Analysing the status quo of CDM projects

Status and prospects

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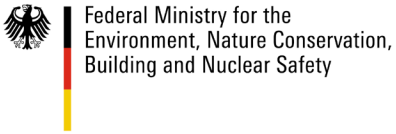

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Executive Summary

The Clean Development Mechanism (CDM) has become one of the world's most important carbon market instruments, diffusing carbon price signals worldwide, stimulating major private investments in climate change mitigation projects worldwide, and supporting the development of mitigation action in developing countries. Following the recent decline of the market conditions, the situation of project activities, in addition to domestic and international capacities related to the CDM, have noticeably deteriorated. This study seeks to address major gaps in the current understanding regarding the status of individual CDM projects worldwide, as well as the barriers and means for supporting the continuation of these projects. A large representative sample of projects were evaluated individually to extract insights and lessons regarding national situations, technology-specific considerations, and the CDM as a whole. The approach of the research is based on the following major steps:

1. **Define and sample the research population**
   A selection of 22 host countries and 14 major project types for analysis was defined, accounting in total for 5,656 of the 7,338 CDM projects with a registration date in or before 2012. Of these projects, a sample of 1,310 projects was taken and a contact database was established.

2. **Evaluation of sampled projects**
   The evaluation of projects' situations included a structured questionnaire of 32 questions related to project status, Certified Emission Reductions (CER) marketing approach, barriers and costs, and support. In total, 82% of the entire sample were evaluated. In addition, further insights were obtained by means of over 50 detailed interviews with important CDM participants.

3. **Analysis of data**
   The first priority and the major output of this report is the transparent presentation of the research findings for all questions. Trends were sought between respondent data and existing information from other data sources, and the major patterns are discussed.

The research finds that between 64% and 79% of registered CDM projects are fully implemented with their CDM component in full operation[1]. However, net CDM-benefits are generally insufficient for project continuation, and there is a high risk of the loss of mitigation activity, as well as the loss of the capacities and institutions that have been developed.

The results of this research demonstrate a strong need for both broader and targeted support for the continuation of mitigation activities under the CDM, and highlight areas where such support may have the greatest impact. Until high international mitigation ambition is restored, a wider coalition of demand-side market participants must cooperate to substantially improve mid and long-term market conditions and restore trust amongst potential project developers. The same coalition of market participants could build-upon, replicate and scale up the commendable efforts of existing credit purchase facilities to provide short-term targeted support to specific countries and technologies, including some technologies that have not yet been considered a major target for support.

[1] Analysis of the non-evaluated projects in section 3.2.3 indicates that the upper end of this range is more likely.

Acknowledgments

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List of Abbreviations

CO_2	Carbon Dioxide
CDM	Clean Development Mechanism
CCER	China Certified Emission Reduction (China's domestic offset scheme)
CER	Certified Emission Reduction
CME	Coordinating Managing Entity
CMM	Coal Mine Methane
COP	Conference of the Parties
CPA	Component Project Activity
DOE	Designated Operational Entity
DNA	Designated National Authority
EB	Executive Board (of the CDM)
EE	Energy Efficiency
ERPA	Emission Reduction Purchase Agreement
ETS	Emissions Trading Scheme
EU ETS	EU Emissions Trading Scheme
GHG	Greenhouse Gases
LDC	Least Developed Country
LFG	Landfill gas
MOC	Modalities of Communication
MR	Monitoring Report
MRV	Monitoring, Reporting and Verification
MSW	Municipal Solid Waste
NorCaP	NEFCO Norwegian Carbon Procurement Facility
PAT	Perform, Achieve, Trade (Indian programme)
PoA	Programme of Activities
PDD	Project Design Document
PPA	Power Purchase Agreement
PMR	Partnership for Market Readiness
PT	Project Type
ROI	Return-on-investment
SSA	Sub-Saharan Africa
SBL	Standardised Baseline
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VI	Verification and Issuance

1 Introduction

This report presents the key findings of a research activity tendered by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) under the title "Concepts and Country-Specific Strategies for the Carbon Market Post 2012" (FKZ UM 13 41 173), conducted by Ecofys in cooperation with NewClimate Institute and TÜV SÜD. This is the main report of the research activity, which also generates several shorter papers which present the outcome of further detailed analysis of aspects relating to the findings of this underlying main report. These shorter papers will be published in the course of 2015.

