Energy Policy 63 (2013) 1051–1055

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Addressing carbon Offsetters' Paradox: Lessons from Chinese wind CDM

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HIGHLIGHTS

- We investigated 143 Chinese wind CDM projects by the eruption of the additionality controversy.
- We examined the application of additionality in the Chinese wind power market.
- We drew implications for the design of effective global carbon offset policy.
- The underlying structural flaws of CDM, the Offsetters′ Paradox, was discussed.
- We charted a reform path that can strengthen the credibility of global carbon markets.

ARTICLE INFO

Article history:
Received 1 February 2013
Accepted 5 September 2013
Available online 24 September 2013

Keywords:
China
Wind
CDM
Offsetters' Paradox

ABSTRACT

The clean development mechanism (CDM) has been a leading international carbon market and a driving force for sustainable development. But the eruption of controversy over offsets from Chinese wind power in 2009 exposed cracks at the core of how carbon credits are verified in the developing economies. The Chinese wind controversy therefore has direct implications for the design and negotiation of any successor to the Kyoto Protocol or future market-based carbon regimes. In order for carbon markets to avoid controversy and function effectively, the lessons from the Chinese wind controversy should be used to implement key reforms in current and future carbon policy design. The paper examines the application of additionality in the Chinese wind power market and draws implications for the design of effective global carbon offset policy. It demonstrates the causes of the wind power controversy, highlights underlying structural flaws, in how additionality is applied in China, the Offsetters' Paradox, and charts a reform path that can strengthen the credibility of global carbon markets.

1. Introduction

The clean development mechanism (CDM) set by Kyoto Protocol is the leading international carbon market which allows developed countries to meet their mitigation commitments by financing emission reductions in the developing world (UNFCCC, 1997). Project based CDM is seen as an important mechanism to achieve global sustainable development by fostering clean energy development in developing countries and cost-effective reduction of greenhouse gasses in developed countries (Olsen, 2007), and typically allows for nations with emissions commitments to invest in greenhouse gas mitigation projects in host countries without commitments. International carbon finance has provided a significant boost to Chinese wind development. China′s installed wind capacity has been growing at an unprecedented pace, the total installed capacity has reached 75.5 GW as of the end of 2012 (CWEA, 2013). CDM first provided finance for Chinese wind in 2005, and we estimate that about 32% of China′s total wind capacity of 25.1 GW has benefited from CDM finance through 2009 (CREIA, 2009).

One of the central criteria used to evaluate CDM projects is "additionality", which is defined as carbon offset payments result in "real" emissions mitigation that "would not have happened otherwise" (UNFCCC, 2006). Controversy over the CDM projects is not new. There have been concerns about the additionality and the economically efficiency of industrial gas projects, for example trifluoromethane (HFC-23), which is inexpensive to cut but received payments via the CDM which may have been many times more valuable than the gas being produced, creating perverse incentives. Scholars have argued that such projects therefore

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0301-4215/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.enpol.2013.09.021

undermine the effectiveness of CDM (Wara, 2007). But other types of projects, such as renewable energy projects, are usually viewed as comparatively higher quality with lower risk of "non-additionality" or economic inefficiency.

The questionable additionality of many CDM projects has become a central issue in the CDM discussion (Paulsson, 2009). Haya (2010) examined hydro CDM projects in India, and found that there is no accurate verifiable indicator of whether CO_2 reduction projects would be built without the CDM. Those concerns raise the incentive problems created by asymmetric information, include adverse selection and moral hazard, in the offset markets (Bushnell, 2010). However, the implementation of CDM in China is less discussed, and the impact of how and whether CDM might interface with domestic policy and regulatory regimes is not seen in the existing literature.

