CARBON TRUST

Global Carbon Mechanisms Annex I:

Analysis of CDM project performance

Introduction

The Clean Development Mechanism ('CDM')is new, and data is only now starting to emerge in enough depth to carry out analysis of how the emissions reductions anticipated from this mechanism match up to its actual delivery.

This Annex is designed to support a larger Carbon Trust publication, "Global Carbon Mechanisms: emerging lessons and implications". In this document, we examine in detail two main sources of analysis which have been used as inputs to the Carbon Trust publication.

"Global Carbon Mechanisms: emerging lessons and implications" is available from the Carbon Trust website at: www.carbontrust.co.uk/publications.

In June 2008, Climate Strategies published a report from Axel Michaelowa and Paula Castro that examined CDM project performance, "Empirical analysis of performance of CDM projects". The aim of the report was to inform governments, policy makers and the private sector about the key parameters that determine project success in the CDM, and what impact these parameters might have on actual emissions reductions delivered in the form of certified emissions reductions ('CERs').

The research scope included:

- Analysis of the publicly available data on the CDM; in particular from the United Nations Environment Programme's Risoe database of CDM projects ('the Risoe database') and from the United Nations Framework Convention on Climate Change's ('UNFCCC') website;
- In-depth case studies of the three countries most active in the CDM: China, India and Brazil;
- Interviews with international experts and project developers; and
- Additional research based on other available literature.

The research was carried out using project data available to the end of June 2007, and covered a sample of: 275 registered projects, 18 projects in validation, 20 rejected projects and 4 withdrawn projects. In doing so, the analysis represented nearly 40% of the 715 projects that had been registered at the time of the research, and around 20% of the total of 1,500 CDM projects that had been proposed.

To complement the Climate Strategies' work, and in view of increasing data available on CDM projects in operation, we also reviewed a more recent Research Note from New Carbon Finance, "False Expectation: Why CDM projects under-perform" published in November 2008.

Based on data available at the end of August 2008, New Carbon Finance looked at the overall delivery of CDM projects and then examined in detail the performance of four technology areas: hydro, wind, landfill and industrial gases. Each of the four areas chosen had different delivery patterns and provided a comparison between reasons for good or reliable performance against those projects with poor or unpredictable performance.

In the following sections we set out some of the findings of these two sources.

Empirical analysis of performance of CDM projects

Projects under the CDM are defined by their project design document ('PDD'), that includes a projection of the emission reductions from that project – and hence, of the forecast volume of CERs that would be issued if the project is verified to have performed as predicted.

In practice, of course, submitted projects may not pass successfully through the assessment process (i.e. they will fail to be validated or to be registered), and those projects that are successfully registered may still under-perform when compared to initial projections of the emissions reductions achievable. This under-performance could occur for many reasons, including – against the ticking clock of the 2012 end to the Kyoto Protocol's first commitment period – delays in project start-up.

Project lifecycle: acceptance or rejection

Projects must navigate a series of steps towards registration and issuance. Firstly, a project must obtain a Letter of Approval from the host government's Designated National Authority ('DNA'), secondly, validation by a Designated Operational Entity (or 'DOE'), and finally formal registration by the CDM Executive Board.

Out of the Climate Strategies sample, the 20 projects rejected by the Executive Board represented less than 10% of those approved by DNAs and DOEs. 13 of the 20 rejected projects were categorised as "energy efficiency" projects, although energy efficiency only accounted for 17% of submitted (and 14% of registered) projects until June 2007. However, 6 of these (i.e. almost half of the energy efficiency rejections) were cement blending projects - which represent only 1% of submitted and 2% of registered projects. These were rejected due to insufficient demonstration that the projects would result in real and additional emission savings compared to what would have happened anyway (i.e. a failure to pass the "additionality" test). Indeed, there seemed to be generic difficulties for demonstrating additionality in cement blending projects: of all 22 such projects submitted for registration, 8 were rejected as the Executive Board clarified its interpretation of additionality arguments.

