[REPORT TASK I.2.5-I.2.6] DATA COLLECTION AND DATABASE SYSTEM INCLUDING THIRD VERSION OF DATABASE

EXECUTIVE SUMMARY

Based on the results from assessment of availability and quality of data and gap analysis, this Report proposes the data collection and management framework for the Viet Nam cement industry and presents the third version of database template. Given the early stage of management awareness and data collection as well as the MRV in the industry, a simplified system including only the minimal required data is provided. It is expected that as a function of the evolution of the project, and especially the collaboration of the cement companies, the system will progressively be further expanded.

The Report is divided into 4 parts:

Part 1: Introduction gives background information about the MRV and database system in the cement industry and the key objectives of this study. It should be noted that the current availability, completeness and especially the reliability of data are considerably less than is needed for enabling a meaningful Vietnamese cement sectoral performance analysis, baseline setting and scenario analysis. Obtaining a sufficiently representative and reliable set of data from the cement companies is likely to be a long-term process spanning over the entire two years of the project, and beyond.

Part 2: Data collection and Management Methodology provides an overview and expert analysis of international methodologies for data collection in the cement sector which include IPCC MRV system, EU ETS MRV system, CSI MRV system, ISO-14064, J-MRV and the Gtriple C and Ecofys templates. In conclusion, the WBCSD/CSI Cement CO2 and Energy Protocol: CO2 and Energy Accounting and Reporting Standard for the Cement Industry and a simplified version of its Excel based tool are recommended for the project. By doing so, the Viet Nam system will be compatible with the global cement industry standard and practice, with the ISO 14064 standard and the MRV system used in the EU ETS.

This part also presents the detailed approach for database collection and management. In the current design stage, database collection and management is performed by the consortium.

The data collection will be aimed at all operating cement companies. The consortium has proposed a detailed approach for data collection to the different groups of

companies in order to increase the feedbacks from them. The supports from the MOC in this collection task are also defined and emphasized. The consortium will stay in a close collaboration with experts from VICEM and Department of Construction at each relevant province where the cement plants are located to get further supports in collecting and verifying the data. Then the database is operated, managed and controlled by a limited group of key experts from Vietnamese consultants of the consortium.

To give a full picture, the consortium also discusses, two Options for data upgrading and management in a long term for the Readiness Stage (after ending this Pilot Project). The MOC will decide and develop an appropriate Option in a later stage.

Part 3: Database template and CO_2 emission calculation method describes the database structure and provides an overview of available data inputs at company level. Notably, the bottom-up approach is applied to design MRV system for this project, i.e. the emission and project boundary are set at the plant level. The project boundary only covers CO_2 emissions including both direct emissions from sources that are owned or controlled by the reporting entity and indirect emissions that are a consequence of the activities of the reporting entity but occur at sources owned or controlled by other entity.

The main calculation indicators for mitigation actions in the Viet Nam cement industry are CO_2 emission and energy performance indicators. In order to help the users of the database system understand and fill in data correctly, the calculation methods of CO_2 emissions from different processes in the cement production that are applied in the excel database template are detailed.

Part 4: Conclusion and recommendation summarizes the main content of the report. It is recommended that in order to be able to conduct the data collection to serve the purposes of this project as soon as possible, a quick decision and approval by the MOC on the data management method is necessary.

- The first version of Viet Nam cement energy and CO_2 database was established on Microsoft Excel with input data and calculations from 17 plants, available to the consortium during 2014.
- The second version was improved with additional 18 installations, and
- The third version was built based on a total of 47 plants out of 55 in operation in Vietnam as of September 2015.

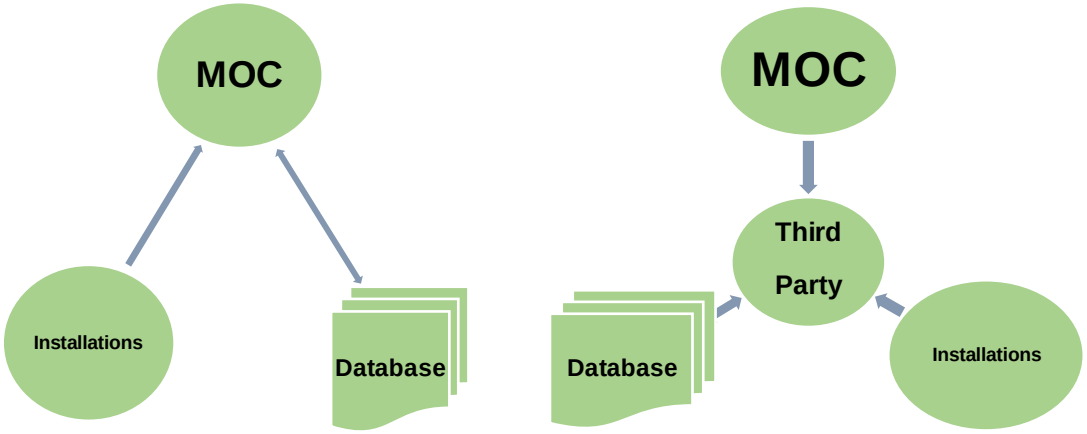
The third version of database includes 5 year-consecutive data of 47 rotary cement plants with total design clinker capacity of 180,700 ton clinker/day, which represents 87% of total clinker capacity of the industry. This excel-based database/Version 3.0 is a simplified version of the CSI MRV system which makes it compatible with the current international industry best practice and also current domestic context.

