



The GTZ-Holcim strategic alliance on co-processing waste material in cement production

A success story we can build on



EXPERIENCE FROM THE GTZ-HOLCIM

PUBLIC PRIVATE PARTNERSHIP – SETTING THE SCENE

Inadequate solid waste management in developing countries and a shortage of fossil fuel call for new technical solutions and forms of cooperation. This challenging development prompted the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, an international cooperation enterprise for sustainable development with worldwide operations, and Holcim, one of the world's leading producers of cement and aggregates, to explore options for using otherwise worthless, or sometimes problematic waste material as a valuable resource in an energy intensive industry.

1. HOW DEVELOPING COUNTRIES HANDLE WASTE

In developing countries, and especially in emerging economies, waste management is one of society's most significant environmental challenges. Reasons for this are the tremendous volume of domestic and industrial waste produced, persistent contamination of natural resources (due to uncontrolled waste disposal), and an increase in public concern for environmental issues. Lack of financial resources, inappropriate legal frameworks, absence of adequate technical infrastructure and weak enforcement systems are the main reasons why valuable resources are not recovered from waste to a greater extent and why residual waste is not disposed of in an appropriate and environmentally sound manner.



Uncontrolled dumping of waste

This harmful practice causes contamination of soil, water resources and the atmosphere, and consequently deterioration in the living conditions and health of the population. Toxic substances and persistent compounds escape into the environment, spread through the air over large areas, and can enter the food chain, affecting human and animal health.

The difficulties caused by these shortcomings are compounded by the fact that the volume of waste continues to grow. Estimates indicate that worldwide

Factors causing shortcomings in the waste sector include:

- Not all developing countries have an integrated waste management strategy
- Only a few developing countries have the appropriate technical infrastructure for disposing of waste in a controlled and environmentally sound manner.
- Although, in many cases, laws concerning the controlled handling of waste exist, they are often not properly enforced
- Uncontrolled disposal is usually the cheapest, and often, the only way to get rid of the waste. Companies generating industrial and commercial waste tend to be unwilling to pay much for sound disposal
- Policymakers rarely pay enough attention to the subject of waste management, and may know little of the consequences for human health or the high cost of remediating the damage caused by uncontrolled waste disposal.

we currently discard up to 8.5 billion tonnes of domestic and industrial waste each year. Volumes of municipal solid waste are expected to double in the next 25 years despite increased efforts to recycle and reduce it. Although several alternative solutions for waste minimization exist, such as policies to reduce, reuse and recycle (3Rs), more than 80% of what we throw away is currently not used, but is landfilled, dumped or burned illegally.

Kind of waste	Millions of tonnes	ESTIMATES OF WORLDWIDE WASTE QUANTITIES
Collected municipal waste	1400 - 1600	
Non-hazardous industrial waste	1400 - 2200	
Hazardous industrial waste	180 - 220	
Construction & demolition waste and mining waste	3500 - 4500	

Source: Lacoste, Chalmin, From Waste to Resource, 2006 World Waste Survey (figures extrapolated to the year 2008)