Background

The CDM was introduced by the Kyoto Protocol and has developed into one of the most important carbon market instruments. The CDM stimulated investments in greenhouse gas (GHG) reductions in developing countries that would not have occurred otherwise. Moreover, it raised awareness of climate change and the possibilities of carbon markets, and led to the development of a wide range of skills and knowledge in developing countries. In this way, the CDM played an important role in transferring the carbon dioxide (CO_2) price signal to almost all parts of the world and can be seen as a pioneer instrument which has paved the way for various emerging market-based mechanisms worldwide.

CERs generated through the CDM are mainly used by national governments to fulfil their targets under the Kyoto Protocol and by companies to meet individual targets – for example, under the European Union Emissions Trading Scheme (EU ETS) – in a way that unlocks the world's most cost-effective mitigation abatement potential. Over a number of years, the market for these credits has seen substantial demand and high liquidity. Although the generation of emissions rights is in the focus, the primary objective of the CDM is to assist Non- Annex I countries in achieving sustainable development. CDM projects, for example, contribute to the development of a sustainable and climate friendly economy within host countries through providing incentives for private investment and technology transfer.

Since the first CDM project was registered in 2004, the CDM has grown to represent the largest GHG emission offsetting scheme in the world today. Over time, the CDM has extended its scope regarding both countries and technologies, something reflected in the increasing number of methodologies (>200) approved by the CDM Executive Board. As of 31 December 2014 7,866 projects, including 277 Programme of Activities projects (PoA), were registered in at least 110 host countries. By the end of 2014, the accumulated amount of issued CERs stood at >1.52 billion. Assessments under the "CDM Policy Dialogue" arrived at an estimate of over US$215 billion of investment induced by the CDM (Spalding-Fecher et al. 2012).

Further developments of the CDM, characterised as scaling-up, include the implementation of the PoA modality, an approach allowing for large numbers of similar activities to be bundled, and the introduction of "Standardised Baselines" aiming at sectoral coverage.

Despite its successes, the current situation of the carbon markets - and the CDM in particular - is characterised by a very low demand for international carbon credits. Due to the worldwide recession and the lack of an ambitious international climate agreement recognising flexibility mechanisms as a means to achieve targets, demand is no longer sufficient to provide monetary incentives for GHG mitigation projects in developing countries. A record low of CER prices, well below most forecasts, is the consequence.

The current low prices for CERs impact CDM project activities through various mechanisms. On the one hand, projects already implemented may no longer be able to cover their operational costs. Furthermore, project owners may no longer find themselves able to pay transaction costs for registration, verification and issuance, as well as to finance CDM-specific monitoring activities. In the absence of any prospect for a price increase in the short term, many projects might go unimplemented, be shut down, or modified in a way that they no longer comply with CDM standards. For these projects, future continuation of the CDM projects and the mitigation activities in general might be dismissed or subject to specific conditions.

Limitations to CDM activities can also lead to market participants, such as project developers, verifiers, consultants and related financial institutions, exiting the market. This in turn leads to drainage of CDM specific expertise. Yet, this CDM specific knowledge is considered to be very valuable in the development of carbon pricing approaches worldwide, including future market-based mechanisms and non-market-based approaches. As a consequence future mechanisms might no longer be able to benefit from the “lessons learnt” of the CDM and might have to undergo time consuming efforts to solve problems to which the CDM might have already developed solutions.

The current low demand has hit host countries, as well as project and technology types, to different degrees. At the start of this research, no CDM project related data permitting the evaluation of the subsequent effects based on project level was publicly available. Host countries, sectors or individual projects might have reacted differently to the current challenges. In addition, little is known about the interaction between national host country policies and international carbon market mechanisms. A detailed evaluation of the actual decisions taken on project level can therefore deliver important lessons for the further development of the CDM, as well as for policy strategies in low-price periods or for the design of future market-based mechanisms. Furthermore, lessons from such an evaluation hold a broader value for all approaches based on incentives for quantified mitigation outcomes (e.g. results-based financing).

