MRV of mitigation actions in cement sector in Vietnam: experience from energy auditing and NAMA developing

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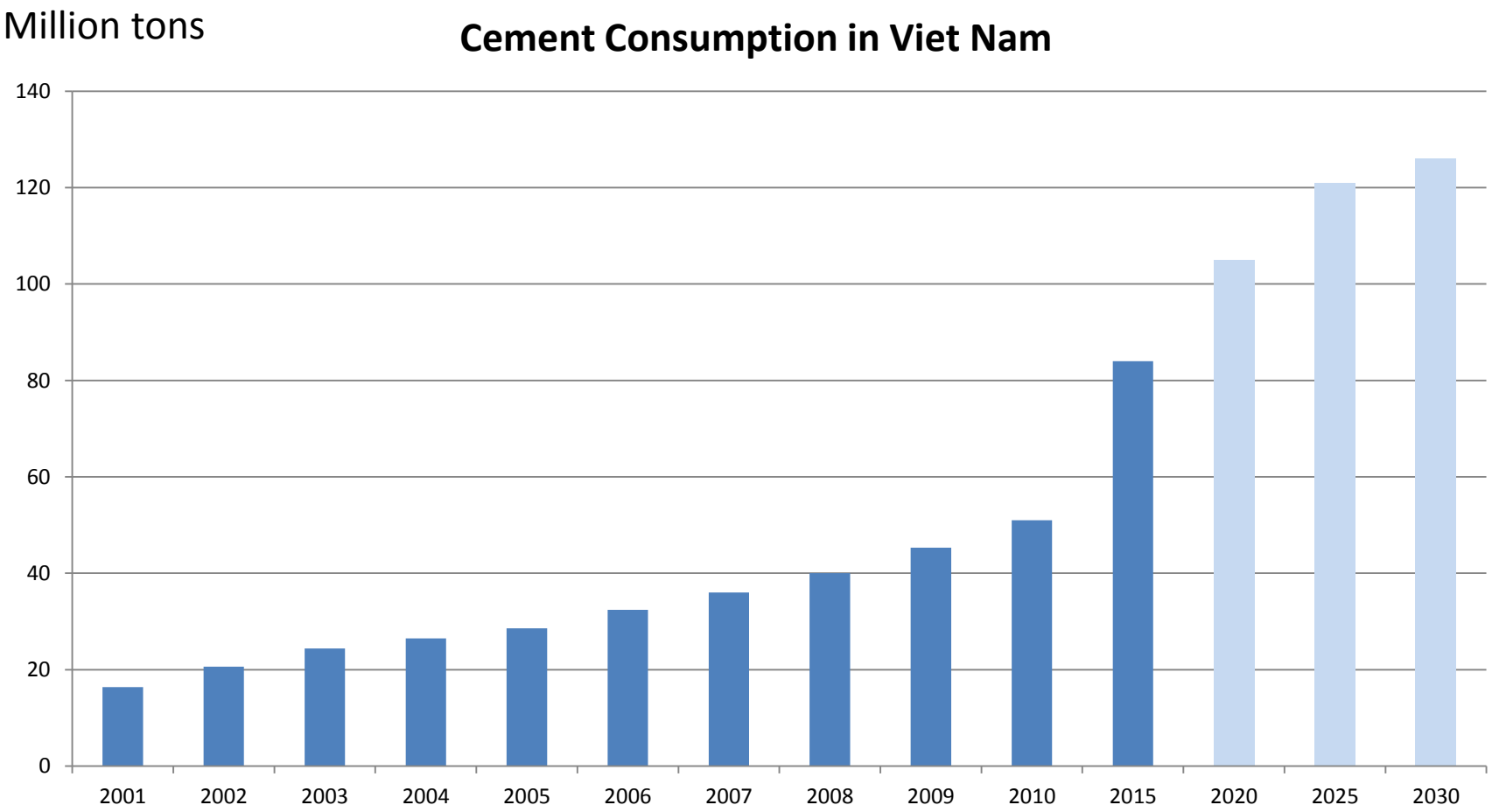
