Quantitative Assessment of Certified Emission Reductions from Non-additional CDM projects

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Summary

- In the assessment of the substantial impact on the emissions reduction by the clean development mechanism (CDM), a large amount of literature indicates that there were concerns about the determination of additionality of CDM projects particularly in the power sector, such as wind power, hydropower, natural gas, coal-fired power and waste heat recovery project.
- Based on literature that discusses additionality of CDM projects to date and financial feasibility considering the situation of low credit prices since 2013, the CERs (Certified Emission Reductions) that had been issued until December 2015 were screened using the following three evaluation criteria: (1) "Performance of internal rate of return (IRR) in investment analysis", (2) "Specific project type and host country" and "CER prices in the PDDs and on the secondary market at the time of its insurance". The result shows that at most 34% of the total CERs were issued from CDM projects that have concerns about being non additional projects.
- Moreover, industrial gas projects such as HFC reduction and N_2O destruction show that there is no contribution to the sustainable development of the host country although they are considered to be additional. The amount of issued CERs from these projects was 835MtCO_2 in total by the end of 2015. Based on this fact, CERs that have both additionality and that contribute to sustainable development are estimated to be 15% of the total.

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1 Introduction

Additionality of the clean development mechanism (CDM) project is an important concept in order to ensure actual greenhouse gas (GHG) reduction. This means that if GHG emissions are offset by certified emission reductions (CERs) from the CDM projects that do not have additionality, it causes an increase in the level of GHG emissions on a global scale.

As a part of CDM policy dialogue (http://www.cdmpolicydialogue.org/), which was organized by the initiative of the CDM executive board (EB) for the purpose of "CDM reform," various assessments and studies on additionality were performed in line with the experience during the first commitment period of the Kyoto Protocol (CDM Policy Dialogue, 2012).

As a result of a series of dialogues and analysis of the CDM projects, particularly in the power sector, such as wind, hydro, natural gas, coal-fired power plant and waste heat recovery, it was pointed out that there were concerns for additionality. Since power generation projects are the most typical project type for the CDM, it is estimated that the half of CER credits that are expected to be issued up to 2020 are from the power generation sector. In this paper, a substantial portion of projects are considered to be non-additional, and this indicates that there may have been a significant increase in emissions at the global level (Spalding-Fecher et al, 2012).

In this paper, therefore, a review on the latest literature with respect to additionality of CDM projects is conducted, followed by an estimation of CERs from those CDM projects that are considered to be non-additional. Based on this analysis, recommendations on the future utilization of the CDM are also suggested.

2 Literature review on the analysis of CDM project additionality

2.1 Evaluations on CDM project additionality in general

Ellis and Kamel (2007) stated that the revenue from CERs is not a critical factor for the majority of projects. Therefore, the project already has an economic advantage even in the absence of the CDM. These projects are considered to be non-additional. In addition, Schneider (2009) claims the reviewing criteria on additionality by the CDM EB before 2008 were more relaxed than the current level, and there is a high possibility that a large number of projects may be non-additional. Gillenwater & Seres (2011) pointed out that there is asymmetry of information between the project participants and the CDM EB. Hence, it is likely that CDM projects had been registered in accordance with biased or insufficient information provided by project participants.

2.2 Evaluations on the additionality in terms of investment analysis

According to Alexeew, Bergset, & Meyer (2010), Bartolucci, Oliver, Jie, & Sambeek (2008), Lütken (2012) and Tatrallyay & Stadelmann (2013), a large number of projects estimated that their internal rate of return (IRR) was improved to 2-3% by revenues of CERs. However, the value is too small to claim the validity of additionality. Furthermore, Schneider (2009) stated that information used in investment analysis lacked transparency, and Haya (2009) noted that information for investment analysis described in the Project Design Document (PDD) was inconsistent with information submitted to financial institutions. In addition, Michaelowa (2009a) indicated the value of the benchmark was not always appropriately claimed.