Objectives

The main objective of the overarching research activity, of which this report is the major component, is to conduct a detailed evaluation and analysis of the implementation status of registered CDM projects, and to show to what extent projects have been affected by adverse CER market conditions. Portfolios of CDM projects are systematically analysed to obtain information on the situation of various projects types in different host countries. The circumstances under which projects are discontinued, and hence might fall back to their initial pre-CDM situation and resume baseline GHG emissions, are documented. The analysis of CDM portfolios in addition aims to identify projects which could be reactivated and continued. Current barriers for CDM project initiation and continuation

– including the described low demand situation – are explored, as well as the existing support provision and subsequent needs of stakeholders. A further focus is to assess the coverage and impacts of existing and emerging domestic and international support and policy schemes that offer alternatives to the CDM.

The unique dataset created during the research and presented in this report may form the basis for more detailed investigations of specific aspects. Some of these are included as part of the overarching research activity, but are not covered by this report. It is expected that insights from the evaluation exercise could inform processes for the design and reform of existing and future mechanisms, both the CDM itself and in the development of alternatives. The research activity is also expected to identity important areas in the carbon market for further international collaboration, which will help CDM participants to continue to contribute to climate change mitigation effort and to maintain the accumulated CDM-specific knowledge.

Approach

As a first step, the research activity defined a representative sample of CDM projects to be analysed covering multiple host countries and project types. As a second step, the identified project contacts were approached to gather project information and produce a database with CDM-specific information. Interviews by telephone or personal meetings complemented email or web-based questionnaires. The generated database allows analysis of individual subgroups of projects, e.g. project types, countries or combinations of both, and holds great value both for answering the questions raised in the light of this research and in providing a potential source for further research. The statistically sound approach and the representativeness of the sample furthermore permits valuable conclusions to be drawn on the CDM as a whole and beyond just the projects contacted during this research.

Further details on the methodological decisions made for this research are presented in section 2 of this report. This includes general choices, the approaches for the selection of countries and project types for the evaluation, the statistical background for the sampling of projects representative of the larger project population, as well as the result of the application of the sampling method. It also gives a picture regarding the overall number of projects and their characterisation for the evaluation.

The further parts of this report are organised as follows. Section 3 presents observations from the different steps of the project evaluation. First, the various data collection methods employed are explained and their success rates indicated. Then, statistics related to the progress of the evaluation phase and details about the data characteristics are presented and further explained. The section is completed with information on projects for which no data could be collected. Section 4 includes the individual presentation of quantitative and qualitative results for each of the 31 key questions, highlights the main research findings, and points to further promising areas of research which are summarised and further discussed in section 5. Final conclusions from the data presented in this study are presented in section 6. Additional annexes contain further background information to complement the main part of this report.

2 Methodology and approach

The objective of the research documented in this report is to conduct a detailed evaluation and analysis of the status of registered CDM projects. This will show to what extent registered CDM projects have been affected by low CER prices, and forms the basis to develop conclusions and strategies for specific project types, countries and combinations of both. Based on this thorough analysis of information regarding the current status of registered CDM projects, ongoing barriers and support needs can further be identified. Figure 1 depicts the work flow and the distinct stages of the methodology applied for the purposes of this research.

