THE EVOLVING ROLE OF CARBON FINANCE IN PROMOTING RENEWABLE ENERGY DEVELOPMENT IN CHINA

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Abstract

The world is negotiating what the international climate change regime will look like after 2012—the year that current Kyoto Protocol greenhouse gas emissions reduction targets expire—and the future of the Clean Development Mechanism (CDM) is under discussion. Critics claim the scale of reductions that the CDM is driving in the developing world is insufficient from a scientific perspective if we are to avoid dangerous climate change, that the project-by-project crediting process is inefficient, and that the reductions being achieved are not "additional"—meaning they would have happened anyway and thus should not be financially supported. Yet, the efficacy of CDM must be examined in the broader context of carbon mitigation in the developing world and the actions that are taking place. This paper examines the role that the CDM has played in promoting renewable energy development in China in order to assess how international carbon finance can best be used to help promote emissions mitigation in the developing world. It also assesses how several options under consideration for reforming the current structure of the CDM may impact renewable energy development in China in the coming years.

1. Introduction

The world is currently negotiating what the international climate change regime will look like after 2012—the year that current Kyoto Protocol greenhouse gas emissions reduction targets expire. Among the key topics that are under discussion are the future emissions targets that may be taken by developed countries, and the need for increased mitigation efforts by developing countries. It is in this context that the future of the Clean Development Mechanism (CDM) is under discussion. The adoption of targets by developed countries has allowed the developing world to enter the carbon market and be compensated for their own emissions reductions through participation in the CDM. Since the CDM's inception, however, criticisms have been rampant. Critics point out that the scale of reductions it is driving in the developing world is insufficient from a scientific perspective if we are to avoid dangerous climate change, that the project-by-project crediting process is inefficient, and that the reductions being achieved are not "additional"—meaning they would have happened anyway and thus should not be financially supported (Wara, 2009). Other criticisms focus on the lack of contribution to sustainable development or technology transfer, or on the inequitable distribution of CDM projects across developing countries (Schneider, 2007; Hultman, 2009; Teng et al., 2008).

Yet, the efficacy of CDM must be examined in the broader context of carbon mitigation in the developing world and the actions that are taking place. In China, for example, the past few years have brought a new commitment from the government to promote renewable energy resources and energy efficiency measures throughout the country. While these efforts were all initiated to meet domestic priorities, not international climate change commitments, in many cases they have benefited from access to carbon markets. In addition, China's continued access to international carbon finance is likely to be linked to its willingness to take on increased greenhouse gas mitigation actions.

This paper examines the role that the CDM has played in promoting renewable energy development in China in order to assess how international carbon finance can best be used to help promote emissions mitigation in the developing world. It also assesses how several options under consideration for reforming the current structure of the CDM as part of a post-2012 international climate treaty might impact renewable energy development in China in the coming years. Any changes made to the CDM in the context of the UNFCCC negotiations could directly affect renewable energy project development decisions in China, or more likely change the economics of such investments. This analysis may therefore inform both the domestic renewable energy policy discussion taking place in China, as well as the international climate policy discussions on how to reform the CDM to better facilitate the developing world's transition to a low carbon economy.

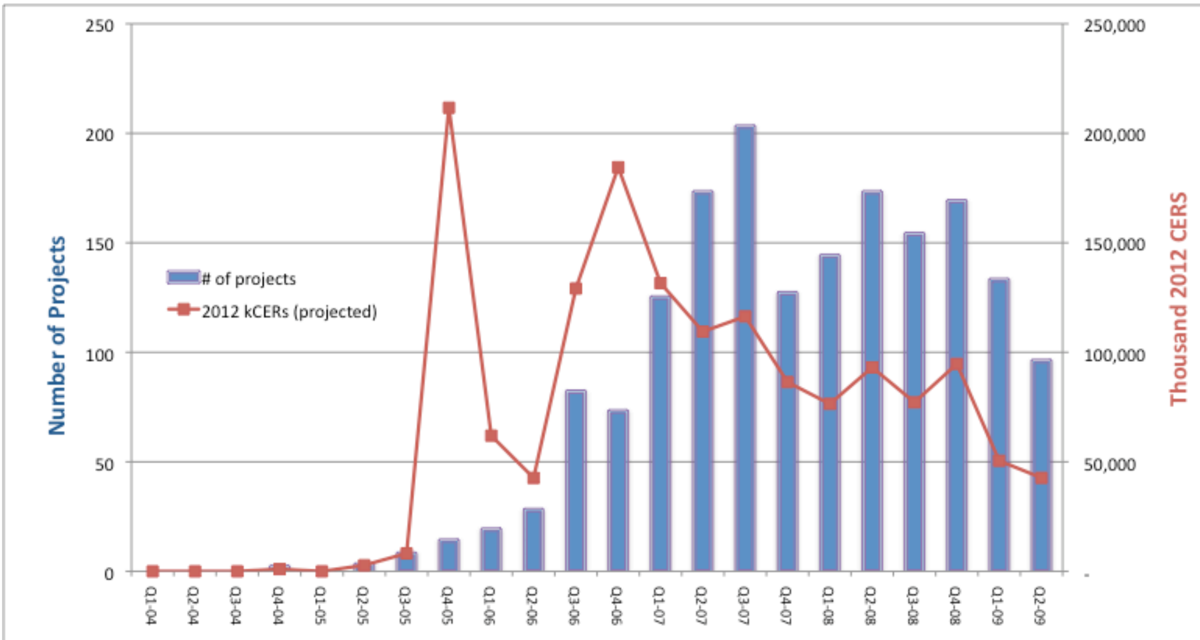
2. Background: The CDM

The international climate change regime began with the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, and was further elaborated in its 1997

Kyoto Protocol. It is the Kyoto Protocol that established the CDM, which allows Annex I (developed) countries to meet their Kyoto Protocol greenhouse gas mitigation commitments by purchasing credits, called Certified Emissions Reductions (CERs),[1] which come from projects in developing countries that contribute to sustainable development.[2] Over 200 types of projects are eligible, including renewable energy, energy efficiency, forestry, and industrial gas capture.[3]

Most of China's CDM projects have been developed in the last 3 years. The Kyoto Protocol was signed in 1997, and CDM credits became eligible for crediting beginning in the year 2000. China ratified the Kyoto Protocol in August of 2002, and established its Designated National Authority (DNA) to approve domestic CDM projects in June of 2004. In 2005, the Kyoto Protocol became a binding international treaty when it met the necessary participation threshold, allowing it to "enter into force."[4] In October of 2005, China's State Council adopted the "Measures for the Operation and Management of CDM Projects in China" (NCCCC, 2005).

