Empirical analysis of performance of CDM projects: case study China

Discussion paper CDM-6

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Abstract: 5% of the Chinese CDM projects registered until end of June 2007 (4 projects) and 10% of the projects that had been submitted for public comments before June 2006, but not been submitted for registration by June 2007 (2 projects) are evaluated in terms of the barriers they face, lead times and expected CER generation, additionality argumentation, stakeholder participation and sustainability benefits. Small-scale CDM projects in China might be facing more technological and financial barriers than large ones. The amount of CERs forecasted changes as projects progress from validation to registration and issuance, due to new standardised baseline information published by China's DNA and to barriers related to the new technologies. Overperformance of some projects could be caused by underestimation of the plant load factor in the PDDs. Delays in the expected start of the crediting period are also observed, caused by delays in the DNA approval, the CDM registration, the acquisition of governmental permits, the use of new baseline and monitoring methodologies, or difficulties in achieving financial closure. All projects in the sample follow the Tool for the demonstration and assessment of additionality. They all argue having investment barriers, but only half perform a complete investment analysis. Other barriers mentioned are technological, unsuitable infrastructure, organisational and prevailing practice. Both projects lagging in the validation step lack independent sources of information, sufficiently objective barrier analysis and detailed common practice analysis in their additionality argumentation. China has no specific procedure for CDM stakeholder participation, but the method most frequently used appears to be the written survey, followed by the public meeting. Several of the projects do not provide sufficient information on the consultation methods. In none of the projects the contributions to sustainable development are described quantitatively. Possible negative environmental impacts are a matter of concern for stakeholders in most projects, but are addressed by developers. The expectation most commonly expressed by stakeholders is the creation of local employment, which is also the sustainability benefit most commonly offered by CDM projects.

1 Miriam Schröder, from Potsdam University, contributed to the report by undertaking preliminary research on the case studies.

Contents

List of acronyms and abbreviations

CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH1 – CH6	Codes given to the analysed projects
CO_2 eq.	Equivalent to carbon dioxide emissions (in terms of global warming potential)
DNA	Designated National Authority
EB	Executive Board
EIA	Environmental impact assessment
ETS	Emissions Trading System
EU	European Union
GHG	Greenhouse gases
IRR	Internal rate of return
NA	Not applicable
NGO	Non governmental organisation
PDD	Project Design Document
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
URC	UNEP Risø Centre

1. Introduction

Under the Kyoto Protocol, the Clean Development Mechanism (CDM) is one of the flexibility instruments aimed at helping industrialised countries, so called Annex I countries, to reach their emission reduction commitments in a cost-efficient manner, by purchasing credits from emission reduction projects in developing countries. These credits are less costly than investing in emission reductions within the industrialised countries themselves. At the same time, the CDM has the aim to benefit host developing countries by promoting investment in sustainable development and facilitating technology transfer.

Certified Emission Reductions (CERs) coming from CDM projects are not only interesting for government parties under the Kyoto Protocol, who need to meet their emission reduction targets by 2012, but also for private companies covered by the EU Emissions Trading Scheme (EU ETS), which are allowed to use CERs to comply with part of their EU ETS reduction requirements.

There are over 1500 CDM projects submitted for validation and almost 1000 already registered at the UNFCCC CDM Executive Board and therefore entitled to generate CERs. A reduction volume of over 1.3 billion tonnes CO_2 eq. by 2012 is expected from the registered projects. However, there are still doubts whether these CDM projects will really produce the volumes of CERs estimated during their design and registration and whether they will do it in time for the 2012 targets (Michaelowa, 2007). Moreover, there are also doubts about the environmental and social integrity of several CDM projects, which could reduce their attractiveness for potential buyers (Lohmann, 2006; Boyd et al., 2007; Ghosh, 2007).

India, China and Brazil are the developing countries where most CDM projects are being implemented. As of end of December 2007, the three countries together account for 63% of all CDM projects registered at the CDM Executive Board and 73% of the projects submitted for validation. Therefore, it is interesting to analyse the performance of projects in these countries in order to try to find answers to the above-mentioned doubts.