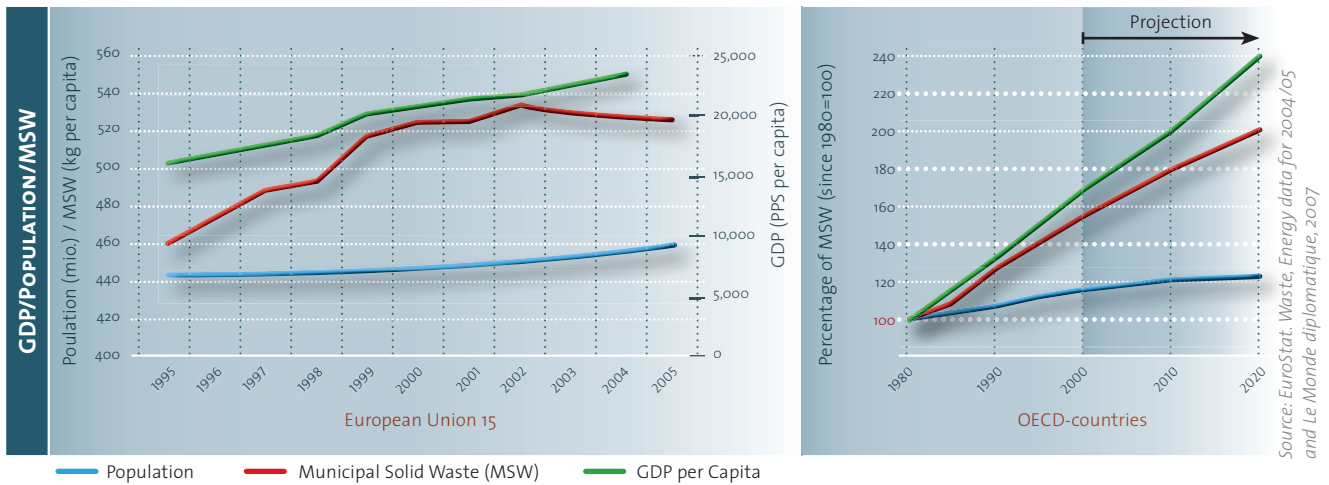


Figure 1: Correlation between GDP, population and generation of municipal solid waste in the European Union and the OECD-countries.

2. ENERGY AND RESOURCE REQUIREMENTS OF THE CEMENT INDUSTRY

The cement industry consumes a significant amount of natural resources and energy. Cement consumption is increasing, especially in emerging countries in Latin America and Asia. Worldwide cement production in 2007 was 2.77 billion tonnes, and will rise to 3.40 billion tonnes in 2015¹. In order to be competitive and to contribute sustainable development, the cement industry continuously works towards improving its environmental performance by optimizing its use of natural resources and reducing its energy consumption. One way of doing this is to gradually replace fossil fuel and primary raw materials with waste-derived materials.



¹ (and Table below) Source: CEMBUREAU: Sustainable Cement Production, 2009 and IEA: Energy Efficiency and CO₂ Emissions from the Global Cement Industry, 2006

KEY FIGURES ON CEMENT	Worldwide cement production, now and in future:	Tonnes per year:
	2007	2.77 billion
	2020	3.80 billion
	2050	5.40 billion
	Average thermal energy consumption for 1 tonne of clinker	3500 MJ = 120 kg coal
	Electrical energy consumption for 1 tonne of cement	190 MJ
Share of energy costs in the total production cost of cement	30 - 40%	
Source of CO ₂ emissions in cement production	60% calcination process, 40% fuel	
Total CO ₂ emitted each year by the cement industry worldwide	Approx. 1.6 billion tonnes per year or 4% of the total CO ₂ emissions	

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PUBLIC PRIVATE PARTNERSHIP – THE OPPORTUNITY

3. COMBINING IMPROVED WASTE MANAGEMENT WITH SUSTAINABLE CEMENT PRODUCTION: AN OPPORTUNITY TO CREATE A WIN-WIN SITUATION

Alternative fuels and raw materials (AFR) from waste material can play an important role in contributing towards reducing fossil fuel use and costs while conserving natural resources, lowering global CO₂ emissions, improving waste management and reducing the need for landfills. The use of AFR in resource and energy intensive industries is called co-processing.

Co-processing is the use of waste as raw materials, or as a source of energy, or both, to replace natural mineral resources and fossil fuels such as coal, petroleum and gas in industrial processes.

A process is classed as co-processing if the waste contains a high calorific value (at least 8 MJ/kg), or a substantial raw material value (at least 50% ash or 80% raw material in ash), or a combination of both. Co-processing fully respects the waste hierarchy and must be seen as an option to lower the industry’s environmental footprint. Although co-processing proved to be successful mainly in the cement industry, it can be

stated that the concept is applicable for any other resource and energy intensive industry.

In a few cases, specific types of hazardous waste, such as PCBs and obsolete or banned pesticides, are co-processed and treated e.g. in cement plants. This is a disposal process that aims to ensure safe, affordable and environmentally sound treatment of highly hazardous wastes.

Since the co-processing approach can only succeed if clear legal provisions are in place and capacity building options for partners are available, Holcim has entered a successful cooperation in the form of a public-private partnership (PPP) with the German-based international cooperation enterprise Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. The Institute of Ecopreneurship at the University of Applied Sciences Northwestern Switzerland (FHNW) is coordinating this cooperation alliance. The PPP, which receives funding from the German Ministry for Economic Cooperation and Development (BMZ), was launched in 2003 and had a time horizon of six years.

