

Cement Production

Richard Heede
 Climate Mitigation Services
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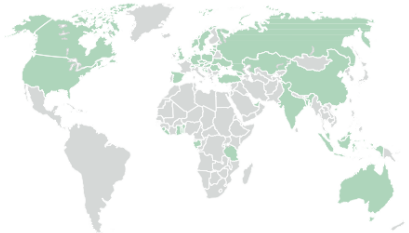
HeidelbergCement

www.heidelbergcement.com Heidelberg

yellow column indicates original reported units

Founded in 1874

Cement production & emissions data

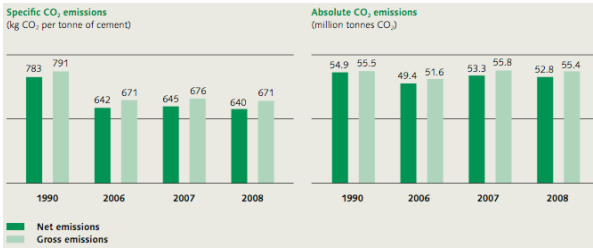


Heidelberg operating regions

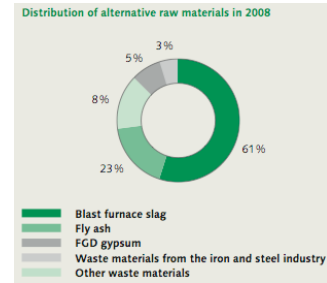
Year	Cement Prod		Energy Use		CO2 emissions	
	Clinker ratio	Annual production	Gross consumption	Gross consumption	Emissions rate	Net emissions
	Million tons/yr	Million tonnes/yr	Billion Btu	Terajoules	kg CO2/tonne	Million tonnes/yr

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HeidelbergCement CSR Rpt 2009, page 38.



Climate protection	2016	2017	2018
Specific net CO ₂ emissions (kg CO ₂ per tonne of cement)	610.5	607.6	599.2
Alternative fuel rate	19.7%	20.8%	21.7%
Clinker ratio	75.2%	75.3%	74.7%

Heidelberg CSR 2018, page 36.

Clinker factor % clinker in cement	Cement sales million tonnes	Thermal mix percent alt fuels	Thermal efficiency MJ/tonne clinker	Net emissions rate kg CO ₂ /t cementitious product	Net emissions million tonnes CO ₂	Gross emissions million tonnes CO ₂
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84.3%						
81.0%						
83.0%	51.1 sale	13.2%				
79.0%	65.2 sale	13.9%	3,600			
		9.1%				
		12.0%				
75.0%	87.9 sales		3,820			
75.0%	89.0 sale	13.5%	3,810			
76.1%	79.3 sale	16.9%				
76.1%	78.4 sale	16.0%				
	87.8 sales (excludes ready-mix 39 million m ³)					
	89.0 sales (excludes ready-mix 39 million m ³)					
76.2%	78.1 sales, CSR 2015, p. 51		3,336			
75.7%	81.8 sales, CSR 2015, p. 51		3,293			
75.0%	81.1 sales, CSR 2015, p. 51		3,236			
	102.8 CSR 2016					
	125.7 CSR 2018					
	129.9 CSR 2018					



CSR Rpt 2007, page 21.

779	54.9	CSR 2008		55.5
Interpolated	53.6			
Interpolated	52.3			
Interpolated	51.0			
Interpolated	49.7			
Interpolated	48.4			
Interpolated	47.1			
Interpolated	45.8			
Interpolated	44.5			
Interpolated	43.2			
765	41.9	CSR 2005		
Interpolated	39.7			
711	37.4	CSR 2005		
696	40.2	CSR 2007		41.7
697	42.9	CSR 2007		44.7
680	42.0	CSR 2007		43.9
667	45.4	CSR 2007		47.5
645	53.3	CSR 2009		55.8
638	52.8	CSR 2009		55.4
629	44.5	CSR 2010		47.1
638	46.6	CSR 2010		49.2
619	44.7	CSR 2011/2012		47.4
608	44.1	CSR 2011/2012		46.8
617	49.7	CSR 2015		52.8
613	51.5	CSR 2015		54.6
606	50.8	CSR 2015		53.9
611	56.6	CSR 2016		60.1
608	70.3	CSR 2018		74.2 CSR 2018
599	72.7	CSR 2018		76.7 CSR 2018