Figure 1. China-Based CDM Projects and Projected Credits, January 2004 – June 2009 (Aggregated Quarterly)



Source: UNEP Risoe, 2009.

Upon adoption of these Rules in October 2005 the number of CDM projects registered in China began to increase dramatically and continued at a high level for about 2 years, before leveling off, as illustrated in Figure 1. More recently, there is an indication that the number of projects being registered is starting to decline, likely due to the uncertainty of the future of the CDM. Many countries that are purchasing CDM credits (CERs) to help them meet their Kyoto targets have already done so as they enter the first commitment period of 2008-2012. The majority of China-based CERs are being purchased by the EU Member Countries, as well as by Japan and Switzerland.

After 2012, there will only be a market for the further purchase of CERs if: 1) countries decide to allow their emitting facilities to purchase CERs to help them meet their commitments under domestic GHG reduction programs; or 2) the CDM continues in the post-2012 period of the Kyoto Protocol. While many domestic cap and trade programs include provisions for the use of international offsets, concerns over the CDM's integrity has led to the limitation or exclusion of CERs from domestic programs currently under development. While the European Union does not currently restrict the use of CERs[5], it has stated that in the absence of an international post-2012 agreement, it will not allow for the further purchase of CERs to meet domestic obligations (which have already been proposed through 2020).[6] Australia does not currently allow the use of CERs in its domestic emissions trading system (Australian Government, 2008), nor do the regional emissions trading systems (including the Regional Greenhouse Gas Initiative, RGGI) being established in the US (RGGI, 2009).[7] The Waxman-Markey bill currently being debated in the US Congress allows for the use of international offsets only if the US is party to a multilateral or bilateral treaty that includes the host country, and if the credits meet the environmental integrity standards set by the US program (WRI, 2009). While it is likely that the CDM will continue in some form in the post-2012 version of the Kyoto Protocol or of a new climate treaty, it may look rather different than it does today, as elaborated in section 6 below.

3. Financial Flows and Carbon Finance

The UNFCCC estimates that global additional investment and financial flows of $200 to $210 billion annually will be necessary in 2030 to return global greenhouse gas (GHG) emissions to current levels, and that an additional $100 billion per year will be needed to de-carbonize developing countries. The power sector alone is estimated to need $30 billion per year between now and 2030 to transition to a low carbon pathway.

The challenge of de-carbonizing investment, however, will be significant. It is estimated that an additional $30 billion per year would be needed in developing countries to "green" the $160 billion of investment already needed in the power sector annually, and additional investment and financial flows of $200–210 billion will be necessary in 2030 to return GHG emissions to current levels (UNFCCC, 2007). The IEA estimates that in order to reduce global greenhouse gas emissions by 50 to 85 percent by 2050 from 2005 levels, as the IPCC recommends, we will need to invest around $45 trillion globally – and much of this investment will need to take place in China. This investment would include additional R&D, larger investments in deployment of technologies not yet market-competitive, and commercial investment in low-carbon options stimulated by CO_2-reduction incentives (IEA, 2008).

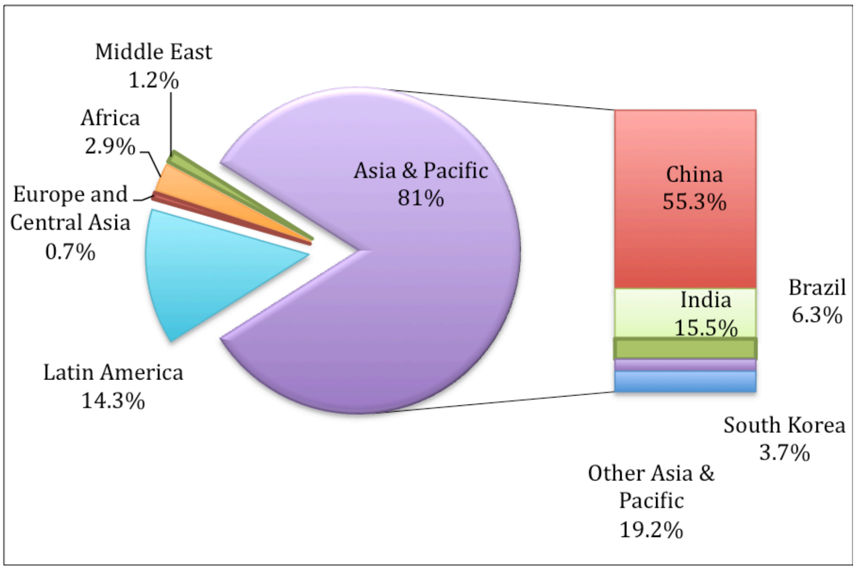
Investment in China's power sector has been astonishing. $50 billion dollars were invested in 2005 alone, a 31 percent increase over the previous year, and a 231 percent increase from 10 years earlier (Sinton et. al, 2004).[8] The IEA projects that China will invest $2.7 trillion in generation, transmission, and distribution in the power sector between 2006 and 2030, as China's installed capacity reaches a projected 1,775 GW by 2030 (IEA, 2007). Unless this investment is specifically directed towards low-carbon technologies, this investment will go towards the same carbon-intensive development path as has been taken by most industrialized nations. That would amount to a vast lost opportunity, because the consequences of the investment decisions made in China today will last for decades. Carbon finance mechanisms such as the CDM could play an important role in redirecting this investment.