2.3 Evaluations on additionality in terms of barrier analysis

Schneider (2009) pointed out that each of the barriers have not been described sufficiently and that there was a lack of concreteness in the PDD, specifically on how the implementation of the project was prevented by the mentioned barrier. Furthermore, Michaelowa (2009a) and Schneider (2009) indicated the financial risk in the barrier analysis is too subjective for validation entities. i.e., designated operational entity (DOE), and the CDM EB to assess the additionality.

2.4 Evaluations on the additionality in terms of common practice analysis

Michaelowa (2009a) and Schneider, (2009) pointed out that the terms "similar" and "distinct" as used in the common practice analysis are ambiguous for validation purposes. In addition, it was indicated that projects supported by the government cannot be excluded in the common practice analysis (Haya & Parekh, 2011; Bogner & Schneider, 2011; Wara & Victor, 2008).

2.5 Evaluations on the additionality in terms of project types

He & Morse (2010) pointed out that renewable energy projects in many developing countries were often implemented for political reasons regardless of the profitability of the project, and there was not necessarily a suitable environment for the market mechanism to function.

Lütken (2012) indicated the high possibility that biogas projects and industrial gas-based projects including HFC and N_2O have been implemented due to CER revenue. On the other hand, for most wind power and hydro power projects, implementation was not promoted by CER revenue, which implies non-additionality of the projects. Furthermore, Wara & Victor (2008), and Haya & Parekh (2011) state that the technologies of hydro power generation are very mature so installing a hydro power project can be considered as common practice. As for wind power generation, the related technologies are also noted as well-established in certain regions such as China and India (Wara & Victor, 2008; He & Morse, 2010; Lema & Ruby, 2007). Lazarus & Chandler (2011) stated that due to an increase in coal prices and governmental regulations of the host

countries which promote the high-efficiency thermal power generation to be preferentially connected to the grid, there is an issue with additionality of high-efficiency gas-fired power generation in China and India. For waste heat recovery systems in the steel industry, Michaelowa & Purohit (2007) and McKinsey Company (2009) indicated concern for additionality because using waste heat for the production process is already less expensive than utilizing fossil fuels.

2.6 Evaluations of additionality in terms of specific host country

A large number of analyses and studies were focused on CDM projects in China, which accounts for approximately 60% of the total number of CERs issued globally. Wara and Victor (2008) concluded that there is an issue with the additionality of CDM projects for hydro, wind and natural gas power generation in China. In addition, based on the assessment of the relevance between the number of hydro projects registered in the CDM and their capacity of hydro power generation as of 2007, Haya (2007) indicates a large portion of hydro power projects in the CDM have a lack of additionality. Similarly, Grubb et al. (2011), Michaelowa and Purohit (2007) also pointed out the majority of CDM projects in China which mainly addressed hydro power and wind power generation were considered to be non-additional. Furthermore, Lema & Ruby (2007) noted that technology for wind power generation has been promoted due to diversification and energy security in China and India.

3 Estimation of CERs from CDM projects deemed to be non-additional

3.1 Assessment of additionally based on three evaluation criteria

Based on the discussion above, this paper estimates the amount of issued CERs from the projects that have concern of non-additionality by developing the three evaluation criteria:

- Criterion A: The difference between IRR with revenue from CERs and benchmark IRR in the PDD is less than 3 %
- Criterion B: "Hydro and wind power projects in China and India" or "fuel switch to natural gas for power plants and waste heat recovery in the iron and steel sector in all countries"
- Criterion C: The difference between "CERs price (USD/tCO_2e) that was used for assessing additionality in the PDD" and "CER price (USD/tCO_2e) at the ECX (European Climate Exchange) on the date of publication of monitoring report" is less than 3 USD/tCO_2e

Reflecting indications in Section 2.2, the evaluation Criterion A was developed. For estimating the amount of CERs that meet Criterion A, the CDM projects where the difference between IRR with CER revenue and benchmark IRR in the PDD is less than 3 % were extracted since the impact of the CER revenue on the profitability of the projects is considered to be small.