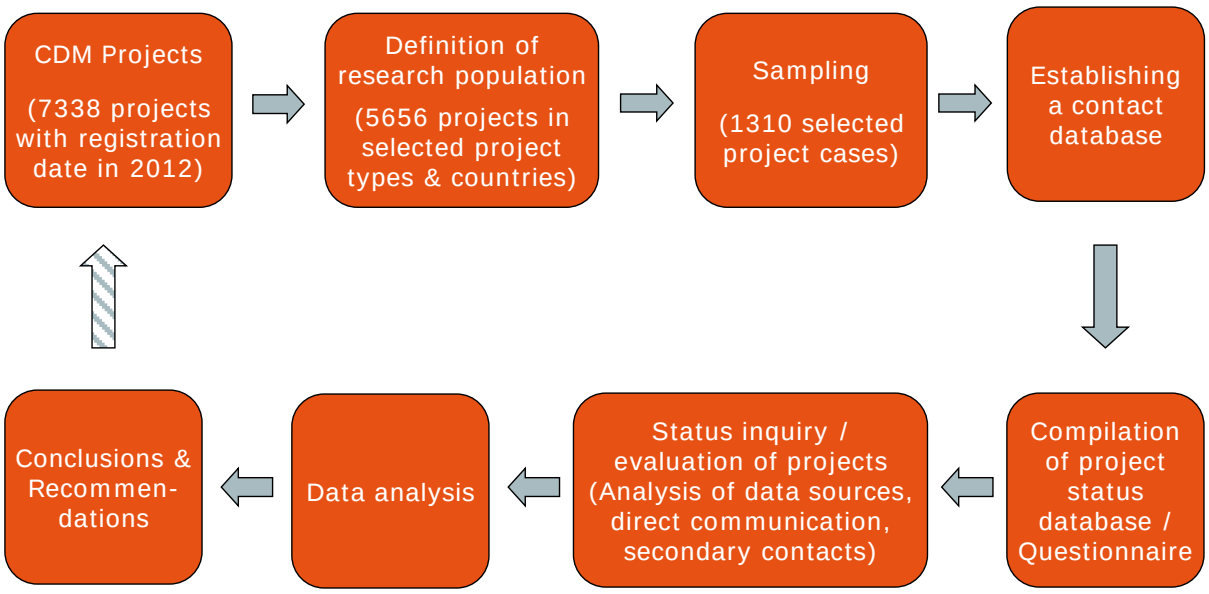


Figure 1: General methodological approach and evaluation steps

Starting from CDM projects that were registered before the end of 2012, a first, overall population of registered CDM projects for the research was defined. From this research population, a representative sample was subsequently taken. For the sample projects, the research team collected contact data and assessed the publicly available project information. A questionnaire and a project status database were thereafter developed. Based on these databases, the research team started to contact projects directly, or via secondary contacts such as host country Designated National Authorities (DNAs) and Designated Operational Entities (DOEs). The collected quantitative information about the status of projects, including their specific opportunities and challenges, was completed by further qualitative information obtained through interviews. Conclusions and recommendations for the larger population of projects were derived from this subset of results based

on detailed data analysis processes. Since this evaluation represents the large majority of registered CDM projects (>77% of the CDM projects with a registration date in 2012 or earlier), it is furthermore shown that it can be assumed the results provide general conclusions about the status of, and recommendations for, the CDM as a whole. This information is qualified to be fed back into the CDM for continued development and support. Each methodological step, as included in Figure 1, is in detail described in subsequent sections of this report.

2.1 General methodological approaches

On account of its accuracy, comprehensiveness and ease of accessibility, the UNEP Risø[2] database (UNEP Risoe 2013) was used as a starting point for the evaluation. Although the latest version of the Risø database available at the start of the evaluation preparation (01 September 2013) has been used, the evaluation focuses on projects registered before the end of the first commitment period. CERs generated by projects with a registration date after 31 December 2012 and outside Least Developed Countries (LDCs) are not eligible for trading under the EU ETS, and it is considered that most of these projects and their business models are designed in anticipation of this condition. Furthermore, it is anticipated that, at the point of evaluation, these projects might not have had enough time to realise their implementation. Therefore, only projects with a registration date on or before 31 December 2012 were selected. However, this includes all projects where the registration action was performed before September 2013 although registration is effective in 2012. Despite not being included in the evaluation, projects that failed to achieve a registration in 2012 but could realistically have expected to achieve this might offer an interesting field for further research (cf. Annex III: CDM projects failing to achieve a registration in 2012).

The introduction of the Programmatic CDM represents great potential for overcoming some of the barriers for successful participation in the CDM. Programme of activities (PoA) projects are therefore of particular interest and are thus included within the study. Given the micro-scale nature of most component project activities (CPA) however, evaluation at the CPA level is beyond the limitations of this research, and instead evaluation of registered PoAs is at the level of the coordinating managing entities (CME). For the purposes of this study, PoAs are bundled with traditional CDM projects. This does not replace detailed analyses targeting PoAs specifically, and still permits a special focus for PoAs of particular project types to be considered in later stages of this research.