While international carbon finance is yet to meet the entire estimated incremental cost of greening investment in the developing world, it is already contributing a sizable amount of funds. The total value of the entire international carbon market is currently estimated at about $28 billion, and the CER market is about half of that (UNEP et al., 2009).[9] Compared with the total scale of power sector investment in China, for example, the total amount of CDM-driven finance available is on the order of 1 to 2 percent. However, compared with the scale of finance going towards renewable energy alone, the share is more sizable, on the order of about 50 percent of the total investment in RE coming from venture capital, private equity, asset financing and public markets (Ecofys/Azure, 2008). Based on these estimates, CDM has contributed significantly to renewable energy investment, and at current revenue levels could continue to play a modest role in decarbonizing the energy system in the developing world.

4. China and the CDM

China is the largest, most active market for the creation of CDM credits. China is home to 55 percent of all CERs for CDM projects in the CDM pipeline proposed to date: the largest share of any country participating in the CDM.[10] 81 percent of all proposed CERs are coming from the Asia Pacific region, followed by Latin America with 14 percent. India has the second largest share of CERs after China, with 15 percent (UNEP Risoe, 2009).

Figure 2. China's Role in the CDM (Share of CERs)



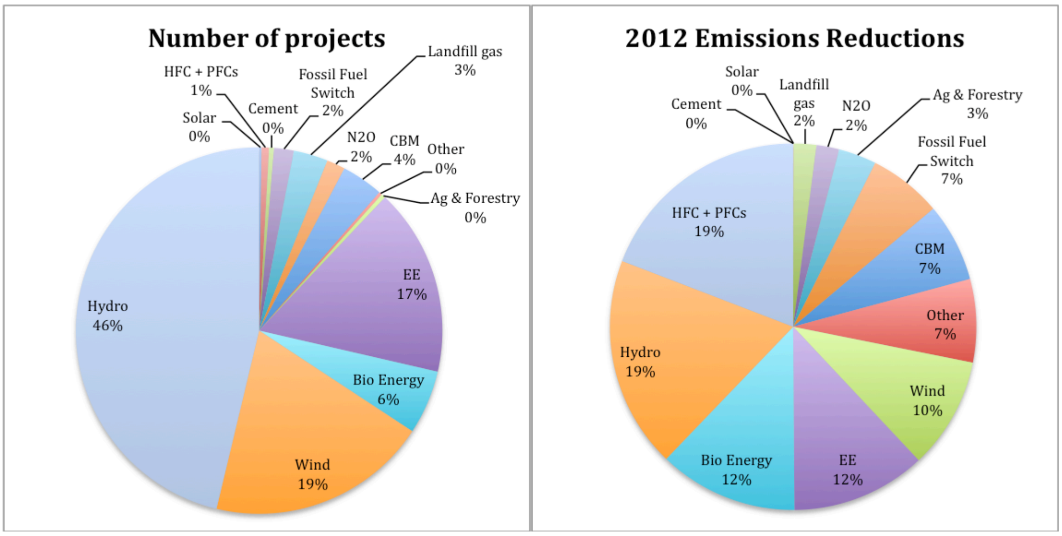
Source: UNEP Risoe, 2009.

There are many types of CDM projects being developed in China. Looking at all the projects in China's CDM pipeline, there are more hydropower projects than any other type, followed by wind projects, then energy efficiency projects. Other types of CDM projects being developed in China include coal bed methane, landfill gas, biomass energy, industrial gas capture projects, fossil fuel switching, biogas, reforestation, and solar energy.

Certain projects—particularly those that capture industrial greenhouse gases—generate a sizable amount of CERs. For example, China has several CDM projects that capture HFC-23.[11] Since HFC-23 has such a high global warming potential, (GWP = 11,700 according to the IPCC second assessment report), even a small project generates a lot of credits. As a result, just 11 HFC projects in China are responsible for almost one-fifth (19%) of China's CERs.[12]

Even by this measure, however, renewable energy CERs are playing a significant role in China, comprising about 41% of CERs. Hydro generates the most at 19%, followed by wind with 10%.

Figure 3. China's Project Portfolio



Source: UNEP Risoe, 2009.

5. The CDM as an Incentive for Renewable Energy Development in China

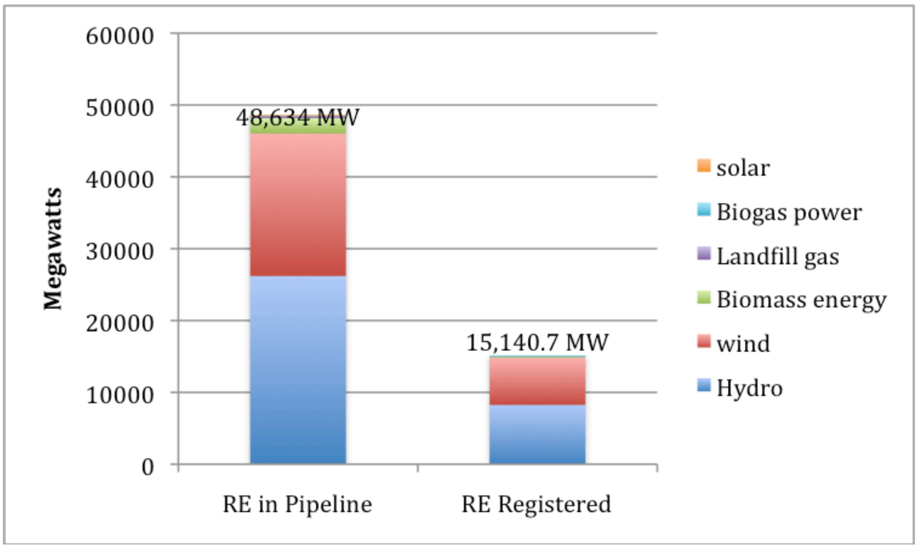
Renewable energy sources currently contribute to about 9 percent of China's energy consumption, and about 21% of electricity generation including large hydropower. At the end of 2008, China had installed an estimated 12.2 GW of wind power, 60 GW of small hydropower, 3.6 GW of biomass and less than 0.1 GW of solar PV, plus about 84 GW of solar hot water (REN21, 2009).

