



**OVERVIEW OF THE TURKISH CEMENT SECTOR  
With Special Emphasis On  
SUSTAINABILITY, ENERGY AND ENVIRONMENT**

**ALF-CEMIND**

**OVERVIEW OF THE TURKISH CEMENT SECTOR  
With Special Emphasis On  
SUSTAINABILITY, ENERGY AND ENVIRONMENT**



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## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

In Turkish cement sector, there are 41 integrated and 19 grinding plants one of which belongs to public sector. Many plants, approximately 30%, are owned by international conglomerates. This sector includes 18 companies in "Top 500" and 25 companies in "Top 1000" largest companies of Turkey.

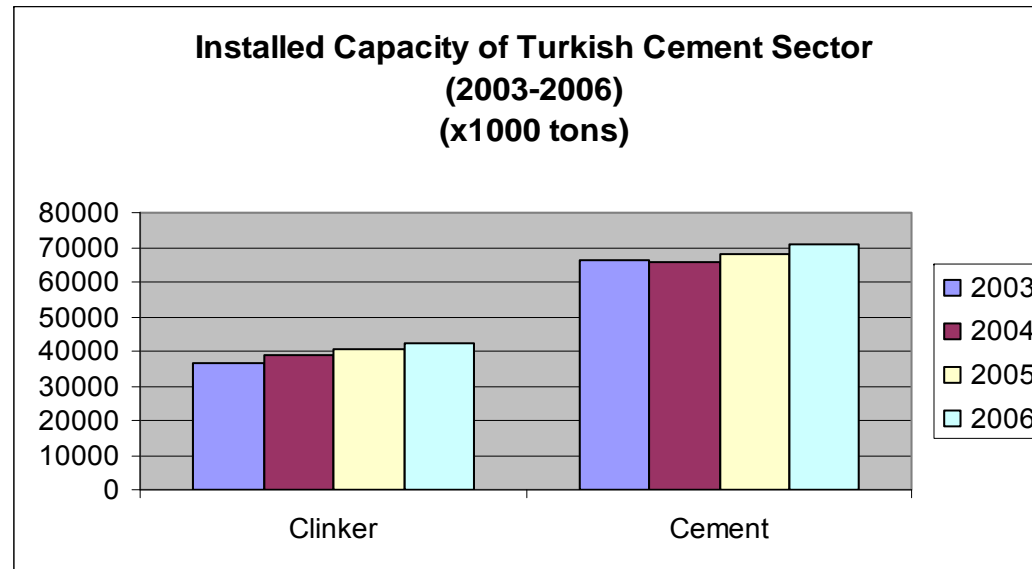
The distribution of the plants by regions

Regions	Integrated	Only Grinding
Marmara	8	3
Aegean	4	3
Mediterranean	4	3
Black Sea	6	4
Central Anatolia	9	6
Eastern Anatolia	4	-
South Eastern Anatolia	6	-
<b>TOTAL</b>	<b>41</b>	<b>19</b>





# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT





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## OVERVIEW OF THE TURKISH CEMENT SECTOR

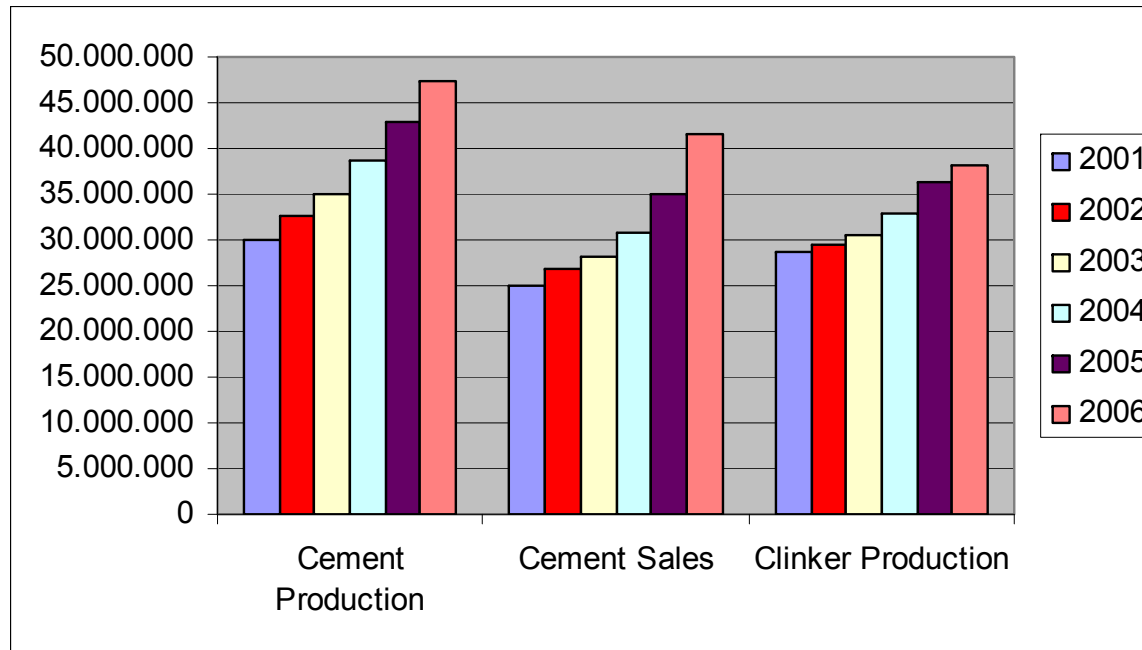
	Installed Capacity		Capacity Utilization	
	Clinker	Cement	Clinker	Cement
<b>Marmara</b>	12112183	19277628	96	72
<b>Aegean</b>	5943144	8088660	92	75
<b>Mediterranean</b>	7831000	12929747	76	52
<b>Black Sea</b>	4631800	8573160	92	67
<b>Central Anatolia</b>	6489667	12233038	93	68
<b>Eastern Anatolia</b>	1641500	2782840	97	74
<b>South Eastern Anatolia</b>	3908900	6768143	83	70
<b>TOTAL</b>	<b>42558194</b>	<b>70653216</b>	<b>90</b>	<b>67</b>





# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

## Cement Production and Sales 2001 – 2006

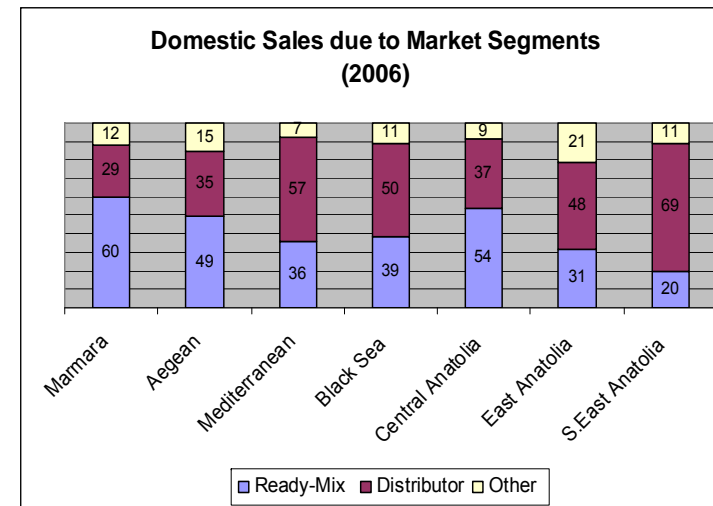




# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

## Distribution of Domestic Sales by the End Users, 2006

End Users	Tons	%
Ready-Mix Concrete	19548469	46.98
Construction Firms	599963	1.44
Contractor	1770936	4.26
Pre-cast Concrete	1730967	4.16
Distributor	17352246	41.70
Public	163758	0.39
Other	443245	1.07
<b>TOTAL</b>	<b>41609584</b>	





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Type	2004	2005	2006
<b>CEM I</b>	<b>41.35</b>	<b>45.46</b>	<b>43.09</b>
<b>CEM II</b>	39.12	32.22	36.43
<b>CEM III</b>	1.29	1.75	1.69
<b>CEM IV</b>	9.70	11.36	9.89
<b>CEM V</b>	6.30	7.47	7.34
<b>Others</b>	2.24	1.74	1.56

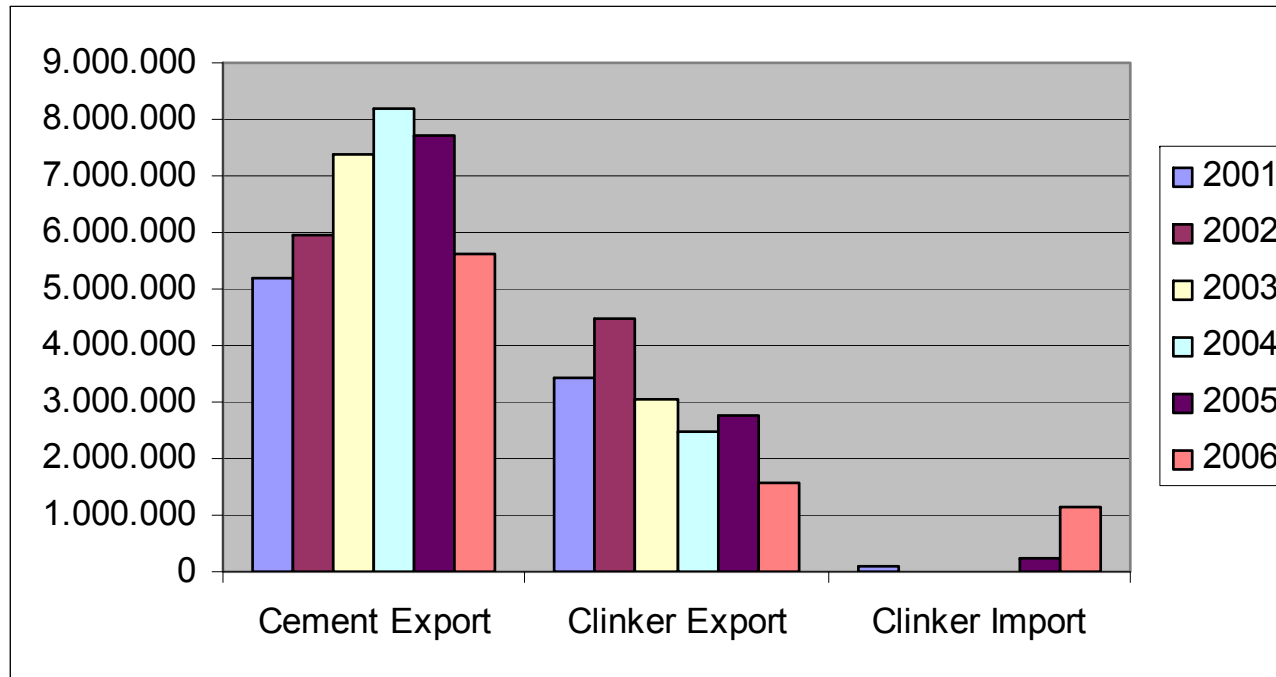
Distribution of Domestic Sales by Cement Type, 2006





# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

Export and Import Figures for  
Cement and Clinker, 2001 – 2006







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## Cement Exports by Countries, 2006

COUNTRIES	Tons	COUNTRIES	Tons
Iraq	1905178	Libya	3200
Italy	772648	Algeria	2927
U.S.A.	479910	Georgia	2209
Syria	437383	Romania	2048
Spain	366324	Jordan	1074
Portugal	333140	Finland	750
Israel	292722	Uzbekistan	404
Northern Cyprus	254136	Estonia	314
Albania	218095	Kazakhstan	204
France	209421	Cameroon	140
Azerbaijan	75821	Greece	110
Iran	49227	Lithuania	102
Germany	47350	Lebanon	50
Russia	39320	Sierra-Leone	27
Nigeria	38037	Mauritania	27
Ukraine	20492	<b>Free Trade Zones</b>	
England	18445	Mersin Free Trade Zone	31561
Morocco	15283	Istanbul Free Trade Zone	983
Ireland	5530	Bursa Free Trade Zone	120
South Africa	5331	Aegean Free Trade Zone	10
Belgium	4839	<b>TOTAL</b>	<b>56383</b>
Denmark	3459		<b>51</b>





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

The level of technologies employed for cement production in Turkey is in par with those employed in the EU countries. Continuous modernization of cement production methods across the country has been receiving the highest priority in the sectoral investments. The success achieved in adapting new technologies to the sector as a whole shows that the sector, although it is composed of 60 separate industrial entities, shows the determination to act as one single body in the application of new technologies, energy consumption related matters and environmental concerns.

Most cement plants are undersized in terms of operating capacities to provide optimum and efficient cement production. Those plants with optimum capacities and efficient productions are located in the coastal regions of the Mediterranean, Aegean and Marmara regions. Nevertheless, most of the cement plants already have efficiency improving systems such as pre-calcination, coal mills and coal and raw material homogenization systems. In addition, process automation investment is continuing at a very high pace.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

The measures for environment protection have been receiving ever increasing share of the total investments within the sector. Increasing environmental awareness have prompted the sector to place the outmost care for the environment and make investments for the technology improvements, pollution control and measurement methods and instrumentation; including installation of electro-filters, bag filters, dust transportation systems, cooling towers, closed storage alleys, continuous dust measuring devices, road vacuum systems and various surrounding designs.

Such a responsible and collective behaviour have successfully turned Turkey into a country who can build turnkey cement plants not only for her, but who can export the technology to other countries.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

Because there is a sizeable production capacity within the country, the need to discipline the market has been long realized. Turkish Standards Institute have prepared and put into force quite a number of standards at a national level, most of which are mandatory . As can be seen from the appendix, there are **90** standards most which are in conformance with the EN and ISO standards. **12** standards are also put in force with the relevant EU directive which is also shown. In addition to the standards given in the appendix, approximately **78** old standards have been taken out of the force or replaced by newer versions. However they are still in use due to validity of the periods described previously.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

Cement production related topics are widely covered in engineering and vocational education programs in Turkey which further enhances the technological capability of the country. Next table summarizes the educational program that are available in Turkey

There is a Cement Research Institute in Ankara formed by TCMA, Cement Laboratories of the Turkish Standards Institute (TSE) and at building related research centres of the Turkish Scientific and Industrial Research Organization (TUBITAK) on cement production and raw materials.

It would not be wrong to say that over 25.000 engineers have taken at least a course in the field of cement production within the last ten years. There are approximately 1000 engineers who are currently pursuing graduate level degrees on cement production technologies, materials and various applications.





# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

## Cement Technologies Coverage in Various Educational Levels in Turkey

DEPARTMENT NAME	LEVEL	NUMBER OF UNIVERSITIES	YEARLY STUDENT ENTRIES
CIVIL ENGINEERING DEPARTMENT	BS	40	1800
CIVIL ENGINEERING DEPARTMENT	GRADUATE	26	500
MATERIAL SCIENCE DEPARTMENT	BS	15	600
MATERIAL SCIENCE DEPARTMENT	GRADUATE	7	200
DEPARTMENT OF BUILDING CONSTRUCTION EDUCATION	UNDERGRADUATE	7	300
DEPARTMENT OF BUILDING CONSTRUCTION EDUCATION	GRADUATE	1	20
<b>VOCATIONAL PROGRAMS</b>	<b>LEVEL</b>	<b>NUMBER OF VOCATIONAL SCHOOLS</b>	<b>YEARLY STUDENT ENTRIES</b>
BUILDING CONSTRUCTION	2 YEAR EDUCATION	73	3000





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

In order to address common problems of the sector in the fields of R&D, energy and environment related matters, testing and other technical problems; Turkish Cement Manufacturers' Association (TCMA) was founded in 1957 by the representatives of the industries manufacturing cement and other hydraulic binders.

In 1978, laboratories were established under a UNIDO project with the purpose of making them a "Centre of Excellence" in the region for testing and research on cement and similar materials.

The laboratories received a boost in 1995 with the formation of the "Cement and Concrete Research and Development Institute" within the Association. New equipments, mainly for testing concrete and studying internal structure were added to the existing facilities.

During the past 25 years, R&D institute staff and the laboratories have extended valuable services to the producers and users of cement and concrete such as routine testing, quality control, research and consulting, earning a reputation for high quality and unbiased work.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

The cement sector has been the leading sector paying attention not only to capacity increase but to a sustainable and clean growth of the sector within the country. Initial steps for this leadership can be seen from the **"The Declaration of the Cement Sector and the Environment"** enacted between the Turkish Cement Manufacturers Association and the Ministry of Environment and Forestry in 1993. With this declaration the cement manufacturers have voluntarily accepted to abide with the emission guidelines. To further emphasise the significance that TCMA is placing on the environmental issues, the Council for Quality and Environment (CQE) was founded within TCMA to cope with the environment related problems and needs of the Sector in 1996.

CQE is composed from the representatives of the 3 Ministries; TUBITAK, Turkish Cement Manufacturers Association, Turkish Ready Mixed Concrete Association, Turkish Pre-cast Concrete Association, Turkish Contractors Union, Union of Chambers of Turkish Engineers and Architects and Universities.







## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

**CQE acts as an independent and impartial body, promotes environmental awareness studies within the sector, encourages compliance to the national and international standards and provides testing services including performing environmental measurements by means of a customer oriented testing laboratories for the Sector.**

**Environmental measurement services are performed by technical staff experienced in his area, and with its modern and mobile environmental measurement laboratories which was accredited by the Turkish Accreditation Agency (TURKAK).**

**The measurements are carried out in the laboratories certified with TS EN ISO 9001:2000 and TS EN ISO 14001. System Certifications and reports are approved by the Ministry of Environment and Forestry. (Numbered 06-195.)**





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

To further emphasize the importance that the cement sector is placing on the environmental issues; the Ministry of Environment and Forestry and TCMA have signed “2nd Cement Sector Joint Declaration” on 24th of June 2004. Basically the sector accepts to even lower emission levels than required by existing National Standards. Major issues covered by this declaration are summarized below:

1. SO<sub>2</sub> emissions from the cement plants will under no circumstances exceed 300 mg/Nm<sup>3</sup> on dried bases. Emissions will be continuously recorded by proper instrumentation.

2. Provided that the sulphur can be held in the Rolling mills, kilns and evaporative coolers with no harm to cement quality, then fuels with high sulphur content will be permitted. Those petro-coke fuels with up to 5 % sulphur, specifically imported for the cement sector, and no. 6 fuel oil may be fired.





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3. The plants will not be operated without filters except during black outs, initial firing and mandatory stoppages due to unforeseen circumstances. Such stoppages will be reported monthly.
4. Nitrogen oxide (or similar) emissions will be below various minimum levels as mentioned in the declaration to be in conformance with the EU limits.
5. Those cement plants with emission permits will obtain emission and air quality reports from laboratories accredited by TURKAK or international accreditation agencies. The ministry will be informed of the results.
6. Dust concentrations will be monitored and recorded continuously at all units who create dust at a rate of more than 15 kg/h or over. The dust levels shall not exceed 120 mg/Nm<sup>3</sup> in plants equipped with electro-filters and Nm<sup>3</sup> with bag or packaged filters for pre-1993 plants, and 50 mg/Nm<sup>3</sup> in the newer plants.
7. All the plants will submit their monthly emission reports both to the Ministry and TCMA.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

### ENVIRONMENT AND ENERGY POLICY OF THE CEMENT SECTOR

Another important protocol signed between the Ministry of the Forestry and Environment and TCMA is the “Protocol on Alternatives Fuels (AF)” in 2004 which encourages the use of various waste materials as an alternative fuel source in the cement plants. This protocol;