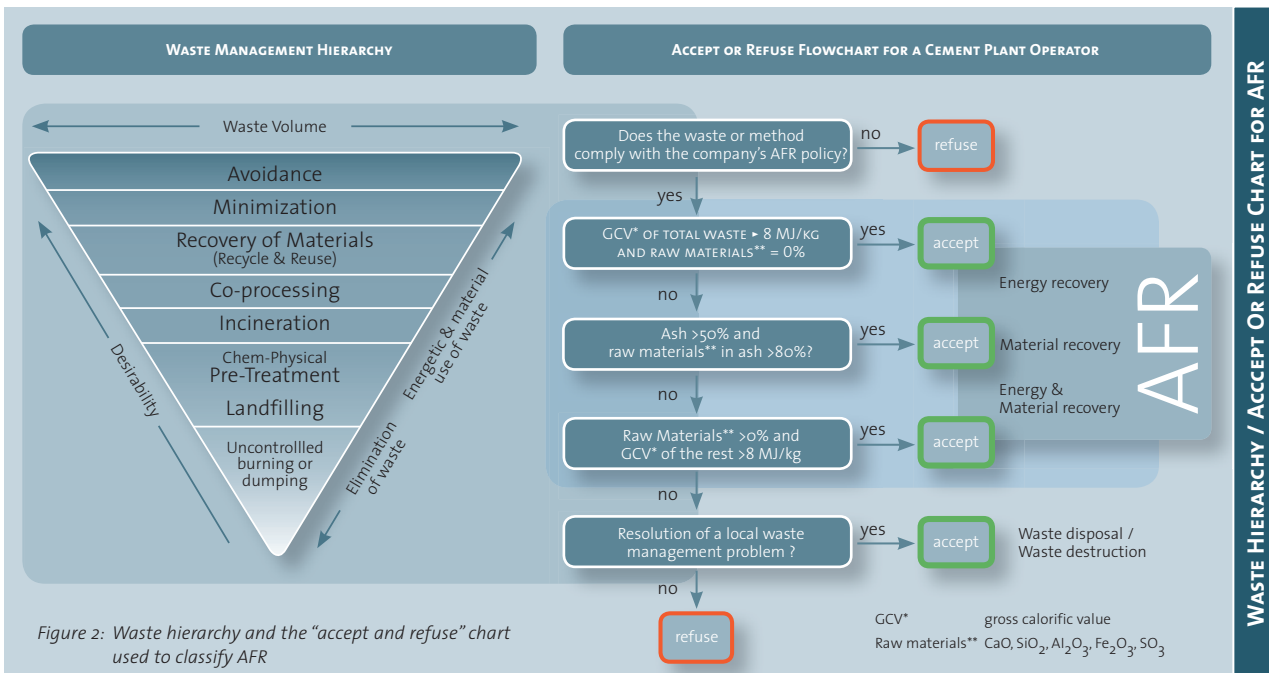


Figure 2: Waste hierarchy and the “accept and refuse” chart used to classify AFR

Source: GTZ-Holcim Guidelines, 2006



Holcim's vision and mission statement

Our vision is to provide foundations for society's future.

Our mission is to be the world's most respected and attractive company in our industry, creating value for all stakeholders.

Placing sustainable development (SD) at the core of our business strategy aims to enhance this value, safeguards our reputation and contributes to continued success.