Hydropower is China's most utilized renewable resource, and there is an estimated 400 GW of potential hydropower capacity in China, with 145 GW installed as of 2007 (of which about 50 MW is small hydropower). China has installed about 12 GW of wind power capacity as of 2008, and has already far exceeded its initial 2010 wind target of 5 GW, as well at the revised target of 10 GW. There is about 2600 MW of biomass power capacity installed in China, including bagasse, municipal solid waste, landfill gas, biogas and gasification, and a national target for 5.5 GW of biomass power by 2010. China has installed about 100 MW of PV capacity at the end of 2007, and has a target for 300 MW by 2010.

The shares of renewable energy projects as illustrated in Figure 3 translate into over 48 GW of renewable energy capacity being proposed in the CDM pipeline, of which 15 GW have been registered. This includes 19.8 GW of wind, 26 GW of hydro, and 2 GW of biomass energy, as well as 400 MW of landfill gas, 50 MW of biogas power, and 13 MW of solar.

Again, the dominance of hydro and wind power projects applying for CERs is not surprising, as these technologies comprise the majority of new renewable energy capacity being installed in China today. While solar power is eligible, there have been only 4 solar projects in China applying for CERs to date, and they are solar cooking projects rather than photovoltaics. The dominance of hydro and wind projects primarily reflects the economics of renewable energy projects in China: hydropower and wind power are the least expensive forms of renewable energy in China. The subsidy value of a CER isn't sufficient, on its own, to make solar electric energy financially viable in China.[13]

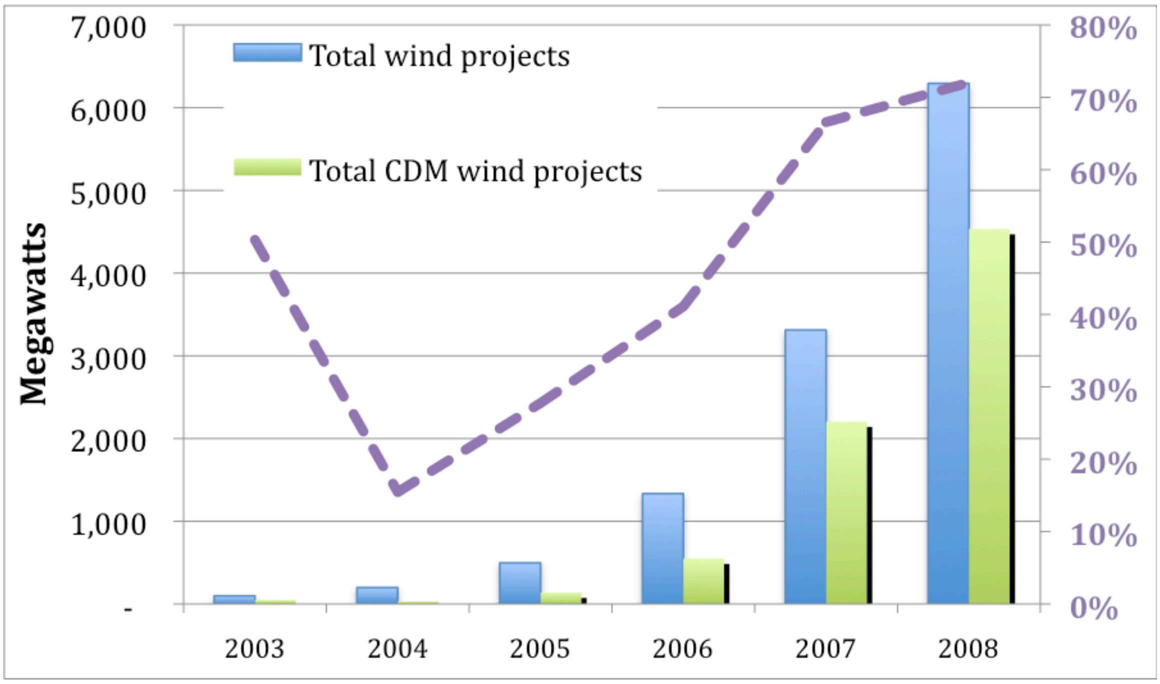
Figure 4. Renewable Capacity Proposed for CDM Credits in China (MW in pipeline vs. Registered Projects)



Source: UNEP Risoe, 2009

To examine the prevalence of CERs in supporting renewable energy projects in China, Figure 5 examines the total number of wind farms that have requested CDM credits between 2003 and 2008. CDM wind capacity in each year is estimated based on the proposed start date of the crediting period as noted in the project description. This analysis shows that the majority of wind farms in China are requesting CERs. This raises the question of whether these emission reduction credits being granted to wind farms in China can really be considered "additional." To do so, one must make the argument that 72% of the wind farms built in China in 2008 would not have been built without the existence of the CDM.

Figure 5. China's Annual Installed Wind Power Capacity and Annual Capacity Requesting CERs[14]



Source: UNEP Risoe, 2009, CWEA 2009.

To estimate emissions reductions associated with a CDM project, a baseline must be established which represents "business as usual" (BAU) emissions trends (projections of the "counter-factual" situation, i.e. if the project did not occur). Emissions reductions must then be demonstrated to be "additional" to BAU trends, meaning that anthropogenic emissions of greenhouse gases are reduced below those that would have occurred in the absence of the registered CDM project activity" (CDM Executive Board, 2008).