The results from the third version database system were assessed and presented with respect to aspects such as coverage, completeness, reliability and resulting baselines and trend lines.

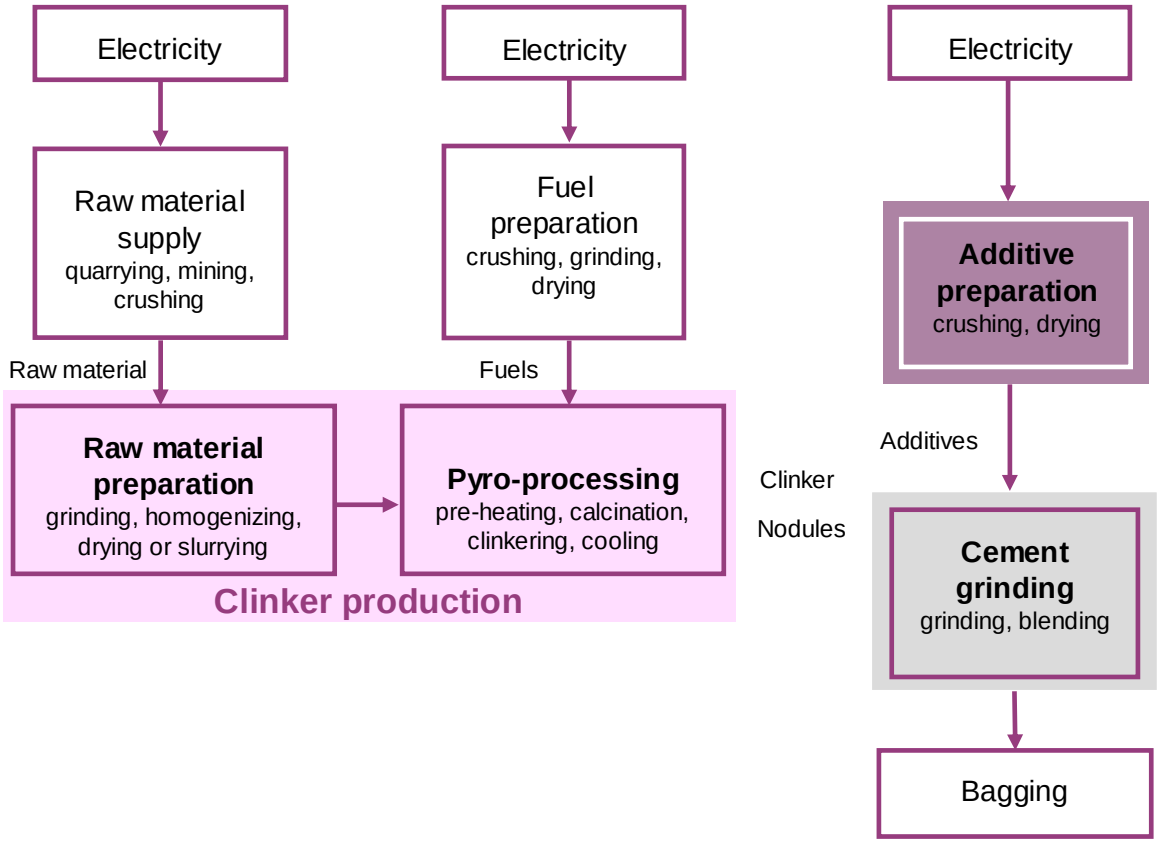
This is the first effort to establish a sector database for the cement sector in Viet Nam. Further effort is needed to continuously update and improve the database.

Annexus

1. Two options for data upgrading and management



2. Project boundary set at the plant level



3. Assessment of the applicability to the data collected from 47 cement plants with the data required by Viet Nam cement energy and CO2 database

No.	Parameter/ Description	Unit	Data coverage
1	Clinker and cement production		
1.1	Clinker production		
	Total clinker production	ton/year	100% (47/47)
	Amount of clinker sold to other companies	ton/year	78.7%(37/47)
	Amount of clinker bought from other companies	ton/year	78.7% (37/47)
	Change in clinker stock (the volume of clinker used to make	ton/year	78.7% (37/47)

No.	Parameter/ Description	Unit	Data coverage
	cement)		
	Amount of clinker transfers between plants from the same company	ton/year	78.7% (37/47)
1.2	Cement production		
	Total cement output	ton/year	100% (47/47)
2	Component matter of feedstock and clinker		
2.1	Component matter in raw material		
	CaO_{In}	%	100% (47/47)
	MgO_{In}	%	100% (47/47)
2.2	Component matter in clinker		
	CaO_{Out}	%	100% (47/47)
	MgO_{Out}	%	100% (47/47)
3	Dust production		
3.1	Bypass dust leaving kiln system	ton/year	4.2% (2/47)
3.2	Cement kiln dust leaving kiln system	ton/year	4.2% (2/47)
4	MICs and clinker in cement production		
4.1	Total volume of MICs used to make cement	ton/year	100% (47/47)
4.2	Amount of each additive used for the production of cement		
	• *Gypsum*	ton/year	100% (47/47)
	• *Limestone*	ton/year	100% (47/47)
	• *Slag*	ton/year	100% (47/47)
	• *Fly ash*	ton/year	100% (47/47)
	• *Pozzolana*	ton/year	100% (47/47)
	• *Other mineral components (specify if any)*		100% (47/47)
5	Fuel consumed for clinker production (including clinker kiln system, dryer system of fuels and raw materials)		
5.1	The volume of each traditional fossil fuel (specify)	ton/year	100% (47/47)
5.2	The volume of each alternative fossil fuel (specify)	ton/year	100% (47/47)
5.3	The volume of each biomass fuel (specify)	ton/year	100% (47/47)
6	Fuel consumed for drying of mineral components in cement production		
6.1	The volume of each traditional fossil fuel (specify)	ton/year	100% (47/47)
6.2	The volume of each biomass fuel (specify)	ton/year	100% (47/17)
7	Net calorific value (NCV) or Low calorific value (LCV) of fuels [MJ/kg or MJ/Nm3]		10.6% (5/47)
8	Electricity consumed for clinker/ cement production		
8.1	Total electricity consumed for clinker and for cement production	MWh/year	100% (47/47)
8.2	Electricity consumed for clinker production	MWh/year	78.7% (37/47)
8.3	Electricity consumed for cement production	MWh/year	78.7% (37/17)
8.4	Self-generated electricity from captive power plant	MWh/year	100% (47/47)
8.5	Self-generated electricity from waste heat recovery	MWh/year	100% (47/47)
8.6	Grid electricity for clinker and cement production	MWh/year	100% (47/47)