This paper analyses a sample of CDM projects in China in terms of the barriers they are facing and their impact on lead times and CER generation. It also evaluates three key aspects of project design: additionality argumentation, stakeholder participation and expected sustainability benefits. In Section 2 we present the project sample used for this analysis; Section 3 elaborates on the barriers faced by CDM projects in China, their possible causes and their effect on project performance; in Section 4 we assess the quality of additionality argumentation in the sample; and in Section 5 we look into the stakeholder consultation process and the expected sustainability benefits of these CDM projects. Section 6, finally, synthesises the findings and draws conclusions.

2. Project sample

5% of the 88 Chinese CDM projects registered until end of June 2007 (4 projects), and 10% of the projects submitted for public comments before June 2006 without having been submitted for registration by June 2007 (2 projects) are evaluated through the analysis of their Project Design Documents (PDDs) submitted for validation and for registration, their validation, monitoring and verification reports. The sample has been chosen so as to include a

range of project types, sizes and developers similar to the one actually occurring in China, as shown in Table 1. In the following sections, all data and calculations will be based on data for the Chinese CDM pipeline as of end of June 2007.

Table 1: Characteristics of projects selected for the sample as compared to the total of Chinese CDM projects

Project characteristics		Number of projects in sample	Percentage of registered and submitted Chinese projects
Project status	Registered	4	-
	In validation	2	-
Project type	Renewable electricity for grid - hydro	4	41%
	Industry - waste heat recovery	2	16%
Project size	Small	1	21%
	Large	5	79%
Developer	International consultancy I	2	1%
	International consultancy II	2	6%
	International consultancy III	2	8%

Source: Author's calculations on the base of UNEP Risø Centre's CDM pipeline (status end of June 2007).

3. Barriers faced by CDM projects in China

CDM project development faces several barriers, depending on the project type, character, size and the host country's specific situation. For example, there is the perception that especially small CDM projects and unilateral ones – this is, projects developed without intervention or investment from an Annex I country – might face more barriers for implementation than large or bilateral ones, respectively (Ellis and Kamel, 2007). They may have more difficulties gathering the financial means needed and overcoming the high transaction costs for applying to the CDM, lack sufficient technological know-how or face difficulties at finding CER buyers. Thus, we try to analyse whether project developers have faced any additional barriers due to the unilateral or small character of their projects.

With respect to the unilateral or bilateral character, all projects in the sample are bilateral, and thus none of them faced problems derived from being unilateral. In fact, most Chinese projects are bilateral: only 11% of all registered and 19% of all submitted CDM projects in China have a unilateral character.

One of the projects in the sample is small-scale, and it did find technological and financial barriers for implementation that were enhanced by its size, as stated in its PDD. On the one side, small hydro projects have a higher risk of low availability of water resources, which may cause considerable variance in the amount of reduced emissions. In addition, the limited capacity of a small project proponent can increase the implementation and maintenance risks, as well as the financial risks. The latter is especially the case for small private companies which face difficulties in securing loans from local banks, which often do not take the expected CERs revenue as a security because they are not familiar with the CDM and do not have trust in its revenues. Approximately 11% of all registered and 22% of all submitted Chinese projects are small-scale. Although the analysed sample is too small to allow

generalisations, other small CDM projects in China could be facing similar barriers to the ones described above.

These barriers might however not be exclusively true for small projects. As described in the additionality argumentation section of their PDDs, all of the analysed projects face financial or investment barriers, and four (67%) face technological ones.

Many CDM projects have, at their design stage, very optimistic expectations in terms of the amount of emission reductions they will achieve and the date by which they will start to operate and generate CERs (Castro and Michaelowa, 2007[2]). In the first case, project developers might want to show high amounts of CERs in order to be able to find buyers or access financing more easily, they might not use conservative enough parameters in their calculations, or they might not foresee possible implementation difficulties. In the second case, the CDM project cycle, the in-country required permits and licenses, the financial closure or the construction phase might take longer than expected, thus delaying the start of the crediting period.