If a host country already has policies in place to promote renewable energy (e.g. a feed-in tariff subsidy or a mandatory RPS), for example, then it could be hard to prove that the project wouldn't have occurred without the CDM. There was some concern about this perverse incentive in which developing countries might be discouraged to adopt policies to promote clean energy technologies or practices that mitigate greenhouse gas emissions if this would make them ineligible for CDM crediting. To address this concern, the CDM Executive Board (EB)[15] clarified that national policies favoring less emissions-intensive technologies, such as subsidies for efficiency and renewables, are not considered business as usual, and therefore do not affect the estimation of a baseline, if implemented after November 2001 (CDM Executive Board, 2004; CDM Executive Board 2005). In the case of China, the National Renewable Energy Law and related provisions such as renewable portfolio standards and feed-in tariff prices were implemented beginning in 2005, and therefore as a result of this EB decision, theoretically should not affect the determination of an emissions baseline for establishing additionality (PRC, 2005).

The existence of a direct subsidy, such as a feed-in tariff, apparently can be used to question the financial additionality calculation of a project. According to a recent Point Carbon article, the CDM Executive Board has highlighted 15 wind projects in China that must be reviewed due to inconsistencies in the documentation of the level of government subsidy or feed-in tariff (Point Carbon, 2009). While it is common for wind project developers in China to estimate a feed-in tariff in the early stages of a project, this number may change after negotiations with the grid operator when the project goes online. Wind projects frequently end up receiving a tariff that is lower than what was initially forecast, which could make the role of carbon finance more important. However, all of this uncertainty in tariff-setting makes it even harder to prove financial additionality and the role of carbon finance in making a project viable. To date, however, only 7 renewable energy CDM projects (one wind project and six hydropower projects) have been rejected by the executive board due to additionality concerns.[16]

Because one CER represents one metric ton of CO_2-equivalent emissions reductions no matter where the reduction came from, returns on CERs are highest for projects that can reduce emissions for lowest cost, as illustrated in Table 1.[17] At the same time, CER price varies within project types; this may be dependent on the degree to which the risk is transferred between the buyer and the seller. In 2007, the CER price in the primary market ranged from 8 to 13 Euros with an average of 9.9 Euros (EU-China CDM Facilitation Project, 2009). The value of CERs in China typically ranges from 8 to 15 Euros (~80 to 140 Yuan or $10 to $20), depending on project type and perceived level of risk.[18] The demand for CERs is also largely expectation driven and is strongly influenced the EU-ETS, including policy changes and member country actions, since it is responsible for the largest portion of CER demand. Projects that can maximize the returns in the period prior to 2012 are also more valuable, due to the current market uncertainty (driven by policy uncertainty) post-2012.

Table 1. The Value of Carbon Credits in Renewable Energy CDM Projects

	Hydro	Wind	Solar	Biomass	Biogas
Average CER Price (Dollars per ton)	11.8	11.9	NA	11.6	12.3
Average Power Price (Dollars per kWh)	0.033	0.085	0.258	0.084	0.095
Carbon Revenues as percent of total investment (Percent)	19	10	NA	27	244

Source: Ecofys/Azure, 2008.

Renewable energy projects typically have a proportionally higher share of initial investment compared with conventional power generation projects. In addition, at the time at which the investment decision associated with the renewable energy project is made, there will most likely still be uncertainty associated with CDM project approval. As a result, the revenue from the CERs cannot necessarily be relied upon in the early stages of developing a project. This means that while the CDM could help tip a project that is on the borderline of being profitable towards profitability, this is unlikely to be a sufficient factor for determining whether to invest in the first place. Wind energy projects require a sizable upfront investment and take many years to yield sizable carbon reductions; therefore it is estimated that total CDM revenue will likely contribute less than 10 percent of the total project investment cost (Figure 1) (Ecofys/Azure, 2008). In contrast, industrial gas capture projects that capture HFCs and N_2O exhibit the highest emission reduction yield per unit of investment, therefore CERs become the primary driver for an investment decision and can represent a very sizable return on investment.[19]

Wind tariffs in China range from approximately 0.4 to 0.6 RMB/kWh. The addition of carbon finance to a wind project in the form of CERs could add about 0.05 to 0.1 RMB per kWh for as long as CDM credits are available, although the ultimate value will vary substantially with project characteristics such as the baseline and the estimated power output. For example, a wind farm that is shown to displace coal-based power could generate more CERs than one displacing hydro or nuclear power, and a wind farm with a higher capacity factor will earn more CERs than one with a lower capacity factor.

A somewhat indirect benefit of the CDM in China has been the increased transparency in data reporting in renewable energy projects. Recent studies have highlighted the fact that capacity factors (CF)[20] for wind farms in China are much lower than in the United States: 23% compared with 34%, and this analysis was based on project operating hours reported through UN CDM project registries.[21] This underperformance is problematic because this is making wind energy less competitive than it should be, and illustrates that despite making great strides in wind power development, there are still some major problems plaguing wind development in China that threaten the future viability of the industry (Meyer, 2009).[22] If less power is being generated, less electricity is sold, and the project is more expensive overall. There have also been concerns raised about wind farms exaggerating their energy output and potential carbon reductions in the initial application for CDM projects, since recent analysis has shown that actual performance is frequently being reported as lower than projected.

6. The CDM Beyond 2012

The CDM has been illustrated to be a valuable subsidy in promoting renewable energy development in China to date, particularly for wind power. It is clear that most wind projects in China are accessing international carbon finance to help subsidize their development. It is also clear that wind energy development in China has benefitted greatly from government policy support in recent years, and that this support has been more valuable than the incremental support stemming from carbon finance. From an additionality perspective, the financial support provided by the CDM may be questionable, since it is unlikely that China would not have built any of these wind farms in the absence of carbon credits. From a global climate change perspective, however, encouraging the use of wind energy as an alternative to higher-emitting technologies such as coal in China is crucial: this is a position with which few in the developed or developing world would disagree. While there is some disagreement within the developed nations over what their role should be in financing this development, there is more disagreement over the nature of this financing, and whether it might be better structured to encourage larger scale reductions, with less inefficiencies in transaction costs, and less ambiguity over additionality. Therefore, the relevant question for the future of the CDM is how it can be better structured such that developing countries are still encouraged to promote renewable energy development, but in a more direct and effective manner.

