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Coal Power in the CDM: Issues and Options

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EXECUTIVE SUMMARY

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ABSTRACT

This paper examines several issues that arise in awarding emission reduction credits to coal projects in the Clean Development Mechanism (CDM). It identifies systematic weaknesses in the coal methodology's (ACM0013) design and application. The authors estimate that shortcomings lead to significant over-crediting of Certified Emission Reductions and discuss why a revision of the methodology to more accurately estimate emissions reductions may not be possible because of data constraints and weak signal-to-noise ratio. The paper also examines evidence that suggests the vast majority of these projects would have proceeded in the absence of the CDM, and are thus non-additional. It considers the suitability of coal in the CDM, given the identified flaws in the methodology, and in the light of coal's impact on climate change and its social and environmental burdens.

EXECUTIVE SUMMARY

Coal has been the fuel of choice for many industrializing countries over the past two centuries. Coal plants generate over 40% of the world's electricity, and a much larger share in major emerging economies like India (70%) and China (80%). Since 1970, new coal-fired power plants have been the dominant source of added CO_2emissions in the power sector, the sector making the largest contribution to increases in global CO_2 emissions. According to International Energy Agency forecasts, these trends are likely to continue. It might seem surprising then that, since the approval of CDM Methodology ACM0013 in 2007, new coal plants in developing countries "using a less GHG intensive technology" are eligible to claim tradable Certified Emissions Reductions (CERs) under the Clean Development Mechanism (CDM). Such plants represent long-lived investments that will deliver emissions-intensive electricity for 30 years or more, with potentially significant local environmental and health impacts from air pollution and associated coal mining. Given this context, it is vital that any CDM methodology for ascribing emission reductions and providing carbon finance to new coal plants be robust and correctly applied. Coal project developers should have to demonstrate conclusively that in the absence of CDM support, a less-efficient, higher-emitting coal plant would have been built. Once operational, the plants must truly emit less CO_2 per unit of electricity than a non-CDM-supported plant would have emitted.

In this sense, using the CDM to improve a coal plant's efficiency is not unlike using it to improve the efficiency of a cement plant, commercial building, or other facility. Carbon finance, in the form of tradable CERs, can, in principle, provide sufficient incentive for a project developer to build and operate a facility that might cost more, but is lower-emitting, than what would have been built and operated absent the CDM. These CERs can be used in place of costlier emission reductions by a country or company subject to a binding emission cap. The cost of complying with the Kyoto Protocol, EU Emissions Trading System (EU ETS), or other relevant emission trading system would be reduced, resulting in economic benefits, and, arguably, increasing the likelihood of more ambitious emissions caps in the future. However, for all this to occur, the emissions reductions must be real and additional. The crediting methodology must ensure that the crediting baseline against which they are estimated is appropriate and realistic, and that indeed, higher-emitting facilities would otherwise have been built. This paper examines whether the ACM0013 methodology, and its application in practice, achieves these objectives.

CDM coal project pipeline overview

As of October 2011, there were 45 coal projects in the ACM0013 CDM pipeline, all in India and China. Six have been registered and approved to generate CERs, and 39 projects are at the validation or review stages. Table ES-1 summarizes the coal power project pipeline.

ES-1: Information on CDM coal project pipeline

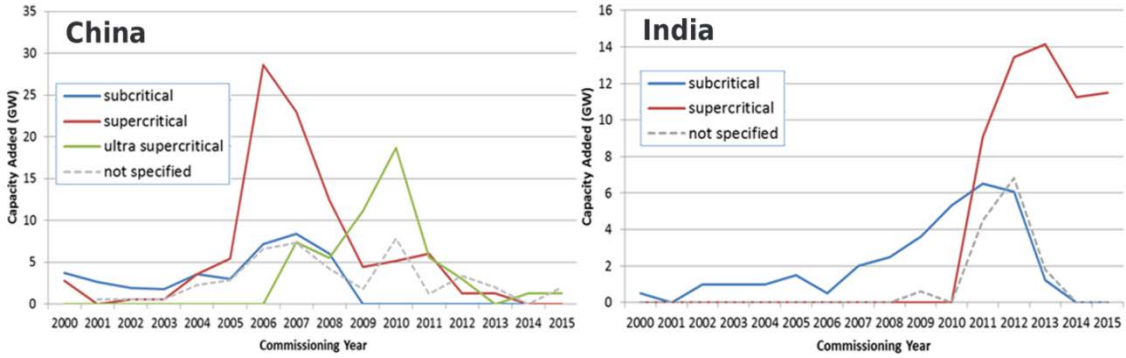
Host Country	Number of projects registered	Total number of projects in the CDM pipeline	Total capacity of projects in the CDM pipeline	Coal boiler technology used	Expected start date of operation
India	5	32	56 GW	supercritical (all projects)	2011-2016
China	1	13	23 GW	ultra-supercritical (all projects)	2009-2012

If all 45 projects are approved under the current ACM0013 methodology, and perform as projected, they will generate 451 million CERs over their project lifetimes – 90% in India

alone. (While this is a significant amount of CERs, it represents only 4% of the expected CERs from all project types in the full CDM pipeline.)