Reflecting indications in Section 2.5 and Section 2.6, Criterion B focuses on specific project type and host countries. If the property of a project is consistent with "Hydro and wind power projects in China and India" or "fuel switch to natural gas for power plants and waste heat recovery in the iron and steel sector in all countries," those project were evaluated as non-additional.

Criterion C, which is related to Criterion A, extracts projects with PDDs where the difference between "CERs price (USD/tCO_2e) that was used for assessing additionality in the PDD" and "CER price (USD/tCO_2e) at the ECX (European Climate Exchange) on the date of publication of monitoring report" is less than 3 USD/tCO_2e. The project is non-additional if at least one monitoring report meets this criterion. The CER price was unified to USD using the average exchange rate for the year 2003. This criteria assumes that the project that managed to continue regardless of the amount of CER revenue may be non-additional[1]. A maximum estimation price of CER in PDDs is approximately 30USD/tCO_2 and the sensitivity analysis on the CDM is usually performed at a range of ± 10%. Therefore, a threshold value for the evaluation of additionally was defined as a price difference of more than 3USD/tCO_2.

As a result of Criterion A, issued CERs from the projects which have a difference of 3% or less between the actual IRR and benchmark (i.e., the CER revenue from projects does not have a significant impact on the IRR) are presented in Figure 1, as well as issued CERs from the rest of the projects. The annual values of issued CERs are presented during a monitoring period. The number of projects that meet Criterion A increases from 2008.

The amount of issued CERs from the projects is calculated to be 310 $MtCO_2$ (21% of all the CP1 credits) in the Kyoto Protocol first commitment period (CP1), and more than 36 $MtCO_2$ (20% of the total credit) in the Kyoto Protocol second commitment period (CP2). In addition, in the case of excluding CERs from the industrial gas destruction and avoidance projects, the percentage of non-additional credit increases up to 45% in CP1, 32% for CP2.

[1] Even though there are cases where production cost is lower than break-even point but higher than shutdown point or where CER purchase price is not affected by the market price due to long-term contract, this paper regards all projects for which the CER price on the secondary market at the date of publication of monitoring report was lower than the estimated CER price in the PDD as non-additional.

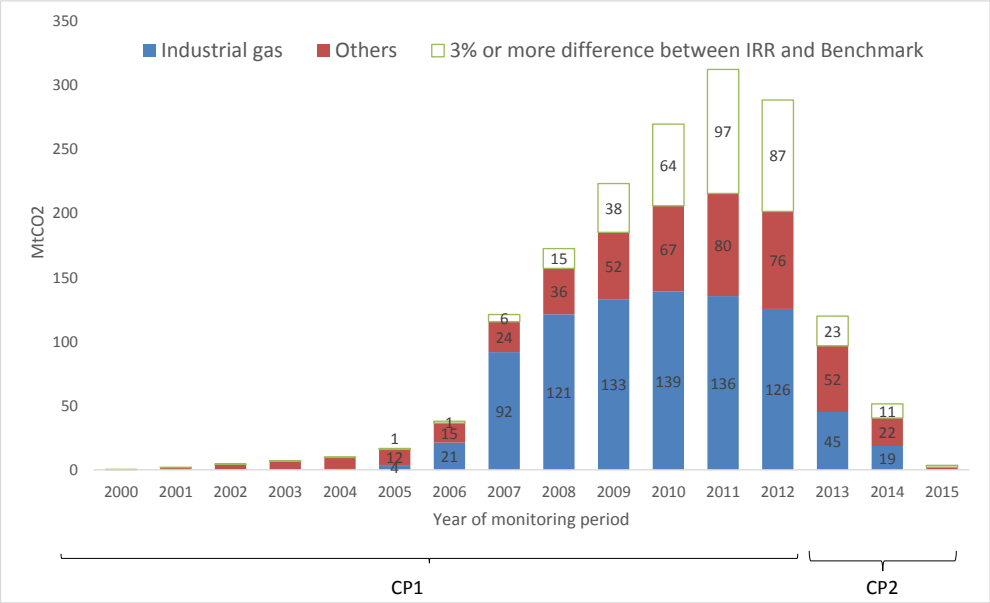

Figure 1 Issued CERs : Difference between the actual IRR and benchmark is 3% or less
Source: Author based on IGES (2016b), IGES (2016a)

