

# Cement Production

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 Climate Mitigation Services  
 File started: 26 December 2005  
 Last modified: December 2011

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**Lafarge**

yellow column indicates original reported units

**Founded in 1833**

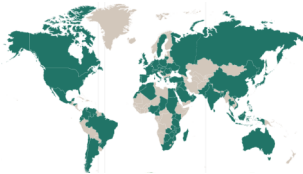
www.lafarge.com Paris

## Cement production & emissions data

**Year**

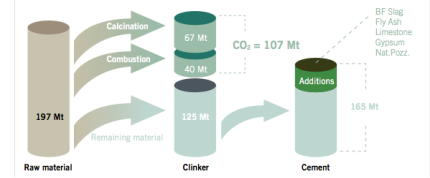
Cement Prod		Energy Use		CO2 emissions	
Clinker ratio	Annual production	Gross consumption	Gross consumption	Emissions rate	Net emissions
Million tons/yr	Million tonnes/yr	Billion Btu	Terajoules	kg CO2/tonne CO2	Million tonnes/yr CO2

- 1950
- 1951
- 1952
- 1953
- 1954
- 1955
- 1956
- 1957
- 1958
- 1959
- 1960
- 1961
- 1962
- 1963
- 1964
- 1965
- 1966
- 1967
- 1968
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- 2005
- 2006
- 2007
- 2008
- 2009
- 2010



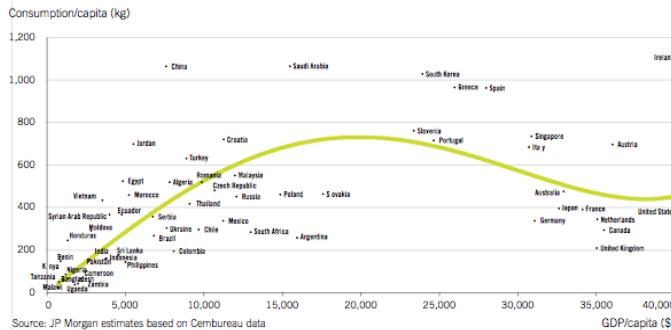
**How CO<sub>2</sub> is emitted in the cement making process**  
 Our Cement activity accounts for 39% of our CO<sub>2</sub> emissions. The cement making process necessarily entails the release of carbon dioxide. In order to make cement, limestone is combusted to produce clinker. The simple formula is limestone (CaCO<sub>3</sub>) plus heat combustion results in clinker (CaO) and carbon dioxide (CO<sub>2</sub>). Decarbonated additives are then mixed into the clinker to make cement. Carbon dioxide comes 60% from embedded carbon dioxide in the limestone, and 40% from the fossil fuels used in the combustion process.

Lafarge CO<sub>2</sub> Emissions in 2008  
 (Only non biomass waste fuels taken into account)



Lafarge CSR 2008, page 34.

### Cement consumption per capita



Lafarge CSR 2008, page 8.

7.13  
 8.30  
 9.82  
 9.82

the above data is inconsistent with reported prod & CO2 per tonne (see below & right) French prod only?

Net emissions rate kg CO2/t cementitious product  
 Net emissions million tonnes CO2

767	73.2
	73.8
	74.5
	75.1
	75.7
Interpolated data inserted 1991-00	76.4
	77.0
	77.6
	78.3
	78.9
	79.5
	80.2
	80.8
	81.3
	81.9
	82.5
	83.1
	83.7
	84.3
	84.9
	85.5
	86.1
	86.7
	87.3
	87.9
	88.5
	89.1
	89.7
	90.3
	90.9
	91.5
	92.1
	92.7

Gross emissions million tonnes CO2  
 79.5

**CMS**  
 estimated emissions CaCO3 decarbonization million tonnes CO2

46.2
46.6
47.0
47.4
47.8
48.2
48.6
49.0
49.4
49.8
50.2
50.6
51.0
51.4
51.8
52.2
52.6
53.0
53.4
53.8
54.2
54.6
55.0
55.4
55.8
56.2
56.6
57.0
57.4
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67.0
67.4
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71.0
71.4
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72.2
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73.0
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74.2
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75.0
75.4
75.8
76.2
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95.0
95.4
95.8
96.2
96.6
97.0
97.4
97.8
98.2
98.6
99.0
99.4
99.8
100.2

Emissions / Product	Annual production
Tonnes CO2/tonne	million tonnes cement
0.666	131.0
0.645	143.0
0.648	148.4
0.629	165.1
	125.6
	112.8

Emissions, thermal	Total energy cement
million tonnes CO2	million tonnes oil eq
31.5	10.1
33.9	10.9
34.6	11.1
40.2	12.9

81.3
85.2
89.3

Thermal input
% of emissions
36.1%
36.8%
35.9%
38.7%

<b>Total</b>	<b>0.647</b>	<b>826</b>	<b>45</b>	<b>1,728</b>	<b>4-yr average:</b>	<b>36.9%</b>	<b>1,091</b>
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**Cell: H9****Comment:** Rick Heede:

CSR 2008: "The world leader in building materials, Lafarge holds top-ranking positions in Cement, Concrete, Aggregates and Gypsum with nearly 84,000 employees in 79 countries." Cement ops employs 50,000 people, sales of 10.9 billion euros, 125 cement plants, 33 clinker grinding stations, in 50 countries.

**Cell: K11****Comment:** Rick Heede:

Emissions from cement fabrication are of two main types: Calcining process of calcium carbonate into clinker liberates carbon dioxide, and emissions from the energy used in the manufacturing process. Typically not included in the emissions estimates are transportation energy, the burning of wastes, or plant construction.

