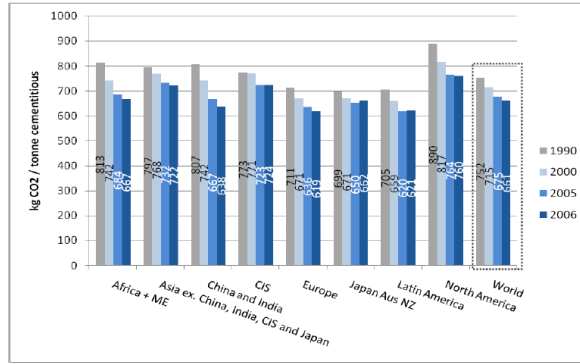
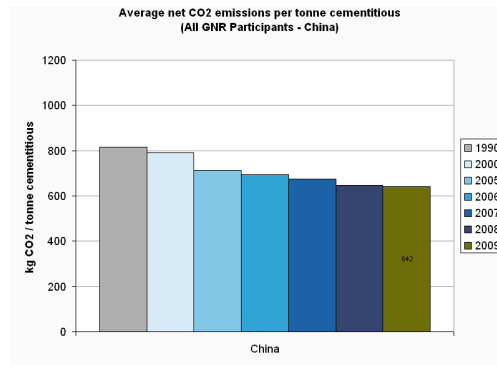
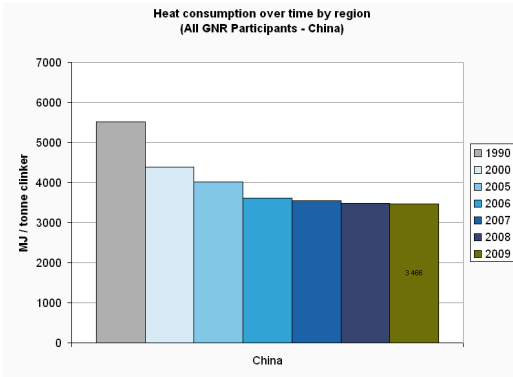


T U V W X Y Z AA AB AC AD AE AF AG

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112



WBCSD, Cement Sustainability Initiative (2009), page 23.

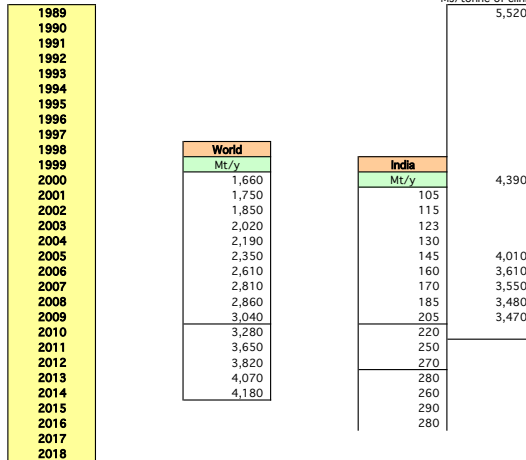


Region	1990 (MJ/t clinker)	2000 (MJ/t clinker)	2005 (MJ/t clinker)	2006 (MJ/t clinker)	2007 (MJ/t clinker)	2008 (MJ/t clinker)	2009 (MJ/t clinker)
China	5,520	4,390	4,010	3,910	3,550	3,480	3,470

Region	1990 (kg CO2 / t cementitious)	2000 (kg CO2 / t cementitious)	2005 (kg CO2 / t cementitious)	2006 (kg CO2 / t cementitious)	2007 (kg CO2 / t cementitious)	2008 (kg CO2 / t cementitious)	2009 (kg CO2 / t cementitious)
China	816	790	713	695	674	646	642