GTZ's vision and mission statement

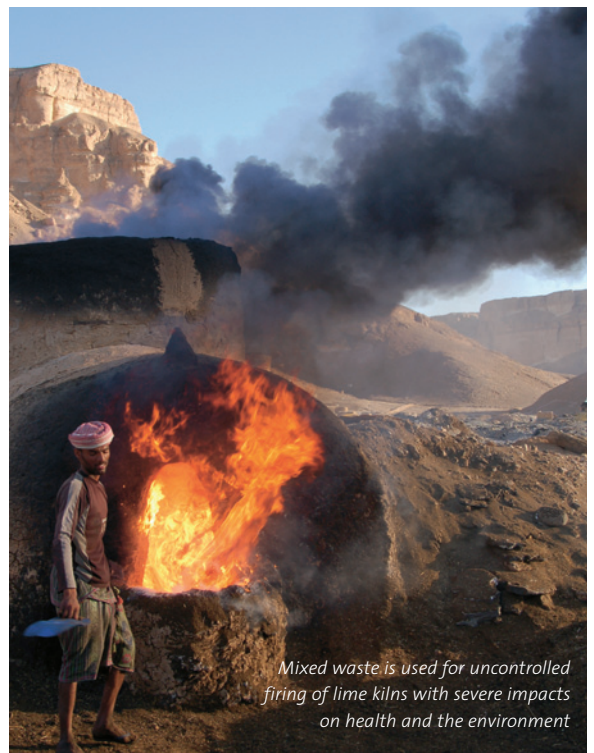
Our vision: "We successfully promote international cooperation which contributes to sustainable development throughout the world. Our company is strengthening its position in the global market for international cooperation services."

Our mission: "We are a government-owned corporation with international operations. We implement commissions for the German federal government and other national and international, public and private-sector clients. We further political, economic, ecological and social development worldwide, and so improve people's living conditions. We provide services that support complex development and reform processes."

Improving waste management and environmentally sound cement production is of interest to both companies and is fully in line with their individual visions.

Despite the general acceptance of co-processing as an integrated part of waste management in Europe and the continuous increase in AFR use in cement plants in industrialized countries, the question as to why co-processing has not been better promoted as an ecologically beneficial form of energy and material recovery in developing countries arises. What basic rules and principles need to be observed to achieve environmentally sound use of AFR in less developed countries? The PPP project intended to offer answers to these questions.

The goal of the PPP was to improve waste management in selected developing countries and to increase resource efficiency through responsible use of waste as fuel and raw materials in the cement industry. The expected impacts are reduced environmental contamination caused by uncontrolled waste disposal as well as partial replacement of fossil fuels and optimization of fossil energy and use of natural resources.



Mixed waste is used for uncontrolled firing of lime kilns with severe impacts on health and the environment

EXPERIENCE FROM THE GTZ-HOLCIM PUBLIC PRIVATE PARTNERSHIP – THE GUIDELINES

The PPP's first milestone achievement was the development of internationally recognized guidelines on co-processing waste materials in cement production and the model application of co-processing in four pilot countries (Chile, Mexico, Morocco, Philippines).

The partnership continued to promote, disseminate and anchor co-processing of waste in cement kilns in developing countries in a participatory way. It aimed to demonstrate that co-processing in this field has an impact on climate change by reducing CO₂ output, to prove its value in better protecting natural resources (soil, water, air) and to document its contribution to improving health by reducing the uncontrolled disposal of waste.

The *figure below* illustrates the environmental advantage of co-processing in the cement industry, taking CO₂ reduction as an example. A significant reduction of greenhouse gases can be achieved if waste is not disposed separately in an incinerator (red column) but co-processed in a cement plant, thus reducing the volume of CO₂ emissions stemming from the use of fossil fuel.

The Guidelines can be downloaded under <http://www.coprocem.com>



Cover of the GTZ-Holcim Guidelines on co-processing waste in cement production.

