Turkey's environmental star

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Norman Greig is managing director of CCS Associates Limited and has worked since 1988 as a Quality, Environmental, SPC and IMS Consultant to Akçansa Cimento, Turkey. In this article, he details some of the environmental initiatives and plant improvements that have been carried out at the second largest cement producer in Turkey.

Akçansa Cimento Saayi ve Ticaret Anonim Sirketi was established after the merger of Akçimento and Çanakkle Çimento

Akçansa Cimento operates two cement plants with a total capacity of 5Mt, one slag cement grinding plant and three terminals together with 25 ready-mixed concrete plants and several quarries in Turkey. The main shareholders are HeidelbergCement, the renowned international cement manufacturer and Sabanci Holdings, one of the largest privately owned companies in Turkey with numerous global partnerships.

Akçansa is a leading company in this sector. Akçansa Cement has realised 12 per cent of clinker and 10 per cent of cement production and eight per cent of domestic sales of Turkey and 19 per cent of export from Turkey in 2003.

Akçansa Cimento has implemented many management initiatives which have achieved significant benefits and savings. We will review some of the key improvements, costs, ROI and benefits together with the Entropy System used for Integrated Management of Environment, Quality, OHSAS and Key Performance Indicators (KPI).

Management vision

Leadership and initiatives

In addition to the cycle of 'Plan, Do, Check, Act,' given in management models such as 'ISO14001ref 2 and ISO9001ref 3' and OHSAS '18001ref 4' there are two other essential prerequisites for managing improvements and achieving excellence. There must be both vision and leadership.

- vision – mission statement – policy
- leadership – benchmarks, objectives, targets, resources
- plan – action plans and Procedures
- do – implement and operate
- check – measure, monitor, evaluate performance
- act – review, take corrective/ improvement actions.

The management of Akçansa Cimento has continually pursued objectives of achieving excellence and efficiency. In 2002, they embarked on a major project to implement Integrated Management Systems (IMS) and achieve third party certification in quality, environment and health and safety. Intrinsic parts of this process were to set objectives and targets, to plan and monitor continual improvements and to manage risks. Akçansa's aspirations are very much in line with the Cement Sustainability Initiative (CSI) as shown in the sustainability compass ref 1.

CSI adopted by Akçansa

Do more with less

Go from a traditional, resource-intensive, and profit-maximising business model to a more eco-efficient, socially responsible, and value-maximising model.

Increase enterprise value

Enterprise Value Added (EVA), also known as Shareholder Value Added (SVA). Akçansa has followed SD initiatives which contribute to EVA. It has implemented many of the CSI to contribute to EVA or SVA.

- cost reductions due to increased operational efficiency and effectiveness
- reduction in capital employed due to process simplification and improved utilisation
- reduction in risk weighting due to improved management practices and reduced liability.

Benchmarking

Management vision, leadership and initiatives at Akçansa have achieved many significant process, quality and environmental improvements, some of which represent Best Available Techniques (BAT). In fact one of the first steps in the Project was to make an analysis of cement industry BAT in Europe (EBAT) and BAT in Turkey (TBAT), taking account of local legislation and conditions. Assessment of both plants against these criteria showed compliance of 90 per cent against EBAT – 100 per cent against TBAT.

Table 1: operational improvements

Years	*Process area*	*Operational Improvements*	*Actual cost ($)*	*Annual payback ($)*
2000				
Raw feed	Pyrite ash	feeding system and hopper	44,722	286,500 (lump)
	Clinker feed	Clinker cross feeding for G3-G4 cement mills	156,200	93,960
2001				
Clinker		Purification energy measurement system	78,600	1,283,789 (lump)
Raw meal	Raw Millsseparator upgrade	314090	400,000	
2002				
Cooler		Hot water and steam production from cooler EP exhaust gas	296,963	173,000
Cement mills		Electrical heating of cement mill fuel oil	11493	57,595
Kiln		High pressure primary fan for burner pipe	6000	366,000
2003				
Support services		Heating of building by hot water recuperator	17,500	8,000
Kiln		Replacement of kiln ID fans with high efficiency ones	130,000	80,000
Coal mills		F405 coal mill filter upgrade	107,000	83,000
2004				
Kiln		Replacement of kiln ID fans with high efficiency D120	150,000	100,000
Coal mills		F405 coal mill modification separator	203,000	95,000
Raw feed		Online analyser project	573,000	323,000
Cooler		Cooler modification	282,000	354,000

Table 2: environmental improvements

Years	*Environmental improvements*	*Actual cost US$*
2001	Kiln modernisation of kiln EP	209,539
	Terminals bag filter for cement silo in Yalova Terminal	13,600
2002	Transport bag filter for clinker transport system	43,935
	IMS Systems ISO 14001 and IMS system implementation	75,579
2003	Kiln NO+CO+O_2 analysers	50,200

Summary of key improvements, cost savings

There are three main classes of improvement projects: operational (OIP), environmental (EIP) and Continuous Improvement Projects (CIP) as well as replacement projects.