www.wbcsdcement.org/GNR-2009/index.html

China WBCSD participants
Thermal efficiency
MJ/tonne of clinker



China, percent of world, 2014 59.6%

- Largest 19 Chinese cement manufacturers
en.wikipedia.org/wiki/Cement_industry_in_China
- Anhui Conch Cement Co., Ltd
 - Tangshan Jidong Cement Co., Ltd
 - Datong Cement Co., Ltd
 - Xinjiang Tianshan Cement Co., Ltd
 - Sichuan Shuangma Cement Co., Ltd
 - Henan Tongli Cement Co., Ltd
 - Inner Mongolia Xishui Chuangye Co., Ltd
 - Anhui Chaodong Cement Co., Ltd
 - Jiangxi Wannianqing Cement Co., Ltd
 - Ningxia Saima Industry Co., Ltd
 - Taiyuan Lionhead Cement Co., Ltd
 - Shaanxi Qinling Cement Co., Ltd
 - Sichuan Golden Summit (Group) CO., Ltd
 - Huaxin Cement Co., Ltd
 - Fujian Cement Co., Ltd
 - Hebei Taihang Cement Co., Ltd
 - Jilin Yantai Group Co., Ltd
 - Guangdong Tapai Group Co., Ltd
 - Gansu Qilianshan Cement Co., Ltd

	CDIAC values prior to adjustment with USGAS data 2008-2013		
	MtC	MtCO2	Mt
2008	188.82	692.35	1,384.69
2009	219.71	805.59	1,611.19
2010	242.77	890.16	1,780.32

Cell: H9**Comment:** Rick Heede:

According to CDIAC estimates (based on U.S. Bureau of Mines data), China has emitted 28.4 percent of global cement process emissions 1928-2010 (US, the second largest producer, emitted 8.5 percent 1900-2010).

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 CO₂ 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 CO₂ 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 CO₂ emissions intensity have declined 16.5 percent from 1990 to 2009 -- from 758 net kg CO₂ per tonne of cementitious product in 1990 to 633 kg CO₂/t in 2009, according to WBCSD data.** This project estimates process emissions from calcining limestone and thus excludes emissions from fuel and electricity inputs 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 CO₂.

** World Business Council for Sustainable Development Cement Sustainability Initiative (2009) Cement Industry Energy and CO₂ Performance: "Getting the Numbers Right", wbcscement.org, 44 pp. See GNR Indicator 326, reproduced at the "Cement industry data" worksheet in this portfolio.

Cell: M13**Comment:** Rick Heede:

CDIAC data on cement emissions (cdiac.ornl.gov/ftp/trends/emissions/prc.dat) 1928-2008 (plus preliminary global emissions for 2009 and 2010, converted to MtC).

Cell: O13**Comment:** Rick Heede:

Following CDIAC we multiply C by 3.667. CMS elsewhere uses the isotopic value of 3.664191 CO₂/C.

Cell: Q13**Comment:** Rick Heede:

CDIAC emission estimation protocol asserts that "CO₂ production (in metric tons of C) = 0.136 metric tons of C per metric ton cement * quantity of cement produced (metric tons)." 0.136 tC * 3.667 CO₂/C = 0.499 tCO₂ per tonne of cement produced; round to 0.5, or 2 tonnes cement production per tonne of CO₂.

The mole calculation is as follows: (12.01 g C/mole CaCO₃ + 56.08 g CaO /mole CaCO₃) * 0.635 g CaO /g cement = 0.136 g C/g cement.
Boden, Marland, & Andres (1995). CDIAC basis its cement emission estimates on US Bureau of Mines cement production data.

Cell: F63**Comment:** Rick Heede:

CMS estimates China's cement production from the chart above* for 1975, 1980, and 1985. CMS interpolates between these dates to USGS data for 1990.

* U.S. Geological Survey China's Growing Appetite for Minerals by David Menzie, Pui-Kwan Tse, Mike Fenton, John Jorgenson, and Hendrik van Oss Open-File Report 2004-1374.

Cell: E92**Comment:** Rick Heede:

USGS Minerals Yearbook 2008, xls data. China: estimated production of mineral commodities, 2004-2008, in million metric tonnes.

Cell: J94**Comment:** Rick Heede:

WBCSD, Cement Sustainability Initiative (2009) Cement Industry Energy and CO₂ Performance "Getting the Numbers Right", World Business Council for Sustainable Development, 44 pp., www.wbcscement.org
CMS assumes that China's hydraulic cement plants improve, on average, by 4 kg CO₂ per tonne of cementitious product per year from 2006 to 2010. This may prove too aggressive.