Streamlining the CDM

The CDM requires an extensive bureaucracy. Government officials must make the relevant rules governing CDM operation in each country, must constantly renegotiate its terms at the UN climate meetings, and must take turns serving on the Executive Board which governs day-to-day CDM decisions—particularly as relates to eligible project types, and methodologies that are acceptable for proving additionality and calculating accurate reductions. The rest of the bureaucracy is composed primarily of technical experts and consultants who help to prepare the paperwork for each project and estimate the emissions reductions it can achieve. Other entities are used to review and verify the reductions from projects. In particular, these designated operational entities or DOEs that are responsible for the validation of proposed CDM project activities and the verification of emission reductions have been shown to have serious shortcomings, such as non-conformities with regard to their "competencies to perform validation and verification functions" and their "compliance with CDM requirements" (Schneider, 2007). Due to the limitations of those entrusted with carrying out the verification process, many have noted the urgent need to streamline the approval process itself. Almost all of this bureaucracy is aimed at getting the most accurate estimate of the number of tons of carbon reduced as a result of each project.

There has been some progress in standardizing the methodologies used in emission reduction calculations for CDM projects. For example, the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002) is based on verifiable historical data, can be calculated once a year for all investments in a given country, and will not tend to fluctuate that extensively over time. Yet such a calculation still requires technical verification.

Several alternatives have been proposed as potentially more effective ways of estimating the emissions reductions achieved by individual projects. In the case of wind power, for example, a performance-based calculation that looks at the total amount of power generated from a wind farm during a certain time period could be grounds for a calculation of how much carbon was avoided if it is assumed, for example, that this wind power replaced coal power. While perhaps slightly less precise than doing this on a project-by-project basis, the difference is likely small, and perhaps worthwhile considering the amount of investment in bureaucracy and transactions costs that would be saved.

Programmatic Crediting

One modification to the CDM has already occurred for the pre-2012 period in the form of a decision to permit crediting from a “program of activities” (UNFCCC, 2005). This expands the definition of “project” to allow crediting of reductions from a “program” or bundle of actions over time, whether the result of government policy or private initiative (Ellis, 2006; Figueres, 2005). Opening the door to crediting a program of reductions could mark the beginning of a shift away from project-by-project quantification of reductions, and towards the quantification of multiple, isolated reduction efforts through estimation techniques that could result in potentially larger scale reductions and less transaction costs than if each action had to be estimated individually. An example of a common form of proposal for crediting a program of activities that has been submitted to date is for decentralized energy efficiency programs. For renewable energy, such a program of activities could include the installation of solar rooftops on multiple buildings in a city, or the installation of solar water heaters across multiple residential apartment complexes.

The CDM and Post-2012 Climate Politics

The discussion of the evolution of the CDM must also be examined in the context of the changing politics of climate change. Developing countries currently have no mitigation commitments, but attract investment from developed countries through CDM. This status quo arrangement may not be sufficient politically to reach a continued post-2012 agreement. Many of the developed country governments, including that of the United States, have said they will not agree to a post-2012 deal that does not require additional actions to be taken by all of the major economies, including China (G8, 2008).[23]

This reflects not just the chicken and egg politics of who goes first, but also that the scale of CDM-driven mitigation that is currently occurring in developing countries is insufficient. Most growth in greenhouse emissions in the next 50 years will come from the developing world, and reductions in line with recommendations being proposed by scientists cannot be achieved without substantial reductions in developing countries (IEA, 2007).[24] The current structure of the CDM, and the labor-intensive nature of project-by-project crediting, simply cannot support the scale of reductions needed. It is also not likely that current developed country buyers of CERs will be willing to support the purchase of CERs at the scale that would be needed. While some form of financial incentives via the carbon market are likely to continue to support developing countries, clearly not all actions can be supported, and those that are may do so under a model that is different from the CDM as currently structured.

To this end, several other options are being considered for reforming or supplementing the CDM in the post-2012 time period (UNFCCC, 2009). Two such options are discussed here, both of which aim to reduce transaction costs associated with crediting of reductions, and also to encourage larger scale reductions in developing countries. One option is to credit policy actions to reward policy commitments, and another is to credit sector-wide actions to reward sectoral commitments, as elaborated below.

1. Policy-Based Crediting

One option for continuing crediting in a post-2012 framework is by crediting policy actions taken as part of a policy commitment (Lewis and Diringer, 2007). In this case, countries would commit internationally to undertake national policies that reduce emissions. The country would be committing to a policy action, not to a specific level of emissions reduction, since this might be more palatable and equitable for a developing country (Lewis, 2007). As an incentive to achieve real reductions, the country would be eligible to earn credits shown to result from the policy action. For example, a country could commit to a national renewable energy target, or a renewables portfolio standard, and upon demonstrating success toward meeting the targets and the associated emissions reductions that resulted could be eligible to earn carbon credits.

Some key issues that arise with policy crediting include double-counting: not being able to discern whether a specific policy is driving emissions reductions. Another is whether policy crediting in one area could create leakage within or across sectors. For example, if you draw a line around the power sector and attempt to quantify emissions reductions that took place within that sector due to a policy decision, you might miss substitution that occurred across sectors (for example, electric heat being replaced by gas). While policy crediting could be highly successful in achieving much larger scale mitigation actions, too many reductions could flood the carbon market, resulting in over-subsidization of actions in developing countries, or CER prices falling to zero. This could be addressed by limiting the volume of credits a country can buy or sell; by discounting all policy-based crediting (receive credits for only a portion of their verified reductions) (Schneider, 2008); or by crediting only reductions that exceed those initially projected.

