MATERIAL
ISSUES

CLIMATE
CHANGE

Buzzi Unicem

Environmental Performance

Consumption of materials

The natural raw materials used in the production of cement are limestones, marls, clays, shales, sands, iron and aluminium minerals, gypsums, pozzolans. In compliance with the principles of a circular economy, under certain circumstances, some of these materials can be replaced with waste material derived from other industrial processes which may otherwise require disposal.

Waste from steel processing and production residues of sulfuric acid can be used instead of iron minerals; chemical gypsum obtained from the treatment of combustion gases from electrical power plants can replace natural gypsum; thanks to their hydraulic properties slag and fly ash can partially be used instead of clinker and pozzolans; contributing to a reduction in direct $C0_2$ emissions.

In 2019, the percentage of natural raw materials replaced for the production of binders was stable at 9.1% (9.5% in 2018).

For the production of concrete, the raw materials used are essentially aggregates (sand, gravel and aggregates). Even in this case it is possible to obtain a partial replacement with non-natural aggregates, by-products of industrial processes, recycled aggregates deriving from the recovery and subsequent treatment of demolition materials or concrete not cast in work sites and/or residues from concrete mixers that are removed before making a new load. Even here, the cement content can be reduced thanks to the direct addition of non-natural materials with hydraulic properties such as slag and fly ash.

In total, in 2019, 446,537 tons of recovered aggregates were used (391,000 tons in 2018). The average cement content per cubic meter was 298 kg, of which 206 kg was clinker content.
In natural locations where its quarries are situated, Buzzi Unicem implements mitigation actions with the aim of protecting existing biodiversity.

Water consumption

Water consumption in the cement technology cycle is mainly due to controlling the temperature of gases from the kilns, the quenching of the cement during grinding, cooling of engines and dust abatement.
Consumption increases in production plants with wet-process kilns (Volyn and Yug plants in Ukraine and Suckhoi Log and Korkino in Russia).

Buzzi Unicem monitors its consumption and uses systems for the collection, treatment and recirculation of rainwater and/or washing water in all of its industrial plants. Specific water consumption in 2019 increased to 368 liters/ton of cementitious material compared to 301 liters/ton of cementitious material in 2018 (this increase is partially due to the change in the reporting methodology of water consumption in Germany).

21% of water consumption comes from recovered water (22% in 2018).

Water consumption required for the production of ready-mix concrete was 164 liters/cubic meter (171 l/ m3 in 2018). Even in this case part came from recovered water (rainwater and/or washing water).

Consumption of thermal energy

Production of cement, and especially of clinker, requires a significant use of thermal energy. Producing clinker with good properties requires a temperature of around 1,450 Celsius degrees in cement kilns. Energy consumption is therefore influenced by kiln technologies and the continuity of production.

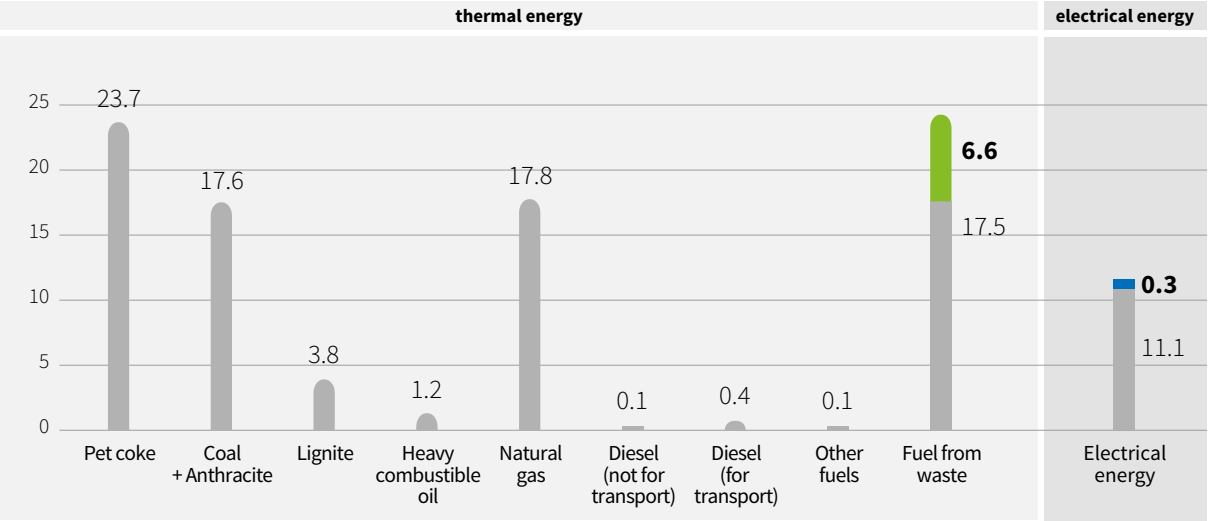
In 2019, specific consumption was 4,109 MJ/ ton of clinker, in line with the result for 2018. Buzzi Unicem continued to promote the use of secondary fuels as an alternative to traditional fuels of fossil origin.