- CIP are typically small amendments and costs with big returns.
- EIP do not require financial return on investment although in many cases the cost and energy savings are significant.
- OIP often also have environmental benefits.

Some of the key projects at the Canakkale plant are summarised below and selections are reviewed later.

Improvements: selected case studies

The following are reviewed here:

- new coal dosing and burner systems
- heat recuperation projects
- online analyser project
- clinker cooler improvements
- upgrade of raw mills
- personnel training, awareness and involvement

Integrated management system for environment, quality, OHSAS and KPI. Certification by BSI/TSE for Product certification, quality, environment, OHSAS.

Online analyser project

At the Büyükçekmece plant the complexity of the existing raw material handling operation (deviations in the kiln feed LSF (of up to 15) required a new raw material concept. Chemical analyses show that the plant cannot handle the material with conventional control loops. Hence the solution was a PGNA Analyser and better raw mill weigh feeder control system to improve raw meal and kiln feed stability.

Before the project:

Büyükçekmece cement plant has a circular blending bed with a capacity of 38,000t used to store limestone from crusher No4 and schist, plus iron ore from crusher No3. Two components were mixed at a constant mass flow in the circular blending bed for a target lime saturation factor and aluminum modulus. This material was then fed to four different raw mills where silica modulus and lime saturation factor are finally corrected by sand and

limestone. The settings of weigh feeders, ie mix, correction limestone and sand are adjusted according to analysis per two hours on samples taken after the raw mill.

The following were the characteristic problems before the project:

- high variation in chemical composition of the preblending mix
- high variation in corrective materials mass flows in the raw mills
- high variations in raw meal and kiln feed chemistry
- long delay time up to 3-4 days to correct TM if needed
- unstable kiln operation
- no additional iron ore for TM correction before the mills.

Table 3: continuous improvement projects

Years		*Continuous improvement projects*	*Actual cost US$*	*Payback US$ year*
2001	Raw mills	Raw mill reject system	3400	57,625 (lump)
2002	Kiln	Modification of burner pipe radial canal		
	Preblending	Preblending new pile method and modernisation of raw material proportioning system	46,307	312,000
		(above resulted in 52,000tpa clinker production increase)		
2003	Raw mills	Modification of raw mill pneumatic pipe line	4948	95,232
2003	Preblending	Day by-pass feeding system after crusher	3247	107,000
2004	Kiln feed	Feeding raw material to kiln	2145	7000

The project was implemented in stages

Stage 1:

PGNA analyser is installed before the circular blending bed. The two components namely limestone and shist, plus iron ore will be stacked for a given lime saturation factor. The control software will regulate the mass flows with respect to the target in lime saturation factor. Actual cost of the first stage: US$510,000.

The results proved that such configuration was not sufficient to stabilise the kiln feed chemistry. Lime saturation factor was stabilised however, silica modulus could not have been stabilised causing subsequent fluctuations in the raw mills. Therefore, second phase of the project was started.


Ambarli Port

Stage 2:

The hoppers for sand and iron ore will be installed before the circular bed for silica correction and iron correction. In this case, four components will be stacked in the circular bed for two target parameters namely; lime saturation factor and silica modulus, aluminum modulus.

Iron hopper for raw mill No1 and No2 will be installed. Actual cost of the second step: US$503,250.

By now, the sand hopper is installed. US$256,100 has been spent for the sand hopper and necessary space for iron hopper is left next to the sand hopper for possible future need. Plant decision is to observe the situation without the iron hopper to avoid high cost investment.

After the installation of the sand hopper in stage two, the kiln feed chemistry is stabilised to a great extent and the quality of the clinker is increased.

PGNA analyser was purchased from ASYS and the software on the control system was supplied by FLS Automation.