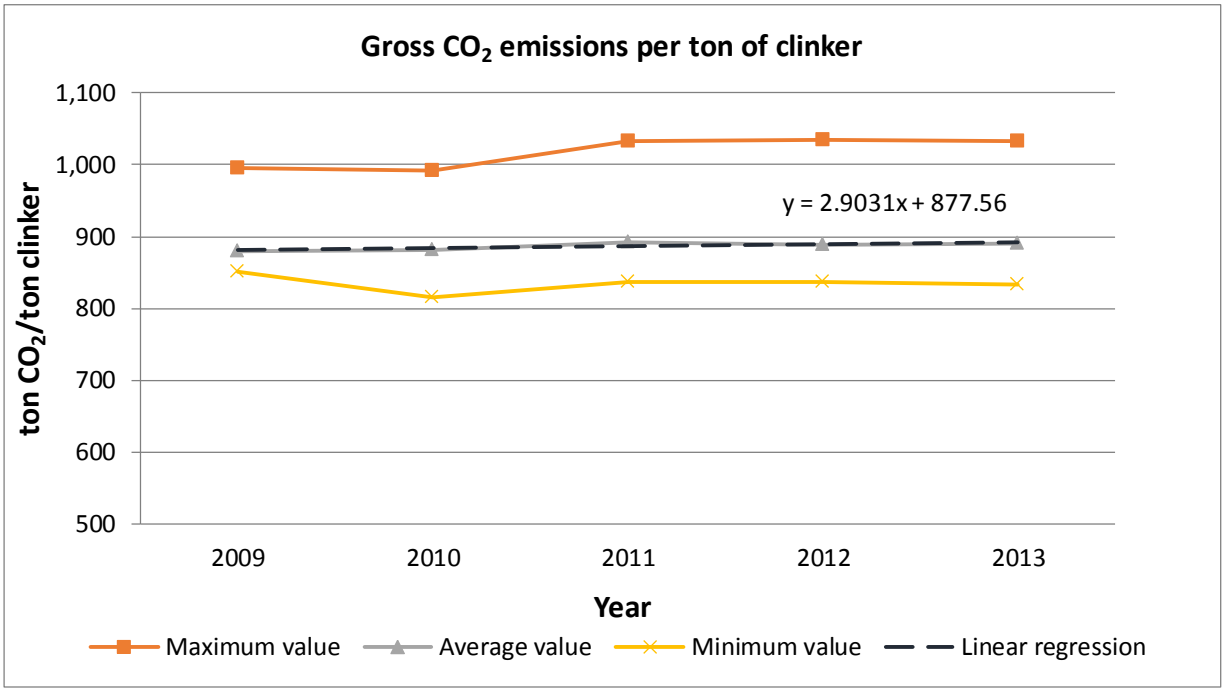
4. Key Performance Indicators (KPIs)

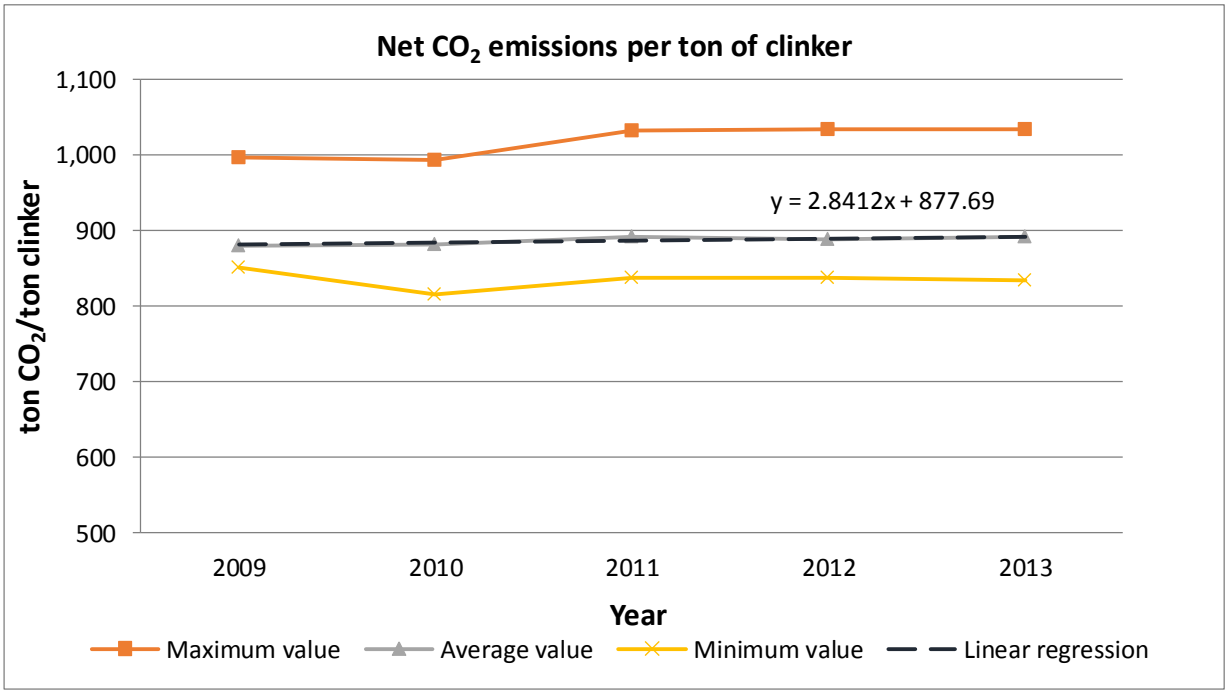
No.	Variable	Unit	Year				
			2009	2010	2011	2012	2013
1	Number of plants/	Number	19	26	34	37	47