Thus, a different approach to assess the barriers faced by CDM projects and their effect on project performance is used in the following paragraphs: we try to find out how much and why the forecasted volume of CERs and the expected start of crediting period change as the projects move along the project cycle, from validation, through registration to CER issuance. For this purpose, the information provided in the PDDs published during validation and registration is compared. Additionally, where available, the amount of CERs already issued is extrapolated to reach an estimation of the total emission reductions expected once the project is operating. As both the Kyoto Protocol's first commitment period and the EU ETS second phase finish in 2012, only emission reductions foreseen up to that year are considered in the analysis.

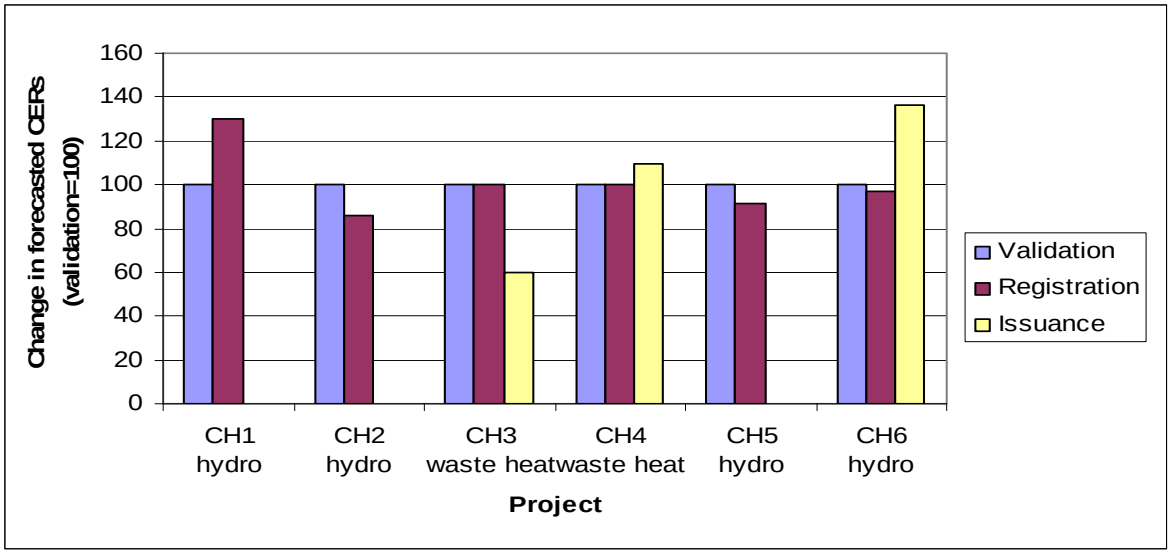
Figure 1 shows the per cent change in forecasted CER generation for each project in the sample. Although it is not possible to draw general conclusions from this small sample, the results show a great variability in the way the amount of forecasted CERs varies. Between the validation stage and the actual issuance of the credits, changes of up to +36% and -42% the original volume of CERs are observed.

Table 2 shows the delays in the expected start of the crediting period of the analysed projects as they moved forward along the CDM project cycle. None of the analysed projects is an "early-start" project, this is, a CDM project allowed to register after its beginning of operations and to claim credits from before the date of registration. In this case, delays in the crediting period would not be expected to take place.

The results also show a great variability in the delays that projects may suffer between validation and registration, but they are consistent in that all projects suffer delays, especially long for the case of hydro power plants. It is interesting to note, though, that the start of the crediting period remained the same at project registration and CER issuance in all cases where information is available. Indeed, at registration projects are usually in a very advanced stage, and so further delays are not usual. On the contrary, as seen above, the amount of CERs issued usually varies more between registration and issuance than between validation and registration.

2 See also Carbon Finance (2007), Point Carbon (2007), and Leoning (2006) for examples of carbon market analyses pointing out the underperformance of some CDM projects in terms of CER generation, especially animal waste and landfill gas projects.