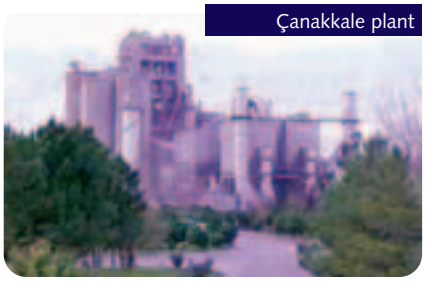

Çanakkale plant

Table 4: phase one: this roller mill had been installed for grinding additive, but it was mostly using for raw meal grinding

	2000	*2001 Phase 1*	*2002 Phase 1*	*2003 Phase2*
Specific heat usage kcal/kg	80	39	37.7	19
Specific heat usage saving kcal/kg		41	42.3	18.7
Production (t)		743,168	815,637	731,995
Heat saving kcal:		30,469,888,000	34,501,445,000	13,688,306,000
Natural gas price : US$/1000 kcal		0.018	0.018	0.018
Saving:		US$548,457	US$621,026	US$246,390

Table footnote:
The objective of this project was to improve dedusting of exhaust gas so that this gas could be used for drying in the mill. Hot gas was used in the mill from its hot gas generator by burning natural gas. Kiln-1's clinker cooler was in poor condition and inefficient. Necessary dedusting system and connection duct were installed.

Quality and environmental benefits

• clinker variation reduced: standard deviation of lime saturation factor in the kiln feed reduced from 4.4 to 2.5
• clinker quality improved: Lime saturation factor was increased from 93.2 to 94.5
• instability of the correlation factor (the difference between lime saturation factor of clinker and kiln feed) was reduced from 4.2 to 1.6
• less deviation in mass flows of the correctives in the raw mills
• amount of additives to improve the cement early strength was reduced to almost zero
• refractory consumption was reduced from 0.93kg/t to 0.57kg/t clinker

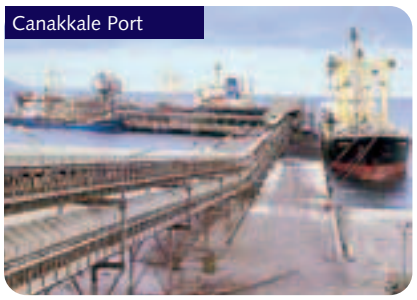
Operational and environmental benefits

• reduced clinker usage in the composite cement
• less quality improver, chemical additives in the final product
• less cement grinding power due to increased quality in clinker mineralogy and less heat consumption due to the stabilised kiln feed chemistry
• cost benefits are calculated as US$500,000.

Clinker cooler improvements

The Büyükçekmece project was in two phases:
Phase 1: waste gas connection to additive mill (investment cost US$350,790).
Phase 2: clinker cooler modification and addition of cooling chamber (Investment Cost: US$40,000).

Canakkale Port



Phase 2: a part of the clinker cooler improvement of Kiln No1 was to reduce the temperature of clinker outlet. To achieve this the last cooling chamber was divided in two parts and an additional fan was connected and some new plates were installed. By doing this modification, clinker outlet temperature was reduced and some mechanical problems were eliminated. But the most important benefits came form the additive mill hot gas usage. This is because of increased amount and temperature of cooler waste gas and increased usage in the additive mill. Usage of natural gas was reduced and optimised.

Summary of benefits
Natural gas usage and cost reduced significantly
• total ROI in 2001-03 = US$1,415,873 compared to cost of US$400,000. Annual savings thereafter estimated at US$800,000 compared to 2000 gas costs
• preservation of natural resources
• CO emissions reduced.

Waste reduction and waste management

In accordance with company policy and the ISO 14001 Environmental system, the objective is to reduce the amount of waste material and to manage its distribution. The steps are shown below.
1. Set objectives and targets and make action plans:
No, objective, target, source*, action, ref no*, responsible department, completion date.

Example of action plan
Reduction of waste and better use of resources. Decrease the garbage which is given to municipality by 10 per cent in 2004 against 2003.

2. Implement recycling collecting points around the site. Collecting places were constructed for every material that can be used for recycling. These materials can easily be used again and will result in an cost and environmental benefits for the plant. Collection points were also made for hazardous wastes.

Betonsa is the brand name for Akçansa's ready-mix concrete

3. Define operating procedures
4. Train the personnel what to do, how and why?
5. Minimise the loss of raw material and transportation costs. Segregate the raw meal, clinker dust and coal dust from each other and recycle them back into the system. (Previously raw material dusts were carried within the wastes so that the transportation costs were extremely high).
6. Manage hazardous wastes: waste oil, batteries, oil filters, fluorescents, X-ray tubes, cartridges and toners, clinical wastes, car batteries, tyres, plastics, solvents.

Many of the wastes are sold for recycling, eg scrap metal and scrap paper. Paper, textiles and suitable non-hazardous wastes are burned in the kiln. In the past waste oil was sold to authorised companies for recycling. Now waste oil and tyres are stockpiled pending permits for burning in the kiln. A licensed hazardous waste contractor (IZAYDAS) takes the other hazardous materials.
7. Akansa continues to monitor the results and seek further improvements.