To qualify for the CDM, coal projects must show the CDM played a decisive role in moving from less-efficient subcritical coal technology to more-efficient and lower-emitting supercritical or ultra-supercritical technologies. As Figure ES-1indicates, however, the transition away from less efficient, subcritical technology to supercritical technology in India and to supercritical, and now, ultra-supercritical, in China is well under way, if not largely complete. There are several indications that this transition has occurred for reasons other than CER revenue.

Figure ES-1. Large (400+ MW) coal plants operating, under construction, and planned by commissioning date



A major factor behind the switch to supercritical and ultra-supercritical technologies is the rising price of coal. International coal prices rose steeply throughout the past decade, by about 10% per year on average. Dependence on coal imports and exposure to rising coal prices in international markets is likely to increase in the future, a problem that is particularly pronounced in Asian markets. In response, the Indian and the Chinese governments have established policies to decrease their dependence on coal and increase efficiency of their coal plants. In fact, China is currently building the world's most efficient new coal fired power plants.

Faced with persistent coal shortages, rising prices and the need to address major power supply deficits, the Indian government has placed a high priority on coal plant efficiency and has mandated the use of super-critical technology for the largest ("ultra mega") projects. Within a few years, almost no new large Indian new coal plants will come on line using subcritical technology, as illustrated in Figure ES-1. Despite this shift to supercritical technology, all coal projects in the CDM pipeline still claim subcritical to be the baseline technology, even for projects not expected to be commissioned until 2015. Furthermore, nearly all of the supercritical plants operating or under construction have applied for CDM funding, or indicated they that intend to do so.

Most of China's new ultra-supercritical plants are applying for CDM funding. Eight of 13 Chinese project documents claim that a subcritical plant would have been built without CDM support. However, as shown in Figure ES-1, no large subcritical unit has been commissioned since 2008. In addition, 11 of 13 Chinese coal projects in the CDM pipeline are expected to be operational by the end of 2011, and only one has been registered as of October 2011. Therefore, it would seem rather unlikely that the CDM was instrumental in technology decisions.

Significant over-crediting due to systemic flaws in ACM0013 and its application

TheACM0013 baseline and monitoring methodology determines how emission reductions will be quantified for improved efficiency coal power projects in the CDM. Among CDM methodologies, it is notable and innovative. It creates a standardized baseline, similar to the approaches now called for throughout the CDM, which is based on the average of the top 15% performing coal plants in terms of emission rate (tCO_2/MWh). This is known as the Option 2 baseline. ACM0013 also establishes a systematic approach to assessing the emission rate of the power plant likeliest to be built without the CDM. This emission rate is the Option 1 baseline. ACM0013 aims to be conservative by requiring the baseline to be the lowest of the Option 1 and Option 2 values.

Despite its careful design, however, ACM0013 has been routinely applied in ways that have led to a substantial overestimation of emission reductions.

- Developers are using unduly high emission baselines under Option 1 by identifying subcritical technology as the ”most likely” alternative without the CDM in all Indian projects and 8 of 13 Chinese projects, despite the transition away from this technology in both countries.
- Use of outdated historical data in the standardized Option 2 baseline ignores the rapid technological shifts away from subcritical technology occurring in both India and China. As the CDM Methodologies Panel has noted, the top performer baseline reflects the efficiency of plants built five or more years before the technology decisions on projects applying to the CDM. The Panel used an illustrative calculation to suggest that neglect of ongoing efficiency improvements in the Option 2 baseline might lead to over-crediting of 25%.
- Project documents for Indian projects inflate the benefits of switching from subcritical to supercritical technology. Specifications of technologies currently available in the market suggest the relative efficiency and emissions improvements are likely to be on the order of 2-4%. In contrast, these coal projects are claiming improvements on the order of at least 11%, on average.