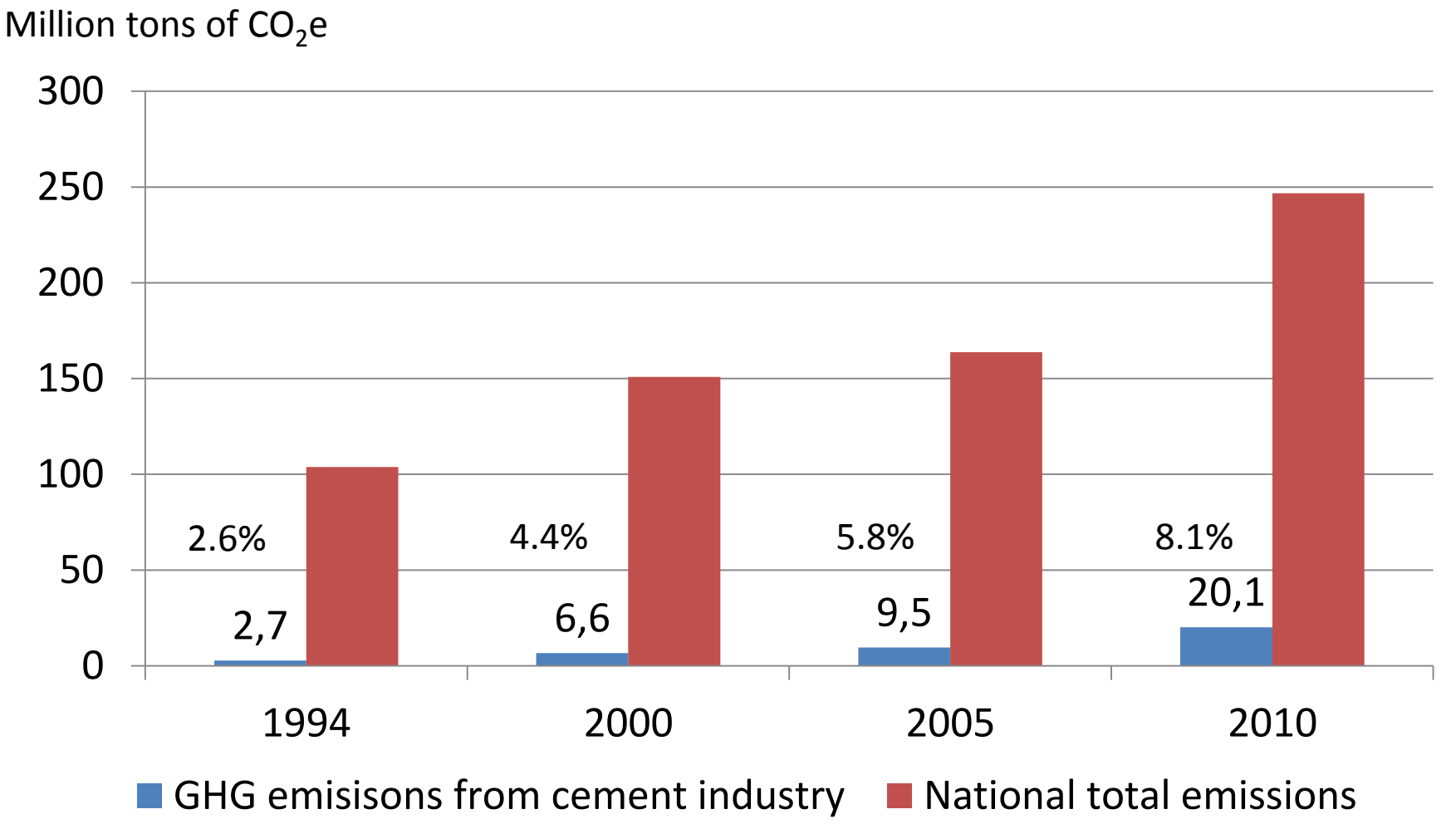
- Overview of cement industry in Vietnam
- GHG emissions from cement industry
- Experience on MRV in cement industry in Vietnam