In particular, these are fuels deriving from waste material, many of which have a significant content of biomass, which is considered neutral for CO_2 emissions purposes. The use of secondary fuels is recognized within the European Union as a BAT (Best Available Techniques) for the cement industry, and is one of the pillars of the circular economy. This generates two main advantages: it reduces CO_2 emissions, based on the content of biomass, and eliminates disposal of waste to landfill.

For 2019, we can confirm the excellent heat replacement levels reached in Germany, Poland and Czech Republic, with indices greater than or equal to 65%, while Luxembourg reported levels of 47%, USA 20% and Italy 14%.

Percentage breakdown of energy consumption by type and source (2019)

The total energy consumption was 110,600 TJ



The average figure for the Group was 27.6%, which represents an improvement on 2018 (27.1%), thanks especially to the contribution from Germany and Czech Republic.

There was an increase in the content of biomass which was 27.6% in 2019 (22.0% in 2018).

Consumption of electrical energy

Reducing electrical energy consumption is another priority for Buzzi Unicem.

In binders manufacturing, electricity accounts for around 10% of the total energy requirement. Specific consumption of electrical energy by the Group in 2019 improved slightly (121 kWh/t of cementitious material compared to 122 kWh/t cementitious material in 2018).

For the second year, Buzzi Unicem is publishing figures on its contribution to the use of electrical energy from renewable sources.

	Average (2018)	Average (2019)
ITA	14%	11%
USA	13%	12%
GER	2%	2%
LUX	24%	30%
POL	11%	11%
CZE	7%	8%
RUS	0%	0%
UKR	0%	0%

Percentage of electrical energy from renewable sources.

Greenhouse gases emissions

In the cement production process most of the CO_2 is generated during the production of clinker, the basic constituent of cement. Its synthesis takes place within kilns where a mix of minerals is 'cooked' at a temperature of up to 1450°C.

One of the main components of the raw mix is limestone, which is 'de-carbonized' and releases CO_2 at temperatures in excess of 950°C. CO_2 is also generated from the combustion of gas, coal or other fuels needed to reach the above-mentioned temperatures. The sum of these two components represents "direct" CO_2 (Scope 1).

A second source of CO_2 emissions is linked to the production of the electrical energy used in the cement production process.

This emission is known as "indirect" CO_2 (Scope 2) because it does not derive from cement plants but rather from electrical power plants.

The remainder is attributable to CO_2 from transport (Scope 3) for which we will provide details in subsequent Sustainability Reports.
The following table shows the level of CO_2 emitted in 2019 at the Group level, including the distinction between 'gross' and 'net':

	Tons emitted (2018)	(2019)
'Gross' direct CO_2 (Scope 1)[1]	18,981,303	19,930,001
'Net' direct CO_2 (Scope 1)[2]	-	18,448,321
Indirect CO_2 (Scope 2)	1,639,497	1,703,718

[1] 'Gross' direct CO_2: emissions of CO_2 deriving from the use of fossil fuels plus those deriving from the use of secondary fuels (without considering the content of biomass).
[2] 'Net' direct CO_2: emissions of CO_2 deriving only from the use of fossil fuels (secondary fuels are not considered).