2. Sectoral Crediting

Another option being discussed is sectoral crediting. In this proposal, a developing country's mitigation actions would be eligible for crediting on a sectoral basis.[25] To do this, a country would set a sectoral target, and would then be eligible for crediting of emissions reductions achieved below a sectoral baseline, or some percent below baseline. Some studies have proposed that this target be "no-lose," meaning there is no penalty for not meeting it, just an incentive for reductions achieved (Schmidt et al, 2006). While this approach has less potential for leakage within a sector as compared with policy crediting, it could still create cross-sectoral leakage. This form of estimating reductions, however, could help eliminate many CDM-related transaction costs.

3. Coupling Domestic Actions with International Financial Support

Additional proposals include some combination of domestically-determined actions coupled with international financial support, which would include but not necessarily be limited to carbon finance. Overseas development assistance or other funds made available for financing energy projects in developing countries, for example from the proposed Clean Technology Fund (CTF), could be utilized (World Bank, 2008). Most all of them require the host country to finance a portion of the reductions unilaterally, prior to being able to access international funding support. While the CDM is aimed to cover the incremental cost associated with substituting an emitting technology for a low or zero emission technology, in practice it became evident that it is difficult to make a simple calculation as to where that line is drawn. As things progress, it is increasingly likely the determination of access to finance will not be determined by an additionality or incremented cost formula, but rather by a political negotiation, where finance is allocated in return for some form of unilateral mitigation actions.

7. Conclusions

The case of renewable energy development in China in many ways illustrates the benefits and failures of the CDM to date. The CDM has provided a useful subsidy for renewable energy projects in China, but this subsidy rarely is the primary reason a project gets developed. While the scale of greenhouse gas reductions driven by renewable power investment in China is significant (setting aside additionality concerns), it is still insufficient compared to the size of reductions that will be needed in China to address global climate change. As a result of the evolving politics of climate change that will likely require increasingly sizable mitigation actions to be taken by the world's major economies, and as a result of the criticisms surrounding the current CDM particularly regarding additionality and inefficiency, the CDM is unlikely to persist in its current form after 2012. Several proposals have emerged for new crediting mechanisms that aim to incentivize more aggressive mitigation actions in developing countries, and to reduce the bureaucratic inefficiencies associated with the project approval and emissions verification process.

The future of the CDM will continue to be discussed in the coming months at the international climate change negotiations. The 13th Conference of the Parties to the UNFCCC in Bali launched at least two tracks of negotiations that are discussing the fate of the CDM. The first is under the UNFCCC and includes discussion of enhanced mitigation action by developing countries, and by the developed countries currently not part of the Kyoto Protocol, including the United States. The second is under the Kyoto Protocol and includes discussion of CDM reform in the context of new Kyoto targets being taken by countries that currently have ratified the treaty. However, there are several other topics being negotiated under which CDM reform could be relevant, including cross-cutting discussions on finance and investment flows, and on technology transfer. The Parties are working to meet a December 2009 deadline for these negotiations at COP 15 in Copenhagen, though it is questionable as to whether all the details of such a complex agreement can be worked out by that date.

While many proposals to reform the CDM have emerged, many uncertainties remain about how to create a new, more effective mechanism that can encourage stronger mitigation actions in developing countries and eliminate bottlenecks and bureaucracy, while still maintaining the integrity of the emissions reduction credits. A crucial obstacle to designing an effective solution is the lack of information flowing between actors involved in CDM implementation and those involved in international climate policy discussions. There is a need for better communication of experiences and lessons learned in the context of implementing the CDM on the ground to the negotiators determining the mechanism's fate. As countries negotiate the next phase of the international climate regime, it will be important to consider the operational experience with the current CDM to date, as well as the evolving political context. It is equally important for those currently relying on carbon finance incentives, including renewable energy project developers in China, to understand the nature of future uncertainty and the likely direction that reforms to the CDM are likely to take, since they could directly affect project development decisions, or more likely change the economics of renewable energy investments.

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Tables

Table 1. The Value of Carbon Credits in Renewable Energy CDM Projects

	Hydro	Wind	Solar	Biomass	Biogas
Average CER Price (Dollars per ton)	11.8	11.9	NA	11.6	12.3
Average Power Price (Dollars per kWh)	0.033	0.085	0.258	0.084	0.095
Carbon Revenues as percent of total investment (Percent)	19	10	NA	27	244

Source: Ecofys/Azure, 2008.

Captions to Illustrations

Figure 1. China-Based CDM Projects and Projected Credits, January 2004 – June 2009 (Aggregated Quarterly)

Figure 2. China's Role in the CDM (Share of CERs)

Figure 3. China's Project Portfolio

Figure 4. Renewable Capacity Proposed for CDM Credits in China (MW in pipeline vs. Registered Projects)

Figure 5. China's Annual Installed Wind Power Capacity and Annual Capacity Requesting CERs

Illustrations
(embedded in text – files also sent separately)

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Footnotes

[1] CER stands for "Certified Emissions Reduction;" 1 CER = 1 metric ton CO2-equivalent.

[2] Sustainable development is a term defined at the discretion of the host country.

[3] Large hydropower projects, nuclear projects and carbon capture and storage projects currently are not eligible. CDM restricts dams with power densities (calculated from installed power generation capacity divided by the flooded surface area) of less than or equal to 4 W/ m2. Most hydro projects applying for CDM projects are <100 MW.

[4]According to Article 25 of the Kyoto Protocol, "This Protocol shall enter into force on the ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in Annex I which accounted in total for at least 55 per cent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession." On February 16, 2005, the Protocol entered into force 90 days after Russia ratified, putting the total percent of emissions for Parties that had ratified over 55 percent.