Total	1,227	0	1,418	HeidelbergCement acquires Italcementi, October 2016
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Strategy & management

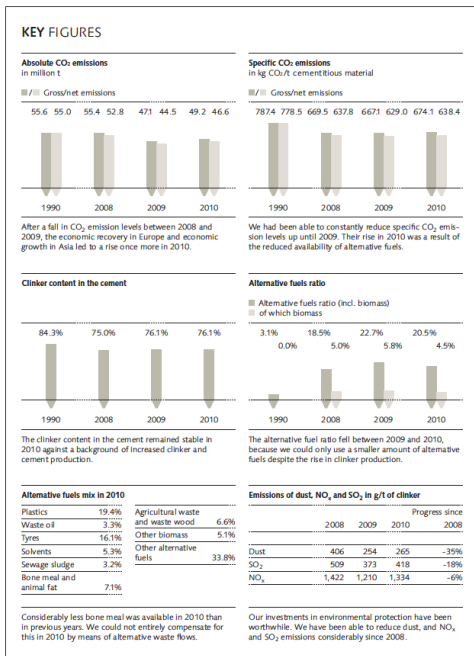
	2016	2017	2018	Unit
Group sales				
Cement and clinker:				
- Western and Southern Europe	22.4	28.9	30.8	million t
- Northern and Eastern Europe-Central Asia	24.2	25.9	25.6	million t
- North America	14.6	16.4	16.2	million t
- Asia-Pacific	28.7	34.7	36.9	million t
- Africa-Eastern Mediterranean Basin	12.7	19.0	19.7	million t
- Total	102.8	125.7	129.9	million t

Heidelberg CSR 2018, page 69.

Production & supply chain

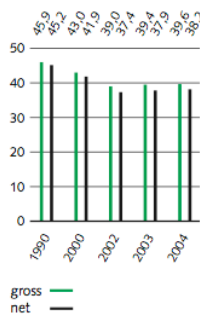
	1990	2016	2017	2018	Unit
Reduction in CO ₂ emissions					
Cement business line:					
- Absolute gross CO ₂ emissions	84.7	74.4	74.2	76.7	million t
- Absolute net CO ₂ emissions	83	70.4	70.3	72.7	million t
- Specific gross CO ₂ emissions (per tonne of cementitious material)	755.5	638.9	636	627.5	kg CO ₂ /t
- Specific net CO ₂ emissions (per tonne of cementitious material)	748	610.5	607.6	599.2	kg CO ₂ /t
- Indirect CO ₂ emissions	9.7	4.2	4.7	5.3	million t

Heidelberg CSR 2018, page 69.

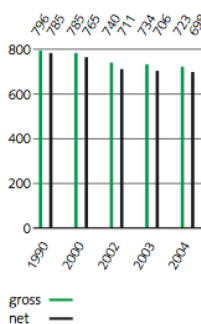


Heidelberg CSR Rpt 2010

Development of absolute CO₂ emissions (Mio t CO₂)



Development of specific CO₂ emissions (kg CO₂/t cement)



Group area	2007	2008
Europe	42.2	43.2
North America	14.9	13.6
Asia-Australia-Africa	30.8	32.2
Total	87.9	89.0

Energy and climate protection

	1990	2008	2009	2010
Cement				
- Absolute gross CO ₂ emissions in million t	55.6	55.4	47.1	49.2
- Absolute net CO ₂ emissions in million t	55.0	52.8	44.5	46.6
- Specific gross CO ₂ emissions in kg CO ₂ /t cementitious material	787.4	669.5	667.1	674.1
- Specific net CO ₂ emissions in kg CO ₂ /t cementitious material	778.5	637.8	629.0	638.4
- Indirect CO ₂ emissions in million t	4.9	5.8	4.1	6.0
- Specific energy consumption in kJ/t cement	4,250	3,516	3,425	3,444
- Absolute energy consumption of cement business line in GJ	300,133	291,119	242,044	251,609

Heidelberg SustRpt 2010, page 44.

