



ALTERNATIVE FUELS FROM WASTE – SPECIAL RECIPE FOR CEMENT KILNS - CASE STUDY -

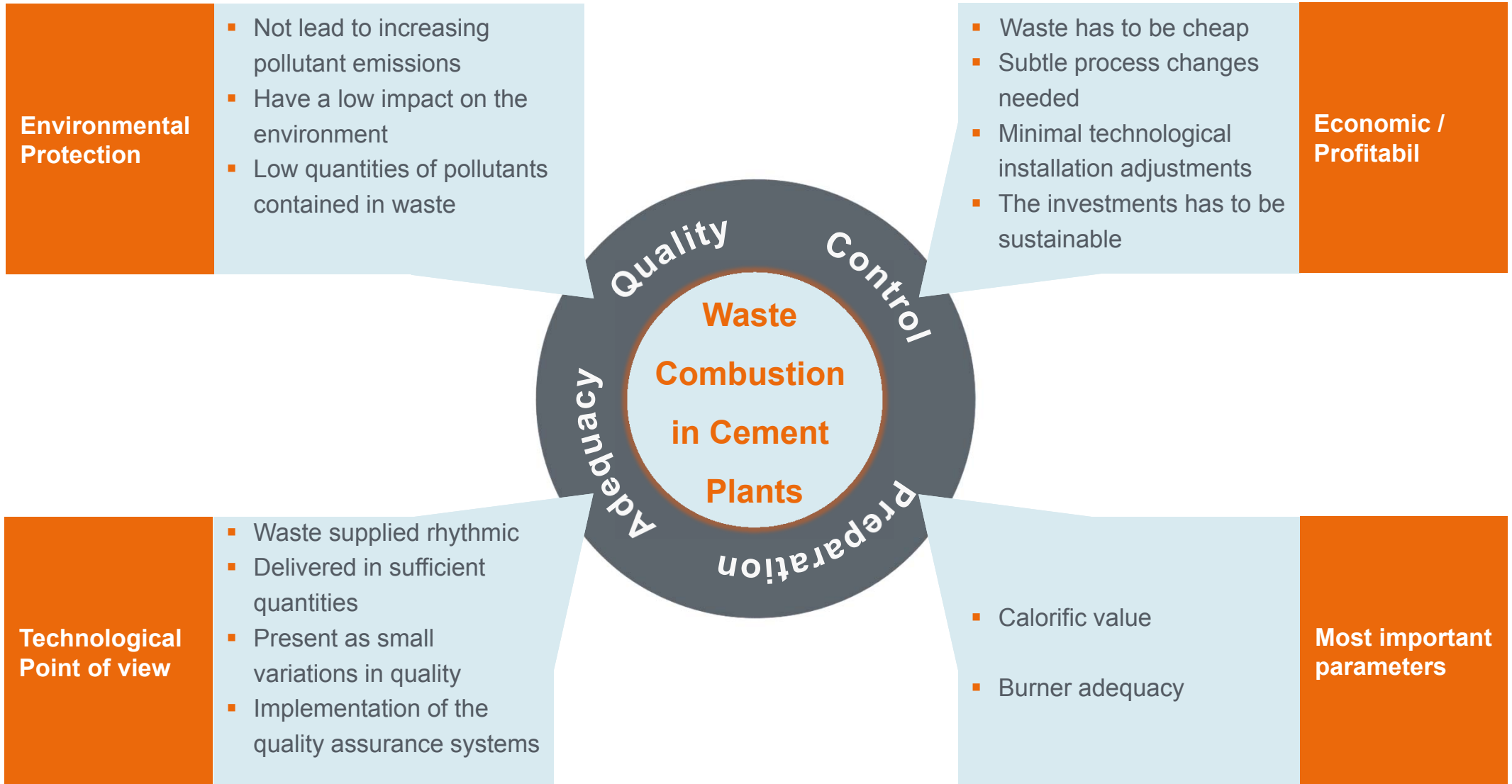
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Introduction

- + Waste recipe in cement production is one of the most closely guarded secrets.
- + The list of wastes accepted for co-incineration included almost 200 type of waste
- + The clinkerization process uses a mixture of conventional and alternative fuels
- + The conducted researches hereof, has the main purpose to constitute the base for further ecological solutions for conversion waste to energy, including:
 - the optimization of the mixture of waste, from calorific point of view, and
 - calibration of existing plants in order to allow the use of solid wastes as alternative fuel
- + The recipe can be used at large scale, in cement kilns, all over the world.