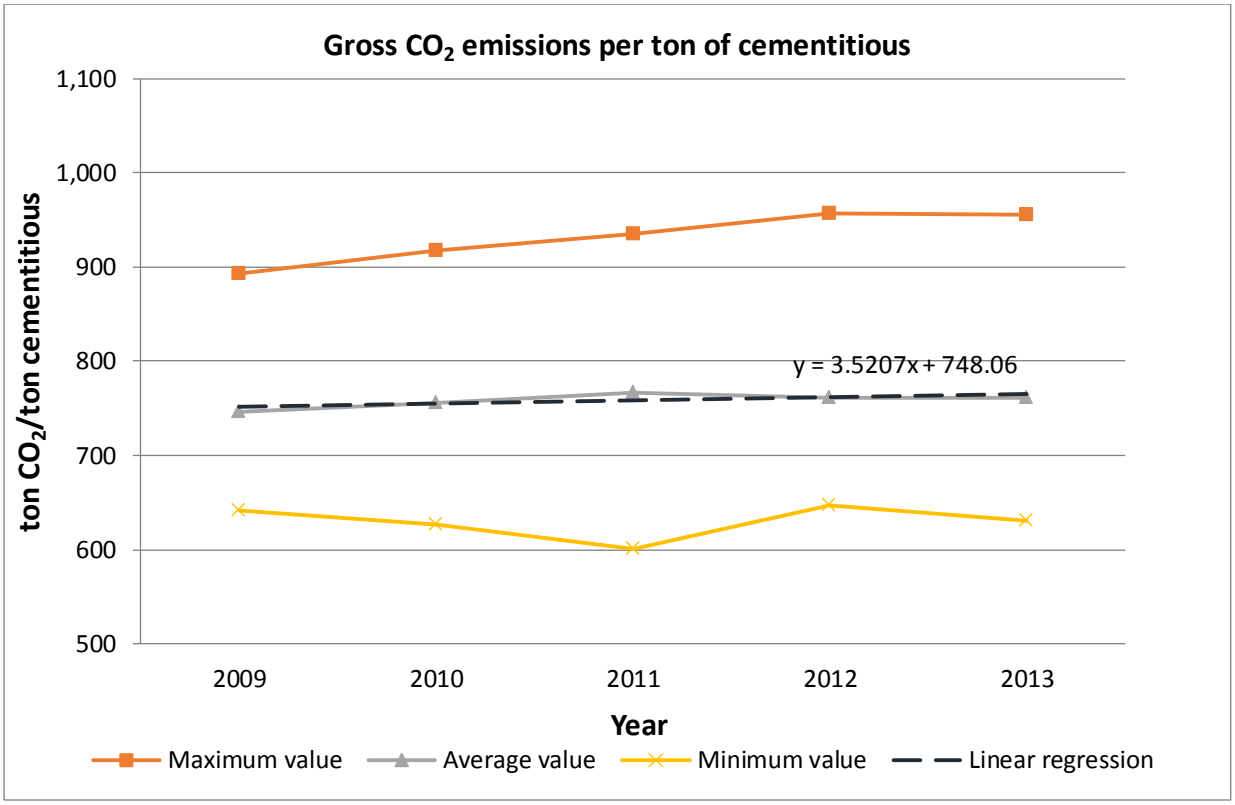
No.	Variable	Unit	Year				
			2009	2010	2011	2012	2013
	installations						
2	Number of companies	Number	19	26	34	37	47
3	Total clinker production	Mton of clinker	20,412	32,515	39,685	42,055	47,490
4	Total cementitious product production	Mton of cementitious product	24,062	37,867	46,113	49,050	55,554
5	Total MICs volume	Mton of MICs	3,650	5,353	6,428	6,996	8,064
6	Gross CO_2	Mton CO_2	17,965	28,636	35,379	37,355	42,306
7	Net CO_2	Mton CO_2	17,965	28,635	35,379	37,355	42,291
8	Specific Gross CO_2 per ton of clinker	kg CO_2/ton of clinker					
	Maximum value		996	993	1,032	1,034	1,034
	Weighted average value		880	881	891	888	891
	Minimum value		851	815	836	837	833
9	Specific Net CO_2 per ton of clinker	kg CO_2/ton of clinker					
	Maximum value		996	993	1,032	1,034	1,034
	Weighted average value		880	881	891	888	891
	Minimum value		851	815	836	837	833
10	Specific Gross CO_2 per ton cementitious	kg CO_2/ton cementitious product					
	Maximum value		892	917	935	957	956
	Weighted average value		747	756	767	762	762
	Minimum value		641	627	601	647	630
11	Specific Net CO_2 per ton cementitious	kg CO_2/ton cementitious product					
	Maximum value		892	917	935	957	956
	Weighted average value		747	756	767	762	761
	Minimum value		641	627	601	647	630
12	Specific Gross CO_2 per ton equivalent cement	kg CO_2/ton cement (equivalent)					