- Encourages the use of various predetermined industrial wastes in the rotating kilns;
- Aims at developing legal infrastructure for such application which is in line with EU directives;
- Encourages collaborative work with European countries who already have such AF, including data and know – how sharing;
- Initiates the infrastructure in AF materials and technology in Turkey.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

TCMA have been acting as the single decision maker for the whole Turkish cement sector and has long been tackling the alternative fuels and raw materials issue. As it has been emphasised in the previous section; TCMA has been instrumental in signing the “Protocol on Alternatives Fuels (AF)” in 2004 with the Ministry of the Environment and Forestry and which encourages the use of various waste materials as an alternative fuel source in the cement plants. This protocol not only encourages the use of various predetermined industrial wastes in the rotating kilns, but aims at developing the proper legal infrastructure for such applications in Turkey.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

Based on the general framework of the Turkish Industry and the capabilities of the other sectors, a list of potential waste materials that can be used in the sector have been determined and summarized in the following table.

Naturally, some if not all, the waste materials given in the tables may also contain hazardous materials. These compounds or parameters are summarized for the candidate waste materials that can be used or are already being used. Similar tables can be formed for alternative raw materials.





# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

## Possible Waste Derived Materials

Waste oil	Fuel, Raw Material
Used bleaching clay	Raw Material
Blast furnace slag	Raw Material, Additive
Steel making slag	Raw Material
Nonferrous metal slag	Raw Material
Used foundry sand	Raw Material
Ash and dust	Raw Material
Fly ash (coal)	Raw Material
Sludge	Raw Material, Fuel
By product gypsum	Raw Material, Additive
Marble Dust	Raw Material
RDF	Fuel





# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

## Waste Utilization Rates by Countries

Country	Waste Utilization Rates (%)
EU	12
Austria	29
Belgium	30
Denmark	4
Finland	3
France	27
Germany	30
The Netherlands	72
Poland	1
Portugal	1
Switzerland	31
England	6
Turkey	5 (estimate )







## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

In the field of the alternative fuels and alternative raw materials, Turkish Cement Sector has been taking the initiative and investing heavily on research and development. Regarding the use of AF and ARM, the joint policy of the Turkish Cement Manufacturers Association is perhaps best summarized by the briefing given by the TCMA to the Turkish Parliament in May, 2007.

1. The cement production is an energy intensive process and the Turkish cement sector is one of the top three consumers of energy. Based on the 2006 figures, energy and electricity costs constitute almost 50 % of the total production cost. At present, fuel oil, petro-coke and coal are the main sources of thermal energy and the electricity consumption is quite high.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

2. The sector as a whole is giving the highest priority to the lowering of the greenhouse gases. This fact is also evident from the two joint declarations between the Ministry of Environment and Forestry and TCMA. In the field of greenhouse gas emissions, reduction policies similar to those of the EU countries are being followed voluntarily by the sector. However, it should be emphasized that heating, air conditioning, energy and the transportation sectors need to adopt similar policies in order to feel the effect nationwide.

3. Within the sector itself, the priority should be given to reduction of the energy and electricity consumption, utilization of energy efficient technologies, employment of alternative fuel resources and utilization of new alternative raw materials. If a realistic incentive policy is adopted by the government, it would speed up the investments on alternative fuels and environmentally friendly technologies and encourage research and innovation efforts both in the alternative fuels and alternative raw materials fields.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

Based on the recently completed the greenhouse gases inventory of the country, the share of the whole Turkish industry is 8.9 %. Accordingly, the energy sector is the highest contributor with 76.7% share, the agriculture sector is responsible for the 5.3% and the remaining 9.3 % is attributed to wastes. However, actual amount of the industrial emissions may be higher due to unreliable data coming from the iron and steel and petrochemical sectors. Nevertheless, energy sector is by far the worst contributor to greenhouse emissions. An increase of over 74 % has been realized in the level of green house emissions in a period covering 14 years from 1990 to 2004.





# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

## Comparison of CO<sub>2</sub> Emissions from the Cement Sector and Turkey – 1990 – 2004

	CO <sub>2</sub> EMISSIONS ( 10 <sup>6</sup> tons/year)		
	1990	2004– No Investments	2004– With Investments
Calcination Process	10.50	17.10	17.10
Fuel Used in Clinker Production	7.61	12.3	11.00
Electricity Consumption in Cement Production	1.40	2.25	1.63
Inplant Electricity Consumption	1.05	1.66	1.2
Total	20.56	33.3	30.93
Total Emissions- Turkey	175.065	296.605	294.175
Cement Sector's Share	%12	%11.2	%10.42





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

The latter part of the same briefing summarizes the goals of the cement sector for increased utilization of alternative fuels and raw materials.