In line with the objectives that have been established over the years by international climate protocols, Buzzi Unicem is committed to reducing its CO_2 emissions. After the Paris agreement of December 2015, the commitment was extended to all countries in which the Group operates and is formalized in the Climate Change Policy.

Although there are many factors in play, and not all of these are easy to predict or are under the control of Buzzi Unicem, by 2022 we plan to achieve a reduction of CO_2 emissions, based on current production capacity, of 5% compared to 2017 levels. In order to reach the objective in the specified time frame, Buzzi Unicem is implementing the Reduction Plans in all countries. The Plans contain the initiatives of every country for optimizing the thermal and electrical efficiency of plants, increasing the use of secondary fuels (with a significant thermal level and content of biomass) and non-natural raw materials and optimizations associated with clinker/cement ratios.

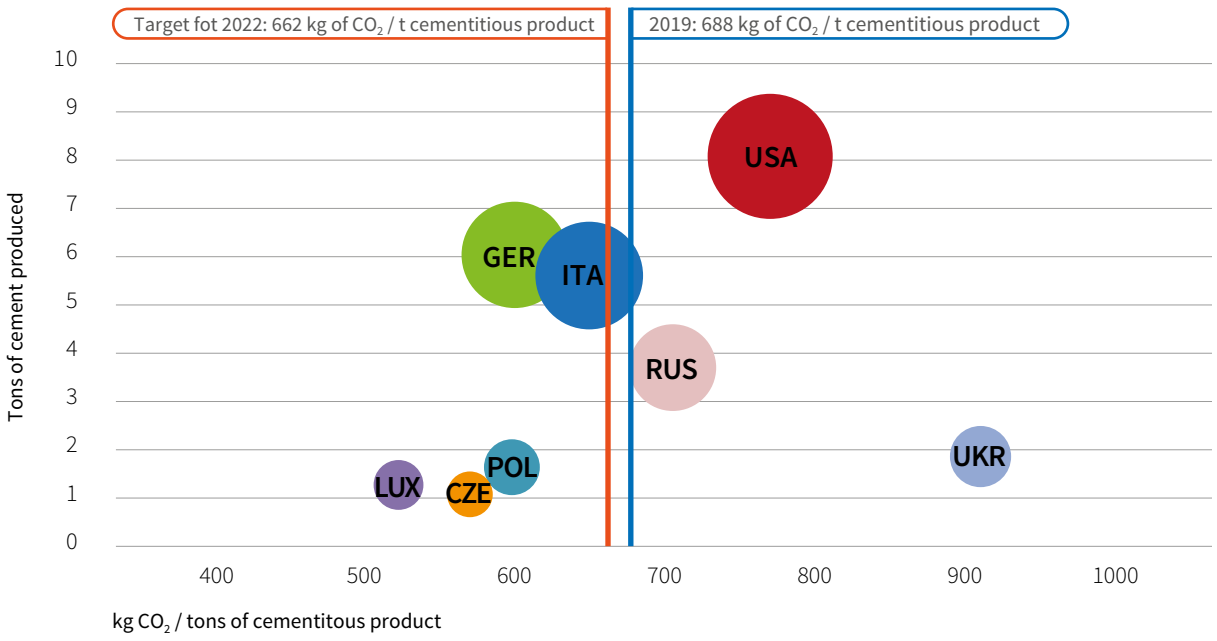
In 2019 the clinker/cement ratio was 79.7% (80,0% in 2018). The content of biomass of secondary fuels has allowed us to avoid 507,780 tons of atmospheric emissions of CO_2.
The Group emission factors are summarized in the following table:

	kg of CO_2/t cementitious product (2018)	(2019)
'Gross' direct CO_2 emission factor[1]	690	688
'Net' direct CO_2 emission factor[2]	-	637

[1] 'Gross' direct CO_2: emissions of CO_2 deriving from the use of fossil fuels plus those deriving from the use of secondary fuels (without considering the content of biomass).
[2] 'net' direct CO_2: emissions of CO_2 deriving only from the use of fossil fuels (secondary fuels are not considered).