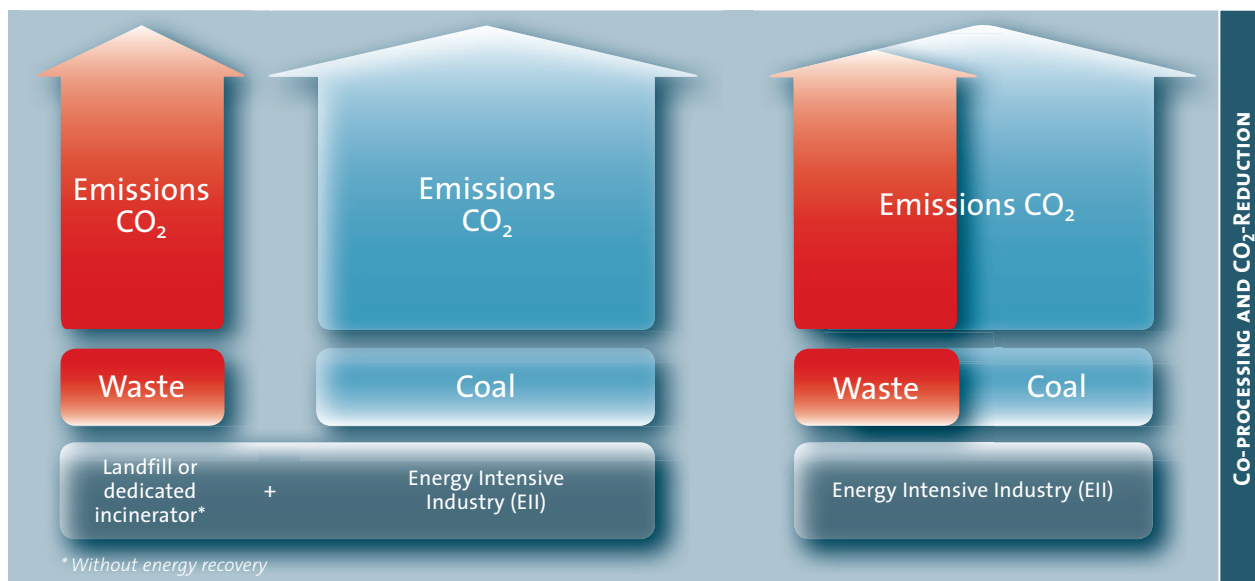


Figure 3: Contribution of co-processing to CO₂ reduction

Source: GTZ-Holcim Guidelines, 2006

Figure 4: Map showing countries where the PPP was active



4. RESULTS ACHIEVED

GTZ and Holcim have worked together for six years to improve waste management in developing and transition countries and have helped to close gaps in legislation in selected countries. Their work paved the way for the transfer of technological expertise and provides an example of how to disseminate innovation. The partnership's achievements since 2003, bringing complementary core competencies to the table, have been far greater than if each partner had worked alone. The main results achieved include:

- Implementation of the Guidelines in more than 20 countries, combined with the provision of training and advisory services to interested parties from the public and private sector (including NGOs)
- Translation of the Guidelines into seven languages
- Ensuring Holcim Group companies co-process waste in compliance with both company policy and GTZ-Holcim Guidelines
- Accreditation of most of the Holcim plants for quality and environmental management systems and implementation of an occupational health and safety system

→ Undertaking trial burns for environmental impact assessments to prove stable product quality and controlled emissions.

The PPP successfully promoted the concept of co-processing in the cement sector. As a result there is now increased awareness in many countries, legal frameworks have improved and finally the volume of waste co-processed in Holcim's cement plants has increased continuously.

Beside these direct results, the PPP has contributed to converting elements of the ambitious UN Millennium Goals into reality by implementing innovative concepts and new forms of cooperation. Cement companies in general - not only Holcim - have improved their efficiency and reduced their ecological footprint. GTZ has enabled partner governments in developing countries to manage waste more effectively and use resources in a sustainable manner.

