

<b>CO2 emissions from Clinker production (base data)</b>		
	Value and unit	Data source:
Calcinations process	525 kg/t clinker	The Cement CO2 Protocol, WBCSD working group Oct. 2001
Fuel firing	715 kcal/kg clinker = 2.993 GJ/t clinker	Design specifications for AYCC plant
Electricity consumption	0.102 MWh/t cement	Design specification for AYCC plant
Coal as fuel	93 t CO2/ 1000 GJ	Based on CDIAC data (US DOE) from: <a href="http://cdiac.ornl.gov/trends/emis/factors.htm">http://cdiac.ornl.gov/trends/emis/factors.htm</a>
Gas as fuel	57 t CO2/ 1000 GJ	Annex II of the Monitoring and Reporting Guidelines, Commission Decision 2004/156/EC
Electricity production	885 kg CO2 / MWh	WBCSD, Yemeni national data
CO2 emission from electricity production	885 kg CO2/MWh * 0.102 MWh/t cement = 90 kg CO2/ tons cement	
<b>Clinker percentage in cement (base data)</b>		
	Value and unit	Data source:
OPC (ordinary Portland Cement)	90% clinker	AYCC plant operational assumption
Blended cement	75% clinker	AYCC plant operational assumption, with local pozzolana as additive

<b>Fuel caused CO2 emissions at AYCC (clinker based):</b>		
Coal:	$93 * 2.993 / 1,000 =$	278 kg CO2 / t clinker
Natural gas;	$57 * 2.993 / 1,000 =$	171 kg CO2 / t clinker
<b>Combined calcinations and fuel caused CO2 emissions (clinker based):</b>		
Coal	$278 + 525 =$	803 kg CO2 / t clinker
Natural gas	$171 + 525 =$	696 kg CO2 / t clinker
<b>Final emissions per unit cement, including electricity caused emission:</b>		
Coal based, OPC	$0.9 * 803 + 90 =$	813 kg CO2 / t cement
Coal based, blended	$0.75 * 803 + 90 =$	692 kg CO2 / t cement
Natural gas, OPC	$0.9 * 696 + 90 =$	716 kg CO2 / t cement
Natural gas, blended	$0.75 * 696 + 90 =$	612 kg CO2 / t cement

<b>Total CO2 emissions based on 30% OPC and 70% blended cement and a total production of 1.54 M tons of cement per year:</b>		
Coal	$0.3 * 1.54 * 0.813 + 0.7 * 1.54 * 0.692 =$	<b>1.12 M tons CO2 / year</b>
Natural gas	$0.3 * 1.54 * 0.716 + 0.7 * 1.54 * 0.612 =$	<b>0.99 M tons CO2 / year</b>