Data from the Risoe database as at 1st November 2008 (the date of writing of the Carbon Trust report) shows that the rejection rates of projects have increased from less than 2% for projects submitted for registration in 2004/2005 to over 10% for projects submitted in 2007. Requests for review – that lead to considerable delay even if the project is eventually cleared - rose from 8% in 2004/2005 to over 40% in 2007. In addition, the Climate Strategies work also found a number of projects (an accumulated total of 174 projects out of all 872 submitted for validation by June 2006) that in June 2007 had been "stuck in validation" for over a year, from which it was inferred that there could be problems preventing these projects progressing further. At the time of writing, there were 371 projects that had entered the validation process in 2003-2006 but had not completed it. The Risoe database assumes that 249 of these will not survive to progress further.

Subsequent performance: the CER 'yield'

Once a project has been officially accepted and registered by the CDM Executive Board, the most basic indicator of its subsequent performance is the ratio of delivered, verified CERs to the amount projected in the validated PDDs at the time of registration. This we term the 'CER yield'.

Although the extent and duration of the overall track record that was available for examination in 2007 was still limited, initial evidence from the research showed a significant underperformance. From its sample, the research concluded that project consultants and validators "tend to strongly overestimate the emission reduction potential of the projects".

This stage of CDM evaluation is most dependent on recent and limited data, because of the time-frames inherent in the CDM process. CERs are only issued retrospectively, after a verified assessment of project performance on an annual or bi-annual basis. The CDM itself is only just now moving into the era of full, verified delivery, as demonstrated by the fact that only 200 million CERs out of a total potential of nearly 3 billion for 2008-2012 had been issued by 1st November 2008.

In the Climate Strategies' work, the average yield across the entire sample was 76% when compared to the CERs that had been expected for the same period in the registered PDD documents. The New Carbon Finance work found that 70% of projects issuing CERs at the time of their research a year later were underperforming to some extent – and that 42% of the issuing projects had "significantly underperformed" with yields of less than 80%. The incidence of CDM projects that overperform by issuing more CERs than expected is lower than that of those that underperform. New Carbon Finance found that 10% of issuing projects were overperforming: the Climate Strategies sample contained 68 overperforming projects out of a total of 203 issuing projects (33%).

Both Climate Strategies and New Carbon Finance examined the projects in further detail in order to uncover the possible reasons underlying the variance in CER yield from original expectations.

Detailed findings of Climate Strategies' research

Project type and size

The CER yield can be expected to vary for different types of projects, and the evidence and data on this, including related issues of project size, are set out in the main Carbon Trust report. The overall conclusion from the Climate Strategies work was that performance appears to be quite strongly influenced by the project type and size – which are to some degree closely linked. This Annex summarises in a similar way data from the other factors examined.

Host country

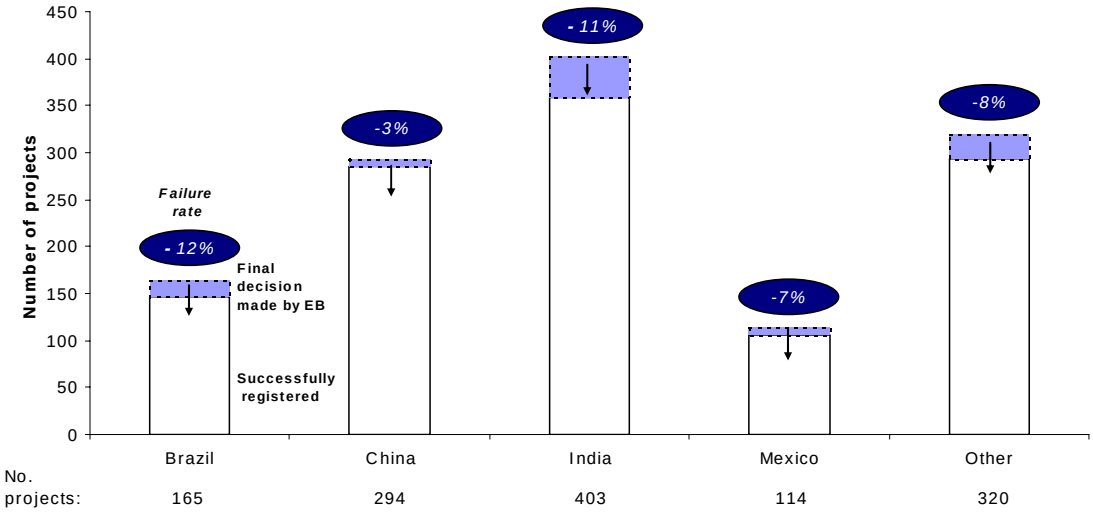
The host country determines the political and economic context in which a project is executed. It influences the overall investment and regulatory environment, as well as the context for operating CDM projects. The investment and regulatory environment includes political and macro-economic stability, and specific energy, industrial and other sector-specific policies that may bear upon the viability and operation of a project. CDM-specific implications include the set-up and operational efficiency of the DNA for approving CDM projects, and also other considerations such as specific taxes or levies on CDM projects that have been introduced by some host countries.