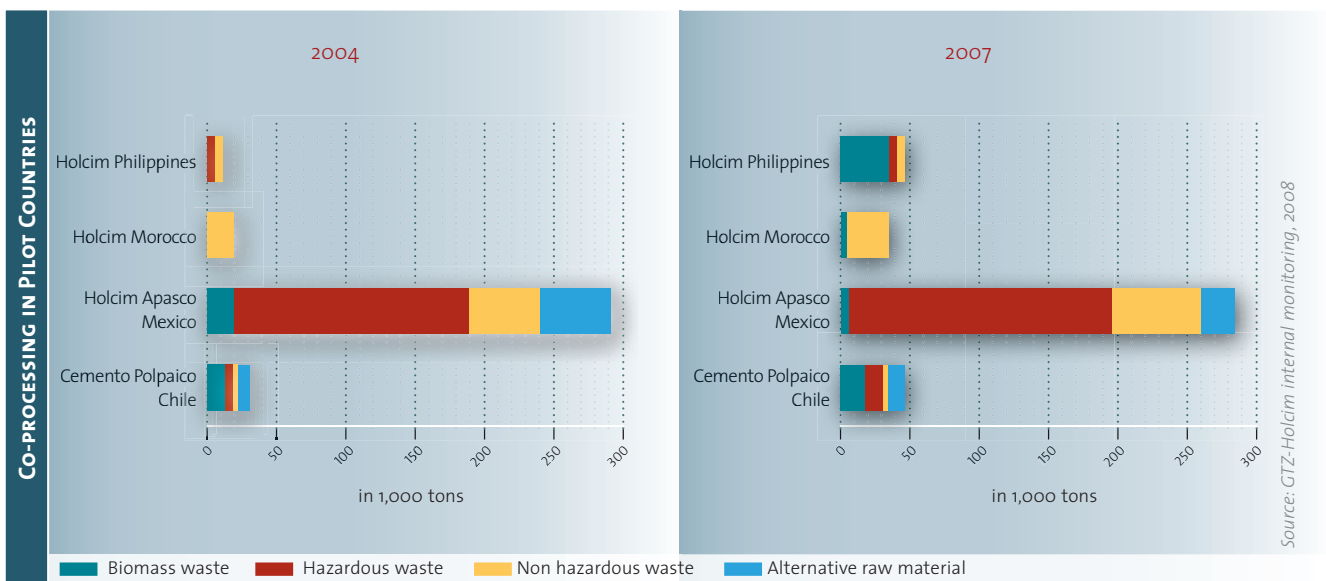


Figure 5: Development of co-processed waste as AFR in the pilot countries

EXPERIENCE FROM THE GTZ-HOLCIM PUBLIC PRIVATE PARTNERSHIP – THE IMPACTS

In addition to these direct results, a considerable number of other impacts can be cited:

- The project made a concrete contribution towards more ecological and economical management of waste materials in the selected countries
- Co-processing waste materials in cement kilns is accepted as an alternative form of waste treatment that sensibly supplements – instead of competing with – the principle of “prevention – recycling – disposal.” Co-processing is an integrated part of local and national waste management concepts and strategies
- Adopting a win-win strategy, the project promoted a dialogue between public authorities and private enterprises, which is essential for successful waste management
- Taking co-processing of waste materials in cement kilns as an example, the project raised awareness and built up technical know-how. This can have

positive developmental impacts across the entire waste management sector

- Dialogue with international and national NGOs, local communities and political decision-makers took place on the basis of recognized scientific criteria, leading to better acceptance and enabling people with divergent positions to engage in a different form of debate
- Pressures on increasingly scarce fossil energy resources are being reduced and countries are able to reduce the levels of foreign currency they spend on costly fossil fuel and raw materials
- The replacement of primary fuels such as coal and oil by high-energy waste materials helps to protect the climate.

The table below shows the impact of co-processing on CO₂ reduction, taking Holcim’s Polpaico plant in Chile as an example:

Pre-processing plant in Santiago, Chile

IMPACT OF CO-PROCESSING ON CO₂ REDUCTION IN A CEMENT PLANT IN CHILE	Cement production 2007	1.42 million tonnes
	AFR substitution	20%
	Energy consumption of the kiln	3653 GJ/t
	CO ₂ -eq reduction compared to waste disposal without gas collection	8.9%



Source: Öko-Institut Freiburg, 2008

5. SPECIAL HIGHLIGHTS

Integration of stakeholder voices

The integration of stakeholder voices is one of the key factors in the success of the GTZ-Holcim PPP. The outreach programme involved communication, consultation and engagement with various bodies. They included national authorities, UN organizations, NGOs (both international and local) and the cement industry itself – all of whom can influence and impact Guideline acceptance and take-up. Stakeholder dialogue is a central tenet of the partnership at both international and local level.

For example, in November 2007 and November 2008, dialogues with NGO representatives were conducted to discuss the challenges and opportunities for waste management. The objectives of the workshops were to explore and define the boundaries and significance of co-processing as part of an integrated waste management concept for developing countries as well as the role of the different actors, including NGOs. The participants also started to develop a decision tree for co-processing.



