CO_2 Reduction under the Law on Air

-Case Study from Japan-China Co-benefits Joint Study-

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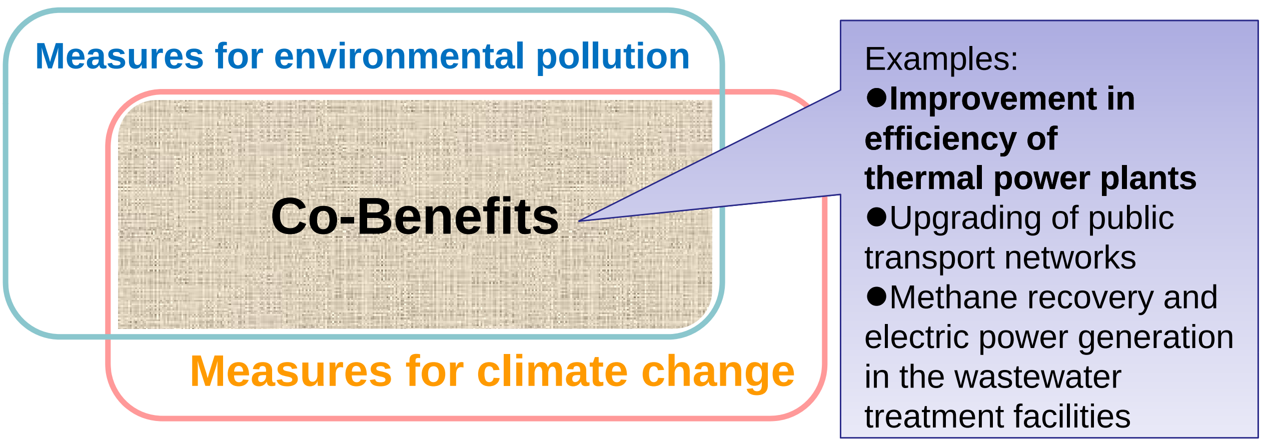
1. Introduction

The background of quantitative evaluation on Chinese local government pollution control plan

What is a Co-benefits Approach?

An approach aimed at reducing greenhouse gas emissions and preventing environmental pollution at the same time.



Japan-China Co-benefits Cooperation

The Statement on the Joint Implementation of Co-Benefits Projects by the Ministry of the Environment of Japan and the Ministry of Environmental Protection of the People's Republic of China was signed. (December 2007)

■Panzhifua City, Sichuan Province

A joint study on evaluation of the impact of co-benefits on the environmental pollutant reduction plan, as well as training for capacity building were carried out.

The annual reductions of SO_2 and CO_2 by air pollution control in iron and steel industry were 56 thousand tons and 210 million tons simultaneously.

Cooperation Target Area

Panzhihua City, Sichuan Province

Xiangtan City, Hunan Province

Pollution Control Plan in Panzhihua City

◆ Goal for 5 years during 2006-2010
- 22% energy consumption reduction
- SO_2 emission reduction 33,741t/year

◆ Sectors
- **Air Management (SO_2 ER)**
- Water Management (COD ER)
- Waste Management

◆Measures
- **Structural Adjustment**
- **Project**
- Management

➡ $ER=ER_{SA} + ER_{P} + ER_{M}$

National Level
11th Five year Plan for Environmental Protection (2006-2010)

Province Level
11th Five year Plan for Environmental Protection (2006-2010)

City Level
11th Five Year Plan for Environmental Protection (2006-2010)

Pollutant Control Plan

2. Methodologies

How to calculate SO_2 and CO_2 emission reduction? Case study on evaluating structural adjustment

Case Study of ER_{SA}: Closure of Power Generation Unit (50MW)

Pollutant Emission Reduction

SO_2 Emission Reduction
= SO_2 Baseline Emission from the facility – 0 (closure)

$$ER(SO_2) = M \times S \times (64/32 \times 0.8)$$
$$= 111{,}400 \times 0.0072 \times 1.6$$
$$= 1{,}283 \text{ t-}SO_2$$

- ER (SO_2) :Annual SO_2 emission reduction from facility
- M: Annual Coal consumption for power generation **111,400t**
- S: Average sulfur content of coal **0.72%**
- 64/32: Mass ratio between S and SO_2
- 0.8: Combustion efficiency of coal **80%**

✓Just changing the parameters **M, S and 0.8**, the same methodology is applicable to Mongolian power generation unit.

Case Study of ER_{SA}: Closure of Power Generation Unit (50MW) (cont.)

GHG Emission Reduction

CO_2 Emission Reduction
= CO_2 Baseline Emission from the facility – 0 (closure)

$$ER(CO_2) = M \times C \times (44/12)$$
$$= 111{,}400 \times 0.5 \times 3.67$$
$$= 204{,}233 \text{ t-}CO_2$$

- ER (CO_2) :Annual CO_2 emission reduction from facility
- C: Average carbon content of coal **50%**
- 44/12: Mass ratio between C and CO_2

✓Just replacing the parameter **S（sulfur content of coal）** with **C (carbon content of coal)** and removing **0.8 (combustion efficiency of coal)**, ER(SO_2) formula is turned into ER(CO_2).
✓ER(SO_2) and ER(CO_2) are also applicable to calculate the emission reduction from **steam boiler**.