Overview of cement industry in Vietnam



Source: Master plan of cement industry in Vietnam for the period 2011 – 2020, vision to 2030

GHG emissions from cement industry



Source: National Communications, Biennial Updated Report, National Inventory Reports

Experience on MRV in cement industry in Vietnam

- Energy audit (Law on energy conservation and saving):
  - Developing and implementing annual and five-year plan on energy conservation and saving and reporting to the government
  - Conducting energy audit every 3 year

Experience on MRV in cement industry in Vietnam (con't)

- Energy audit for cement factories:
  - Electricity consumption per ton of clinker (kWh/t)
  - Electricity consumption per ton of cement (kWh/t)
  - Coal consumption per ton of clinker (t/t)
  - Coal consumption per ton of cement (t/t)
  - FO consumption per ton of clinker (kg/t)
  - FO consumption per ton of cement (kg/t)
  - DO consumption for drying 1 unit of FO (l/kg)

Experience on MRV in cement industry in Vietnam (con't)

- CDM in cement industry (con't):

	Hon Chong Waste Heat Recovery Power Plant (2012)	Nghi Son Waste Heat Recovery and Utilization Project (2013)
Production capacity	4000 ton clinker / day	12400 ton clinker / day
Annual power demand	77.6GWh	
Electricity generation capacity	6.27 MW	15 MW
Annual energy saving	43,716 MWh	99,840 MWh
Annual GHG emission reuduction	24,297 tCO2e	53,993 tCO2e

Experience on MRV in cement industry in Vietnam (con't)

- CDM in cement industry (con't):
  - AMS-III.Q. (version 04.0) refers to ACM0012, "Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects", the current version of which is version 04.0.

Experience on MRV in cement industry in Vietnam (con't)

- CDM in cement industry (con't):

Data	EGi,j,y	$Q_{PHB,y}$	$Q_{AQC1,y}$	$T_{PHB,y}$	$T_{AQC,y}$	$P_{PHB,y}$	$P_{AQC,y}$
Unit	MWh/yr	m3/year	m3/year	deg C	deg C	kg/m^2	kg/m^2
Description	Annual power generation	Quantity of WECM used by PH boilers	Quantity of WECM used by AQC boilers	Average temperature of WECM used by PH boilers	Average temperature of WECM used by AQC boilers	Average pressure of WECM used by PH boilers	Average pressure of WECM used by AQC boilers
Monitoring frequency	monthly record, at least annually	monthly record, at least annually	monthly record, at least annually	daily, averaged yearly	daily, averaged yearly	daily, averaged yearly	daily, averaged yearly