**Cell: E12****Comment:** Rick Heede:

The industry calcination factor ranges from 525 to 900 kg CO<sub>2</sub> per tonne of clinker (net), but of course varies from company to company, and will tend to decrease over time as process efficiencies improve. WBCSD (2002) "Toward a Sustainable Cement Industry: Key Performance Indicators," by Joseph Fiksel, Battelle, for WBCSD. "Each tonne of Ordinary Portland Cement generates ~900 kg of net CO<sub>2</sub> emissions ... and consumes roughly 3,000 MJ of total electrical and thermal energy," p. 8.

**Cell: H12****Comment:** Rick Heede:

Most cement companies will aggregate emissions from energy use with emissions from cement fabrication. This column is provided for companies that provide both data.

**Cell: K12****Comment:** Rick Heede:

Average CO<sub>2</sub> emissions intensity have declined 16.5 percent from 1990 to 2009 -- from 758 net kg CO<sub>2</sub> per tonne of cementitious product in 1990 to 633 kg CO<sub>2</sub>/t in 2009, according to WBCSD data.\*\* This project estimates process emissions from calcining limestone and thus excludes emissions from fuel and electricity inputs to cement manufacturing. The emission rates and net total company emissions both include process and energy-related emission; a subsequent worksheet (SumCement.xls) estimates process emissions of CO<sub>2</sub>. \*\* World Business Council for Sustainable Development Cement Sustainability Initiative (2009) Cement Industry Energy and CO<sub>2</sub> Performance: 'Getting the Numbers Right', wbcscement.org, 44 pp. See GNR Indicator 326, reproduced at the "Cement industry data" worksheet in this portfolio.

**Cell: N30****Comment:** Rick Heede:

"How CO<sub>2</sub> is emitted in the cement making process: Our cement activity accounts for 98% of our CO<sub>2</sub> emissions. the cement making process necessarily entails the release of carbon dioxide. in order to make cement, limestone is combusted to produce clinker. the simple formula is limestone (caco<sub>3</sub>) plus heat combustion results in clinker (cao) and carbon dioxide (CO<sub>2</sub>). decarbonated additives are then mixed into the clinker to make cement. carbon dioxide comes 60% from embedded carbon dioxide in the limestone, and 40% from the fossil fuels used in the combustion process."

**Cell: E37****Comment:** Rick Heede:

Lafarge production data for 1970, 1980, 1982, and 1990 from Martin, John (1999) Location and Corporate Structure: The Case of the French Cement Industry, Research Papers in Environmental and Spatial Analysis No. 54 (Dept of Geography & Environment, London School of Economics), 32 pp., various appendix tables. Units in million tonnes of cement production.

**Cell: P53****Comment:** Rick Heede (Mar10):

It remains uncertain that cement producers report calcining emissions (decarbonizing CaCO<sub>3</sub>) separately from emissions from combustion fuels (thermal input to cement production). CMS here estimates calcining emissions on the basis of total reported cement emissions and emissions from thermal input (column "H": million tonnes energy input to cement production calculated in column "G"). The average energy input emissions for 2005-2008 as a percent of total cement emissions is calculated in cell O76 (36.9 percent). This factor is then applied to reported net emissions in column "K" and shown in this column "P".

**Cell: J57****Comment:** Rick Heede:

Lafarge reports that their emissions rate is based on "a calcination factor of 525 kg CO<sub>2</sub> per tonne of clinker." Total emissions rate, however, is significantly higher (685 to 767 kg/t).

**Cell: K57****Comment:** Rick Heede:

Lafarge (2005) Sustainability Report 2004, p. 26: total emissions of CO<sub>2</sub> in million tonnes, and emissions rate per tonne.

**Cell: M57****Comment:** Rick Heede:

Lafarge CSR 2005, page 40: "group's cement plants gross CO<sub>2</sub> emissions" for 1990, 2003, 2004, and 2005, in million tonnes CO<sub>2</sub>.

**Cell: G66****Comment:** Rick Heede:

Carbon content in tonnes C per tonne crude oil = 0.85 ± 1%; Marland, G. and R. M. Rotty. 1983. Carbon Dioxide Emissions from Fossil Fuels: A Procedure for Estimation and Results for 1950-1981, DOE/NBB-0036, TR003, U. S. Department of Energy, Washington, D.C.

**Cell: K72****Comment:** Rick Heede:

Lafarge CSR 2005, page 44, "net CO<sub>2</sub> emissions" for cement operations.

**Cell: K73****Comment:** Rick Heede:

Lafarge CSR 2006, page 56, "net CO<sub>2</sub> emissions" for cement operations. Lafarge CSR 2008 page 64 shows net emissions "tonnes CO<sub>2</sub> per tonne of cementitious product" (converted to kgCO<sub>2</sub>/tonne by CMS). CSR 2006 shows 655 kg CO<sub>2</sub>/tonne net and 670 kg CO<sub>2</sub>/tonne gross.

**Cell: K74****Comment:** Rick Heede:

Lafarge CSR 2007, page 66, Net CO<sub>2</sub> emissions, cement ops 96.2 MtCO<sub>2</sub> (97.4 MtCO<sub>2</sub> Group).

**Cell: K75****Comment:** Rick Heede:

Lafarge CSR 2008, page 66: Cement operations only (105.4 MtCO<sub>2</sub> for Lafarge Group. (97.4 MtCO<sub>2</sub> in 2007).