Accordingly, the leading priority of the cement sector is to lower the consumption of fossil driven fuels and thus lower the CO<sub>2</sub> emissions. The briefing suggests the following: When and if the clinker use is decreased in the cement production, the indirect benefit will be the reduction of the CO<sub>2</sub> emissions. A substantial decrease in the clinker use will only be possible with the increased utilization of alternative raw materials and additives.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

New Turkish standards such as EN 197-1 for cement and EN 206-1 for concrete, encourage such a change. At present 95 % of the cement produced in EU countries are produced with additive.

For example, in the Cembureau member states, the use of 42.5 class CEM II type cement has been replacing the same class CEM I type cement at an increasing pace.

In 1994 CEM I and CEM II type cements had a share of 65% and 25 %, respectively. In 2004 figures, we notice the dramatic change in their shares; the share of CEM I cement has dropped to 30%, whereas the share of CEM II type has risen to 60 %.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

However, as we have seen from domestic sales figures, CEM I type sales were highest with a share of about 43 % in Turkey, in 2006. CEM II type had a share of 36 % and CEM IV about 10 % in Turkey.

For the same class 42.5 concrete, the figures for CEM I and CEM II types were 80% and 15 %, respectively. Although there is no clear trend that can describe trend of the past few years, it can be said that CEM I still dominates the market. The increase in CEM II type is evident but is slower than expected.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

TCMA sees 2 major roadblocks for the wider use of alternative fuels

1. In the legal framework, when compared with the EU experience, present legal infrastructure in Turkey is to say the least, quite inadequate. In order to overcome this problem the bottlenecks should be clearly identified and the legal framework should be completed immediately.

2. Proper definition and treatment of the industrial waste is needed. Waste collection, its classification and waste utilization streams need to be well defined. Especially, the responsibilities of the waste producers and municipalities and/or local authorities should be clearly identified. Both the public and the industry as a whole should agree to change their attitude towards industrial waste. Instead of classifying the industrial waste as a commercial commodity with value, the waste, regardless of the type and the origin, should be treated as an environmental problem that needs to be eliminated safely.







## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

# Alternative Fuels and Raw Materials Utilization in Turkey

Protocol on Alternatives Fuels (AF) signed by TCMA and the Ministry of Environment and Forestry in 2004, encourages the use of various waste materials as an alternative fuel source in the cement plants.

Immediately after signing of this protocol, several cement plants have applied for license or permission for utilizing waste derived fuels in their premises.

It should be noted that there are several regulations in force in Turkey concerning the utilization and or burning the industrial waste.

Most important and recent directives are listed below:

- The regulation on the waste oils, their classification and control, 2004,
- The regulation on the hazardous wastes and control, 2004,
- The Directive on the use of waste materials as an alternative fuel.

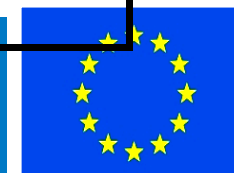




## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

### A shortened List of Cement Plants with Permissions to Utilize Waste Derived Fuels

Plant Name	Waste Type To be Burned Within the Plant	License /Permission Date
Bolu Cimento Sanayi A.Ş	I and II Category Waste Oils, Used Tires and Paint Sludge	04/10/2004
AKCANS A Cimento A.Ş. (Canakkale Fabrikasi)	I and II Category Waste Oils, Used Tires	07/10/2004
SET Cimento San. Ve Tic. A.Ş. - Ankara	I and II Category Waste Oils, Used Tires, Contaminated Waste	07/10/2004
BAŞTAŞ Cimento Ankara AŞ	I and II Category Waste Oils, Paint Sludge	03/05/2005
Konya Cimento A.Ş.	I and II Category Waste Oils, Paint Sludge	24/06/2005
CİMSA Cimento San. A.Ş.	I and II Category Waste Oils	29/08/2005
CİMENTAŞ İzmir Cimento Fabrikasi A.Ş.	I and II Category Waste Oils, Used Tires	17/08/2005
BATICİM Bati Anadolu Cimento San. A.Ş.	I and II Category Waste Oils, Used Tires, Contaminated Waste	17/08/2005
AKCANS A Cimento A.Ş. (Buyukcekmece Fabrikasi)	I and II Category Waste Oils, Used Tires, Contaminated Waste, Plastic Waste	07/10/2004





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

### *Blast Furnace, Steel Furnace Slag*

Steel production has a long past of approximately 70 years in this country, Based on the World Iron and Steel Institute Report of 2006, Turkey ranks 11th largest producer in the world with 21 million tons produced in 2005.

During the production process a considerable amount of blast furnace slag forms. The binding effect of the slag is well known. It has been used as an additive in the cement production as early as 1900. For the last 10 to 15 years almost all of the blast furnace slag is being utilized in the western countries. Although Turkey possesses one of the highest capacities in this field it lags behind in terms of slag utilization in cement production.

The slag production is well known process the liquid metal is formed at about 1400 to 1600 C and then the floating particulates are separated and cooled rapidly with help water and the slag is obtained in a granular form.