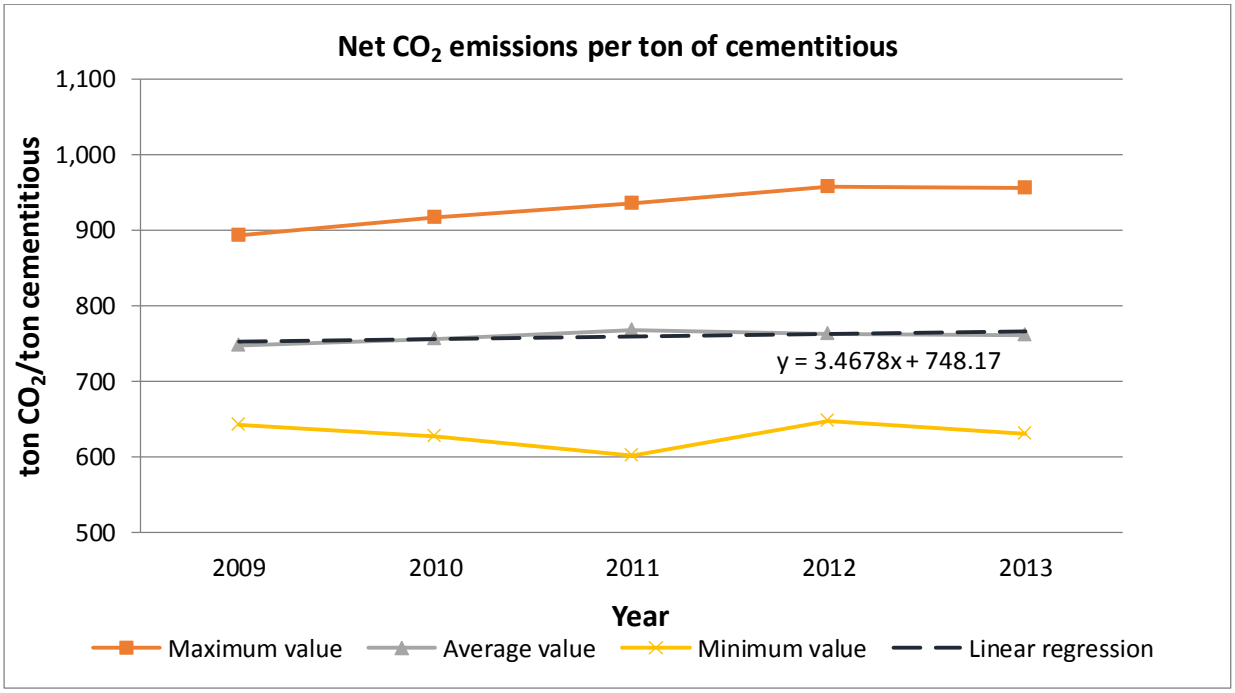
No.	Variable	Unit	Year				
			2009	2010	2011	2012	2013
	Maximum value		861	911	915	900	892
	Weighted average value		734	741	753	741	738
	Minimum value		641	627	601	573	606
13	Specific Net CO_2 per ton equivalent cement	kg CO_2/ton cement (equivalent)					
	Maximum value		861	911	915	900	892
	Weighted average value		734	741	753	741	738
	Minimum value		641	627	601	573	606
14	Clinker substitution (Clinker to cement ratio)	%					
	Maximum value		95.0%	96.6%	96.7%	96.5%	97.6%
	Weighted average value		83.4%	84.2%	84.5%	83.4%	82.9%
	Minimum value		70.0%	63.2%	60.2%	63.3%	67.1%
15	Thermal energy efficiency	MJ/ton clinker					
	Maximum value		4,788	4,752	5,172	5,194	5,193
	Weighted average value		3,598	3,602	3,708	3,673	3,698
	Minimum value		3,285	2,910	3,133	3,138	3,096
16	Electric energy efficiency for clinker production	kWh/ton clinker					
	Maximum value		117.2	86.6	91.4	104.0	91.3
	Weighted average value		60.0	59.7	59.0	60.5	60.2
	Minimum value		31.6	33.9	33.7	35.5	34.7
17	Electric energy efficiency for cement production	kWh/ton cement					
	Maximum value		117.2	119.7	133.9	125.5	123.7
	Weighted average value		92.2	88.6	84.6	84.3	84.2
	Minimum value		57.8	71.1	57.1	64.6	57.4