However, this issue came to a head when the CDM Executive Board (CDM EB) shocked the carbon market by forcing an unprecedented review of whether Chinese wind projects satisfied UNFCCC additionality requirements and then rejected 10 Chinese wind CDM from registration in 2009 (CDM EB, 2009a, 2009b). CDM investors were shocked as the safest CDM bet became the riskiest; the Chinese stakeholders publicly attacked the UN′s oversight of carbon markets and criticized the decision "unfair" and "non-transparent" (10 Chinese Wind Power Project, 2009); and the CDM EB prepared itself for an unprecedented fight over how carbon offsets could be verified in the world′s largest CDM market. In 2010, the EB′s 52nd meeting saw two of the ten wind projects registered after clarification, but the remaining eight projects were rejected (CDM EB, 2010). We call the controversy along the additionality of Chinese wind CDM project the "Chinese wind controversy" (controversy for short).

Additionality is the concept employed to verify that credits for carbon reductions are not payments for business as usual (BAU) (UNFCCC, 2001). Additionality is at first glance a simple counterfactual, but proving a counterfactual is not easy (Haya, 2010; Schneider, 2009; Sutter and Parreño, 2007; Wara and Victor, 2008). The CDM′s "additionality tool" attempts to do this by comparing the financial returns of all possible investments, with the logic that businesses will invest in the projects with the highest projected internal rate of return (IRR) (CDM EB, 2008). Project developers wishing to receive CDM credits must demonstrate that the proposed CDM activity is not the most profitable (has lower IRR) when compared to a BAU investment scenario (which might be a coal plant in China, for example), but that with CDM finance it becomes competitive with the alternative investments. Two conditions are necessary for the IRR comparison to be a credible indicator of additionality: (1) the selected baseline that wind is compared to must represent actual BAU in the relevant market, and (2) IRR must be a credible indicator of behavior and investment patterns in the relevant market. As we will show, there are serious problems meeting either of these conditions for Chinese wind because of the complex structure of China′s power market.

At the center of the controversy was the concern that the Chinese government might be manipulating power tariffs in order to guarantee additionality and subsidize domestic renewable energy development with carbon finance. If it were, the credibility of the CDM in its largest market would be crippled. It is important to note that the challenges of CDM project validation in China are relevant in most of the developing world. A solution to the controversy is therefore imperative – not just for CDM investment in China – but for preserving the credibility of offsets as a global mitigation regime. In addition to EU Emission Trading Scheme (ETS), the major carbon offsets buyer, national or sub-national schemes are already in place in Australia, New Zealand, Japan, the U.S., Switzerland and Canada, and are planned in South Korea and Brazil (Promethium Carbon, 2013). China has also opened its pilot carbon trading program in June 2013. The potential for these programs to allow international credits as offsets in national or sub-national carbon pricing schemes and to meet mitigation targets are under discussion. The lessons and experiences from CDM will be essential in the development of standards and procedures among those emerging carbon policies and ETSs around the world.

Yet despite the best efforts of developers, Designated Operational Entities (DOEs), and the EB to address this problem, a comprehensive solution has so far remained elusive. In trying to decide whether the Chinese government was setting artificial power tariffs to "game" additionality, the EB initially suggested a rule which would compare power tariffs for new projects to the highest historical tariffs. Thus if new tariffs were significantly below historical tariffs, the thinking was that this could be an indication of manipulation. However such approaches are not effective because both the Chinese wind industry and Chinese wind power pricing policy have change drastically since 2005, and there exist numerous market-based reasons for altering the tariffs. Thus applying the "additionality tool" to compare power tariffs for new projects to the highest historical tariffs are not effective because both the Chinese wind industry and Chinese wind power pricing policy have change drastically since 2005 (CDM EB, 2008; CREIA, 2009; Li and Gao, 2008), making such comparisons obsolete in a rapidly changing market. The wind industry of 2005 looks very little like the wind industry of 2012. But more importantly, focusing so narrowly on the question of historical tariffs risks missing the forest for the trees. One central question and challenge to solve the Chinese wind controversy is how can the CDM reliably separate the impact of domestic regulations and policies from that of international carbon finance?