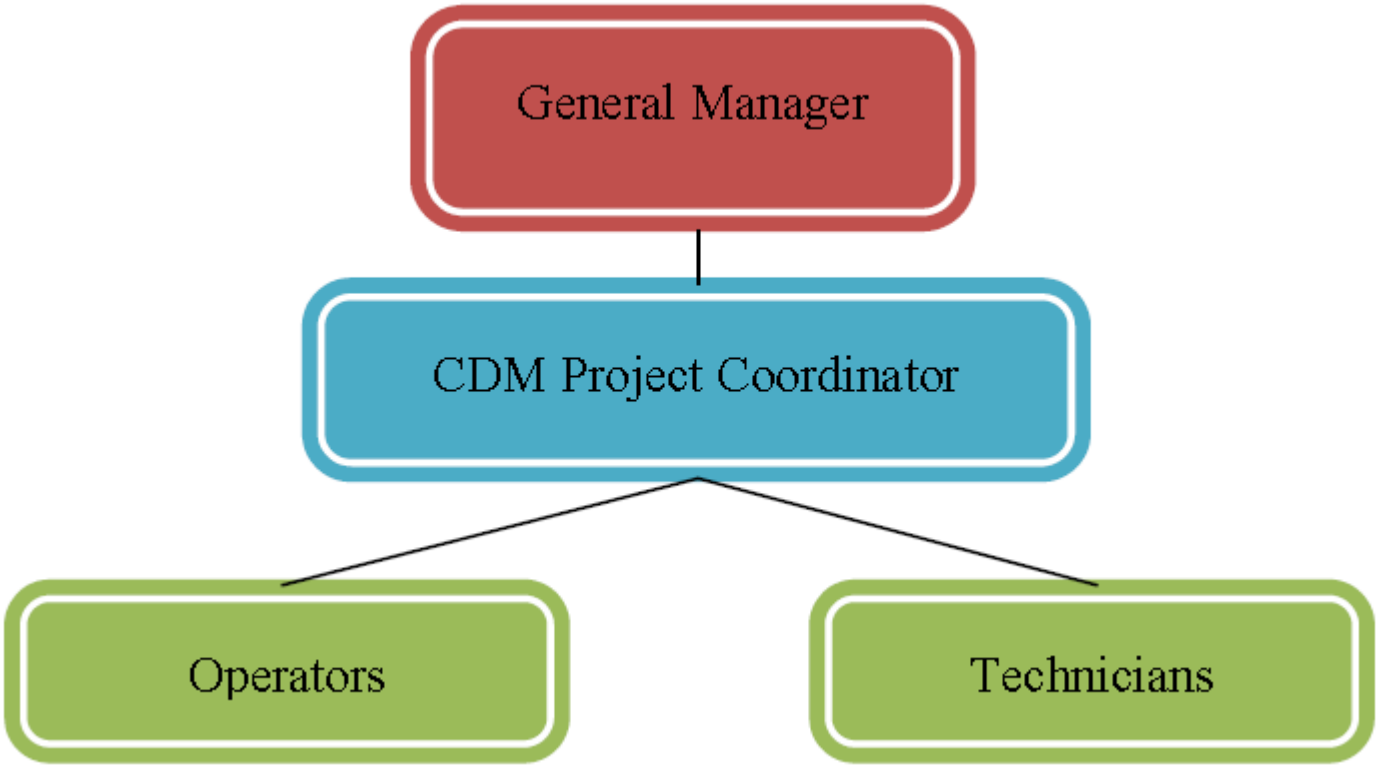
Experience on MRV in cement industry in Vietnam (con't)

- CDM in cement industry (con't):

Data	$H_{PHB,y}$	$H_{AQC,y}$	$d_{PHB,y}$	$d_{AQC,y}$
Unit	TJ/kg	TJ/kg	kg/m3	deg C
Description	Average enthalpy of WECM used by PH boilers	Average enthalpy of WECM used by AQC boilers	Average density of WECM at actual temperature and pressure used by PH boilers	Average density of WECM at actual temperature and pressure used by AQC boilers
Monitoring frequency	daily, averaged yearly	daily, averaged yearly	Standard data books	Standard data books

Experience on MRV in cement industry in Vietnam (con't)

- CDM in cement industry (con't):



Experience on MRV in cement industry in Vietnam (con't)