Based on Criterion B, Figure 2 shows the CERs classified into project types. In China and India, issued CERs from the projects that meet Criterion B (i.e., hydro power, wind power, natural gas power generation project as well as the waste heat recovery projects in the iron and steel sector) were 403MtCO$_2$. This is 27% of the total issued CERs in CP1, which corresponds to 58% of the total CERs excluding the industrial gas destruction and avoidance projects. During CP2, CERs from the project that meet Criterion B were 46MtCO$_2$. This corresponds to 27% of the total CER issuance amount in CP2, 42% of all the CERs excluding the industrial gas destruction and avoidance projects.

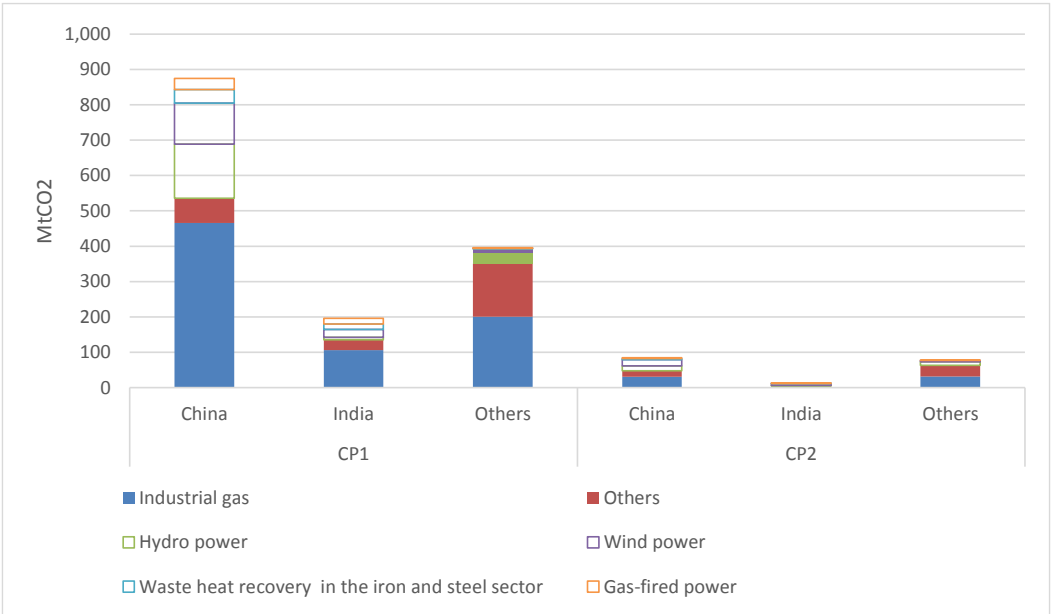

Figure 2 Issued CERs: Difference among project types and crediting period
Source: Author based on IGES (2016b), IGES (2016a)

Based on Criterion C, Figure 3 shows the total issued CERs from the projects that the actual CER price in the secondary market is lower than the CER price in the PDD. The amount of issued CERs from those projects in the CP1 is 371 $MtCO_2$, that is 25% of the total CER in CP1, and 53% excluding the industrial gas destruction and avoidance projects. Issued CERs from these projects in CP2 is 52$MtCO_2$, and that is 30% of the total issued CERs in CP2. The total CERs excluding the industrial gas destruction and avoidance project is 47%. Similar to Figure 1, the number of projects that were deemed to be non-additional increased from 2008 to 2012.