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Turkey has a number of large steel plants. According to the studies made to this date the suitability of utilizing the blast furnace slag is possible. Below list ranks the various major steel plants with respect to SiO<sub>2</sub> content and the specific surface area:

- Isdemir – High SiO<sub>2</sub> content and high specific surface area – Excellent as an ARM.
- Kardemir – Highest SiO<sub>2</sub> content and normal specific surface area – Acceptable as an ARM.
- Erdemir – Lowest SiO<sub>2</sub> content and low specific surface area – Not recommended as an ARM.





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### *Fly Ashes*

Fly ashes and slag are widely used as mineral admixture in concrete industry.

Fly ash, which is a by product material of thermal power plants, is widely used to produce economic and durable concrete. Fly ashes consist of combination of crystal and amorphous forms. The important factor for classification of fly ash is chemical composition. The total amount of  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$  and  $\text{Fe}_2\text{O}_3$  is 70% for class F and 50% for class C fly ashes. Most of fly ashes, which are obtained from thermal power plants of Turkey, are satisfying the conditions of **Class C**. The studies made to this date make the **Soma and Orhaneli** fly ashes suitable for ARM [15].





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

### *Refuse Derived Fuel (RDF)*

Refuse Derived Fuel is basically a plastic waste. As it is well known as an RDF technology is a large scale technology; it has high calorific and biomass value, it is possible to use RDF in gasification and pyrolysis plants and RDF should be combusted at high temperatures in order to minimize hazardous flumes.

One of the cement plants located nearby Istanbul AKCANSAN – ISTAC (the Waste Collection Directorate of the Istanbul Greater City Municipality) have an ongoing project on RDF utilization in the cement production RDF Project . This project is also being supported by TUBITAK, Scientific Research Council of Turkey.





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The work completed to this date is mainly on the characterization of the RDF and includes the following data:

- Physical properties of the waste
- Humidity
- The ease of homogeneity
- Chemical properties of the waste
- Pollutants it contains (PCB, heavy metal, etc)
- The risky components it possesses for clinker production such as sulphur and chlorine containing components
- Calorific value





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

### *Other potential Waste derived fuels and raw materials*

A complete list of potential industrial waste types was given before. Two interesting applications that are worth mentioning are;

- The use of the sludge formed at drinking water treatment facilities.
- Another industrial waste which has a very high potential in Turkey, is the use of marble dust as an ARM.







## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

According to the briefing given by the TCMA to the Turkish Parliament in May, 2007, it is emphasised that the cement production is an energy intensive process and the Turkish cement sector is one of the top three consumers of energy. As was mentioned before the Turkish cement sector is responsible for the 13% of the total energy consumption in the country. Based on the 2006 figures, energy and electricity costs constitute almost 50 % of the total production cost.

At present, fuel oil, petro-coke and coal are the main sources of thermal energy and the electricity consumption is quite high.

Within the sector itself, the priority should be given to reduction of the energy and electricity consumption, utilization of energy efficient technologies, employment of alternative fuel resources and utilization of new alternative raw materials in addition to research and innovation efforts both in the alternative fuels and alternative raw materials fields.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

In 2002, with the co-operation between EIEI (General Directorate of Electrical Power Resources Survey & Development Administration) and TCMA, “Energy Efficiency & Benchmark Study in Cement Sector” was started. With the help of the database prepared by TCMA, data evaluations have become more accurate and rapid. The results of this benchmark study were analyzed jointly with EIEI & TCMA experts. This survey results were distributed to the factories in order to help them calculate their energy efficiency potentials. Newly enacted “Energy Efficiency Law” also places high burden on the cement sector.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

### DSM In The CEMENT SECTOR

In line with the national DSM plan, integral DSM plan for the cement sector should include;

- Electricity Demand DSM Program, including measures to promote peak load management;
- Fuel resources DSM Program including natural gas, fuel oil and coal;
- Fuel Switching Program.





# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

## Process Opportunities for Improving Energy Efficiency and Reducing Emissions in Cement Industry

Process Description	Annual Energy Use Percent (%)	Pollutant Emission (%)	Energy Efficiency (%)		Sample Targeted Technologies
			Existing	Possible	
Quarrying	6 – 10*		6 – 25	10 – 30	. Better electric motors . Bio-diesel
On Site Raw Material Preparation (Cement + Concrete)	3 – 4	1 – 1.5	6 – 25	25 – 30	. Better electric motors
Kiln Operations	73 – 75	83 – 85	24 – 37	38 – 42	. Preheating . Formula Change
Cement Milling	6	4	6 – 25	25 – 30	. Better electric motors
Concrete Blending And Mixing	6	5 – 5.5	6 – 25	25 – 30	. Better electric motors
Transportation	10 – 12	4 – 5	20 – 30	30 – 32	. Bio – diesel





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

### CONCLUSIONS

Following the two joint declarations made with the Ministry of Environment and Forestry, environmental investments of the sector in excess of 500 million dollars have been completed. Most plants have received emission permissions and have been classified and recognized as proper law abiding industrial businesses according to the existing “Public and Health Safety Laws” and most plants have received their ISO 9001 Quality Management System Certificates, ISO 14001 Environment Management Certificates and all plants have begun operating according to OHSAS 18001 Labour Health and Safety Management Systems. These achievements can be seen as the success of the two joint declarations and how sincere the sector is in dealing with the environmental issues.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

The cement sector has repeatedly demonstrated that it wants to remain as the environment conscious leader and the major actor of the Turkish economy and the main objective of the sector is to grow without lowering cement consumption or production, make use of all possible technological advancements, especially in the fields of energy and environment and thus contribute heavily in steering Turkey to reach the “Sustainable Growth” platform.