Vietnam cement data base

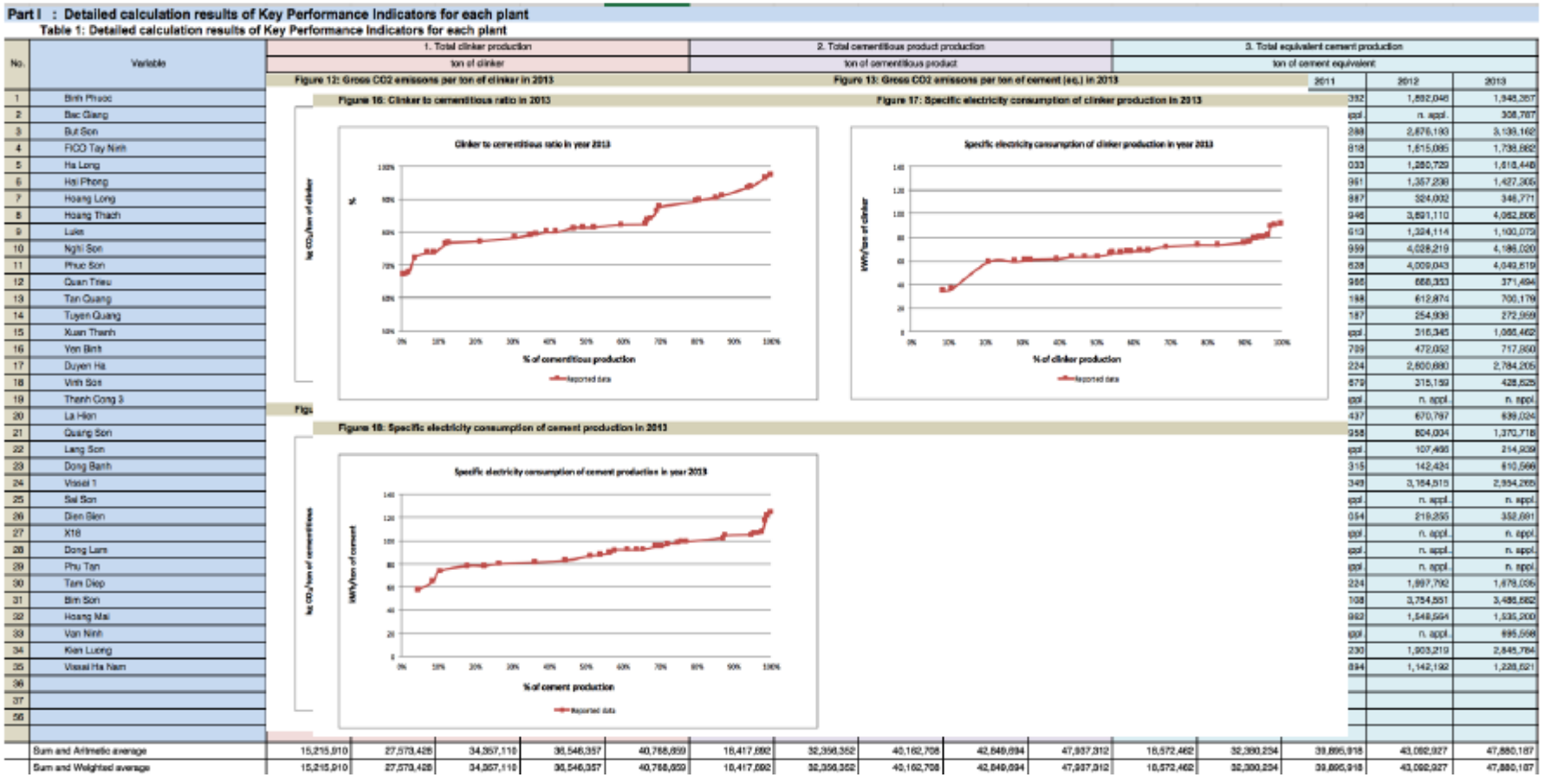
First effort to establish a sector database for the cement sector in Vietnam

- Excel-based database as a simplified version of the CSI MRV system, compatible with the current international industry best practice and domestic context
- Data collections are from two sources:
  - Top-down: Current Master Plan for list of rotary kiln cement plants with specific capacity and location
  - Bottom-up: Sectoral data collection via questionnaire and site visits
    - General plant information
    - Clinker and cement production
    - Mineral components (MIC) in cement production
    - Energy consumptions: fossil fuels and electricity; alternative fuels; waste heat use
    - Calculate power balance and KPIs
    - Calculate CO2 emissions from calcination and energy use

Experience on MRV in cement industry in Vietnam (con't)

Vietnam cement data base

Data inputs and calculated results from 47 cement plants accounting for 85% of total of 55 rotary kiln cement plants in operation



Part I : Detailed calculation results of Key Performance Indicators for each plant

Table 1: Detailed calculation results of Key Performance Indicators for each plant