Based on the choice of the registration date, the number of registered CDM projects that are of interest for the research amounts to 7,338, of which 204 are PoAs. The overall population of registered CDM projects from which samples are taken however is slightly reduced due to the focus on specific countries and technology types (for more details see sections 2.2 and 2.3). The sampled population still covers >77% of the registered CDM projects with a registration date in 2012 or earlier (cf. Table 5).

[2] Although UNEP Risø was renamed to UNEP DTU in the course of the research activity, for consistency reasons we use UNEP Risø throughout the report.

The CDM Loan Scheme, announced in May 2012, offers interest free loans to potential CDM project participants in countries with fewer than 10 registered CDM projects to cover costs for PDD development, validation, registration and verification. Whilst such a facility may have significant potential for overcoming project development barriers and may therefore have been of specific interest to this study, the CDM Loan Scheme was still in a very early stage of development when methodological choices for this research were made. By December 2013 only eight of its supported projects were at the validation stage, and only one was registered before the 31st December 2012 deadline (cf. Annex I: Status of the CDM Loan Scheme (December 2013)). CDM Loan Scheme projects do not therefore receive any special consideration as part of this research.

2.2 Selection of countries

In order to ensure a cost-effective approach for this study, the research focussed on a selection of CDM technology types and host countries. The process of country selection reflected the objective to include the CDM's top-ten largest participants in addition to some smaller countries, countries which are relatively underrepresented in the CDM, and additionally aimed to achieve a sound regional representation. To facilitate the inclusion of underrepresented regions in a way that would provide meaningful results, some selected countries have been grouped together and were sampled and analysed at the regional level: Guatemala, Costa Rica, Honduras and Panama have been selected for a Central America group, whilst Kenya, Rwanda, Senegal and Uganda have been selected for a Sub-Saharan Africa group. These countries have been selected based on a combination of their modest participation in the CDM and the significant extent of their political and economic influence within the respective regions. Due to low project numbers within these countries, it would not have been possible to take meaningful samples from these countries if they were treated on an individual basis.

Table 1 lists the final selection of countries to be evaluated and summarises the reasons for their consideration.

Table 1: Countries selected for evaluation

Country	Explanation
Brazil	Brazil is the largest CDM participant in Latin America, and has the third largest number of projects in the world, behind China and India.
Chile	Chile accounts for more than 10% of all registered Latin American CDM projects and has a major political and economic influence in South America.
China	With over 50% of registered CDM projects worldwide, China is an essential inclusion in the CDM evaluation. China is also of particular interest to this study due to its participation in project types which are otherwise not well represented, including Coal Mine Methane (CMM) extraction, Energy Efficiency (own generation) and Fuel Switch.

Country	Explanation
Colombia	Colombia has a modest number of registered CDM projects by worldwide standards, but is still an important participant within its region, and is considerably more active than many other countries with comparable populations and resources.
India	India accounts for nearly 20% of all registered CDM projects and, like China, is of interest due to its engagement with uncommon project types. India accounts for nearly all household and industry energy efficiency projects, as well as nearly half of fuel switch projects and a very large number of wind projects.
Indonesia	Indonesia is of particular interest as it has the fourth largest population in the world and a significant potential for GHG emission abatement. Indonesia's CDM portfolio is modest compared to its Asian counterparts, accounting for nearly 2% of projects worldwide, but it has a large portfolio of Methane Avoidance projects.
Israel	Israel is the most significant participant of the CDM in the Middle East, hosting nearly 40% of the region's projects. However, Israel's portfolio accounts for just 0.43% or worldwide projects, demonstrating the underrepresentation of the region.
Malaysia	Malaysia is of particular interest since it accounts for the vast majority of Composting (Methane Avoidance) projects.
Mexico	Mexico is the second largest CDM participant in Latin America with 20% of the region's projects, and 2.5% of projects worldwide. This, alongside Mexico's economic and political influence in the region, makes it particularly interesting.
Peru	Peru is the fourth largest CDM participant in Latin America and is a major economic and political influence in the region.
South Africa	Although South Africa accounts for over 30% of registered African CDM projects, it accounts for less than 1% of worldwide projects and is therefore significantly underrepresented in the CDM compared to other transition countries. Compared to Brazil, India and China, the number of projects per capita and relative to national GDP is very low. South Africa is therefore of particular interest as a country which may be considered relatively inactive in the CDM, despite its ambitious approach to climate change mitigation.
South Korea	South Korea is a major participant in the CDM, accounting for nearly 5% of all CERs issued in 2012. South Korea also hosts a large proportion of all solar projects.
Thailand	Thailand's CDM portfolio is modest compared with other leading Asian nations, although it does still account for nearly 2% of global projects. The country is however a major economic and political influence in the South East Asia region.
Vietnam	Vietnam has the third largest CDM project portfolio in Asia, and is considerably more active in the CDM than neighbouring countries with comparable economic indicators. Vietnam is particularly active in Hydro projects.