Figure 1: Changes in forecasted amount of CERs along the CDM project cycle



Sources: Own calculations based on data from PDDs and monitoring / verification reports.
Notes: Projects CH1 and CH2 are not registered yet, and thus CERs are not yet being monitored or verified; figures shown for "registration" are based on expectations of the developers. Project CH4 has not requested issuance of CERs yet; the figure shown for the "issuance" stage is based on approximate monitoring data. Project CH5 and project CH6 will be verified only in 2008; the figure shown for the "issuance" stage is based on the monitoring report.

Table 2: Delays in expected start of crediting period along the CDM project cycle

Project	Delay validation-registration (days)	Delay validation-issuance (days)
CH1 - hydro large	366	NA
CH2 - hydro small	547	NA
CH3 - waste heat large	20	20
CH4 - waste heat large	33	33
CH5 - hydro large	365	NA
CH6 - hydro large	275	275

Sources: Own calculations based on data from PDDs and monitoring / verification reports.
Notes: Projects CH1 and CH2 are not registered yet. Data provided are based on expectations of the developer. NA: Not applicable because no monitoring and verification reports are available yet.

The reasons behind

Why does the amount of expected CERs vary so much in the sample, and why is this variation so different from project to project? In all cases the CER levels had to be readjusted because China's DNA published new standardised emission factors for the country in August 2007. Some of the projects had been developed already in 2005, when there were no standard emission factors for China and so each project developer used their own figures, which were then only checked by the EB for conservativeness. Now, all projects have to use the same standard.

Additionally, the waste heat recovery projects described technical factors that resulted in changes in their expected emission reductions:

- Lack of reliable historical data on waste gas production, resulting in incorrect figures used for feasibility studies.
- Unpredictable, high variability of waste gas output. This issue affects also the financial viability of the project and its additionality.
- Monitoring difficulties due to the new fuel type, for which prior experience is lacking.
- Higher power requirements for plant operation than foreseen, due to the use of new technologies.
- Unforeseen increase in absolute in-project emissions due to variance in volume and/or type of coal used for firing.
- Use of new, unknown equipment leading to heat losses in the transportation system and a decrease in the available heat for power production, and resulting in decreased emission reductions.

Further, all the hydro projects in the sample have experienced delays in the expected start of the crediting period, which may also be affecting their expected performance in terms of volume of CER generation.

Finally, the high variability in the observed change in forecasted amount of CERs may be due to incentives that differ among project types. For example, the plant load factor, which is a key parameter for renewable electricity projects, may be underestimated in the PDD to make the project look less financially attractive than it actually is and so fulfil the additionality requirements. Such projects would then have a tendency to show an overperformance. On the contrary, for projects that have no problems in passing the additionality test, an optimistic estimate of the parameters is likely, which would result in underperformance later on.

What are the reasons behind the delays in the start of the crediting period of the analysed projects? Reasons for delay are more varied than those for changes in expected emission reductions, but they are mainly of institutional, methodological and financial nature:

- Three projects experienced delays in the DNA approval process.
- The use of a new methodology (either unknown in the country or completely new) caused longer lead times in three cases.
- Two projects had delays in the EB registration process.
- Two projects needed longer time than expected for processing the governmental permits for the project (apart from CDM approval), partly due to the low efficiency of the local administration.
- One project had problems with financial closure to acquire the necessary equipment.

4. Additionality argumentation

Additionality is the key parameter that ensures that CDM projects result in real reduced greenhouse gas emissions and are not “business as usual” projects. It implies demonstrating that the project would have not been viable without the positive impact from the CDM registration and CERs sale. This demonstration is usually performed through a standard tool, the “Tool for the demonstration and assessment of additionality”, which includes specific steps that need to be followed in order to substantiate why the project can only happen thanks to the help of the CDM component. Although this tool is required in most consolidated methodologies and is nowadays common practice, it is not formally mandatory. Especially small-scale projects are allowed to follow simplified procedures to demonstrate additionality, and some methodologies for large-scale projects have specific requirements in terms of additionality demonstration.