Raw materials and fuels

	1990	2008	2009	2010
Fuel mix for burning clinker				
- Hard coal	59.6%	55.3%	55.3%	56.7%
- Brown coal	0.0%	5.3%	5.4%	7.6%
- Petroleum coke	2.3%	8.1%	10.1%	8.2%
- Natural gas	22.6%	10.6%	4.8%	4.9%
- Light fuel oil	0.9%	0.4%	0.3%	0.5%
- Heavy fuel oil	8.3%	0.7%	0.7%	0.6%
- Other fossil fuels	3.2%	1.2%	0.7%	0.9%
- Alternative fuels	3.1%	13.5%	16.9%	16.0%
- Biomass	0.0%	5.0%	5.8%	4.5%
- Proportion of biomass in mix of alternative fuels	0.0%	27.1%	25.7%	22.0%
Alternative fuel mix for burning clinker				
- Plastics	0.0%	16.9%	18.7%	19.4%
- Waste oil	39.0%	4.8%	3.5%	3.3%
- Tyres	34.2%	17.1%	14.7%	16.1%
- Solvents	4.7%	5.2%	4.6%	5.3%
- Sewage sludge	0.0%	3.8%	3.3%	3.2%
- Bone meal and animal fat	0.0%	9.0%	9.4%	7.1%
- Agricultural waste and waste wood	0.0%	7.9%	8.2%	6.6%
- Other biomass	0.0%	6.4%	4.7%	5.1%
- Other alternative fuels	22.2%	28.8%	32.9%	33.8%
Clinker content in cement	84.3%	75.0%	76.1%	76.1%
Proportion of alternative raw materials		13.0%	11.3%	11.6%

Heidelberg SustRpt 2010, page 46.

Cell: H9

Comment: Rick Heede:

"In 1873, Johann Philipp Schifferdecker began building a cement plant in Heidelberg, laying the foundation stone for an international group: Today, HeidelbergCement employs 42,000 people in 1,500 locations in 50 countries. At the end of the 2004 financial year, the total turnover was EUR 6.9 billion."
 CSR Rpt 2005, page 4.

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 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: K57

Comment: Rick Heede:

HeidelbergCement, 2009 Sustainability Report, p. 38: data for 1990, 2006-2008 in total CO2 (net and gross: we report net emissions here), and net kg CO2 per tonne of production. Charts reproduced above.

Cell: G66

Comment: Rick Heede:

"At Cirebon (Indonesia), 18,000 tonnes of coal per year are saved by using 30,000 tonnes of rice husks. This makes a significant contribution to the plant's CO2 reduction initiatives."
 Used tyres pictured.

Cell: G70

Comment: Rick Heede:

Use of alternative fuels in 2003-2004, of which 3.2 percent is biomass.

Cell: K70

Comment: Rick Heede:

HeidelbergCement CSR Rpt 2007, page 19, shows data on net and gross emissions, million tonnes CO2 for 2003 - 2006.

Cell: E74

Comment: Rick Heede:

Heidelberg SustRpt 2009, page 37.

Cell: K74

Comment: Rick Heede:

HeidelbergCement CSR Rpt 2009. pg38

Cell: E76

Comment: Rick Heede:

AR 2010 pdf pg 48, cement and clinker sales. Excludes ready-mix concrete: 35.0 million tonnes in 2010.

Cell: K76

Comment: Rick Heede:

CSR 2009-10, pg 33, SR

Cell: K78

Comment: Rick Heede:

Heidelberg Cement, Foundations: SustRpt 2011/2012, page 45

Cell: K80

Comment: Rick Heede:

HeidelbergCement (0216) Sustainability Report 2015. Data for 2013-2015, "Environment" tables, pages 52-fwd.

Cell: K83

Comment: Rick Heede:

HeidelbergCement CSR Key Figures, "Production and supply chain."

Cell: AC87

Comment: Rick Heede:

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