Criteria of Waste Selection



Preparing the Fuel from Waste - Large solid waste



- Using scrap tires as alternative fuel is recommended
 - high calorific value similar to that of brown coal,
 - availability in significant quantities.
- An additional advantage of using scrap tires is steel insertion.
 - The steel can substitute, in part, or all, for the iron requirement in the raw meal recipe thereby reducing the raw meal cost



Tires – Storage and Automated conveyor transports of the scrap tires to the injection point in the kiln system

Preparing the Fuel from Waste - Small solid waste



System for processing of plastics, paper and cardboard to be used as alternative fuels

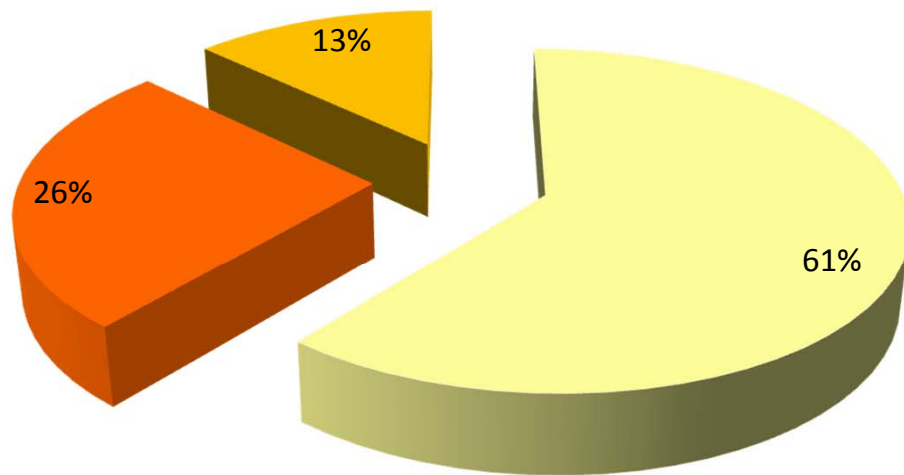
System for processing of wood, to be used as alternative fuels in cement kilns