[5] The 2003 EU ETS – Directive (2003/87/EC, Art. 30) allows for the linking of the EU-ETS to project-based flexibility mechanisms like the CDM so long as the use of these offsets is supplemental to domestic reductions. The 2004 Linking Directive (2004/101/EC, Art. 11a) states that individual member states may restrict the percentage of offsets that can be used to meet domestic obligations for each facility. As a general rule, installations covered in the EU ETS in Phase I and Phase II are allowed to use up to 10%

CDM/JI credits to meet their allowance allocation. However, an assessment of actual allocations under Phase I and II shows that the "harmonised approach" resulted in CDM/JI limits for individual member States of up to 10-15% of approved trade sector caps in most cases, exceeding the 10% threshold. EU-China CDM Facilitation Project, 2009.

[6] If there is no new international agreement for the post-2012 period, use of credits from the Clean Development Mechanism (CDM) and Joint Implementation (JI) will be limited to leftover credits from projects approved before 2012. These credits can be used only through 2014 and only from project types approved by all Member States. Additional credits will be accepted only from countries with which the EU has signed bilateral or multilateral agreements. If a new international agreement is reached, additional use of CDM/JI credits will be allowed. Member States will be permitted to use credits to achieve half of the additional reduction required to meet the EU's 30 percent emission reduction commitment (i.e., if an additional reduction of 100tCO2 is agreed upon, the limit on the use of credits will be increased by 50tCO2). (European Commission, 2008.)

[7] RGGI may permit the use of CERs "under limited circumstances."

[8] Estimate, based on investment in fixed assets of state-owned units in the energy industry.

[9] According to the report, if the US introduces a federal cap and trade scheme in line with the latest proposals the global carbon market could increase significantly in the post-2012 period, turning over of the order of $2.1 trillion (€1.5bn) per year by 2020.

[10] The CDM pipeline includes all CDM projects to date, including those that have been proposed but not yet approved, or "registered."

[11] HFC-23 is a by-product from HCFC-22 production (CHClF2), which is used as refrigerant and as a feedstock for the production of PTFE (Polytetrafluoroethylene - Teflon).

[12] The inclusion of credit for HFC-23 abatement in the CDM has been criticized for creating

perverse incentives that could undermine the environmental efficacy of the CDM. A developing country producer of HCFC-22 reaps more profit from the byproduct HFC-23 than it does from its primary product, creating an incentive to generate more HFC-23 than they might have in the absence of the CDM and critics have pointed out that there are much more cost-effective ways of eliminating HFC-23 emissions. (Wara, 2008) The Chinese government taxes HFC and PFC projects at 65% with revenue going into its CDM fund that is used support actions for combating climate change in China.

[13] Recent policy decisions to further support solar PV could change the economics for solar dramatically in China in the coming years.

[14] Note that since CDM projects cover multiple years, the start of each CDM project is estimated by using the date for the start of the crediting as specified in each project document.

[15] The CDM Executive Board supervises the CDM, under the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP), and is fully accountable to the CMP.

[16] Hydro projects that failed to demonstrate additionality: "Hejiang County Yuanxing Hydro Project" (1804);

"Sichuan Shimian Xieluo Wanba River Hydropower Station" (1969); "Yunnan Nujiang Fugong Guquan River Hydropower Station" (2006); Zilenghe 24 MW Hydropower Project in Yunnan Province" (2164); "Sichuan Yanyuan Yongning River Hydropower Station" (2190); "11.4 MW Bundled Small Hydropower Project in Shanjunyan and Liaolil, Guizhou Province, P. R. China" (2251); "12.82 MW Bundled Small Hydropower Project in Qiandongnan

Autonomous Region, Guizhou Province, P. R. China" (2253). The wind project that failed to demonstrate additionality is the "Dalian Tuchengzi Wind Power Project 30 MW" (2209).

[17] CDM returns are not linked to the overall return on project investments but only to the project's ability to reduce emissions, although quality standards such as the Gold Standard are linking higher sustainability performance with a price premium.

[18] In China there is a de facto price floor for CERs set at 8 Euros. The CER value range is derived from Point Carbon reports and other similar carbon market reporting sources. The actual price of CER transactions is often proprietary.

[19] For example, the ratio of total CER income through 2012 to total investment for a N_20 project could be 1440 percent, and for a HFC project 596 percent. (Ecofys/Azure, 2008)

[20] The capacity factor (CF) defines the fraction of the rated power potential of a turbine that is actually realized over the course of a year given variations in wind speed.

[21] The relatively low performance for wind farms in China has been attributed to the sub-optimal siting of wind farms due to inadequate wind resource studies, limitations of the Chinese electricity grid in handling wind's intermittency, and the potentially lower quality of the domestically produced turbines deployed in China as compared with turbines available on the international market.

[22] While the average price of wind power in China is 0.55 RMB/KWh, if the capacity factor were increased to 34%, the cost would be decreased to 0.38 RMB/kWh. This represents a difference of 2000 vs. 3000 full load hours.

[23] The G8 Statement on Climate Change and Environment stated that "in order to ensure an effective and ambitious global post-2012 climate regime, all major economies will need to

commit to meaningful mitigation actions to be bound in the international agreement to be negotiated by the end of 2009."

[24] The extensive scientific studies by the Intergovernmental Panel on Climate Change (IPCC) provide a benchmark for the scale of both the problem and the response needed to avoid catastrophic climate change. To prevent global average temperatures from rising more than 2-2.4 degrees Celsius from pre-industrial levels requires that the accumulation of greenhouse gases in the atmosphere be kept below 450-500 parts-per-million (ppm), meaning that global greenhouse gas emissions must be capped within 10-15 years and reduced to at least 50 percent below 1990 levels by 2050. The "business as usual" (BAU) scenario of the International Energy Agency (IEA)'s WEO projects the current world trajectory of emissions growth will lead to a 57 percent increase in global carbon emissions between 2005 and 2030, with the United States, China, Russia and India contributing to two-thirds of this increase (IEA, 2007).

[25] A sector could be broadly or narrowly defined, e.g. the electricity sector, the transportation sector, the cement sector, the automobile manufacturing sector, etc.