The tool consists of the following steps:

- Step 0: Preliminary screening based on the starting date of the project activity – Only for projects beginning between 1 January 2000 and 18 November 2004, which wish to claim credits for the operation time before their registration under the CDM. This step was removed from the tool in February 2007.
- Step 1: Identification of alternatives to the project activity consistent with current laws and regulations.
- Step 2: Investment analysis.
- Step 3: Barrier analysis (only one of steps 2 and 3 needs to be done).
- Step 4: Common practice analysis.
- Step 5: Impact of CDM registration.

In this section of the paper we assess whether the analysed Chinese CDM projects fulfil the criteria of the Tool for the demonstration and assessment of additionality, as well as the quality of the argumentation brought forward. Only one of the projects in the sample is small-scale, and in the additionality section of the PDD it follows the steps given by the standard Tool, therefore we assess its quality together with the large-scale projects.

None of the analysed projects pass Step 0, as all of them begun their activities after November 2004. All projects identify alternative scenarios to the proposed CDM project, taking into account the legal and regulatory requirements for each of them.

Three of the projects perform just a barrier analysis, while one project makes both barrier and investment analyses, and two perform an investment analysis (at first these also had both investment and barrier analyses, but in the last PDD version only the investment analysis remains).

All six projects argue having investment barriers for project implementation, although only half of them perform a complete investment analysis, which helps to substantiate this barrier stronger. Two of the projects performing barrier analysis use the IRR (internal rate of return) to substantiate the investment barrier, but without providing a detailed account of their calculations or a benchmark figure. The third one just presents a qualitative description of the barrier, without any quantitative indicator. The three projects performing a complete investment analysis use the IRR as indicator. In all three cases, the validator requested further clarification, documentation or data to substantiate the IRR calculation and/or benchmark, and as a result two of them included an annex with the detailed cash flow. All three projects perform a sensitivity analysis, although one of them limits this analysis only to changes in the operating hours of the facility.

Four of the projects also describe technological barriers for implementation. These include construction difficulties and/or high cost of materials in the case of hydro projects, and lack of knowledge of the new technology (because it is external to the sectoral expertise of the company or because it is imported equipment) in the case of waste heat recovery projects[3].

Other types of barriers mentioned are unsuitable road infrastructure for transporting equipment and materials, organisational barriers due to lack of expertise of the project owner in the sector, and prevailing practice barriers.

3 Ultimately, according to the validation report (TÜV Süd), sufficient trainings were provided, and the Japanese equipment is running as foreseen.

All analysed projects go through step 4 of the additionality tool, this is, the common practice analysis. However, in two of the PDDs this analysis does not seem detailed enough, as it does not really present other similar projects happening in the region or country. One of these projects, a large hydro power plant, received a public comment during the publication of the PDD in the UNFCCC's webpage, expressing doubts about the quality of the PDD, including the common practice analysis in the additionality section: "In common practice analysis, I see there were already 500 MW small hydropower projects developed without CDM. It's not "very few". In addition, hydro electricity is more than 60% of all electricity generation capacity in Hubei"[4].

Finally, all six projects describe the way in which they expect the CDM will help to overcome the described barriers (impact of CDM registration). Three of them provide a quantitative account of the effect of the CDM on their expected revenues, and the other three give a qualitative description of these effects.

The reference to third-party, independent evidence and information sources is important for substantiating the additionality argumentation, especially in the cases where no complete investment analysis is performed. Four of the assessed projects consistently cite independent evidence, while one cites only one reference for the IRR benchmark source and the other one does not cite any independent source of information at all (this last one is the small-scale project).

The two projects lacking independent supporting information, sufficiently objective barrier analysis and detailed common practice analysis are the ones that have not been approved at validation yet, and this might be one of the reasons why validation is taking so long. The other four projects, which have already been validated and registered, show an improvement in the quality of additionality argumentation between the PDD submitted for validation and the one used for registration, as in all of the cases the validator required additional information, documentation or clarification for this section.