No.	Variable	1. Total clinker production (ton of clinker)	2. Total cementitious product production (ton of cementitious product)	3. Total equivalent cement production (ton of cement equivalent)												
		Figure 12: Gross CO2 emissons per ton of clinker in 2013		Figure 13: Gross CO2 emissons per ton of cement (eq.) in 2013										2011	2012	2013
1	Binh Phuoc	Figure 16: Clinker to cementitious ratio in 2013												392	1,692,046	1,946,357
2	Bac Giang													appl.	n. appl.	308,787
3	But Son													288	2,876,193	3,139,162
4	FICO Tay Ninh													818	1,615,095	1,738,882
5	Ha Long													033	1,280,729	1,618,448
6	Hai Phong													961	1,357,238	1,427,205
7	Hoang Long													887	324,002	346,771
8	Hoang Thach													946	3,891,110	4,052,805
9	Luks													613	1,324,114	1,100,079
10	Nghi Son													999	4,028,219	4,186,020
11	Phuc Son													628	4,009,043	4,049,619
12	Quan Trieu													980	668,353	371,494
13	Tan Quang													198	612,874	700,179
14	Tuyen Quang													187	254,936	272,969
15	Xuan Thanh													appl.	316,345	1,066,462
16	Yen Binh													789	472,052	717,860
17	Duyen Ha													224	2,600,880	2,784,205
18	Vinh Son													879	315,159	428,525
19	Thanh Cong 3													appl.	n. appl.	n. appl.
20	La Hien													437	670,797	639,024
21	Quang Son													958	804,004	1,370,718
22	Lang Son													appl.	107,466	214,939
23	Dong Banh													315	142,424	610,566
24	Vissai 1													349	3,164,515	2,954,265
25	Sai Son													appl.	n. appl.	n. appl.
26	Dien Bien													054	219,255	352,691
27	X18													appl.	n. appl.	n. appl.
28	Dong Lam													appl.	n. appl.	n. appl.
29	Phu Tan													appl.	n. appl.	n. appl.
30	Tam Diep													224	1,897,792	1,679,036
31	Bim Son													108	3,754,551	3,486,882
32	Hoang Mai													982	1,548,994	1,535,200
33	Van Ninh													appl.	n. appl.	695,568
34	Kien Luong													230	1,903,219	2,845,784
35	Vissai Ha Nam													894	1,142,192	1,228,621
36																
37																
56																
	Sum and Arithmetic average	15,215,910	27,573,428	34,957,119	36,546,357	40,768,659	18,417,692	32,356,352	40,162,708	42,649,694	47,937,312	18,572,462	32,390,254	39,895,918	43,092,927	47,880,187
	Sum and Weighted average	15,215,910	27,573,428	34,957,119	36,546,357	40,768,659	18,417,692	32,356,352	40,162,708	42,649,694	47,937,312	18,572,462	32,390,254	39,895,918	43,092,927	47,880,187

Experience on MRV in cement industry in Vietnam (con't)

MRV in cement sector

- No consistent MRV system has been established and operated for the cement sector in Viet Nam; hence no MRV institutional arrangement existed
- The MRV system for the NAMA in the cement sector in Viet Nam is structured into two sub-components including:
  - MRV of GHG emissions (and emission reductions)
  - MRV of non-GHG impacts (including co-benefits and support)
- And it is divided into two levels, namely (1) installation (plant) level and (2) sector level.
- Application of the MRV system at a sector level is a new management practice for both the NAMA operating entity (MOC) and other relevant authorities

Experience on MRV in cement industry in Vietnam (con't)

MRV at plan level

MRV system of GHG emissions at a cement plant level is based on the already existing practices at almost all cement plants in Viet Nam

- Measurement
  - M of 29 indicators (similar to CSI indicators) on energy consumption and CO2 emissions is current practiced as part of regular measurement activities in cement plants
  - The procedures and frequency for record and data archive are varied by cement plants
  - Challenge is to increase of the accuracy of data monitored. Additional installation of direct measurement devices and improvement in data management practice is required to ensure high data quality.
- Reporting of data measured is mainly limited within a cement plant for management purposes
- Verification at a plant level is limited to the internal QA/QC, not yet involving any independent third party

Experience on MRV in cement industry in Vietnam (con't)