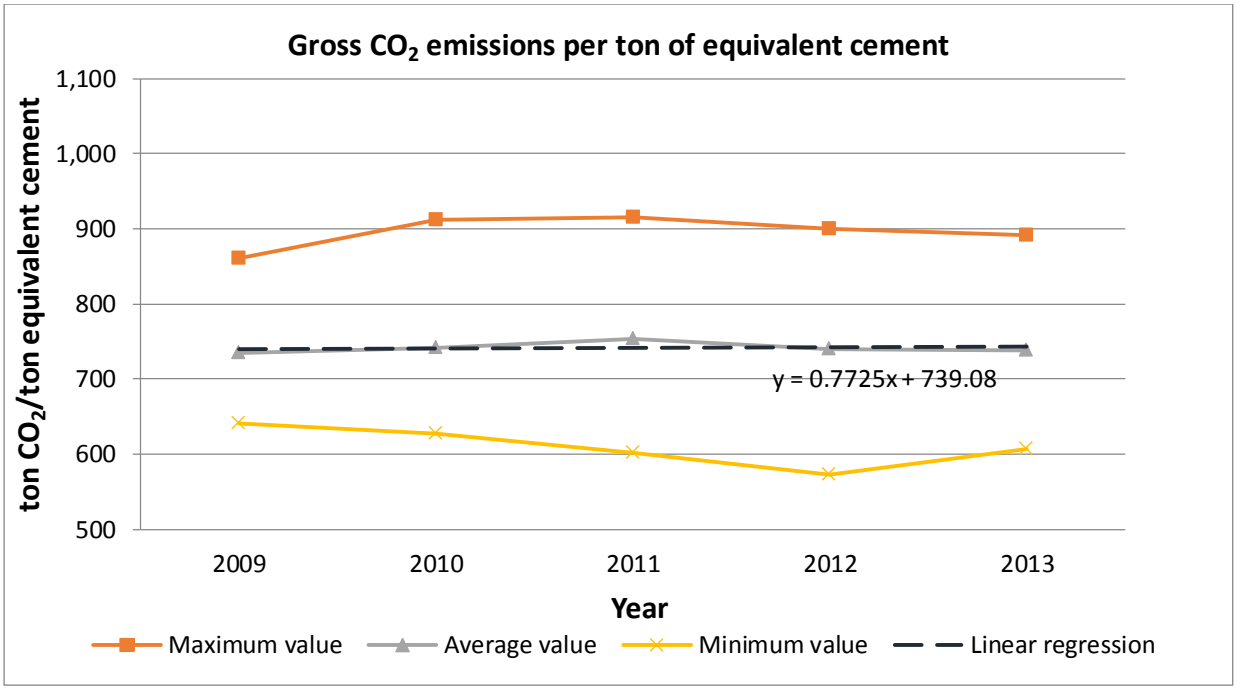
The KPIs are also presented in the following figures:

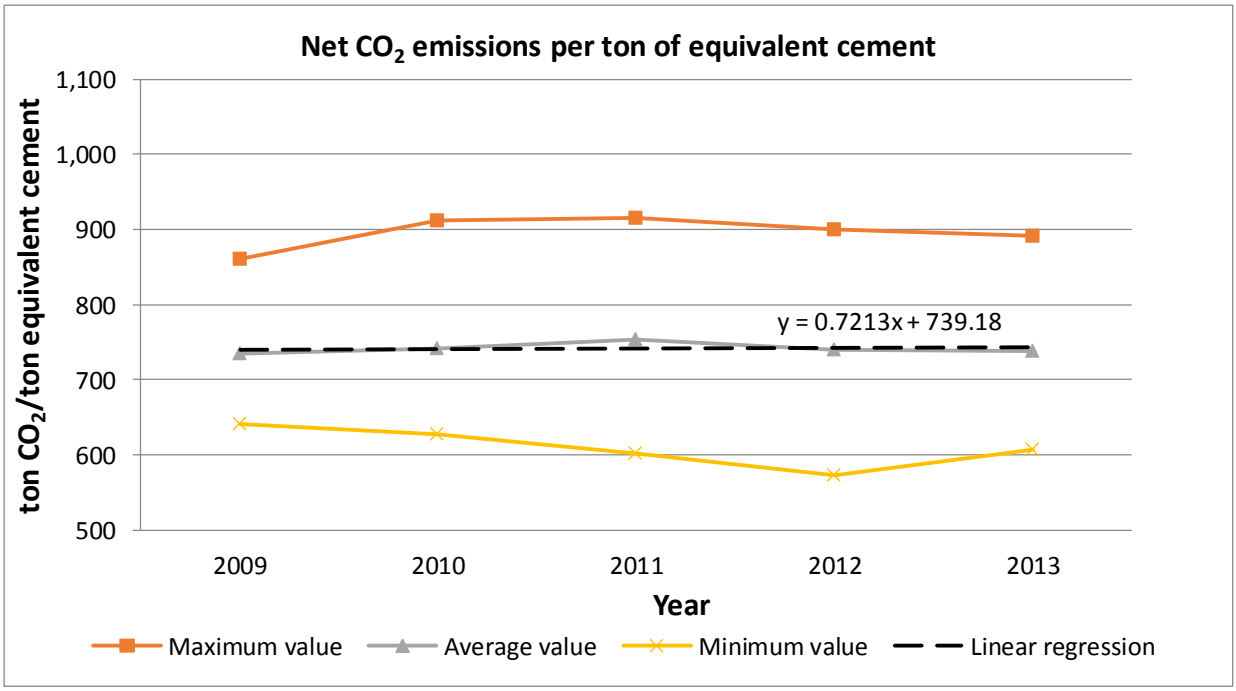


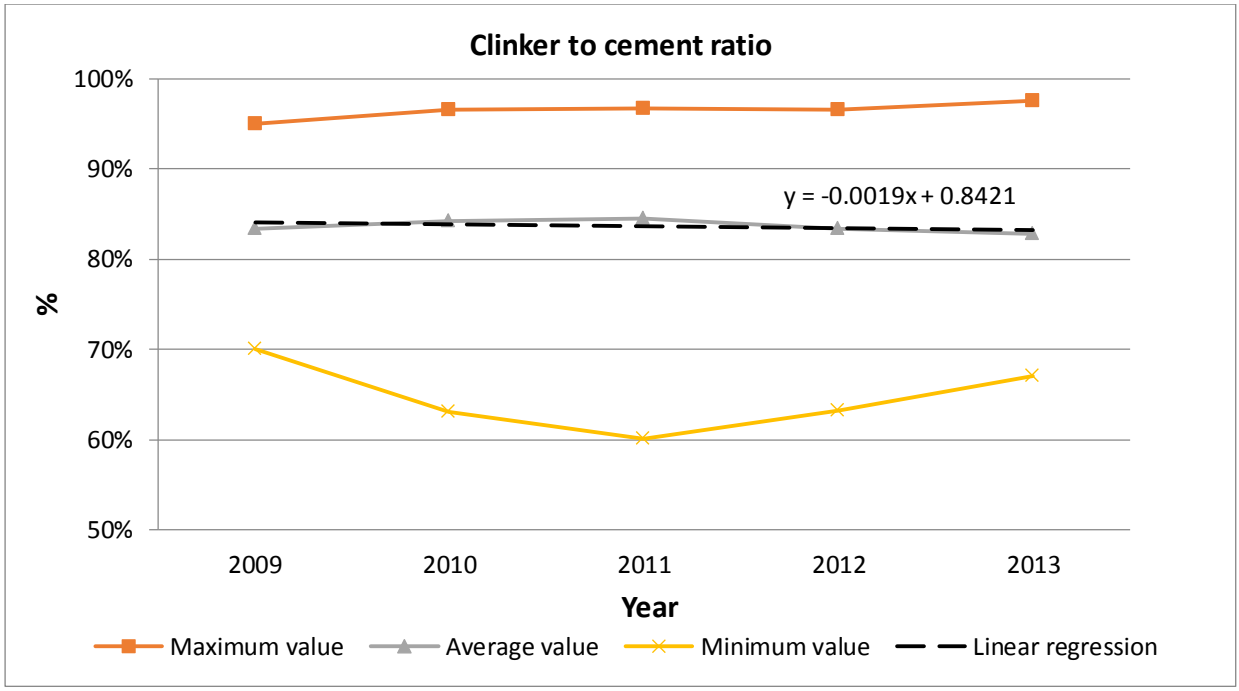


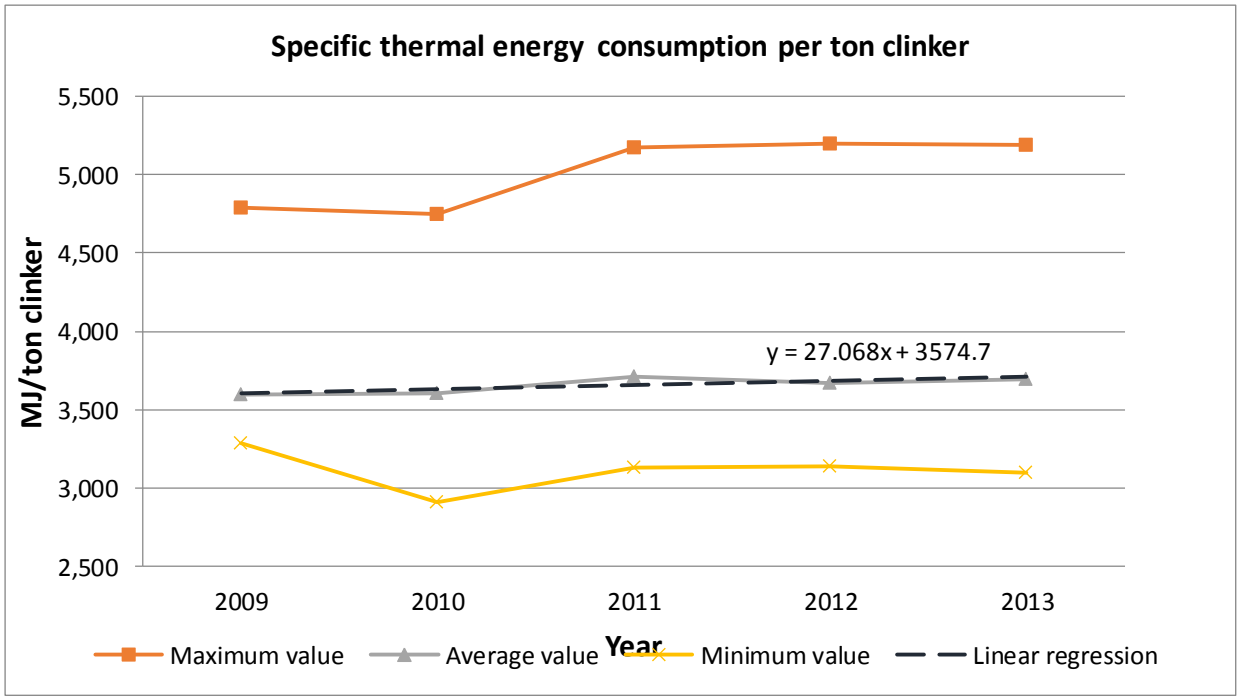

Gross CO_2 emissions per ton of cementitious
1,100
1,000
900
800
700
600
500
ton CO_2/ton cementitious
y = 3.5207x + 748.06
2009
2010
2011
2012
2013
Year
Maximum value
Average value
Minimum value
Linear regression