5. Stakeholder participation and sustainability impacts

Promoting sustainable development in the host countries is one of the main objectives of CDM projects. Therefore, CDM projects have to receive a national approval from their Designated National Authority (DNA), which is based on the sustainability benefits that the project will achieve in the host country. Moreover, the Project Design Documents have to explicitly detail what are the expected sustainability benefits to be achieved by the projects, they have to present the documentation related to the environmental impact assessment of the project, and they have to describe how the relevant local stakeholders were allowed to participate and issue comments on the project. By engaging in consultation with the relevant stakeholders, projects can demonstrate that they respond to the development demands of the local population, while ensuring social and environmental sustainability.

However, there are no specific internationally recognised requirements for ensuring good-quality stakeholder consultation processes in CDM projects. It is up to each host country to establish their own requirements for stakeholder consultation, and some may even not do so at all, leaving it up to the project developer to decide in which manner they invite stakeholders to participate. Therefore, the stakeholder consultation process varies from project to project and its analysis can

4 Comment by Long Yan, Huanneng Environmental Consulting, available at http://www.dnv.com/focus/climate_change/projects/projectdetails.asp?ProjectId=514.

provide an idea of how seriously a project developer, vis-à-vis the in-country regulations, considers participation and social engagement. However, according to Boyd et al. (2007), it can be misleading to evaluate project performance in terms of sustainable development benefits only through project documentation, since local conflicts might not be visible due to biases in selecting participants for stakeholder consultation meetings (Cole, 2006; Corbera and Brown, 2007).

Similarly, as established by the Marrakech Accords, it is the host country's prerogative to define whether a CDM project contributes to sustainable development (UNFCCC, 2001), and thus international sustainable development standards are absent (Sutter and Parreno, 2007). Several studies show that CDM projects are failing to achieve real synergy between emission reductions and sustainable development in the host country (Lohmann, 2006; Boyd et al., 2007; Michaelowa and Michaelowa, 2007; Olsen, 2007; Sirohi, 2007).

The Chinese government considers sustainable development to be a national strategy and China's approval procedures and requirements stress that CDM projects must make a contribution to sustainable development. So far, however, the CDM approval procedures do not include quantifiable indicators to measure project's contribution to sustainable development. Projects are rather evaluated on the basis of their impact within a clearly defined priority area than by a quantified measurement of sustainable development (IGES and CREIA, 2005).

China has identified the following priority areas for CDM project implementation: energy efficiency improvement, development and utilisation of new and renewable energy sources, and methane recovery and utilization. These priority areas comprise projects reducing carbon dioxide and methane, because reducing emissions of these two GHGs is closely related to energy conservation and renewable energy development, and it often involves much higher emission reduction costs per unit. The emissions of the other four GHGs are mainly generated by chemical industries, and reducing them generally involves end-of-pipe treatment and other simple technologies. It also offers limited social, environmental or economic benefits other than GHG abatement or CER revenues. These emission reductions are thus charged with high levies by the Chinese government (IGES and CREIA, 2005).

With respect to the stakeholder consultation, the Chinese government has a centralised CDM approval procedure and the DNA has not established any explicit procedure to fulfil this CDM requirement. Chinese provincial or local government bodies have no mandate to clear or approve CDM projects independently.

The first step to make a consultation possible is to identify the relevant stakeholders. All six analysed projects identify their stakeholders, however, the number of organisations or rather "categories" of stakeholders vary greatly:

- One PDD identifies 5 categories of stakeholders: government and non-government parties, local residents, NGO's, local social organisations.
- One PDD identifies 4 categories: local government officials, local residents, related employees and members of the general public.
- Three PDDs identify 3 categories: government officials, local residents and local trade association or related employees.
- One PDD only identifies 1 category of stakeholders: local landowners.

On the other side, the number of people actually responding to the project developer's invitation to participate in a public consultation process also varies significantly from project to project:

- Two projects had a response from over 50 people.
- One project had between 20 and 50 people attending its invitation.