Up to the time of the research (and indeed subsequently), most of the carbon capital flow associated with the CDM has focused on China, India and Brazil. At first, India clearly dominated the market in terms of volumes of issued CERs as well as the number of registered projects. China has subsequently emerged at the forefront. The main reason for the attractiveness of these countries may lie in their geographical and demographical size and the related emission reduction potential due to increased industrial activity. Moreover, the potential for large-scale projects such as those in HFC-23 and N_2O, the supportive investment environment and the CDM facilitating framework, as well as CDM awareness and capacity building activities, may have contributed to the leadership of these host countries too.

Out of all the 20 rejected projects in the Climate Strategies sample, 11 were developed in India and 5 in Brazil (the others being in Mexico (2), Argentina and Chile (one each)) – a high share even compared to large number of the projects from these countries. In contrast, up to June 2007 China had not approved any CDM projects that were subsequently rejected by the Executive Board, or withdrawn.

Since the time of the Climate Strategies's research it has been possible to update the data regarding relative "failure rates" of host countries in completing the registration process. Chart 1 shows the "rates" as at 1st November 2008 by host country, (defined as the total number of registered projects compared to the total that have received a final decision from the registration process).

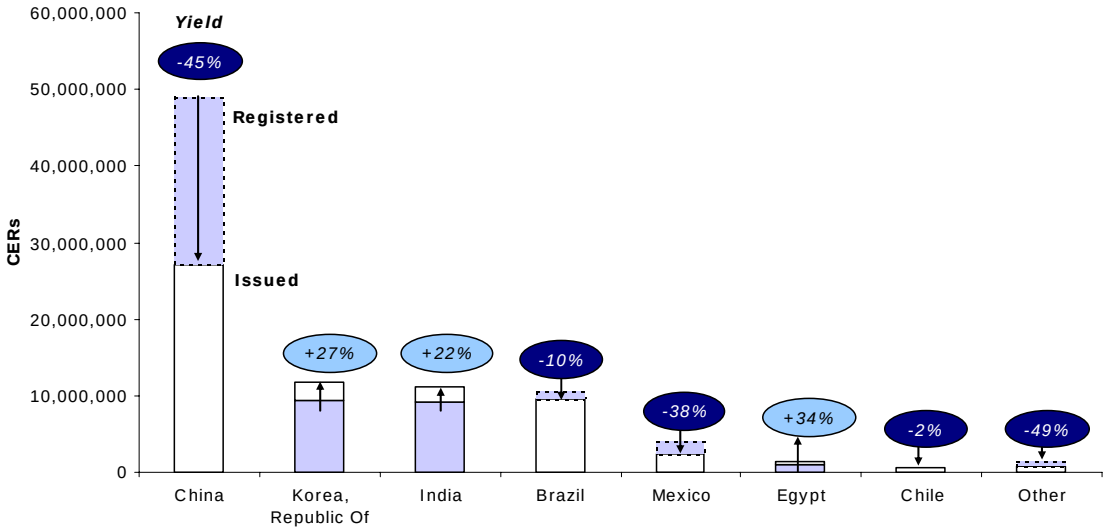
Chart 1: Projects registered compared to projects submitted, by host country



Source: Carbon Trust calculation using UNEP Risoe Centre November 2008. Figures used comprise projects with status of "registered", "rejected" or "withdrawn".

