials
- as mineral components

# EXAMPLES OF WASTE CO-PROCESSED IN CEMENT PLANTS

## Alternative Fuels

- waste oil, waste wood
- sewage sludge
- waste tyres
- plastics
- animal meal
- solvents
- impregnated saw dust

## Clinker Substitute (Mineral Components)

- fly ash (power generation)
- artificial gypsum (flue gas cleaning)
- ground slag (steel industry)

## Alternative Raw materials

- foundry sands
- contaminated soil
- waste from road cleaning
- iron-, aluminum-, silica-containing wastes
- contaminated soil

## Auxiliary Materials

- water containing ammonium (for de-NO<sub>x</sub>)
- water containing solvents
- water from photo chemical process

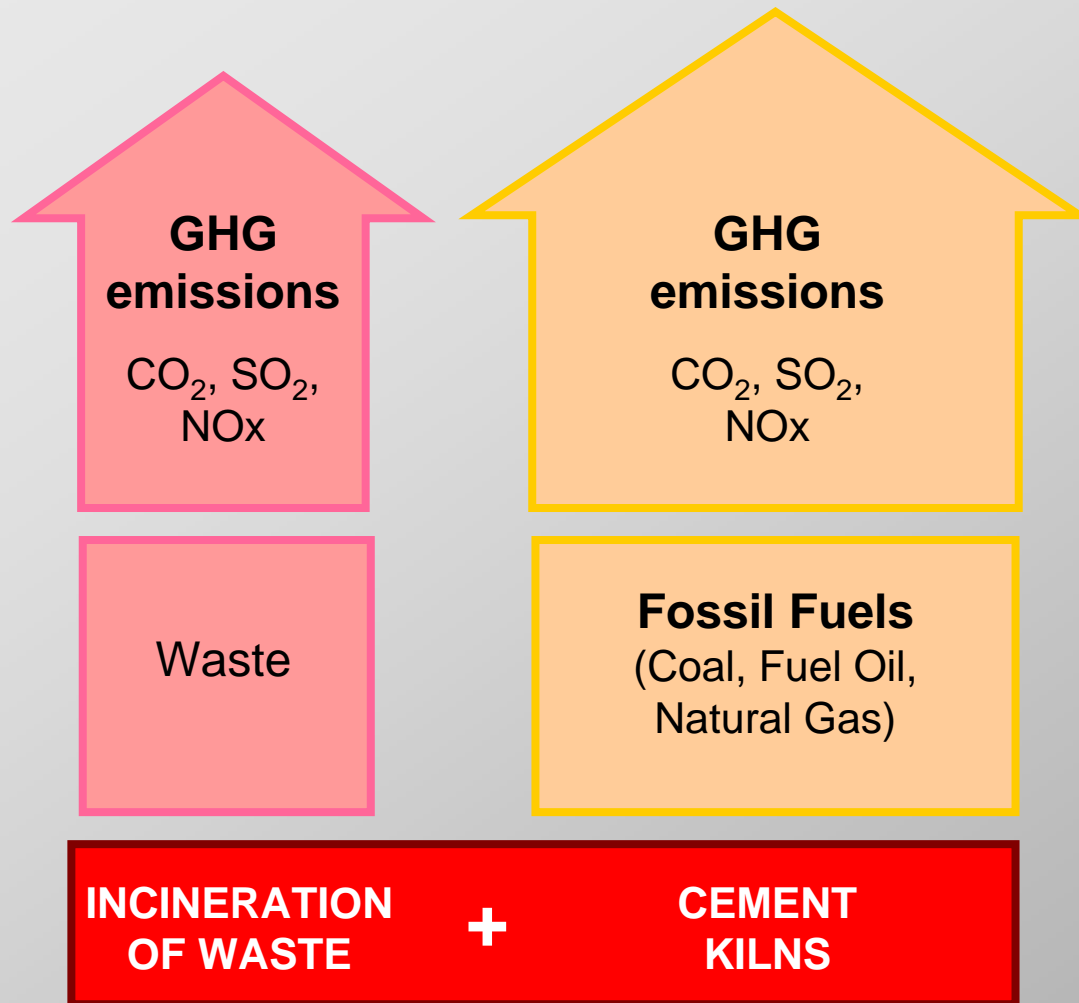


# BENEFIT TO THE ENVIRONMENT

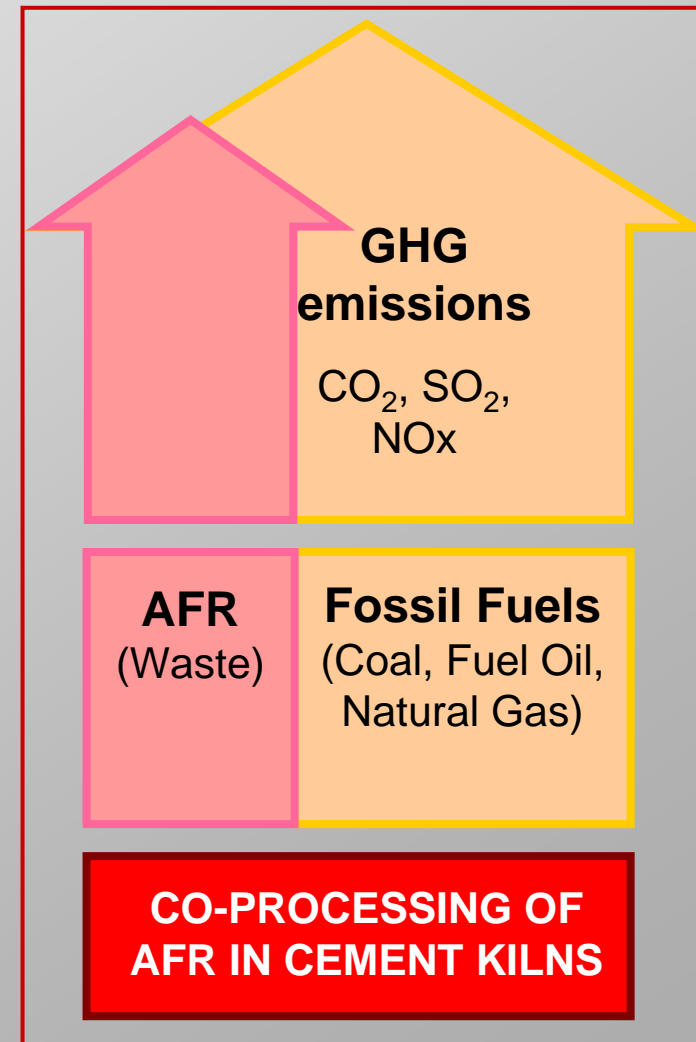
- 4 million tonnes of coal saved every year
- Lower global CO<sub>2</sub> emissions

# CO-PROCESSING AND REDUCTION OF GHG EMISSIONS

## Conventional approach



## Integrated approach



# ALTERNATIVE FUELS: CO<sub>2</sub> EMISSIONS AVOIDED

YEAR	SUBSTITUTION RATE	CO <sub>2</sub> EMISSIONS AVOIDED
1990	3%	1.7 Mt
1998	13%	7.4 Mt
2000	About 12%	6.8 Mt
2004	17%	9.7 Mt

## CLUSTERED STATISTICS RANKED WITH DECREASING QUANTITY FOR THE YEAR 2001

	Volume in kT	Average calorific value MJ/kg	Energy in TJ	Substitution rate (% on energy)
<b>Solid fuels (80%)</b>	<b>3532</b>			<b>9.19</b>