Case Study of ER_{SA}: Closure of Kiln (Cement Sector)

Pollutant Emission Reduction

SO_2 Emission Reduction
= SO_2 Baseline Emission from kiln – 0 (closure)

$$ER(SO_2) = SO_2\text{-}EF \times P$$
$$= 2.638 \times 10^{-3} \times 102{,}398$$
$$= 270 \text{ t-}SO_2$$

- ER (SO_2) :SO_2 emission reduction from kiln
- SO_2-EF: SO_2 emission factor per clinker **2.638×10^{-3} t-SO_2/t-clinker**
- P: Annual production quantity of clinker **102,398 t-clinker/y**

✓Just changing the parameters(SO_2-EF and P), the same methodology is applicable to Mongolian cement sector.

Case Study of ER_{SA}: Closure of Kiln (Cement Sector) (cont.)

GHG Emission Reduction

CO_2 Emission Reduction
= CO_2 Baseline Emission from kiln – 0 (closure)

$ER(CO_2)$ = **CO_2-EF** x **P**
= 0.619 x 102,398
= 63,384 t-CO_2

- ER (CO_2) :Annual CO_2 emission reduction from kiln
- CO_2-EF: CO_2 emission factor per clinker **0.619 t-CO_2/t-clinker**

✓Just replacing the parameter **SO_2-EF** with **CO_2-EF**, $ER(SO_2)$ formula is turned into $ER(CO_2)$.

Results of Quantitative Evaluation

	Measure	SO_2 ERs ($t\text{-}SO_2/y$)	CO_2 ERs ($t\text{-}CO_2e/y$)
Structural Adjustment	Closure of 4 Power Generation Units (50MW)	6,757	1,006,363
	Closure of 2 Sintering Machines	129	0
	Closure of 2 Wet Rotary Kilns	194	63,384
	Closure of 8 Coke Ovens	1,654	404,487
	Closure of 3 Shaft Kilns	67	100,802
	Closure of 5 Steam Boilers	3,080	513,333
	Closure of 2 Limekilns	43	9,197
	Closure of 1 Shaft Furnace	40	8,470
Project	1 Waste Gas Settlement utilizing ammonia water	19	0
	6 Flue Gas Settlement utilizing desulfurization	3,116	-2,074
	Installation of 5 Desulfurization Equipment	29,744	0
	Upgrading of 2 Sintering Machines	11,000	0
	Total	55,843	2,103,962

cf. Goal for 5 yrs(2006-2010): 33,741t-SO_2/y

Source: Dr. Hiroaki TAKIGUCHI (2011) GHG Reduction in Developing Countries and a Co-benefits Approach, Environmental Research Quarterly, Feb 2011 No. 160, p. 69

3. Way Forward

A Co-benefits Approach is a useful tool to evaluate the Air Pollution Reduction Program in Mongolia.

Conclusion: Possibility of Co-benefits Quantitative Evaluation in Mongolia

- Synergy will be expected between:
  - i) Pollution control measures under the Law on Air
  - ii) GHG mitigation actions under Mongolia's NAMA
- i) and ii) can be calculated using almost the same methodologies with one or two parameters replaced.
- We can utilize the following material:
  - -Result of Japan-China Co-benefits Joint Study
  - -Co-benefits Evaluation Manual

For you information:
Co-benefits Evaluation Manual

The Manual…

- Provides quantified and simple methods to evaluate effectiveness of Co-benefits, including environmental pollution improvement and GHG mitigation measures
- Promotes public/private entities to implement effective CDM or new market-based mechanism projects with Co-benefits Approach

www.kyomecha.org/cobene/e/tools.html

Manual for Quantitative Evaluation of the
Co-Benefits Approach to Climate Change Projects

Version 1.0

June 2009

Ministry of the Enviroment, Japan

Co-benefits Evaluation Manual (cont.)

Evaluation Methodologies

Level	Description of Evaluation Methodology	Explanation
Tier 1	**No calculation** Based on evaluation criteria corresponding to the actual details of the activity.	When it is difficult to obtain the data for the quantitative evaluation. This approach is the easiest to implement.
Tier 2	**Using a predetermined equation** and the available measurement data.	Use actual measurement data. Where no measurement data is available, default values are used.
Tier 3	Using measurement data for activities and parameters, and **using specific equations**.	Use actual measurement data and specific equations.

Co-benefits Evaluation Manual (cont.)

Evaluation Criteria for Tier 1

Category: Air quality improvement

Evaluation Criteria	Example	Expected Emission Reduction	Grade (Certainty of reduction)
Certain	**・Fuel switching (to fuels with low sulphur and low nitrogen content) improvement of combustion equipment.** **・Upgrading to high-performance boilers installation of waste-heat and exhaust-gas recovery equipment.**	Large	5
High probability	・Installation of flue gas desulfurization equipment. ・Installation of flue gas denitrification equipment. ・Installation of particulate precipitators.	Large	3
	・Regulation of air pollutant emissions. ・Low interest financing and tax incentives relating to investments needed to promote implementation of air pollutant emission reduction measures. ・Subsidy programs for research and development	Small	2
Likely to	・Provision of related information through related organizations ・Technical guidance ・Education and awareness raising	—	1