For the projects that were successfully registered by mid-2007, Chart 2 overleaf shows the subsequent performance in terms of the CER yield for different host countries. In aggregate, Indian projects in the sample had performed above expectations, whereas projects in Brazil and China had underperformed by 10% and 45%, respectively. However, these results are dominated by a few large industrial gas projects: two well-performing HFC-23 projects in India made up 74% of all registered and 81% of all issued CERs in Chart 2 (with 32% more CERs issued than predicted), whilst Chinese performance was dragged down by two low-performing projects whose yield, however, has improved since the chart cut-off date in mid-2007. Brazil's performance is less dependent on large industrial gas projects, with its projects in the sample primarily focusing on renewable energy and waste. The Brazilian sample included only one N_2O project, which accounted for 75% of all CERs issued and which performed well. However, the performance of the waste projects in the Brazilian sample lowers the yield to some extent.

Chart 2: Forecast certified emission reductions (CERs) compared to actual verified performance (CERs issued), by host country



Source: Climate Strategies, Castro and Michaelowa (2008)
Note: data derived from UNFCCC website and UNEP Risoe Centre (2007). CER volumes have been standardised to a one-year period starting from the beginning of the crediting period. Cut-off date, July 2007.

Although the overall yield does differ between countries, and, on average, some countries' CDM project portfolios are presently performing better than others' in terms of CER yields, the survey found no evidence that any one country performs consistently better or consistently worse – in all projects – than the others. Most of the variation is accounted for by the differing kinds of projects, and especially the performance of individual very large projects.

Unilateral or bilateral character of CDM projects

The idea of the CDM was initially promoted by many developed countries in the belief that it would act as a vehicle to support direct foreign investment in emission-reducing projects in developing countries. After its outline incorporation in the Kyoto Protocol, developing countries increasingly pointed out that they had the capacity to develop such projects without direct foreign involvement. Providing these met the same standards as the bilateral projects – those involving foreign investment - such unilateral projects obviously deserved the same treatment, in terms of generating CERs. In some quarters, there was some scepticism about whether such projects would prove as reliable as bilateral ones, given the lack of technology and capital transfer in unilateral projects.

The sample analysis does suggest that bilateral projects have a somewhat higher CER yield – about three quarters (77% of the forecasted CERs), compared to two thirds (67%) from unilateral projects. Out of the bilateral projects, those with European participants performed best, with a 121% yield. Possible reasons for the better performance of bilateral projects might be improved access to technology, technical support and upfront financing. In addition, 65% of all rejected projects up to June 2007 were unilateral, whilst all withdrawn projects were bilateral.

Type of project developer

The process towards registration of potential CDM projects, and subsequent issuance of CERs, is complex. The number of methodologies and their specifications, and the accompanying UNFCCC regulations, have grown steadily, so that the whole registration procedure has become harder to navigate. As a consequence, the intermediary role of consultants has become more important. Consultants help project owners develop the PDDs and associated methodologies, provide procedural support, and sometimes act as a broker once the CERs are generated.

The sample results showed wide variation of project performance between technology-specific consultants (i.e. those that specialise in one, or at most two, project types), multi-project consultants, and in-house developers. The results suggested that technology-specific consultants have more success than multi-project consultants in getting their CDM projects registered, but the picture is more mixed in terms of subsequent performance.[1] One more consistent insight is that in-house development of PDDs shows better results in project performance than most consultancies do. This could indicate that project proponents seem to know their project best, which would question the "facilitating" role of external consultancies to some extent. Again, the limited number of sampled projects may still be too small to draw final conclusions, and the high variance shows, in addition, that other project characteristics – project type in particular – are probably affecting performance more decisively than the type of developer.

[1] 85% of all rejected and 75% of all withdrawn projects were developed by a multi-project developer, this is, a consultancy firm working with different types of CDM projects. The remaining 15% of rejected projects and 25% of withdrawn projects were developed in-house by the project proponents themselves. In comparison, out of a sample of the registered projects, only 57% were developed by multi-project consultants, while 26% were developed by technology-specific consultants and 17% by the project proponents.