MRV of non-GHG impact

- Designed MRV of co-benefits covers a wide range including four major groups: economic, social, environmental, technological
  - 10 parameters shall be monitored at sector-level
  - 7 parameters monitored at plant-level
- MRV system of support shall be designed according to the specific requirements of the donors
- Importance of non-GHG impacts is seen differently depending on the stakeholder.
- The selection of which non-GHG impacts to be MRV-ed depends on the consensus of the national authorities and international donors, and the level of willingness, commitment of cement installations as well as the resources available to do MRV

Experience on MRV in cement industry in Vietnam (con't)

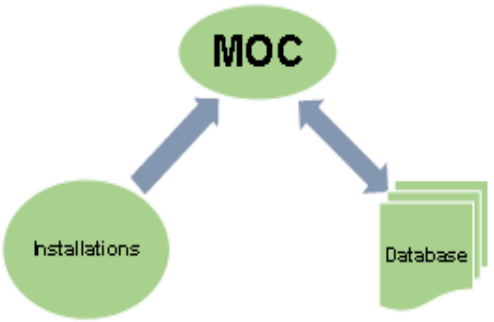
MRV indicators

Emission components	Parameters	Units	Proposed source of parameters
CO_2 from raw materials:			
Calcination of clinker	Clinker produced	t	Measured at plant level
	CaO + MgO in clinker	%	Measured at plant level
	CaO + MgO in raw meal	%	Measured at plant level
Calcination of dust	Dust leaving kiln system	t	Measured at plant level
	Emission factor clinker	t CO_2/ t cli	As calculated above
	Dust calcination degree	% calcined	Measured at plant level
Organic carbon in raw materials	Clinker	t cli	Measured at plant level
	Raw meal : clinker ratio	t / t cli	Default = 1.55; can be adjusted
	TOC content of raw meal	%	Default = 0.2%; can be adjusted
CO_2 from fuel combustion:			
Conventional kiln fuels	Fuel consumption	t	Measured at plant level
	Lower heating value	GJ /t fuel	Measured at plant level
	Emission factor	t CO_2 /GJ fuel	IPCC / CSI defaults, or measured
Alternative fossil fuels (fossil AF)	Fuel consumption	t	Measured at plant level
	Lower heating value	GJ /t fuel	Measured at plant level
	Emission factor	t CO_2 /GJ fuel	CSI defaults, or measured
Biomass fuels (biomass AF)	Fuel consumption	t	Measured at plant level
	Lower heating value	GJ /t fuel	Measured at plant level
	Emission factor	t CO_2 /GJ fuel	IPCC / CSI defaults, or measured
Non-kiln fuels	Fuel consumption	t	Measured at plant levell
	Lower heating value	GJ /t fuel	PCC / CSI defaults, or measured
	Emission factor	t CO_2 /GJ fuel	IPCC / CSI defaults, or measured
Wastewater combusted	—	--	Quantification of CO_2 not required

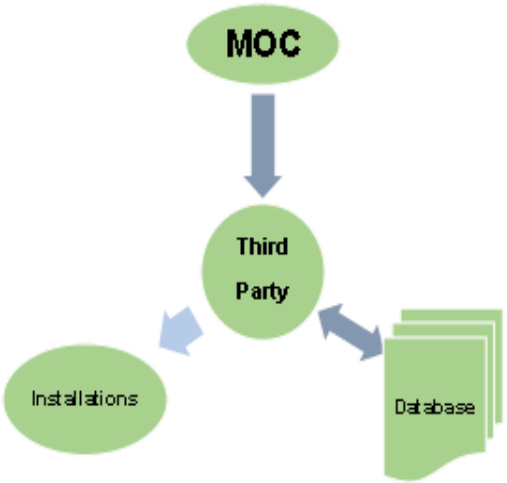
t = metric tonne, AF = Alternative fuels, cli = clinker, TOC = Total organic carbon

Experience on MRV in cement industry in Vietnam (con't)