New Coriolis coal dosing system and burner pipes

The Büyükçekmece project had two phases:
• new coal dosing system (investment US$2.5m)

Table 5: summary of persons trained in awareness of the integrated systems

	Blue collar	*White collar*	*Total*
QMS	133	49	182
EMS	709	290	999
OHSAS	478	241	719
Total	1320	580	1900


Akçansa has won an award for its 'Superior Achievements in Exports'

• change the burners to obtain better burning conditions (investment US$0.4m)
• total investment US$2.9m.

In May 2002, the project began to change the coal dosing system of kilns from Schenck's Simplex system into Coriolis system – starting with Kiln No3.

Energy reduction after Project completion

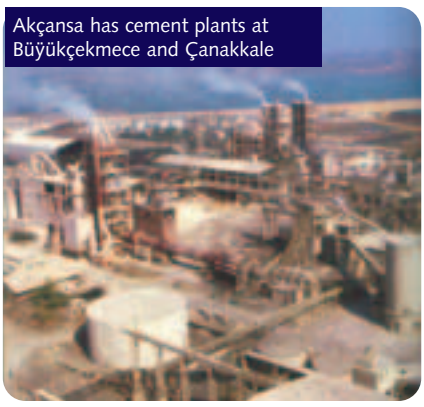
Reduction in CO

Reduction in EP CO trips after project
Key benefits:
• specific heat consumption reduced by about 10 per cent
• stable coal feed obtained
• CO level much reduced (0.4 per cent down to 0.1 per cent
• petcoke usage increased to 100 per cent (30 per cent in kiln No 3)
• electrostatic precipitator (ESP) CO trips decreased by 900 per cent (23 per month compared with 343 per month before the new system)
• increase in kiln capacity by 4.5 per cent.

Heat recuperation projects

The main objective of these projects was to maintain the hot water and building heating needs by means of cooler exhaust hot gas instead of burning coal or fuel oil.

The project at Canakkale factory takes the excess heat from the clinker coolers and feeds it over all the factory and also to the surrounding residential accommodation some 2km away via insulated pipes. The boiler houses are not needed except during kiln shutdown.


Akçansa has cement plants at Büyükçekmece and Çanakkale

Economic, environmental and social benefits

• reduction in fuel oil (1150t) and energy use
• less emissions and pollution
• less use of materials
• social responsibility, good relations with the neighbourhood who get free heating
• hot water and steam production from cooler EP exhaust cost US$296,963, savings US$173,000/year
• internal rate of return after taxes: 72 per cent.

Personnel training awareness and involvement

A vital part of the improvement process is training and competence of all personnel and participants. Akçansa embarked on an ambitious training and awareness programme covering all of the systems together with operational procedures and working methods. This included training in emergencies and waste management.


Bagged product from Akçansa

As an auditor of the systems, from start to finish, I found great satisfaction in the extent to which all of the personnel and sub-contractors really got on board and took ownership.

Entropy integrated management system

The environmental, quality and safety systems have been integrated into one system and is managed through the Entropy Integrated Management Solution software. This provides a common toolset based on the proven cycle of plan–do–check– act for continuous improvement, to manage, maintain and utilise organisation data effectively and efficiently for.

• EMS Environmental Management – ISO 14001
• H&S Health and Safety Management – OHSAS 18001
• QMS Quality Management – ISO 9001
• KPI Key performance Indicators
• CSR Corporate Social Responsibility, Social Accountability – SA 8000.

Each site is set up as a process and then sub-process and operations are attached. Environmental aspects, Health and Safety risks and quality risks are attached to the parts of the process together with the personnel and roles.

Entropy also helps manage and monitor the effect on sustainability and business efficiency (KPI, corporate governance, social accountability, corporate reporting).

Risk management forms the foundation of the Entropy system. Having set corporate aims, objectives and targets, users at all levels are able to monitor, quantify and measure performance to assist in top-level strategic planning, budgeting and decision-making for day-to-day management, scenario analysis and performance improvement.

Monitoring of key performance indicators such as:
• critical operational performance indicators
• overdue action items
• alerts, exceptions and overages.

The system manages document control, training records, objectives, action plans, audits and review amongst many others.

Summary

Some examples of how to turn problems into benefits have been shown. This can only be achieved efficiently with teamwork, leadership, planning and monitoring of performance. It seems that Akçansa Cimento has had some success and it is certain that the company will continue to seek more improvements and pursue excellence in order to add further to the value of the enterprise.

References:

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ISO9001 – Quality Management System requirements
ISO14001 – Environmental Management System Requirements
OHSAS 18001 – Occupational Health and Safety Management System
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