Getting the Numbers Right. 
A Database for the Cement Industry

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Objective

CSI CEO’s decision October 2006

“Develop representative statistical information on the energy and CO2 performance of clinker and cement production, worldwide and regionally, to serve the need of internal and external stakeholders”
PWC

- PWC appointed as contractor in 2007
  - PWC Paris
- 2 Data collection cycles complete
- Information available for
  - 1990
  - 2000
  - 2005
  - 2006
- Anti-trust concerns preclude collection of data less than 1 year old.
Structure

• Project Agreement
  – WBCSD and PWC
  – Confidentiality
  – Code of Conduct
  – Project Management Charter

• Individual Service Agreement
  – Participant and PWC
  – Participants may be CSI members, non-CSI members or Federations

• Non-CSI members foreseen by the Project Agreement
Intellectual Property Rights

- Database software: PWC
- Database content: PWC
- Database inputs: Participants
- Database outputs:
  - Participant Specific: Participant
  - Federation Specific: Federation
  - Broader than one participant or federation: WBCSD/CSI
Queries

- The GNR will answer queries from interested stakeholders.
- 15 queries have been answered in 2008 to date.
- Queries are channeled through the PMC.
- PWC are obligated to anti-trust and confidentiality commitments
- Payment may be requested to cover costs
Queries

• Direct to gnrpmc@wbcsd.org

• Request should indicate:
  – Name and function of requesting organisation
  – Description of the proposed use of the data
  – Contact details for response or clarification
  – Details of the requested information
  – Geographic coverage required
  – Specific variables requested
  – Time frame for data
Basic Data

• Basic document:
  “The Cement CO$_2$ Protocol”
  – A methodology for calculation and reporting CO$_2$ emissions
  – Available at [www.wbcscement.org](http://www.wbcscement.org)
  – Features
    • An Excel tool
    • Explanation manual

• Aligned with the WRI/WBCSD protocol
Assurance of Data

- Assurance at plant and company level is required for all CSI companies.
- “Limited Assurance” * is the standard.
  - At least every 3 years
  - Practitioner to assess need for site visits
  - National & regional trading system verifications accepted.
  - 1990 is not verifiable
- Assurance necessary, for example, for CDM benchmark setting.
- Collection tool requests the assurance status of all data

*As per ISAE 3000
The Collection Tool

- Downloaded from PWC, the tool filters the information in the “protocol”
- Simple checks for completion
- Filtered information uploaded to portal and taken into database by PWC
- Both company and plant level information is collected
The data base

- PWC execute a number of “business” checks on incoming data including:
  - Compatibility with industry norms
  - Compatibility with historical data
- Clarifications of inputs regularly required.
- PWC consolidates to:
  - Specific company reports
  - Regional and world reports
Coverage: 794 million tons
The representivity of the data base varies from region to region. Care is required in interpretation.
GNR Outputs 2006
CO₂ Emissions Per Tonne Clinker

Average gross CO₂ emissions per tonne clinker
(All GNR Participants)

Average net CO₂ emissions per tonne clinker
(All GNR Participants)

<table>
<thead>
<tr>
<th>Year</th>
<th>World</th>
<th>1990</th>
<th>2000</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td></td>
<td>907</td>
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<td></td>
<td></td>
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<tr>
<td>2000</td>
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<tr>
<td>2005</td>
<td>847</td>
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<tr>
<td>2006</td>
<td>844</td>
<td></td>
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</tr>
</tbody>
</table>
CO$_2$ Emissions Per Tonne Cementitious

Average gross CO$_2$ emissions per tonne cementitious (All GNR Participants)

Average net CO$_2$ emissions per tonne cementitious (All GNR Participants)

1990: 752 kg CO$_2$ / tonne cement
2000: 715 kg CO$_2$ / tonne cement
2005: 675 kg CO$_2$ / tonne cement
2006: 661 kg CO$_2$ / tonne cement
CO$_2$ Emissions for Kiln Type

Weighted average gros CO2 emission per tonne clinker per kiln type (All GNR Participants)

- **DRY WITH PREHEATER AND PRECALCINER**
  - 1990: 842 kg CO2 / tonne clinker
  - 2000: 861 kg CO2 / tonne clinker
  - 2005: 955 kg CO2 / tonne clinker
  - 2006: 896 kg CO2 / tonne clinker

- **DRY WITHOUT PREHEATER (LONG DRY KILN)**
  - 1990: 842 kg CO2 / tonne clinker
  - 2000: 861 kg CO2 / tonne clinker
  - 2005: 955 kg CO2 / tonne clinker
  - 2006: 896 kg CO2 / tonne clinker