The paper addresses this essential question, utilizing a detailed analysis of all Chinese wind projects registered through 2009 when this controversy erupted. First, we demonstrate the structural dependency of IRR-based additionality in state-controlled power sectors on host country regulators. This dependency simultaneously gives host countries control of additionality outcomes while preventing additionality verification by the UN, and is a major cause of such problems. Second, we argue that the available evidence does not suggest that China games the CDM. Finally, we argue that the CDM must upgrade its policy to deal with the reality of power markets where additionality is inherently impacted by domestic policy. However, this challenge presents a paradox for climate policy makers that must be weighed carefully.

2. Data and methods

Data used in this paper was extracted and compiled by the authors from the project design documents (PDDs), investment analysis spreadsheets, and validation reports which are used for CDM project registration provided through the UNFCCC CDM official website (http://cdm.unfccc.int/Projects/projsearch.html). PDDs are the key documents involved in the validation and registration of CDM project activities submitted by project developers and validated by DOEs. Key project-based data, including the power tariff, investment costs, IRR with and without CDM, and sensitivity analyses, from all registered PDDs was manually entered to a database and adjusted for consistency of currencies, exchange rates over time, and tax policies. The basic statistics of studied wind CDM projects are presented in Table 1. One hundred forty three projects in total were included and analyzed, representing all Chinese wind CDM projects registered through the end of 2009. Sixty seven projects did not provide complete data in their sensitivity analysis in their PDDs, the authors calculated the sensitivities by extrapolating available data on percentage changes of IRR with changes of power tariff and investment costs.

Table 1
Basic statistics of the studied wind CDM projects.

Key variables	Mean	Max	Min	SD	Sensitivity
IRR with CDM	9.04%	11.87%	7.24%	0.0075	
IRR without CDM	6.40%	8.43%	4.24%	0.0070	
Power tariff (RMB/kWh)	0.5443	0.7600	0.3521	0.0973	11.35%
Investment cost (RMB/MW)	9,549,846	18,071,400	2,358,885	1,488,498	12.03%

3. Key findings

3.1. Additionality is highly dependent on domestic regulation

If China were manipulating power tariffs to game the CDM, it would only be possible because the current design of additionality gives them that power. The structural dependency of additionality on Chinese regulators can be clearly demonstrated as follows. Additionality for Chinese wind is largely determined by IRR comparisons of CDM projects to the 8% baselines given in the "Internal Notice on New Project Feasibility Assessment" by the State Power Corporation (2002). And our analysis shows that the single largest factor determining Chinese wind project IRR is the power tariff, in fact the data shows that on average, an 11.35% increase of the power tariff will make Chinese wind farms non-additional while China's average on-grid power tariff had already increased from 0.3175 to 0.3676, 15.78% increase from 2006 to 2009 (SERC, 2010, 2007). There have been four major phases in the development of the Chinese wind power tariff system. In the first phase (1986–1993), wind power developments were funded by overseas aid funds and the tariff paid was less than 0.3 RMB/kWh, similar to that for coal-fired plants. In the second phase (1994–2003), the tariff was proposed by local governments and approved by the central government. During this period prices ranged from the relatively low price of 0.3 RMB/kWh up to 1.2 RMB/kWh. In the third phase, from 2003 to 2009, tariffs were decided by a concession process. Projects larger than 50 MW or in special wind-rich areas used this system (projects less than 50 MW were still subject to tariffs appointed by local regulatory decree), in which they submitted bids to the NDRC that included a proposed power tariff and the proposed share of domestically manufactured turbines. NDRC then approved the winning projects. The concession system ended in late 2009 when the NDRC established the "regional flag price" system, which set a single wind power price in major regions that functions like a feed-in tariff. These mandated prices are derived from the principle of "cost+reasonable return (with consideration of available wind resources)" (CREIA, 2009; NDRC, 2009). The power tariff in those stages is highly dependent to China's National or Local Development and Reform Commission. Thus the current design of the additionality test makes the Chinese government the most important arbiter of additionality – whether it wants to be or not – because IRR-based additionality is by design a function of NDRC power pricing.