In the overall sample, technology-specific consultancies performed much worse (25%) than multi-project ones (106%) and small ones (73%). However these results are affected by the especially low performance of one technology-specific consultant with a large portfolio of animal waste management projects, and the very good performance of one multi-project consultant with a large portfolio of projects in India. Without taking these outsiders into account, technology-specific consultancies would perform better than multi-project ones.

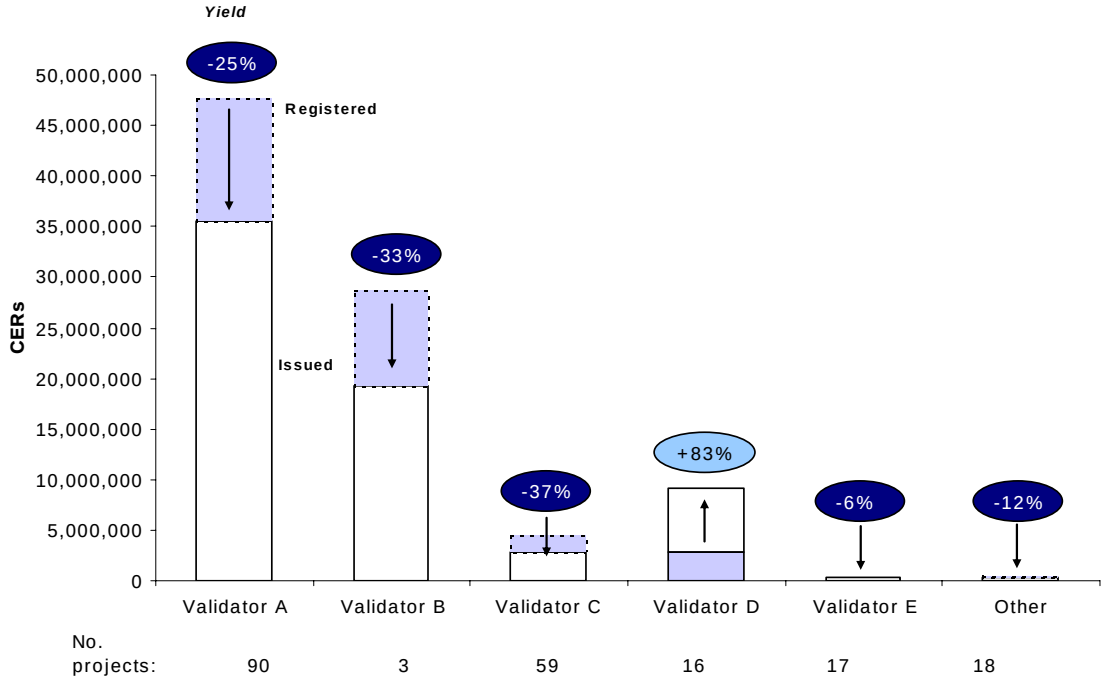
Validators

Similar conclusions appear to apply to the role of validators (the DOEs), whose role in relation to project proposals is analogous to that of due diligence. Chart 3 below indicates the CER yield for projects scrutinised by different validators.

The largest (Validator A) reflects the market average of around 75%. Others show wide variation; however, this appears to depend mostly upon the type of projects they were handling. The exceptional performance of Validator D is due almost exclusively to one large, very well performing HFC-23 project that dominated its portfolio, without which, its aggregate delivery would be 15% below projections. Poorer performers are associated with project types that have struggled to deliver, such as methane capture from pig wastes.

The analysis of CER issuance rate by validator suggests that the performance of DOEs is related mostly to the types of projects held in their portfolios, rather than to differences in their approach.

Chart 3: Forecast compared to actual verified performance (CERs issued), by validator



Source: Climate Strategies (2008): Castro and Michaelowa
Data derived from UNFCCC and UNEP Risoe database 2007

Although it is not possible to reach any robust conclusions about the actual comparable performance of different validators, the Climate Strategies research suggested that their role in the overall process did require further scrutiny. Validators are hired and paid for by the project developers. As most project developers are developing multiple projects, validators have an incentive to make life easy for project sponsors. This is exacerbated by a fierce competition between validators and as a result prices for validation services fell until very recently, when the increasing demand for validation services led to a sudden increase in prices. There is debate about whether the fact that project developers pay for the validation services may influence their assessments. This reflects the norm in other areas of private sector quality assurance services – where producers are paying to convince markets of the quality of their products or services. However, there is at least one difference, as the Executive Board stands between validated projects and final approval. This may also raise questions about the relationship of private validation to public confirmation, and may also lessen the independence and extent of scrutiny by validators, who would be in a stronger position if their services could be independently funded.