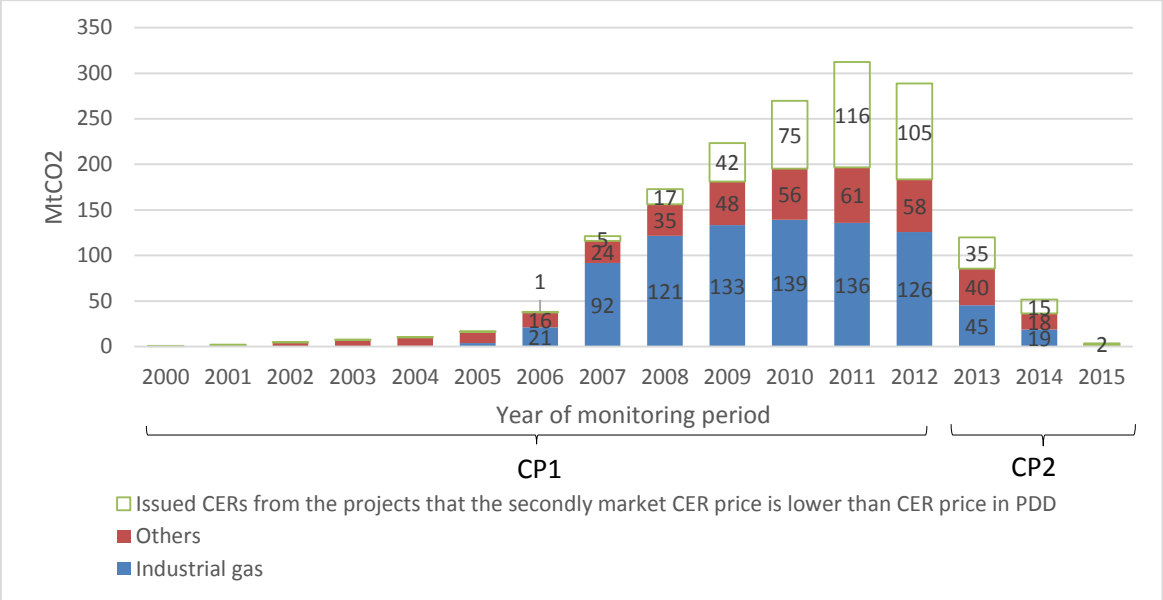

Figure 3 CER issuances : Projects assumed CER price lower than the CER price in the PDD
Source: Author based on IGES (2016b), IGES (2016a)

3.2 Summary of CER estimation from the non-additional projects based on three evaluation criterion

As a result of the assessment on the project additionality, Venn diagrams that summarize how many CERs meet the criteria from A to C are shown in Figure 4 during CP1 and in Figure 5 during CP2. In Figure 4, the CERs from those projects which were determined to be non-additional according to all three criteria in CP1 were 244$MtCO_2$. Furthermore, issued CERs from projects that are determined be non-additional according to at least two criteria were estimated to be 96 $MtCO_2$ (38 + 35 + 23). CERs from projects that are determined as non-additional according to just a single evaluation criterion were 155 $MtCO_2$ (10 + 86 + 59). In CP1, therefore, 495 $MtCO_2$ of CERs were issued from projects that are likely to be non-additional, and 244 $MtCO_2$ of CERs were issued from projects that are highly likely to be non-additional. Overall, it can be concluded that 17% to 34% of the total CP1 credits, and also 35% to 71% of CERs excluding industrial gases are issued from non-additional projects.