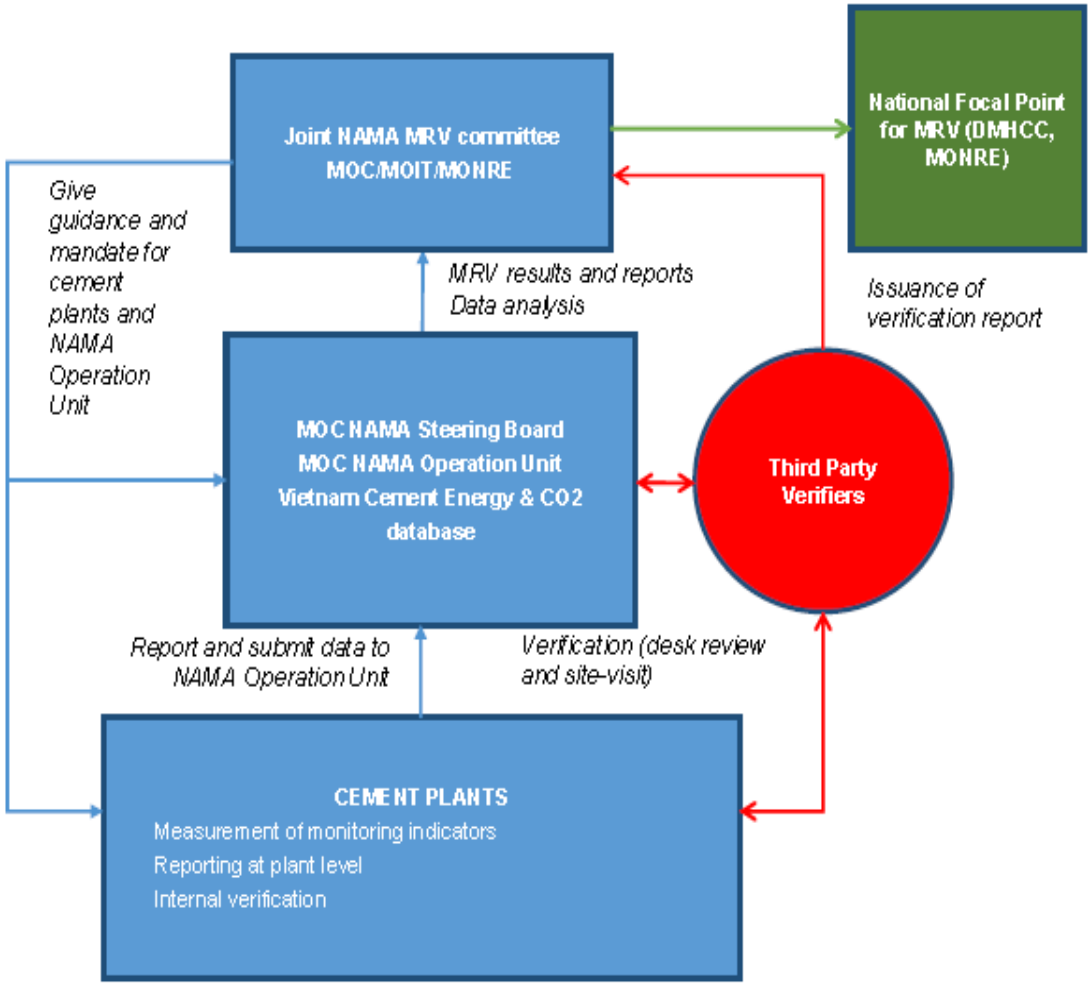
Suggestions on MRV Institutional Arrangement



Option 1: The database is managed by MOC



Option 2: Data collection and management by a Third Party



Conclusion

- Cement industry in Vietnam has high mitigation potential;
- Only energy audit for cement is put in practice;
- Cement CDM projects has not been implemented yet;
- The cement NAMA is in readiness phase;
- There should be a link between MRV at project level, sectoral level and national level;
- There should be a link between energy efficiency projects and CDM projects or NAMAs

Question

- How to link the requirement in energy audit , MRV for CDM projects and MRV for NAMA?
- Should the data be managed by Ministry of Construction or by a third party