Detailed findings of New Carbon Finance research

The research by New Carbon Finance identified a number of factors underlying project yields:

- Mis-calculation;
- Delay in project implementation;
- Technical failures;
- Force majeure; and
- Seasonal variations.

Of these, the first two factors were by far the most influential on CER yields, together accounting for at least 75% of the delivery failure in each of the four project types investigated (i.e. hydro, wind, landfill and industrial gases).

Mis-calculation

Errors in calculating the load factor were a major cause of both over- and under- performance of the CDM projects examined.

For example, landfill gas projects have been amongst the most disappointing projects in terms of CER yield with 90% of the issuing projects examined by New Carbon Finance under-performing – many with yields below 50%. Their work found this to be mostly due to poor application of the landfill gas models used to calculate the projected emission savings. The models require adjustments to be made for factors particular to each site, such as the composition of the waste or for the efficiency of the waste management systems, both of which will significantly affect landfill generation. In practice,

New Carbon Finance concluded that the developers using the models had not allowed for these types of adjustment, perhaps due to inexperience or because the models were originally designed for use in developed countries where landfill conditions are very different to those in the developing world.

Delay in project implementation

Any delay in project start up (in addition to the time taken to complete the CDM registration process) obviously leads to an impact on the CER yield, and can be caused by delays in construction, commissioning, grid connection, local bureaucracy or other very specific factors.

For example, New Carbon Finance found that the one poorly performing industrial gas project that they examined had failed to take account of the possibility of the HFC gases being stored before release – leading to a timelag in the emissions reductions achieved once the project was implemented.

Technical failures

Techical issues were of less influence than the factors already discussed. However, around 20% of the underperformance of the hydro projects could be attributed to technical issues – mostly focussed around issues with grid connection.

One factor noted by New Carbon Finance was the relatively poor performance of Chinese wind projects compared to those elsewhere (and in particular India). One of the reasons underlying this appears to be the use of domestically-produced turbines in Chinese projects. New Carbon Finance argued that the domestic turbines are more prone to technical faults and to delays in achieving full load capacity, both of which appeared to have adversely affected CER delivery rates for Chinese wind projects.

Force majeure and seasonal variations

The failures discussed above are largely within project developers' control (with the exception of items such as unforeseen technical difficulties or access to local infrastructure). However, the New Carbon Finance work also noted that projects may be affected by factors outside their control – categorised as force majeure and seasonal variations.

Force majeure included, for example, events such as the disruption of a hydro project by a landslide in the area. Both hydro and wind projects had been affected both positively and negatively by unforeseen seasonal variations in rainfall and windspeeds.

Outlook

New Carbon Finance concluded that the variation in project performance should even out over time as project developers gained in experience and learned to take account of controllable factors, (for example the development of localised knowledge about project performance in the developing world should lead to more accurate estimates of load factors in PDDs).

Even the effect of uncontrollable factors should decrease to an extent: for example, the effect of seasonal fluctuations should reduce as projects generate over longer periods of time.

Conclusions

The findings of both the Climate Strategies work and that of New Carbon Finance uncovered significant variation in performance from project to project underlying the overall aggregate average yield for the CDM as a whole (which at 1st November 2008 was running at around 95%). The reasons for this are complex, and suggest that particular technology types or host country circumstances will strongly influence delivery risk. It is also, at this early stage of CDM, necessary to consider the effect of individual very large projects that cause a significant effect on the average performance for the whole portfolio.

However, both studies support the conclusion that a greater understanding of the performance of CDM projects will be gained over time as the mechanism continues to towards a full "run rate" and that time will also soften the variations in performance as data accumulates, project developers gain in experience and criteria for validation and registration become more consistent and widely understood.

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