- One project had below 20 people.
- Two projects do not specify in their PDDs how many people attended their invitation.

It is also interesting to analyse what kind of communication media project developers use to engage stakeholders, invite them to participate and receive their comments. Using open, mass communication media (such as radio, TV or public notices in community centres) shows that "everybody is invited", which is a sign of openness and transparency in the consultation process. Using, on the other hand, only "closed" communication channels, directed to specific people or organisations (letters, emails, telephone calls), can limit the ability of the general public to express their concerns. We should note here that the results from this analysis may rather reflect the current Chinese institutional setting than project developer's degree of openness.

In this analysis, two stages are differentiated: the communication media used for inviting stakeholders to make comments, and the media used during the consultation process itself. Half of the analysed projects do not describe in their PDDs what the communication media used for inviting stakeholders is. The other half uses written media[5], directed to specific stakeholders, possibly limiting the range of stakeholders allowed to participate.

Half of the projects used the written survey or questionnaire as the tool for gathering comments, one of them in a process linked to the Environmental Impact Assessment (EIA) for the project, one additional to the EIA consultation, and one in cooperation with the local government. While allowing the participation of a large number of different people, written surveys gather comments that might not be sufficiently informed (a survey normally includes a brief written description of the project and its expected benefits, but does not allow for detailed explanations and answers to questions and doubts, as consultation meetings do). They also normally have concrete questions and provide limited space for additional comments. In one of these cases, the validator additionally organised a public discussion with some local families.

One third of the projects organised public meetings and had additional discussions with authorities. One project, finally, does not state in its PDD what kind of consultation process it organised, but states that it had been linked to the EIA process and the acquisition of permits and governmental licenses.

Four of the analysed projects state having received positive comments from the stakeholders, while two of them do not report about receiving any positive comments or not. Five projects did not receive any negative comments from the stakeholders, and one does not report on negative comments. Finally, also five of the projects report having requests for further action or information, while one does not report on that. In all five cases, the questions or demands are answered in the PDDs. The main concerns or demands raised by stakeholders are summarised in Table 3.

Some of these concerns are related to the general negative perception of large hydro power plants, whose construction may entail negative environmental impacts and population displacement. In the last several years, news about local protests against hydro projects in China has spread (Chen, 2004; Cheng, 2005; Liu, 2007; Yardley, 2007; Everding, 2008). Although apparently none of these protests have involved projects within the CDM, this is a sensitive issue for large hydro power projects. In all the projects in the sample with these kinds of concerns, the developers have assured that none of the feared impacts will take place.

5 Written surveys or questionnaires directed to a specific number of people. Depending on the method used for selecting the sample of people to include in the survey, which is not described in any of the cases, the sample could or could not be representative of all the projects' stakeholders.

Table 3: Main concerns and expectations raised by stakeholders

Type of concern or demand	Number of projects
Requests or expectations related to creation of local employment	5
Concerns about possible negative environmental impacts of project / Request for compliance with environmental regulations and management plans	5
Expectations of possible positive environmental impacts	2
Requests to ease the local power shortage situation / Expectation for improved energy use	2
Concerns about possible land expropriations	2
Requests for compensation to land owners if project affects their lands	1
Requests for further communication to communities about the project	1
Interest in replicability of project	1

The demands and concerns raised by the stakeholders during the consultation processes can be compared to the sustainability benefits that the projects expect to achieve, as stated in the first part of their PDDs (see Table 4). In many of the cases, especially when referring to employment generation opportunities and positive environmental impacts, the concerns and demands of the population are in accordance with the sustainability benefits that the project developers expect to attain. However, none of the PDDs gives a detailed, quantitative account of the expected benefits to be reached. Moreover, as can be seen in Table 4, all of the expected sustainability benefits derive directly from the project activities themselves or from the country's environmental regulations and requirements. In none of the cases any voluntary, additional contribution to local development (e.g. community support activities, corporate responsibility programmes) is mentioned.