Participants at two stakeholder events



Awareness building event in Chile

Awareness building and dissemination of results

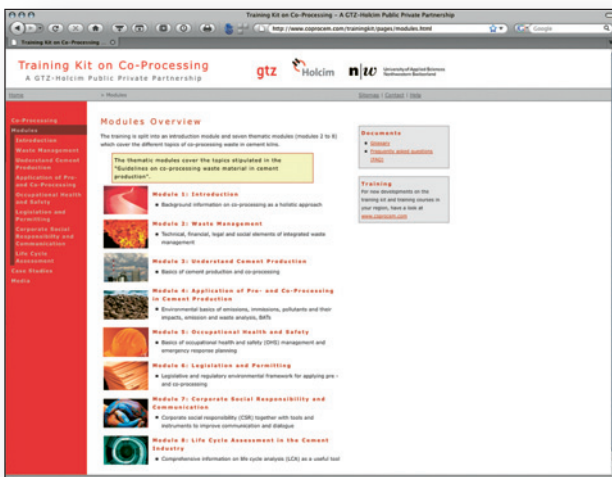
At various events, GTZ and Holcim representatives presented the results and experiences acquired during this cooperation project. A number of articles were published in the press and international journals and a video about co-processing was made and can be used as an introduction and learning tool.

Capacity building

Putting AFR co-processing into practice requires capacity building for the involved stakeholders if the full benefit is to be achieved. Training in the environmental, operational, legal, occupational health and safety, social and communication aspects of co-processing must be provided. A modular training kit aimed at public authorities and NGOs has been designed. It includes slide presentations, textbooks, exercises, case studies and a video. The training targets are based on the requirements for capacity building as stipulated in the Guidelines on Co-processing

of Waste Materials in Cement Production. The modules of this training kit cover the following areas:

- Formulation of waste management policies and interpretation of waste statistics
- Permitting and monitoring co-processing
- Assessment of new materials for co-processing and waste source qualification
- Monitoring operations and transportation (methodologies for emission analysis and evaluation of analytical data)
- Management of occupational health and safety of the workers within the cement plant and during transportation operations
- Enforcement of national regulations and permits
- Systematic communication with stakeholders and the public
- Applying Life Cycle Analysis (LCA) as decision tool.



The entire training kit is available on the *attached CD* and can also be downloaded from www.coprocem.com/trainingkit/pages/home.html.

Selected partners, such as universities and NGOs in different countries, will deliver the training.

EXPERIENCE FROM THE GTZ-HOLCIM

PUBLIC PRIVATE PARTNERSHIP – LESSONS LEARNT

6. LESSONS LEARNT AND CONCLUSIONS

Today's society faces the challenge of balancing environmental protection and economic interests. Co-processing is an ideal example of how to link business activities with providing an environmental protection service. It also demonstrates the commitment of the private sector to its social and environmental responsibility and the attempt of public authorities to ensure impact-oriented cooperation.

It is generally agreed that co-processing of waste in cement kilns can be a valid option for solving waste problems in developing countries, provided basic rules and principles are observed. There is a common understanding that high environmental standards must be set and their enforcement ensured. Special attention must always be given to the following components:

- Changes in or adaptations of laws and regulations so that co-processing acquires legal status and is considered in national waste management plans
- Use of a decision tree for co-processing as an integrated part of a waste management system. This will help to document the path of decisions that lead to co-processing and make them transparent
- Skills and knowledge of personnel and government regulators/inspectors on waste incineration, including toxic/hazardous waste
- Proper enforcement of the legal framework for all waste management activities, combined with monitoring by the authorities and strict enforcement of regulations
- Good knowledge of established disposal paths in order to identify potentially improper disposal at an early stage
- Prevention of rival disposal paths that are less viable both environmentally and economically
- Establishment of local emergency preparedness and response programmes, in addition to any national programmes
- Launching of a “corporate responsibility” approach by the private and public sector alike
- Assuring transparency in information and communication schemes.

Six years after the partnership began, the lessons learnt confirmed that transparency, ethical conduct, good governance, and social responsibility are essential for successful cooperation and sustainable development. Firm partnerships between the public and the private sectors are the key to achieving the maximum benefit from co-processing of waste in cement kilns. There is a clear distribution of tasks and responsibilities. Innovative techniques and technical expertise are available and will be further developed by the private sector, whereas both the private and the public sector should ensure that environmental standards are maintained and health and safety regulations applied and enforced. In this context, the private sector is already one step ahead and there is a strong need to further strengthen the public sector's institutional and Human Resources capacity to ensure it is qualified to fulfil its mandate.