The analysis in this paper shows that, taken together, these issues could lead to over-crediting on the order of 250%. By using an Option 2 baseline that reflect other plants implemented closer to the projects' timing, and an Option 1 baseline that reflects a supercritical baseline in China, and more modest differences in efficiency for Indian projects, we estimate that instead 451 million CERs, the coal project pipeline would yield 132 million CERs. Echoing the CDM Methodologies Panel's earlier findings, we believe the magnitude of this potential error should warrant immediate suspension of the current methodology, pending adequate revision.

Low signal-to-noise ratio and unintended outcomes

In addition, factors not controlled for by the methodology can influence plant efficiency on a scale similar to changes in boiler technology, e.g., from subcritical to supercritical. Coal unit efficiency is influenced by factors other than boiler technology such as cooling technology, the use of pollution abatement equipment, and the moisture, ash, and sulfur content of the fuel. Together, these variables can affect relative unit efficiency by 7% or more. In other words, these variables can have as great an impact on unit efficiency as the choice of boiler technology, which is what the CDM seeks to influence. Furthermore, uncertainty and annual variation in coal unit emissions data can, in some circumstances, be quite high, reducing confidence in standardized baseline values and reported emission reductions.

ACM0013 does not control for any of these variables, making it difficult to determine whether a plant that claims CERs under the standardized baseline (Option 2) actually reduces emissions due to improvements in boiler technology, or for other reasons. The addition of sulfur and particulate emission controls to mitigate local pollution impacts, for example, can have the effect of reducing net unit efficiency. As a result, ACM0013 may inadvertently penalize projects that minimize local air pollution impacts, if plants included in the standardized baseline calculation have not implemented similar controls. Conversely, it could reward projects that do not take steps to mitigate local air pollution impacts if plants in the Option 2 baseline have generally implemented pollution controls. This perverse outcome would run contrary to the sustainability objectives of the CDM.

Questionable additionality

We find the standard CDM additionality procedures, in particular the common practice test, are not appropriate for assessing coal technologies in India and China. Common practice analysis is intended as a credibility check to determine whether the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region. As we show in this paper, ultra-supercritical technology is already diffused and widely implemented in China, and a similar situation exists for supercritical technology in India. However, the common practice test excludes from consideration any project that is registered or applying for CDM approval. Nearly all supercritical and ultra-supercritical units in India and China, respectively, are excluded on this basis, and, therefore none are considered common practice. While this exclusion makes sense for project types where there are clearly decisive cost or technical barriers, that is not the case here, and a result the common practice analysis does not function as an important credibility check.

Given the pressure to build super or ultra-supercritical coal plants due to ongoing coal price increases and Indian and Chinese government policies that foster or require supercritical or ultra-supercritical coal designs, it is highly unlikely that a significant fraction, if any, of the coal projects in the pipeline are truly additional. We have also found significant limitations in the investment and sensitivity analyses used to assess additionality. Despite these issues, six of the seven coal plants that have applied for CDM registration have been approved. (The one rejected plant is in the process of reapplying – and in the meantime, is nearly done with construction, again raising questions about the need for CDM incentives.)

Conclusions

It might be possible to address the identified weaknesses in the application of the Option 1 and Option 2 baselines though further revisions of the ACM0013 methodology. However, the influence of factors other than boiler technology improvements, as well as uncertainty in coal plant emissions estimates (the low “signal-to-noise” ratio), may prove hard to control effectively. It is therefore unclear how a revised ACM0013 methodology could estimate verifiable emission reductions in a feasible, robust and conservative manner.

Coal plants represent major, long-lived investments using the highest-emitting electricity resource. For example, even at ultra-supercritical efficiency levels, coal plants produce twice the emissions per kilowatt-hour of a new natural gas plant. Using much-needed climate finance to support construction of these plants, even if it leads to slight increase in the efficiency of some coal plants, may undermine the overall objective of limiting dangerous climate change. Under the current rules, nearly 80 GW of new coal plants could be supported through the CDM, representing 3-4 billion euros in CER revenue at 8 euros per CER.

It is essential to re-evaluate whether an offset-based, incentive-only system such as CDM should support coal investments at all. The coal projects in the CDM pipeline offer, at best, marginal improvements in emission rates, while locking in over 400 million tCO_2 in annual emissions – as much as the annual CO_2 emissions of countries such as France, Spain and South Africa. Sectoral crediting or trading, if designed well and at the electricity sector-wide level, offers an alternative way to spur improvement in coal plant efficiencies and minimizes the risk of significant over-crediting and non-additionality that currently characterizes the pipeline of CDM coal power projects.

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