This would not be a problem if China had market-based power pricing that could be validated by CDM regulators because power prices, and thus IRRs, would be a function of market pricing rather than regulatory decree. In this case IRRs would be a reliable indicator of project viability. But China's power sector is not fully market-oriented. Unlike in liberalized power markets where prices are the result of bids and offers subject to some regulatory constraints, Chinese power prices are either tightly controlled by state regulators or are distorted by the presence of large state owned enterprises (SOEs). Wind is no exception. NDRC is directly determining wind tariffs based on its judgment of appropriate IRR as is China's sovereign right. In fact, the official NDRC pricing policy of "cost+reasonable return with consideration of available wind resources" explicitly indicates that the NDRC is determining the "reasonable return" through the tariff. But NDRC does not specify what the appropriate return is or how it is determined which again is China's right, but a problem for CDM. In this context it is nearly impossible to know whether China is gaming the process or not. IRR-based additionality tests are fundamentally incompatible with state-controlled power pricing regime.

Further, where more market-based pricing mechanisms have been tried, outcomes have been distorted by the presence of major SOEs that are not always motivated by market-based incentives. Investment and operations decisions in the power sector can be more sensitive to politics than profit, and politically driven losses are subsidized from the state balance sheet. In 2008 the "Big 5", the largest SOE power producers including Huaneng, Datang, Huadian, Guodian, and China Power Investment, alone lost 40 billion RMB because raw coal was worth more than tightly capped power prices and generators were forced to run at a loss, which they wrote off as a "policy loss" that the government would make whole (He and Morse, 2010). Wind investment and pricing has been afflicted by a similar phenomenon. The national "concession system" for establishing wind power prices, which tried bidding by developers to establish tariffs five times from 2003–2009, certainly helped China move some projects closer to a market-based price discovery mechanism. But major SOEs were known to bid below-market prices in order to win projects and meet central government renewable energy quotas. Accordingly, observers have noted that the tariff outcomes of the concession system were artificially depressed and prices were low enough to discourage investment from private, non-SOE investors (Li and Gao, 2008). These distorted concession prices heavily influenced the setting of current regional feed-in tariffs (NDRC, 2009).

3.2. No evidence of manipulation in China's wind case

The empirical analysis of power data for all CDM wind projects in China shows no obvious evidence of dramatic changes in pricing policy that might reveal deliberate price manipulation by the NDRC. While the design of current additionality policy creates the opportunity for manipulation without a way of proving it, the available evidence does not directly suggest that the Chinese government is in fact gaming the CDM. Figs. 1 and 2 below show the trend in Chinese power tariffs granted to registered CDM wind projects since the inception of the CDM in China, and most projects were registered until late 2009. Though policies have changed, prices have not dramatically shifted lower. The single tariff granted higher than 1 RMB/kWh is an offshore wind project and therefore received an exceptional tariff. All tariffs discussed here exclude VAT. It should also be noted that the Chinese feed-in tariff for wind is roughly 1.5 times higher than the average tariff for on-grid power; the average price granted to CDM wind projects was 0.5443 RMB/kWh (excluding VAT), and the average on-grid power price was 0.36034 RMB/kWh in 2008 (SERC, 2009). The average wind tariff (excluding VAT) for the 10 rejected wind projects is 0.5094, compared to 0.5443 of the total average. Those projects locate in Inner Mongolia, Heilongjiang, Liaoning and

Xinjiang, which have the best wind resources thus are granted lower on-gird wind prices set by NDRC (2009). The average IRR without CDM for those projects is 6.39%, IRR with CDM is 9.99%, and CDM would make 3.6% difference.

Table 2 shows the average wind tariff of the projects registered in a year decreased 5.8% from 2006 to 2008, then increased 3.7% in 2009, an overall 2.3% decrease from 2006 to 2009. At the same time, the reported average wind investment cost had grown 6.2% from 2006 to 2009, which is not consistent with what reported in the industry that the wind investment cost started to fall in 2008 due to the localization of manufacture and economy of scale (Li et al., 2010). As the total wind capacity in China has risen, absolute subsides for Chinese wind projects have increased dramatically. Total subsidies paid by the Chinese government have rocketed from 229.29 million RMB in 2003 to 2379.94 million RMB in 2008 (CREIA, 2009). However, on a per-MW basis, those subsidies have mostly decreased from 0.4 million RMB in 2003 to 0.2 million RMB in 2008, half of that five years ago.