Country	Explanation
Central America (Guatemala, Costa Rica, Honduras, Panama)	This country grouping has insufficient project numbers to be studied in detail at country level. However, the region is of particular interest, as the majority of Latin America's major CDM participants are South America nations and aside from Mexico, Central America is particularly underrepresented.
Sub-Saharan Africa (Kenya, Rwanda, Senegal, Uganda)	Sub-Saharan Africa is of great interest due to the very low penetration of CDM, but also due to the emergence of a significant number of PoAs, particularly targeting household energy efficiency.

2.3 Selection of project types

Project types for evaluation were selected to provide a representative sample of CDM activity, particularly in the target countries, whilst also respecting the project types that are most attractive targets for support, and the need to maintain a robust sample size for each project type and country combination. The process of project selection also attached importance to project types which are typically smaller-scale in nature and therefore considered more likely to be negatively affected by the aforementioned difficulties with the CDM process.

Since the UNEP Risø database was taken as the starting point for this study and Risø's project type categorisation is widely known and accepted as standard, the Risø categorisation has also been used as a reference point for the definition of project subtypes in this research. The subtypes defined therefore deviate only slightly from UNEP Risø's project types. Alternative approaches, for example based on UNFCCC methodologies, would have been resource intensive and provide an excessive level of detail without adding substantial additional information to the analysis. Indeed, since some methodologies are used specifically for certain types of projects, and some individual projects employ several methodologies, a categorisation approach based on UNFCCC methodologies would be more subjective, and the analysis and comparison of information would present significant difficulties.

Table 2 shows the list of project type categorisations identified for evaluation. Expert judgement has been applied to select the most important subtypes for analysis and where we deviated from UNEP Risø, for example to categorise small collections of Risø subtypes where appropriate. To supplement this table, a list of excluded UNEP Risø subtypes can be found in Annex II: Excluded project subtypes.

Table 2: Project type categorisations selected for evaluation

UNEP Risø Type	Project Code	Project Subtype	UNEP Risø project subtypes included
Biomass energy	01.1	Agricultural and forestry residues	Agricultural residues: mustard crop, poultry litter, risk husk, other kinds; Forestry residues: sawmill waste, other.
	01.2	Bagasse Power	Bagasse power
	01.3	Palm oil solid waste	Palm oil solid waste
Cement	02.1	Clinker replacement	Clinker replacement
Coal Mine Methane	03.1	Coal Mine Methane	Coal Mine Methane
EE Households	04.1	Stoves	Stoves
	04.2	Lighting	Lighting
EE Industry	05.1	EE Industry	Chemicals, Petrochemicals, Coke oven, Building materials, Cement, Electronics, Food, Glass, Iron & steel, Machinery, Mining, Non-ferrous metals, Paper, Recycling, Textiles
EE Own Generation	06.1	Coke oven gas / iron & steel heat	Coke oven gas, Iron & steel heat
	06.2	Cement heat	Cement heat
Fuel switch	07.1	Oil to natural gas	Oil to natural gas
	07.2	New natural gas plant	New natural gas plant
Hydro	08.1	Micro hydro (<2MW)	Existing Dam, New Dam, Run of river (up to 2MW)
	08.2	2-20MW	Existing Dam, New Dam, Run of river (from 2MW up to 20MW)
Landfill gas	09.1	Flaring	Flaring
	09.2	Power generation	Power
Methane avoidance	10.1	Flaring	Manure, Palm oil waste, Waste water (no power)
	10.2	Power generation	Manure, Palm oil waste, Waste water (with power)
	10.3	Composting	Composting