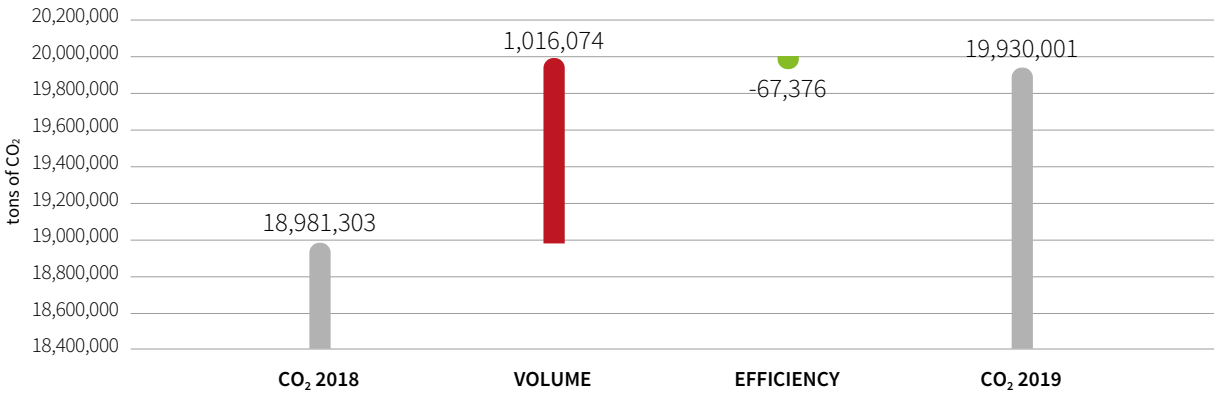
Distribution of the CO_2 footprint on a country basis

The 'ball' dimension is proportional to cement produced in each Country.