Paper, cardboard, plastic, textiles, solid fraction of waste from catch pits

Composition of Waste Recipe Fuel Mixture

■ liquid waste ■ small solid waste ■ tires & large solid waste



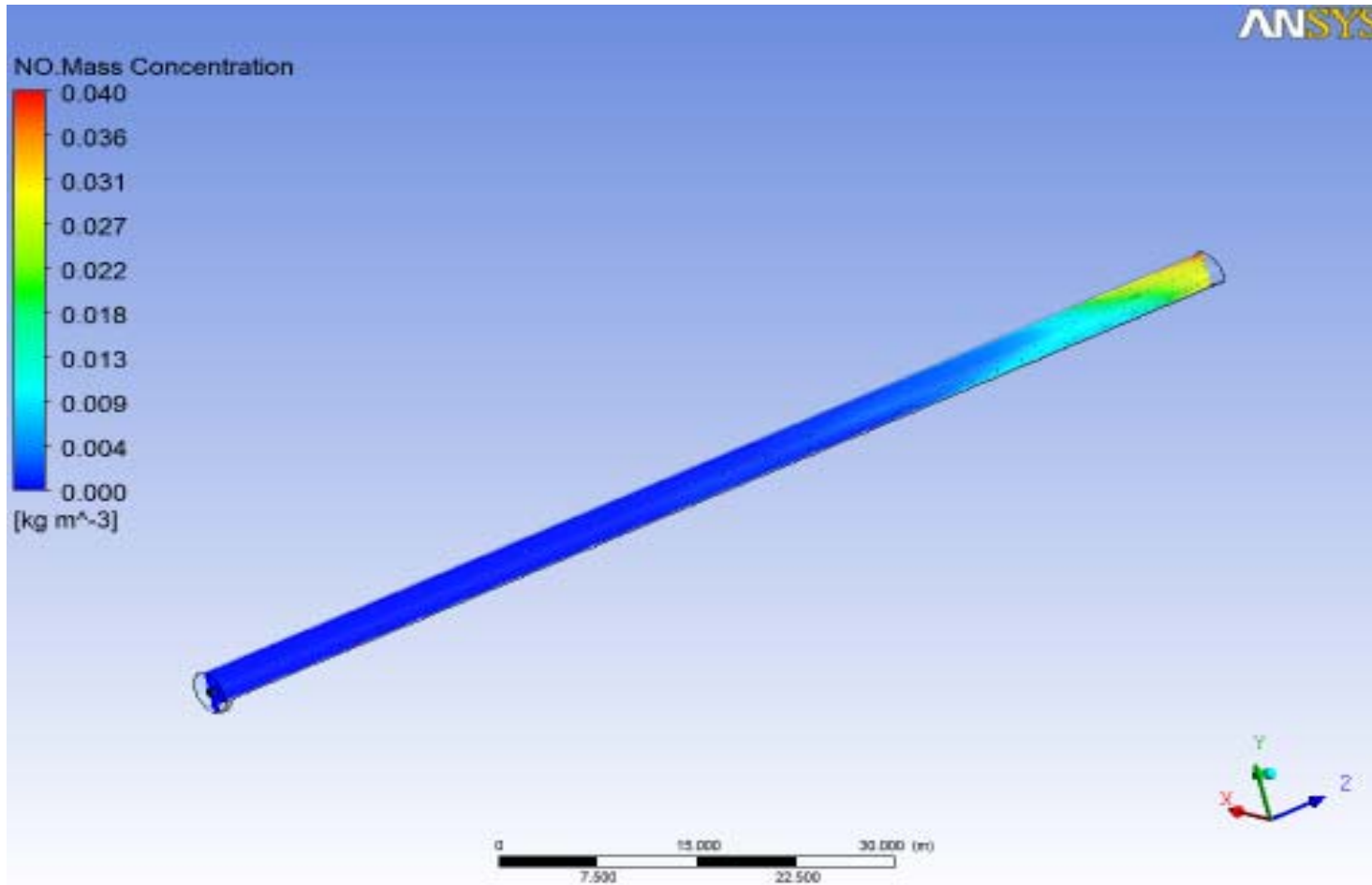
Type of waste	Calorific value MJ/kg	Share in the mixture %
Liquid waste	25	61
Small solid waste and wood waste	27	26
Tires and large solid waste	26	13
Mixture	25,65	100