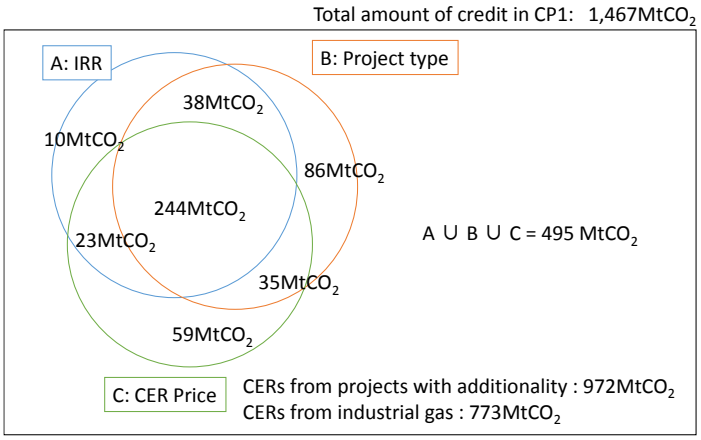

Figure 4 Assessment of additionally on credits during CP1

In Figure 5, CERs in CP1 from the projects that are shown as non-additional by all three evaluation criteria became 29MtCO₂. Moreover, issued CERs from the projects that are determined to be non-additional according to at least two or more of the evaluation criteria were 14MtCO₂ (5 + 3 + 6 MtCO₂). Issued CERs from the projects indicated as non-additional according to a single criterion are 25MtCO₂ (1 + 10 + 14 MtCO₂). From the above, in case of CP2, 67MtCO₂ of CERs have been issued from the projects that are likely to be non-additional, and 29MtCO₂ of CERs have been issued from the projects which are highly likely to be non-additional. Therefore, 17% to 38% of the total CP2 credit, and also 26% to 60% of CERs excluding industrial gases are issued from non-additional projects.

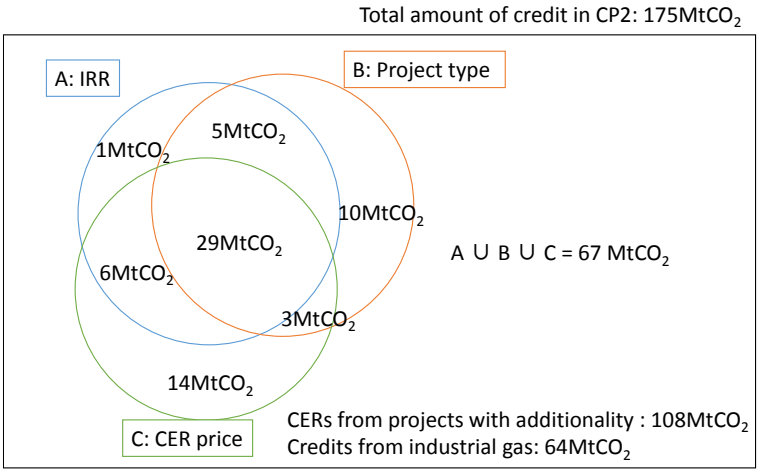

Figure 5 Assessment of additionally on credits during CP2

4 Conclusions

This paper summarized existing literature which indicates the concerns on non-additionality of CDM projects. From various indications, the following three evaluation criteria were formulated: “Performance of IRR in investment analysis”, “Specific project type and host country” and “CER prices in the PDDs and on the secondary market at the time of its insurance”. Based on the three criteria, screening was conducted for all issued CERs up to December 2015. The CERs of the whole CP1 through CP2 period were 1,642 $MtCO_2$ in total. Out of that, there is high possibility that 563$MtCO_2$ of CERs have been issued from non-additional projects; in particular, 273 $MtCO_2$ of CERs are not guaranteed as additional. From the above, it is considered that 17% to 34% of the total CERs credit had been issued from projects that are likely to be non-additional. Furthermore, 806$MtCO_2$ of CERs had been issued from projects that are certainly additional, but not contributing to sustainable development such as the industrial gas destruction and avoidance projects (Olsen & Fenhann, 2008), which is equivalent to 15% to 32% of the total CERs.

Three years have passed since the period after 2012 and the Kyoto Protocol’s second commitment period. Although the demand for credit from the CDM has weakened, measures to stimulate demand have been implemented by the UNFCCC secretariat such as the establishment of individual accounts for voluntary cancellation of the CERs. However, while the existing literature has raised issues and uncertainty with the additionality of CDM projects, this paper pointed out there could be already a large number of CERs from non-additional CDM projects. Therefore, the utilization of those issued credits in the CP2 target must be carefully examined further.

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