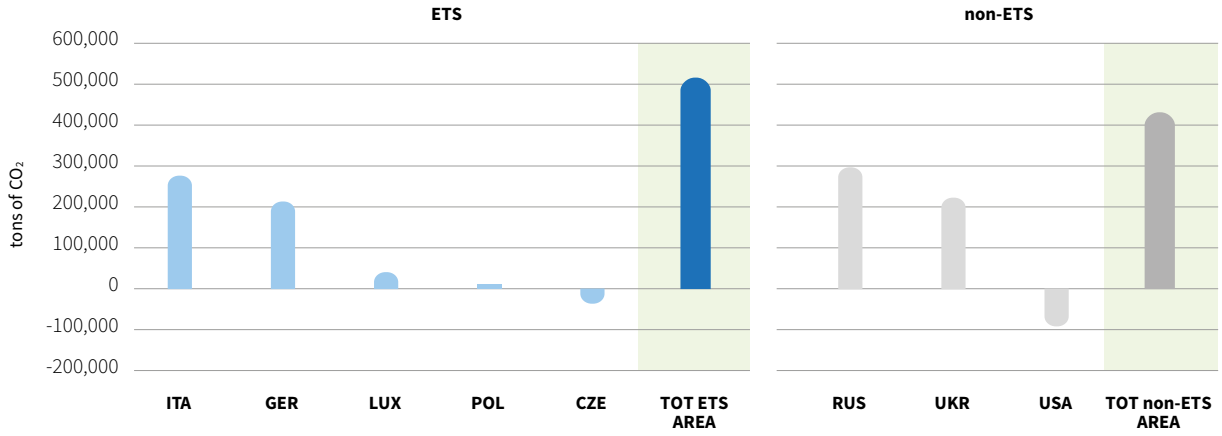


Comparison of 'gross' CO_2 Scope 1 emissions 2018–2019

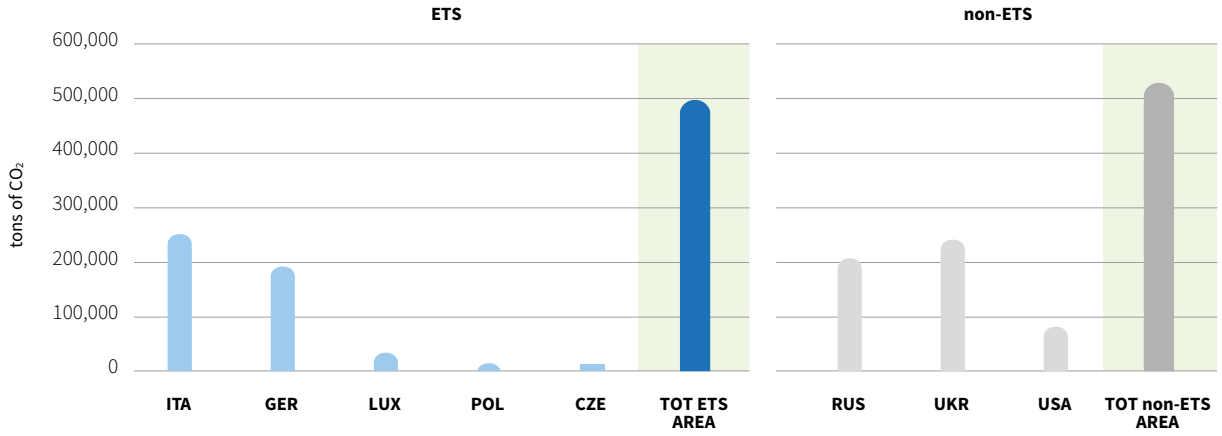
The charts also show the net emissions contributions from each individual country in relation to production volumes and efficiency.



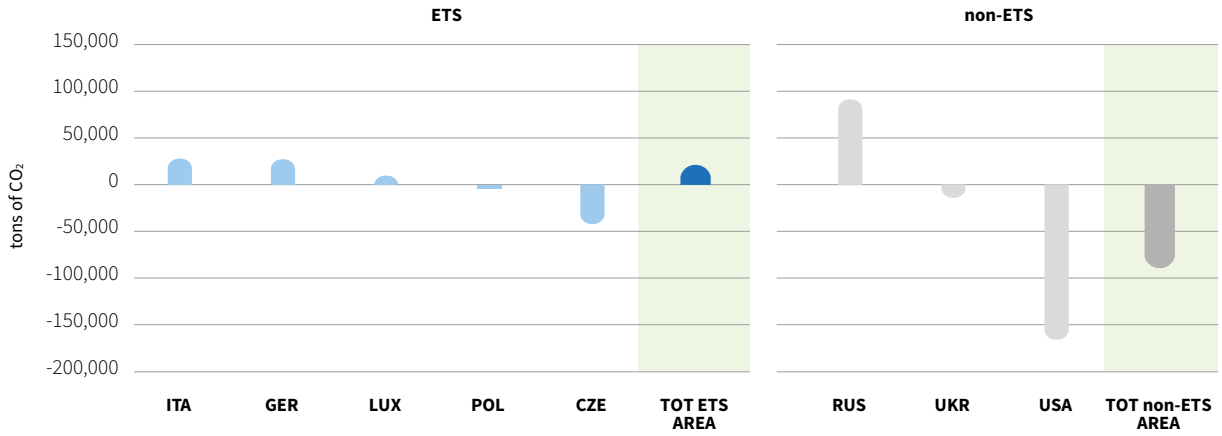
'Gross' CO_2 emissions scope 1: total net variation (compared to 2018)



'Gross' CO_2 emissions scope 1: net volume variation due to volumes (compared to 2018)



'Gross' CO_2 emissions scope 1: net variation due to efficiency (compared to 2018)



Buzzi Unicem has successfully extended the use of the monitoring and reporting procedure of greenhouse gases emissions according to Regulation (EU) 601/2012 which is valid in Countries involved in the Emissions Trading System (ETS) – clinker-based output method B2 - even in non-EU countries not bound by this obligation. In 2019 the procedure was also implemented in the US, and therefore 100% of Group emissions are calculated with the methodology (clinker-based output method B1) that ensures the highest level of accuracy, abandoning the use of the standard factor.