Others non-hazardous	788	19.1	15035	2.00
Animal meal, bone meal & animal fat	890	19.3	17203	2.29
Tyres	554	27.0	14980	2.00
Other hazardous waste	357	18.3	6545	0.87
Plastics	210	23.9	5026	0.67
Paper/cardboard/wood	180	15.6	2802	0.37
Impregnated saw dust	167	11.6	1931	0.26
Coal slurries/distillation residues	112	14.8	1654	0.22
Sludges (paper fibre, sewage)	107	9.6	1032	0.14
Fine/anodes/chemical cokes	89	18.0	1603	0.21
Refused Derived Fuels	41	13.0	531	0.07
Shales/oil shales	14	9.3	130	0.02
Packaging waste	12	22.0	264	0.04
Agricultural & organic waste	11	15.5	170	0.02
<b>Liquid fuels (20%)</b>	<b>841</b>			<b>3.04</b>
Waste oil + oiled water	402	35.6	14331	1.91
Solvents and others	266	15.3	4081	0.54
Other hazardous liquid fuels	173	25.4	4398	0.59
<b>TOTAL</b>	<b>4373</b>			<b>12.23</b>

## LATEST PUBLICLY AVAILABLE DATA ON THE SUBSTITUTION LEVEL PER COUNTRY FOR THE YEAR 2001

	Substitution level in %	Number of plants using alternative fuels/ Total number of plants
Austria	<b>46</b>	9/9
Belgium	30	5/5
Czech Republic	24	6/6
Denmark	4	6/7
Finland	3	2/2
France	34.1	38/44
Germany	30	32/35
Greece	<1%	1/8
Hungary	3	2/6
Ireland	0	0/4
Italy	2.1	23/60
Luxembourg	25	1/1
Netherlands	<b>83</b>	1/1
Norway	35	2/2
Poland	1	6/6
Portugal	0	0
Spain	1.3	16/36
Sweden	29	3/3
Switzerland	<b>47.8</b>	8/8
United Kingdom	6	8/16