Table 4: Expected sustainability benefits according to PDDs

Type of sustainability benefit	Number of projects
Contribution to local economy through generation of employment and/or demand for local services	5
Increase of clean energy supply / diversification of electricity sources	4
Provision of capital investment to project developers / enhancement of local investment environment	3
Demonstration of a new technology for an industrial sector	2
Improvement of local environment (air, water, etc.)	2
Project location in poor rural area with high percentage of ethnic minorities[6]	1
No sustainability benefits detailed in PDD	1

6. Conclusions

Small-scale CDM projects in China might be facing more technological and financial barriers than large ones, especially if they are implemented by small, private companies without prior CDM experience[7].

6 This characteristic of the project is regarded by the Chinese authorities as a positive contribution to sustainable development, as the project is expected to contribute to poverty alleviation.

7 When asked about the disadvantages of the CDM, project owners always mention the tedious registration process, which takes much longer time and effort than they expected in the beginning (interviews with ten local project owners, November and December 2007).

The amount of CERs forecasted changes as the projects move on from the design and validation phase to registration and actual issuance of CERs, and it can both increase or decrease. These changes are mainly due to new standardised baseline information published by the country's DNA, but also due to technological barriers related to the new technologies involved in the CDM projects. Underperformance may also be caused by the long delays experienced by hydro projects. Overperformance could be caused by a previous underestimation of the plant load factor in the PDDs.

The expected start of project operation and CER generation can also change as the project advances from validation to registration, but no changes have been observed between registration and issuance of CERs. These delays are explained by different institutional, technological and financial causes, such as delays in the DNA approval process, the CDM registration process and the acquisition of all required governmental permits; the use of new baseline and monitoring methodologies; or difficulties achieving the financial closure of the project.

Additionality is the key parameter that ensures that CDM projects result in real reduced greenhouse gas emissions and are not "business as usual" projects. All projects evaluated follow the steps given by the Tool for the demonstration and assessment of additionality. All projects argue having investment barriers for project implementation, but only half of them perform a complete investment analysis. Other barriers found are technological (two thirds of the projects), unsuitable infrastructure, organisational and prevailing practice ones.

One third of the projects lack independent sources of information, sufficiently objective barrier analysis and detailed common practice analysis. These projects have been in validation for over a year, without having been submitted for registration yet, and this lack of quality of the additionality argumentation might be one of the reasons why. All the projects already registered were requested additional information, documentation or clarification to substantiate the additionality argumentation by the validators, and thus show an improvement in the quality of additionality argumentation between the PDD submitted for validation and the one used for registration.

In China there is no specific procedure for carrying out stakeholder consultations in CDM projects, and therefore the consultation process varies from project to project. The number of stakeholders identified varies greatly, as well as the number of people actually participating in the process and issuing comments. The consultation method mostly used in China appears to be the written survey or questionnaire, followed by the public meeting. While allowing the participation of a large number of different people, questionnaires gather comments that might not be sufficiently informed and provide limited space for additional comments. Several of the PDDs do not provide sufficient information on the consultation methods, the people participating or the communication channels they used. This could reflect just the current institutionality in China or also a lack of transparency in the description of the consultation process.

The expectation most commonly expressed by stakeholders is the creation of local employment, which is also the sustainability benefit most commonly offered by the projects. Possible negative environmental impacts are also a matter of concern for stakeholders in most projects, but project developers normally have environmental management plans that are legally binding. Concerns about possible negative impacts on land or rehabilitation problems have been raised for some of the hydro projects in the sample, but they have been appeased by the project proponents. Other sustainability benefits offered by projects are the increase in clean energy supply (issue also requested by stakeholders in some of them), the provision of new capital for investment and the demonstration of a new technology.

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- Hubei Yunlonghe Hydropower Project of Enshi City, Hubei Province, P.R. China
- Jiaojiping Hydroelectric Project
- Ningguo Cement Plant 9100KW Waste Heat Recovery and Utilisation for Power Generation Project of Anhui Conch Cement Company Limited
- Yutan Hydroelectric Project.