Other atmospheric emissions

Buzzi Unicem uses continuous emissions monitoring systems (EMS) to measure emissions of the main pollutants such as nitrogen oxides (NOx), particulate matter (dust), sulfur dioxide (SO_2), and mercury (Hg). The use of EMS enables a precise monitoring of emissions by line managers, who can at any moment, view emission levels and promptly intervene in the process. Moreover, this represents a guarantee for supervisory bodies and other stakeholders interested in having reliable and traceable data.

With regard to the production of clinker in 2019, monitoring coverage increased once again: dust monitoring climbed to 67% (53% in 2018), NOx is 87% (73% in 2018), SO_2 is 92% (64% in 2018) and Hg is 58% (47% in 2018).

In 2019, the average value of dust fell to 49 g/t clinker compared to 76 g/t clinker in 2018 (a reduction of 35%). The improved results have been possible thanks to significant improvements at the plants in Russia and Ukraine. In Italy, Germany and Czech Republic emission levels remained below 10 g/t clinker, in line with the best practice for the sector.

With regard to nitrogen oxides (NOx), deriving from combustion in the clinker kiln system, the use of SNCR abatement systems using urea or ammonia solutions and new-generation Low-NOx burners, enables compliance with strict emission limits. In 2019, the average value for Buzzi Unicem fell to 1,125 g/t clinker (1,361 g/t clinker in 2018). Improvement works were successfully completed in Russia and Ukraine. Italy, Germany, Luxembourg, Poland, Czech Republic and Ukraine confirmed an emissions factor below 1,000 g/t clinker in line with best practice for the sector.

Sulfur dioxide (SO_2) emissions come from sulfur contents of natural resources and fuels. The average emission factor for the Group was 189 g/t clinker (it was 188 g/t clinker in 2018). In Luxembourg and Ukraine emission levels remain below 40 g/t clinker.

Finally, the average value of mercury emissions (Hg) was 18 mg/t clinker (25 mg/t clinker in 2018) thanks to the significant improvement in Poland (reduction of more than 50% of the emissions value for the year thanks to a different composition of the mix of alternative fuels).

Waste management

The cement production cycle generates two types of waste:

- **Dust from production process.** Cement Kiln Dust (CKD) is dust generated during production activities that contain quantities of sulfur and chlorine. If CKD is excessive it could alter the product characteristics. Therefore CKD is normally reintroduced into the production cycle with an appropriate dosage. In the United States this is not permitted by local standards and therefore CKD must be treated as waste; moreover, in Poland, part of the CKD is reused in the process and a part is treated as waste (in order not to interfere with the quality of the final product). This brings the respective indicator to approximately 5,217 g/t of cementitious material, up from 2018 (4,005 g/t cementitious material) with an increase in the production of waste in the US, Poland and Ukraine.
- **Waste deriving from ordinary and extraordinary maintenance, laboratory activities and any demolitions.** Given their origin, it is possible for there to be a significant year-on-year variation that is not connected to the prodcution process. Buzzi Unicem's daily commitment is thus focused on increasing selection and differentiation. In 2019, 32% of waste was recovered (down from 34% in 2018), with this result strongly influenced by the disposal of CKD - indeed, in the countries where this can be used, the percentage of waste that is recovered is actually higher than 80%.

Noise

The environment and safety management systems implemented by Buzzi Unicem require periodic monitoring of external noise emissions from its plants. This activity enables the identification of any criticalities and the respective targeted investments, with particular regard to cement plants situated near or within highly developed areas.

In 2019, the monitoring of acoustic emissions was conducted in 45% (it was 49% in 2018) of the Group's production sites (100% of sites in Luxembourg, Czech

Republic, Poland and Russia). This monitoring led to improvement investments of approximately Euro 265,000 to install silencers and sound-absorbing panels.