# BENEFITS TO LOCAL COMMUNITIES

- No capital cost
- Lower operating costs
- A safe -strictly regulated- solution

# BENEFIT TO THE CEMENT INDUSTRY

- Long term viability – in an era with fewer and fewer fossil natural resources
- From “Polluter image” to “Supplier of safe waste solution”

# STRICT REGULATION AT EU LEVEL

- IPPC Directive
- Incineration of Waste Directive (2000/76/EC)

of 4 December 2000 ... to be transposed into national laws by 28 December 2002



# DIRECTIVE “INCINERATION OF WASTE”

## The Directive covers:

- Cement plants burning waste
- Hazardous waste and non-hazardous waste
- Waste oil, but the specific requirements for hazardous waste do not apply to waste oil

# DIRECTIVE “INCINERATION OF WASTE”

## The Directive prescribes obligations on:

- Application and permits
  - *Types and amounts of waste*
- Delivery and reception of waste
  - *Control*
- Operating conditions
  - *Gas temperature > 850 °C/1100 °C, 2 sec*
- Access to information
  - *Applications for permits, annual reports*

# EMISSION LIMIT VALUES

*The following emission limit values are provided for cement plants burning non-hazardous waste or less than 40% hazardous waste:*

<b>Total dust</b>	<b>30</b>
<b>Hydrogen Chloride (HCl)</b>	<b>10</b>
<b>Hydrogen Fluoride (HF)</b>	<b>1</b>
<b>NOx for existing plants</b>	<b>800</b>
<b>NOx for new plants</b>	<b>500</b>
<b>Cadmium (Cd) &amp; Thallium (Tl)</b>	<b>0.05</b>
<b>Mercury (Hg)</b>	<b>0.05</b>
<b>Antimony (Sb), arsenic (As), lead (Pb), Chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V)</b>	<b>0.5</b>
<b>Dioxins and furans</b>	<b>0.1</b>
<b>Sulphur dioxide (SO<sub>2</sub>)</b>	<b>50</b>
<b>Total Organic Carbon (TOC)</b>	<b>10</b>

Exceptions may be authorised by the competent authority in case where TOC and SO<sub>2</sub> do not result from the incineration of waste

*Limit values expressed as a daily average, 10% O<sub>2</sub>, dry, mg/m<sup>3</sup>  
(dioxins ng/m<sup>3</sup>)*

# WASTE FOR RECOVERY V. DISPOSAL

## CEMBUREAU position:

### co-processing is a recovery operation because:

- The combustible parts of the waste replace fossil fuels;
- The non-combustible parts of the waste replace raw materials;
- The energy efficiency in cement kilns is high;
- The environmental impact is low:
  - emission to air (strictly regulated)
    - kiln - preheater system - “neutraliser” of the acid gases
    - high temperatures assures complete combustion
  - there are no releases to soil (no ash and slag) or to water.



# WASTE CASE LAW

## Case C-228/00

Judgment of the Court (Fifth Chamber) of 13 February 2003

European Commission v. Germany

### **Ruling:**

A ruling delivered by the European Court of Justice holds that using waste as a fuel in cement kilns should be classified as recovery, while burning municipal waste in dedicated incinerators, even with energy recovery, should be classified as disposal.

**The calorific value of the waste is not a relevant criterion for the purpose of establishing whether an operation involving the combustion of waste is a recovery operation**



# REMAINING BARRIERS

## At national level:

- No incentives for collection and sorting of waste
- No implementation of Waste Action Plans
- No action versus illegal landfilling
- No reduction of landfilling

**EU Member States should take waste management seriously**

# NEW BARRIERS AT EU LEVEL

- EU Biomass Action Plan (Dec. 2006):  
Biomass  $\Rightarrow$  electricity and transport
- EU target 20% of renewables by 2020 (8-9 March 2007)  
 $\Rightarrow$  use of biomass fundamentally redirected

# **THE OBVIOUS CONCLUSION:**

**WASTE CO-PROCESSING IN  
CEMENT KILNS IS A SOUND  
WASTE MANAGEMENT POLICY**



# ALTERNATIVE FUELS: OUR AMBITION

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1990	3%	1.7 Mt
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2004	17%	9.7 Mt
<b>Our Ambition:</b>		
2010 (No barriers)	27%	15.4 Mt

**OUR AMBITION ...**

**BUT           New (revised) Framework Directive ???**

**New Definition of Recovery ???**



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