- **SEMI-WET/SEMI DRY**
  - 1990: 1043 kg CO2 / tonne clinker
  - 2000: 1043 kg CO2 / tonne clinker
  - 2005: 1043 kg CO2 / tonne clinker
  - 2006: 1043 kg CO2 / tonne clinker

- **WET**
  - 1990: 1043 kg CO2 / tonne clinker
  - 2000: 1043 kg CO2 / tonne clinker
  - 2005: 1043 kg CO2 / tonne clinker
  - 2006: 1043 kg CO2 / tonne clinker
Clinker Volume by Technology

Clinker volumes by technology
(All GNR Participants)

Clinker Production
(All GNR Participants)

Asia ex. China, India, CIS and Japan
China and India
Africa + ME
Latin America
CIS
Japan Aus NZ
North America
Europe
Alternative Fuel Usage

Absolute volumes of alternative fossil fuels
(All GNR Participants)

- Asia ex. China, India, CIS and Japan
- China and India
- Africa + ME
- Latin America
- CIS
- Japan Aus NZ
- North America
- Europe

Thousands of alternative fossil fuels:
- 0
- 1000
- 2000
- 3000
- 4000
- 5000
- 6000
- 7000
- 8000
- 9000
- 10000

Years:
- 1990
- 2000
- 2005
- 2006
Biomass Usage

Absolute volumes of biomass
(All GNR Participants)

Thousand tonnes of biomass

Asia ex. China, India, CIS and Japan
China and India
Africa + ME
Latin America
CIS
Japan Aus NZ
North America
Europe
Energy Consumption Per Tonne Clinker Per Kiln Type

Weighted average thermal energy consumption per tonne clinker per kiln type
(All GNR Participants)

- DRY WITH PREHEATER AND PRECALCINER: 3,382 MJ/tonne clinker
- DRY WITH PREHEATER WITHOUT PRECALCINER: 3,699 MJ/tonne clinker
- DRY WITHOUT PREHEATER (LONG DRY KILN): 4,489 MJ/tonne clinker
- SEMI-WET/SEMI DRY: 3,844 MJ/tonne clinker
- WET: 6,343 MJ/tonne clinker

Energy Consumption Per Tonne Cement

Average electric energy consumption
(All GNR Participants)

kWh / tonne cement

World

- 1990
- 2000
- 2005
- 2006
Clinker Cement Ratio

Clinker to cement ratio
(All GNR Participants)

<table>
<thead>
<tr>
<th>Year</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>83</td>
</tr>
<tr>
<td>2000</td>
<td>82</td>
</tr>
<tr>
<td>2005</td>
<td>79</td>
</tr>
<tr>
<td>2006</td>
<td>78</td>
</tr>
</tbody>
</table>

World %

- 1990: 83%
- 2000: 82%
- 2005: 79%
- 2006: 78%
Regional average emissions

Average gross CO2 emissions per tonne cementitious
(All GNR Participants)

Average net CO2 emissions per tonne cementitious
(All GNR Participants)
2006 Net CO₂ per tonne clinker

Net CO₂ emission per tonne clinker

Formula of the linear regression between 10% and 90%

\[ y = 1.49x + 766 \]

Regression coefficient (r²) between 10% and 90%

0.98

Weighted average

844 kg CO₂/t clinker

Corresponding percentage

52%

Standard deviation

97.6 kg CO₂/t clinker

Number of plants

615

Total production volume in the graph

620 Mt clinker
2006 Net CO\textsubscript{2} per tonne cement

**Graph generated with data at company and country level**

- **Formula of the linear regression**
  - between 10% and 90%
  - \( y = 2.68x + 530 \)
  - Regression coefficient \((r^2)\) between 10% and 90%
  - 0.99

- **Weighted average**: 661 kg CO\textsubscript{2}/t cement
- **Corresponding percentage**: 49%
- **Standard deviation**: 222 kg CO\textsubscript{2}/t cement

- **Number of companies**: 231
- **Total production volume in the graph**: 800 Mt cement

CSI - "Getting the Numbers Right"
- **Year**: 2006
- **Region**: World-wide
- **Company**: All GNR participants
Objective and Conclusion

Objective

“Develop representative statistical information on the energy and CO2 performance of clinker and cement production, worldwide and regionally, to serve the need of internal and external stakeholders”

Conclusion: GNR:

- A wealth of data
- to develop knowledge
- to manage and improve the cement industry’s CO2 and energy performance
- CSI invites further participation especially PCA, Latin American Federations, China, Russia & Japan.