UNEP Risø Type	Project Code	Project Subtype	UNEP Risø project subtypes included
	10.4	Domestic manure	Domestic manure
N_2O	11.1	Adipic acid	Adipic acid
	11.2	Nitric acid	Nitric acid
HFCs	12.1	HFC23	HFC23
Solar	13.1	Solar PV	Solar PV
	13.2	Solar water heating	Solar water heating
Wind	14.1	Wind	Wind

EE: Energy efficiency

Special considerations for project selection and categorisation

Agricultural and forest residues are combined into project type (PT) 01.1 due to both the similarity of technologies and the fact that the subtype '*agricultural residues: other kinds*' is already a mixture of several subtypes. Further differentiation of technology is therefore not appropriate. *Bagasse power* and *palm oil solid waste* are included as separate categories due to the specificity of the technologies required. Bagasse power is also separated due to the fact that these projects are often larger in size, common practice and might therefore be continued.

Although *coal mine methane* (CMM) projects are generally larger in size, the number of projects makes CMM an important subtype and its analysis can help to support hypotheses relating to the irreversibility and continuation of such project types in the absence of CDM support. The technology of *ventilation air methane* differs too much from CMM for these two project types to be combined. *Ventilation air methane* is therefore excluded due to the insufficient quantity of projects.

Projects within the subtypes of industrial energy efficiency are so low in number that they must be combined. There are concerns regarding the diversity of technologies represented by this grouping, but the project type is of importance and insights might be derived despite its inhomogeneity.

Coke oven gas and *iron & steel heat* are combined, as they normally refer to processes occurring in the same facilities. The two activities are often linked or integrated in so much as they have different technical methodologies but are normally conducted within the same process. The combination of both also ensures that projects integrated in larger industries are not over-weighted.

It might be argued that *fuel switch* project types should be excluded from this study due to the potentially dominating influence of fuel market price developments and the perceived irreversibility of the technology: most fuel switch subtypes could be excluded based on the consideration that the investments in the technologies are large enough to be considered irreversible, regardless of the status of CER credits. However, oil to natural gas switching project activities are included, as they require only minor modifications of the combustion facilities and are therefore easily reversible, and

new natural gas plants are included due the large number of projects and the consequential importance for analysis.

All *hydro* projects considered to be large scale and above 20MW are excluded as they represent large investments that are irreversible despite poor CER prices. In addition, large scale hydro projects are not seen as the primary objective of project support aiming to ensure reactivation and continuance. For the remaining hydro projects, the subtypes (*new dam*, *existing dam* and *run of river*) are merged due to the somewhat arbitrary nature of the Risø categorisation. For example, run of river projects normally also include (smaller) existing or new dam technologies. It is considered that the best indicator of technology subtypes for the hydro sector is the capacity for the electricity output. Micro-scale projects typically used at community level (under 2MW) are included as one subtype since they are an interesting target for support and might actually need further CDM support to be continued.

It was considered that the remaining hydro projects between 2MW and 20MW be separated into two groups according to the scale of technology used; it was assumed that a *technology jump* lies somewhere between 5 and 10 MW, and that the overall investments further increase with effects on the conditions for projects. However, since we could not identify one single significant jump (see Figure 2) we have chosen to not separate the hydro categorisation, but instead to treat 2 – 20 MW as one category. Assuming a large and randomised sample size, any technologies separated by a technology jump will still achieve fair representation.