75% traditional fuels
25% alternative fuels from waste

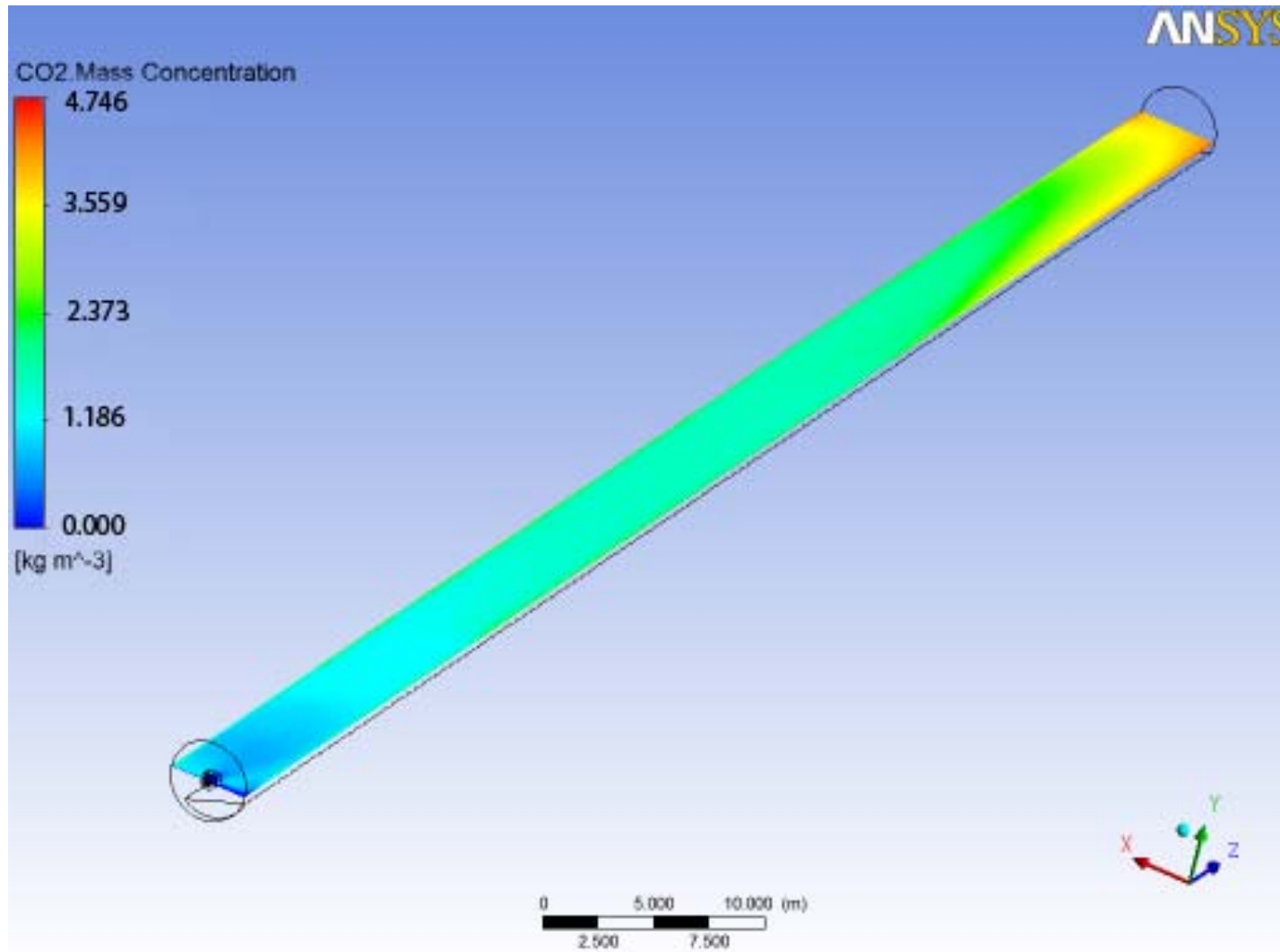
Calorific Value of the Fuel Mixture

Type of fuel	Fuel	Calorific value MJ/kg	Percentage in the mixture
Traditional	Natural gas	50	75 %
	Coal	26-30	
	Heavy oil	40-42	
	Mixture - recipe	33,5	
Alternative	Liquid wastes	30	25 %
	Wood waste and other solid waste small dimensions	27	
	Tires and large solid wastes	26	
	Mixture - weighted	25.65	
Calorific value of the mixture		31.54	100 %