The use of such systems together with the use of appropriate Personal Protective Equipment (PPEs) can reduce the noise exposure of employees, internally and externally on site.

Product Life Cycle (LCA/EPD)

Measuring the environmental impact of products is the basis of the Green Public Procurement Policies around the world. The diffusion of procedures for quantifying the main environmental impacts relating to products or services in individual production phases (from the acquisition of raw materials to the end of the product life cycle, i.e. during the entire life cycle) has resulted in a greater interest for LCA (Life Cycle Assessments). Customers, architects and engineers, as well as public authorities, are increasingly stressing the need to receive this data.

Buzzi Unicem has been committed to evaluating the life cycle of its products since 2003, starting with its cement factory in Vernasca (Italy). Over the last few years, this practice has been extended to all cement types produced in Italy, thanks to the Environmental Product Declaration (EPD). The EPD is a modern tool which supports the calculation and communication of the main environmental impacts of products.

Buzzi Unicem is now capable of producing specific LCAs of all of its concrete for each construction site.
To facilitate its take-up, the company has successfully implemented a web tool for the Environmental Product Declaration, which in Italy is open and accessible to all customers architects and engineers interested in sharing the company's transparency process on the impact of materials and products.

Environmental Performance: Summary table

2017	2018	2019		
80.2	80.0	**79.7**	Clinker/cement ratio	%
			Energy	
26.0	27.1	**27.6**	Thermal substitution	%
4,121	4,080	**4,109**	Specific thermal consumption	MJ / t clk
124	122	**121**	Specific electricity consumption	kWh / t cementitious product
			Raw materials	
10.1	9.5	**9.1**	Non natural raw materials	%
			Air emissions	
137	76	**49**	Dust	g / t clk
1,438	1,361	**1,125**	NO_X	g / t clk
204	188	**189**	SO_2	g / t clk
26	25	**18**	Hg	mg / t clk
696	690	**688**	Direct CO_2 emissions (gross)	kg / t cementitious product
-	-	**637**	Direct CO_2 emissions (net)	kg / t cementitious product
			Waste	
3,655	4,005	**5,217**	Waste produced	g / t cementitious product
47	34	**32**	Waste recycled	%
308	301	**368**	**Water consumption**	l / t cementitious product
-	-	**21**	of which recovered water	%
			Certifications	
20	20	**19**	UNI EN ISO 14001 Envrionmental Certifications or equivalent	number
16	18	**20**	OHSAS18001, UNI EN ISO 45001 Health and Safety Certifications or equivalent	number
16	17	**17**	EPD (Enviornmental Product Declaration)	number

* The data for Cimento Nacional (BCPAR) and Corporación Moctezuma (MOC) have not been consolidated within the Group figures (companies not consolidated using the line-by-line method).

ITA	USA	GER	LUX	POL	CZE	RUS	UKR	BRA*	MEX*
76.7	91.5	67.2	64.1	72.5	76.7	85.3	83.7	70.0	72.9
14.3	20.1	69.3	47.1	66.8	74.4	1.1	0.1	19.8	0
3,594	3,859	4,099	3,826	3,903	3,595	4,866	5,813	3,316	3,331
101	140	117	100	109	119	130	119	94	80
6.0	6.1	14.7	25.0	13.4	12.3	4.7	9.4	9.1	0.3
7	16	5	24	12	10	215	167	62	24
953	1,503	587	695	507	805	1,677	976	1,024	3,642
46	411	71	36	347	136	115	2	496	21
9	24	31	9	56	2	0	0	0,03	0
663	771	598	520	603	573	708	907	581	629
646	737	474	448	489	486	704	907	562	629
1,113	15,005	1,127	926	4,804	232	1,617	1,307	1,641	199
90	17	89	93	100	75	86	89	88	82
270	316	300	88	213	109	412	1.512	118	119
5	65	25	0	0	100	0	0	0	0
8	0	7	1	1	1	1	0	0	0
6	0	7	0	1	1	3	2	0	0
8	0	7	1	0	1	0	0	0	0

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