Cell: D96**Comment:** Rick Heede:

China Cement Industry Report, 2008-2009, www.researchinchina.com/htmls/Report/2008/5615.html, "In 2007, cement output reached 1.35 billion tons in China, and during the first ten months of 2008, cement output has reached as many as 1.135 billion tons in China."

Cell: D97**Comment:** Rick Heede:

Bharat Book Bureau (2010) Research Report on Chinese Cement Industry, 2010-2011, March 2010, 40 pp, \$3,000.

Abstract: In 2009, Chinese cement production amounted to 1.63 billion tons, rising by 17.91% YOY; the growth rate was raised by 12.71% YOY. In 2009, Chinese cement industry maintained a good momentum with the expanding scale. The growth rate of total assets was also higher than 2008, but the growth rate of the product sales revenue saw a slight decrease. In 2009, Chinese cement industry realized the sales revenue of CNY 500.72 billion with the YOY growth rate of 17.21%; the growth rate was reduced by 6.77% YOY.

Thanks to Chinese domestic high demand for cement and robust profitability of cement enterprises, Chinese cement industry continued the high-speed expansion in 2009. In 2009, the investment in Chinese cement industry came up to CNY 170.07 billion, rising by 61.75% YOY. By the end of 2009, there were about 420 cement production lines under construction and over 140 production lines remaining to be started in China. After the completion of all these production lines, Chinese cement production capacity will be increased by 800 million tons and the annual cement production capacity will be 2.7 billion tons. However, the annual demand for cement in China is only 1.6-1.7 billion tons, leaving the severe surplus of about 1 billion tons.

Cell: E97**Comment:** Rick Heede:

USGS Minerals Yearbook 2009, Table 22: Hydraulic Cement: World Production by Country 2005-2009, at:
<http://minerals.usgs.gov/minerals/pubs/commodity/cement/index.html#myb>

Cell: E98**Comment:** Rick Heede:

China's cement production is expected to expand 9.09 percent over 2009.

China Cement Task Force (2010) Status Report of China Cement Industry, 8th CTF Meeting, Vancouver, March 2010, www.asiapacificpartnership.org/pdf/Cement/8th_meeting/Project_01_China_PPT.pdf
China production estimated by USGS for 2010 totals 1,800 thousand tonnes. <http://minerals.usgs.gov/minerals/pubs/commodity/cement/mcs-2011-cemen.pdf>

Cell: Q98**Comment:** Rick Heede:

USGS Minerals Yearbook 2014, China, Table 1, page 9.18, hydraulic cement production 2010-2015. Table 3 shows China's exports at 13.9 Mt in 2015.

Cell: W98**Comment:** Rick Heede:

USGS Minerals Yearbook 2014, Commodities, Cement, May 2017, Table 22.

Cell: Y98**Comment:** Rick Heede:

USGS

Cell: R100**Comment:** Rick Heede:

U.S. Geological Survey, Mineral Commodity Summaries, February 2014, page 39.
Hendrik G. van Oss [(703) 648-7712, hvanoss@usgs.gov]

Cell: Q103**Comment:** Rick Heede:

Previous Statista data updated with estimated China cement production for 2015-2017,
US U.S. Geological Survey, Mineral Commodity Summaries, January 2018,
<https://minerals.usgs.gov/minerals/pubs/commodity/cement/mcs-2018-cemen.pdf>

Cell: Q106**Comment:** Rick Heede:

Preliminary 2014-2018 estimate from Statista, whose sources are not revealed.

2015: 2,316 Mt

2016: 2,405 Mt

2076: 2,346 Mt

2018: 2,478 Mt

China PRC

Revise with USGS data when published. CAI has contacted Hendrik van Oss of USGS (Cement specialist) and Sean Xun (China specialist) for updated data.
Statista data updated April 2019, China cement production 2015-2018. Again, no sources revealed, behind high paywall.
Update with USGS data when available.

Cell: AG111

Comment: Rick Heede:

Left Intentionally Blank