The cooperation between GTZ and Holcim can be regarded as a success, despite the completely different core businesses of the two companies. The common vision of the companies and of individual experts and their desire to contribute to improving waste management in developing countries has been the main driver and motivation for a fruitful collaboration.

Strong partners, shared visions and a clear commitment have proved to be key success factors in the strategic alliance between the private and public sector. Compared to ‘traditional’ development cooperation, a PPP has a more practical approach: resources can be accessed more easily and quickly and may potentially be used in a more sustainable way, as the ‘private’ part of the work continues after the partnership has ended.





7. WHAT NEXT?

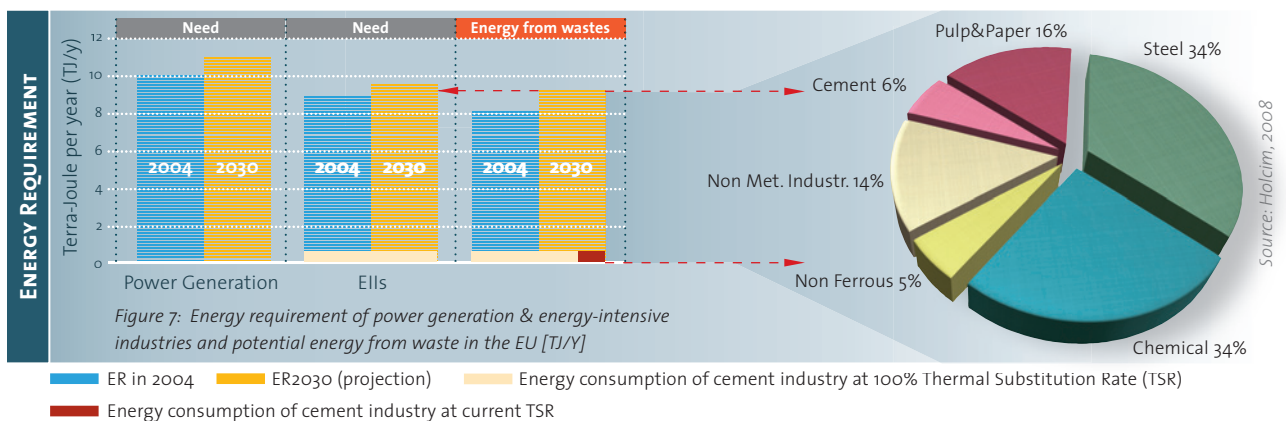
Since the objectives set have been achieved and the government-supported PPP was restricted to a pre-determined time horizon, the corporate partnership between GTZ and Holcim formally ended at the beginning of 2009. However, collaboration between the two parties will continue at a national level to ensure implementation of the Guidelines. Furthermore, at the end of 2008, the Basel Convention initiated a process for the preparation of Technical Guidelines for Co-processing of Hazardous Wastes in Cement Kilns.

These Guidelines will be developed on the basis of experience gained within the GTZ-Holcim PPP and are scheduled to be presented to the Conference of Parties in 2011 as a draft document for consideration. Since co-processing offers significant advantages for many other industrial sectors, it is the intention of all partners involved to promote it beyond the cement industry.

A study conducted by the FHNW in 2008 reveals that the expected energy content in disposed waste within EU-25 could almost satisfy the energy requirements of the entire industry in Europe by the year 2030. This means that co-processing of waste is an enormous opportunity for many industrial sectors to contribute to the preservation of natural resources.

In addition to the above mentioned activities, GTZ and Holcim already explored opportunities for future cooperation. New strategic alliances have been identified and will be proposed for the area of climate change and resource management as well as biodiversity.

“Now this is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning.”
Sir Winston Churchill



GTZ, Holcim and FHNW would like to express their sincere gratitude to all experts and institutions who accompanied the PPP in the past six years and contributed in making this partnership a success either as co-authors, as reviewers or by providing other valuable inputs. Our thanks also go to BMZ for financing the public part of the project.

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