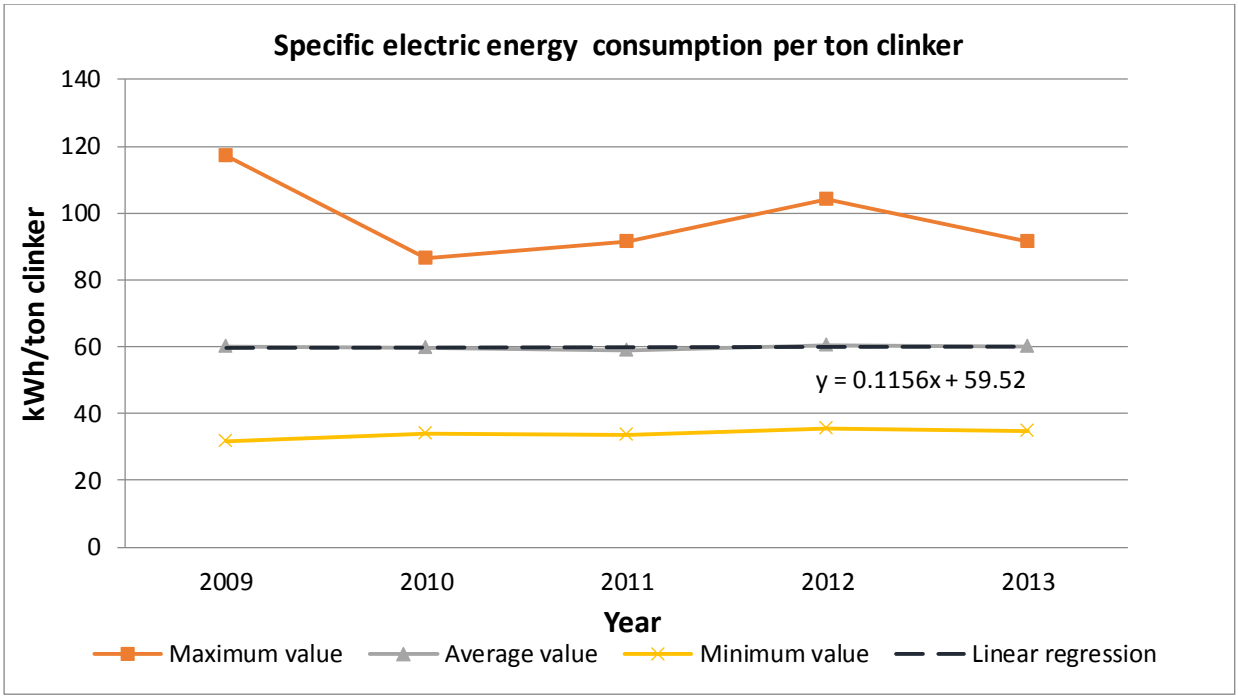

Net CO_2 emissions per ton of cementitious
1,100
1,000
900
800
700
600
500
ton CO_2/ton cementitious
y = 3.4678x + 748.17
2009
2010
2011
2012
2013
Year
Maximum value
Average value
Minimum value
Linear regression


Gross CO_2 emissions per ton of equivalent cement
ton CO_2/ton equivalent cement
1,100
1,000
900
800
700
600
500
2009
2010
2011
2012
2013
Year
y = 0.7725x + 739.08
Maximum value
Average value
Minimum value
Linear regression


Net CO_2 emissions per ton of equivalent cement
ton CO_2/ton equivalent cement
1,100
1,000
900
800
700
600
500
2009
2010
2011
2012
2013
Year
y = 0.7213x + 739.18
Maximum value
Average value
Minimum value
Linear regression


Clinker to cement ratio
100%
90%
80%
70%
60%
50%
%
y = -0.0019x + 0.8421
2009
2010
2011
2012
2013
Year
Maximum value
Average value
Minimum value
Linear regression


Specific thermal energy consumption per ton clinker
5,500
5,000
4,500
4,000
3,500
3,000
2,500
MJ/ton clinker
y = 27.068x + 3574.7
2009
2010
2011
2012
2013
Year
Maximum value
Average value
Minimum value
Linear regression



The report was developed under the framework of the Nordic Partnership Initiative Pilot Progamme for Supporting Up-scaled Climate Change Mitigation Action in Vietnam's Cement Sector.

The Nordic Partnership Initiative (NPI) established in December 2011 to support climate change mitigation efforts in developing countries and funded by Denmark, Finland, Iceland, Norway and Sweden. The budget of the NPI Programme in Vietnam is €1.6 million, and it is financed by Nordic Development Fund (NDF) and the Ministry of Construction of Vietnam. The implementation of the Vietnam cement sector Pilot Programme started in March 2014, by a consortium led by NIRAS A/S (Denmark) in collaboration with Perspectives GmbH, South Pole Group, VNEEC JSC and NIRAS Vietnam.

For more information on the project and the full report, please contact:
Mrs. Luu Linh Huong
Department of Science, Technology and Environment
Ministry of Construction of Vietnam
ndfc34@moc.gov.vn