4. Implications for climate policy

We have shown the additionality test dependent on an IRR generated from Chinese power prices. This problem is not limited to Chinese wind – it applies for almost all renewable energy projects in developing countries with state controlled power sectors – and thus could damage the credibility of the CDM (Haya, 2010; Victor, 2011; Wara, 2007). Reform is necessary to use additionality metrics that are less dependent on domestic regulators. Possible reforms in the near term might contemplate using an enhanced barrier analysis that phasing out easy investment projects, interacting with NDRC to better understand domestic pricing policy so to make more transparent and sound observation of the pricing dynamics, or using a more credible baseline that reflect the evolution of China's changing power sector (He and Morse, 2010). This could be challenging as the projects involve multiple technologies in multiple countries, however, a more transparent, credible baseline will apply immediate improvement to the mechanism. In the long-term, offset policy needs to be agnostic to market structure in developing country power sectors. The thinking on new market mechanisms (NMMs), for example sectoral approaches and program of activities that decouple the host entity from specific activities or policies, mitigates the additionality tests by building a sectoral baseline (Aasrud et al., 2009; IGES, 2013). The NMMs issue allowances based on a sectoral ex-ante, no-lose targets, with penalty for missing target, thus make incentives more compatible.

Even if reforms eliminated the dependency of additionality on domestic power pricing decisions, a more difficult question remains. How should additionality account for the impact of broader changes in domestic policy over time? China's wind power polices have changed dramatically since 2003, making additionality a moving target (Li and Gao, 2008). "E+/E−" policies were introduced to provide clear rules on how to treat domestic policies impact emissions, "E+" policies increase emissions, "E−" policies reduce them (CDM EB, 2009c). "E+/E−" policies refers to clarifications on the consideration of national and/or sectoral policies and circumstances to be taken into account on the establishment of a baseline scenario, without creating perverse incentives that have impact the host country's contributions to the ultimate carbon mitigation (CDM EB, 2009c). But they were not designed to accommodate complex issues like Chinese feed-in tariffs where subsidies are embedded within a complicated, state-controlled power pricing regime (Morse et al., 2010; Peng, 2011).

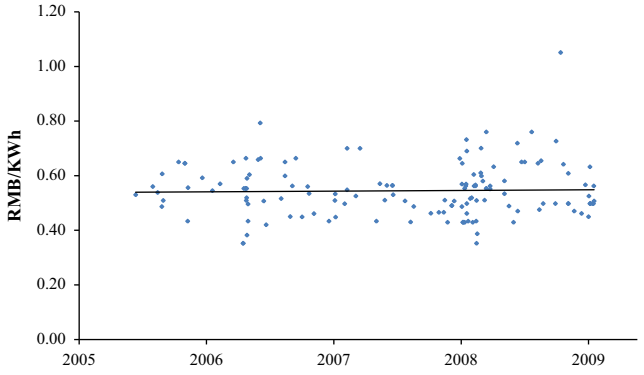

Fig. 1. Wind tariff by registration date for CDM projects.

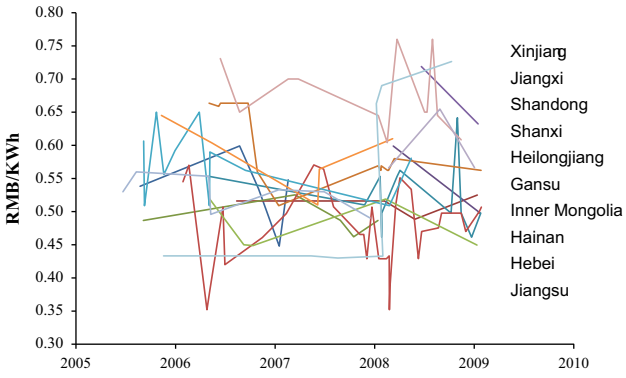

Fig. 2. Wind tariff by province for CDM projects, Note: The provinces are appeared in the order of their 2009 tariffs.