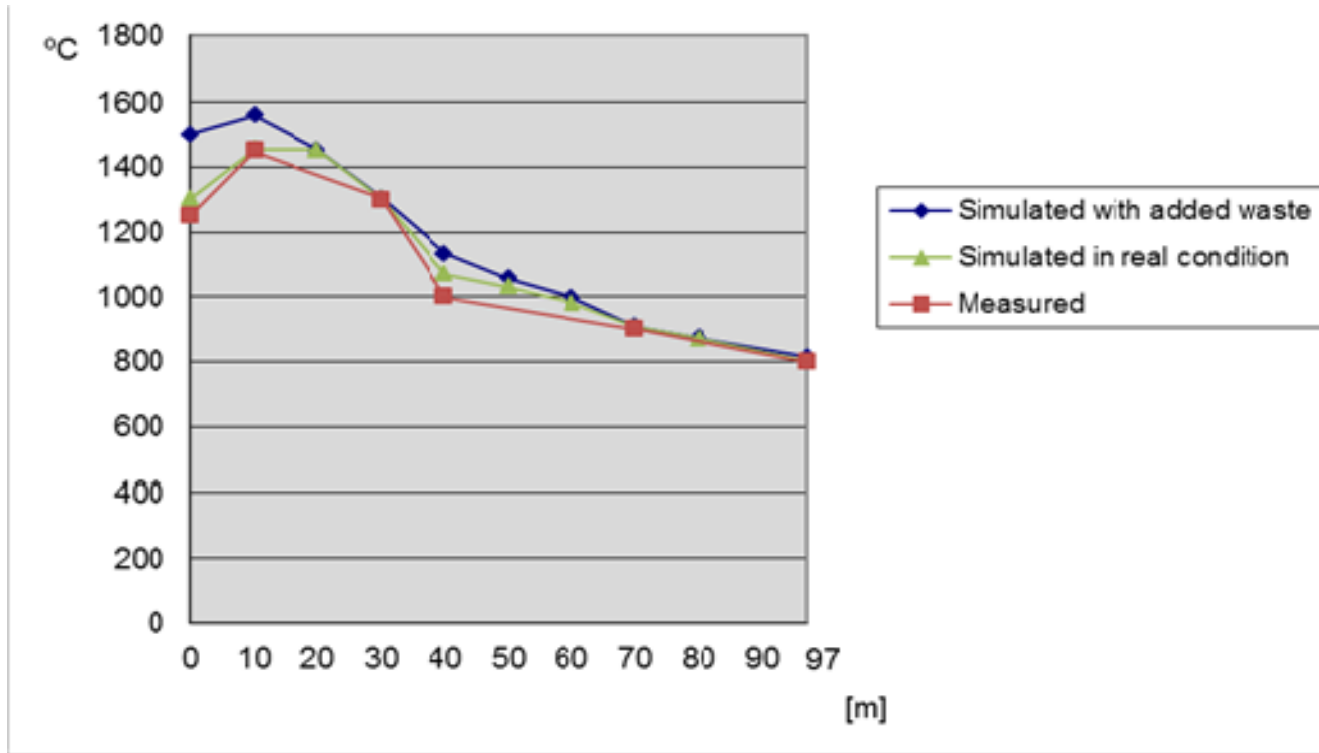
Greenhouse gas simulation – NO_x



Greenhouse gas simulation – CO₂



Results



Kiln Length [m]	Temperature simulated in real conditions [°C]	Temperature Simulated with added waste [°C]	Temperature (measured) [°C]
0	1302	1500.	1250
10	1455	1560	1450
20	1452	1454	
30	1303	1304	1300
40	1070	1133	1000
50	1031	1056	
60	980	997	
70	905	909	900
80	870	873	
97	800	814	800

Increasing the quantities of waste used as alternative fuels+
 Increasing oxygen amount by supplementing excess air =>
 Optimal conditions required for a high-quality clinker product

Conclusions

- The use of waste as alternative fuels, involve some special quality requirements, control and preparation but, following a special recipe, the cement producers can successfully replace the traditional fossil fuels with alternative secondary fuels having multiple benefits
- The research results can be used by the managers of the cement industry in order to extend the quantity and the variety of waste prepared as alternative fuels and, also to optimize waste burning in rotary kilns. The other interest on the research results may be from the part of the environmental authorities in order to include the new approach into the national waste management plan.
- For further research we can vary the percent of wastes in the mixture and analyze what's happen with calorific value of the mixed fuel and the greenhouse gas emissions of the plant.

Thank you for your kind attention!

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