Especially the lack of funding for the infrastructure investments and lack of government incentives is bound to influence the sector on a negative note. It is thus expected that construction sector will improve only in the housing sector driven by the newly enacted mortgage system and the industrial and infrastructure investments will be at a standstill.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

If the legal framework is set up properly, the level of waste fuel utilization can be increased from the negligible percentage of today to 25%. Thus, when the clinker use is lowered and the waste fuel utilization is increased, the increase in CO<sub>2</sub> emissions will only be limited to 35% while the production/consumption capacity will increase 65%.

It is inevitable that the cement consumption will increase at least 65 % over the next twenty years. Naturally, similar increase is also expected for the semi – finished raw material of the cement, that is, the clinker production. At present the clinker/cement ratio stands at 80%. When more additives and alternative raw materials are used this ratio can be lowered easily to 70% which is the average value of the same ratio in the EU countries. If this goal achieved, then the increase in CO<sub>2</sub> emissions will only be limited to 44 %.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

The cement consumption is perhaps the most important material that can not be reduced due to our national goal of rapid industrialization. This goal will be achieved in a sustainable and environmentally friendly growth that can be achieved only when the utilization of both the alternative fuels and the raw materials are supported not only by the cement sector alone but through proper government policies.







# OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

## ROAD MAP 9th PLAN PERIOD 2007 – 2013

For the coming 7 year period the forecasts in the cement sector took place in the Special Cement Committee Report of the 9th Plan Period show a smooth development in the sector:

### Cement Forecasts for 2007-2013

	Annual Average Increase (%)	
Domestic Demand	4.68	
Production	2.95	
Exports	-17.08 *	* -6.65 % as clinker
Imports	0.00	

The sector is self sufficient in raw material. Therefore no imports are expected.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

In the same period it is estimated that a 20 million tons capacity will be added to the present cement production capacity. This amount goes up to 21 million ton as clinker capacity. This increase in the capacity will be countrywise rather than in certain regions. A major technological change is not expected in the next period due to present high technological level of the industry.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

In the Accession Period to the EU, the sector has already completed the necessary changes in the production processes, end products and test standards therefore compiled with the European TS EN 17025 standard in laboratories and test methods.

Through TCMB, the sector takes place actively in the committees of CEMBUREAU.

The whole sector has obtained the emission permits and started to establish the systems for "Environmental Management and Occupational Safety and Health Management."





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

By joining to the EU it is envisaged that a positive development will take place in the cement sector due to the possible increase in the public investments, especially in the concrete roads which are environmentally sound. On the other hand the industry should complete the environmental investments and be ready to confront the environmental limits for competitiveness where the European producers are obliged to apply.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

Even though in the negotiations with the EU, Turkey has not been requested to implement a common environmental regulation and the national environmental and air quality control Regulations are strictly followed up by the industrialists in the sector, they will face considerable investment in dust prevention and adjusting themselves to the laws and regulations on water, soil, waste i.e. As a result it is estimated that the emission limits will be decreased further and related investments will be increased.

In the coming period it is expected that the accreditation process will be completed and CE mark will be issued domestically as well.

As other development in the EU which will be transferred to Turkey in the coming years is the implementation of "eProcurement" in trading in the sector. For this purpose investments for automation to integrate to the internet platform will take place in the sector. In parallel to these automation activities, restructuring and training will be needed.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

### PROPOSED STRATEGY

Considering the technological level reached in the sector, the next step for Turkey should be to become a “global player” and export her know-how.

For this target the headlines of the mission can be as follows:

- Image and promotion
- Efficient use of cement and concrete
- Continuous awareness of the public
- R&D, education, international cooperation, certification
- Increasing the power for the global competitiveness
- Cooperation with the other sectors, universities, chambers, NGOs and other related institutions.





## OVERVIEW OF THE TURKISH CEMENT SECTOR With Special Emphasis On SUSTAINABILITY, ENERGY AND ENVIRONMENT

For reaching the global target main policies can be briefed as follows:

- Sustainability in the supply of the secondary fuels
- More efficient implementation of the environmental regulations on the use of waste as fuel
- Decrease CO<sub>2</sub> emissions by using waste as fuel in the sector.
- Incentives for investments in existing plants for energy conservation, environment, solving bottlenecks, decreasing cost and modernization should continue and there will be no incentives for the investments besides those above mentioned and particularly for new cement plants.