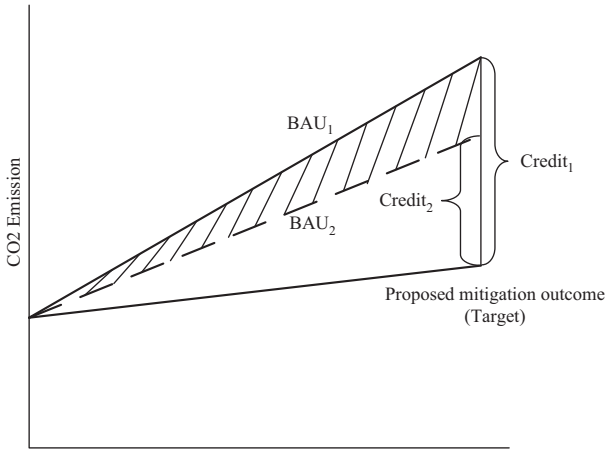

Fig. 3. The Offsetters' Paradox.

Table 2
Average wind tariff and investment cost of registered wind CDM projects by year.

Year	2006	2007	2008	2009
Average project power tariff (RMB/kWh)	0.5613	0.5355	0.5288	0.5485
Average wind investment cost (million RMB/MW)	8.96	8.81	8.99	9.51

Carbon policy must craft rules for the entire CDM that segregate the impact of evolving domestic policy from the impact of carbon finance when judging additionality. Unfortunately, this challenge presents a paradox for policy makers. On one hand, including domestic subsidies in the additionality calculation creates perverse incentives for the host country by making projects less eligible for CDM and therefore discouraging policies that would jeopardize CDM revenues. On the other hand, ignoring these subsidies assures crediting for business as usual projects, which reduces the integrity of global emissions caps (Morse and He, 2010).

This problem applies in nearly any situation where additionality is the central principle because additionality by definition compares a baseline of BAU to a lower emissions trajectory. As shown in Fig. 3, if credits are given for the difference between BAU_1 and target trajectories, any domestic policy that lowers baseline emissions to create BAU_2 reduces carbon payments, and therefore disincentivizes domestic emissions-reducing policies that would shift BAU_1 to BAU_2. Alternatively, if the offset mechanism attempts to solve the perverse incentive problem by crediting against BAU_1 instead of BAU_2 and ignores the domestic mitigation policy, then carbon offsets pay for what would have happened anyway as the shaded area depicts. We call this fundamental tension of additionality the Offsetters' Paradox. Post-CDM offset policy will need to directly confront this problem and decide how to strike an appropriate balance. This will become increasingly important as negotiators push for Nationally Appropriate Mitigation Actions (NAMAs) of developing countries that give domestic policy an even larger role in international climate policy.

5. Conclusion

The analysis presents additionality's dependence on domestic regulators in the near-term and draws an uneasy line between creating perverse incentives and crediting for BAU in the longer-term. The controversy over the additionality of Chinese wind offers key lessons for how the world can design, validate, and implement carbon offsets. This calls into question the integrity of the global carbon cap set under the second commitment period of the Kyoto Protocol. Post-2012 carbon policy should confront these imperfections and seek to reduce them by addressing the type of failures exposed by the Chinese wind controversy. Short-term reforms can immediately make project approval more credible and expeditious. Longer-term, mechanisms that are agnostic to market structure and independent of domestic regulators offer a better chance for avoiding controversy and proving the viability of carbon markets as a sound mitigation regime. Finally, the designs of offset mechanisms and linking of different trading schemes need to directly confront the Offsetters' Paradox because ignoring it will ultimately undermine the ability of the market to function.

Acknowledgments

This paper is adapted from Working Paper #90 of Program on Energy and Sustainable Development (PESD) at Stanford University. The authors like to thank PESD for the support of the research. We appreciate the valuable comments by the two anonymous reviewers to improve the paper.

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