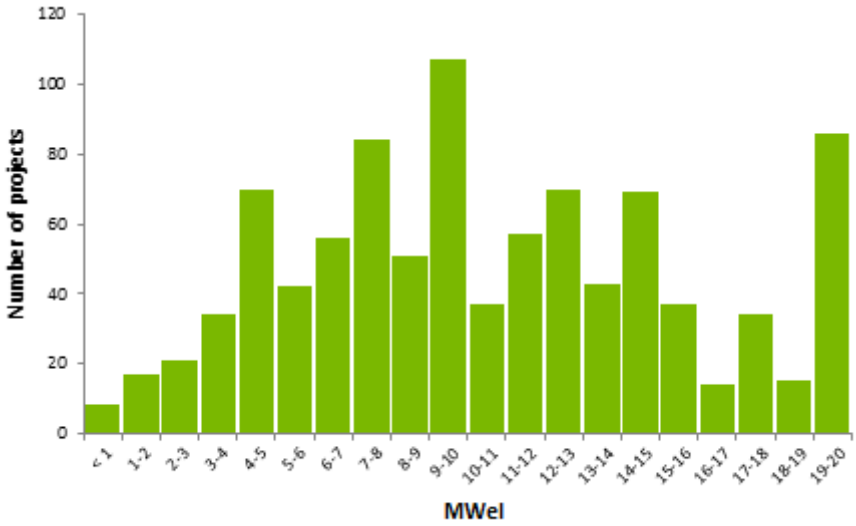


Figure 2: Frequency diagram showing the facility size of CDM Hydro projects[3]

[3] Numbers based on UNEP Risoe CDM and PoA Pipeline Overview, October 1st 2013, http://www.cdmpipeline.org/

The two UNEP Risø subtypes *landfill gas flaring* and *power generation* are considered and treated as different subtypes due to the different revenue streams. Flaring fully depends on CERs while power generation also generates income from sales of electricity. Another large subtype of *landfill gas* is *combustion of municipal solid waste (MSW)*, which is excluded as it is not considered as target technology in the scope of this study.

Consistent with the approach for landfill gas, the Risø subtypes *manure, palm oil waste,* and *waste water* are re-categorised according to their revenue stream and business model: flaring or power generation. Whilst it is relatively resource intensive to conduct such a categorisation through PDD analysis, the difference between the business models is considered more significant for the purposes of this research than the specific industry sector in which the project is situated.

Solar cooking is excluded, since community cooking technologies are already covered in the energy efficiency household project type and it is difficult to assess the situation of projects that are formed by a large number of micro activities but which are not organized in a PoA approach via a CME.

2.4 Sampling approach

Since the project population for the study is broken down into groups and subgroups (strata) which require analysis on an individual level, *stratified sampling* is the most appropriate approach. As well as allowing for the individual analysis of each stratum, stratified samples are more representative of the entire population since they guarantee the inclusion of all homogenous subgroups (Daniel 2012; von der Lippe 2011).

Definition of strata

This study seeks to make observations about the CDM on three levels:

1. A holistic view of all projects within the CDM (population level)
2. For specific project types, and for specific countries (primary strata)
3. For specific combinations of project type and host country (substrata)

We therefore refer to a grid system (see example, Table 3) whereby rows and columns represent the primary strata, and individual cells account for the substrata. Numbers within the cells show the number of projects within the substrata. Primary strata include all substrata within the respective column or row. For example, in Table 3, *Brazil* and *Project Type 1* are individual primary strata with 315 and 861 projects respectively, whilst the specific combination of *Brazil* and *Project Type 1* is a substratum with 276 projects.

Table 3: Example of strata and substrata definition

(For illustrative purposes only – project numbers are fictional).

	Project Type 1	Project Type 2	Project Type 3	TOTAL	
Brazil	276	70	5	**351**	← Primary Stratum 1
China	564	221	30	**815**	← Primary Stratum 2
Vietnam	21	6	0	**27**	← Primary Stratum 3
Total	**861**	**297**	**35**	**1193**	← Population total
Substratum	↑ Primary Stratum 4	↑ Primary Stratum 5	↑ Primary Stratum 6		

Stratified sampling strategies

There are several different approaches to stratified sampling, which are differentially selected according to the composition of the population and the requirements of analysis.

In *proportional stratified sampling*, the sample size of each stratum is proportional to the size of the stratum within the population. For example, when assessing a population of n= 1,000 divided into two groups of n_1= 450 and n_2 = 550, 45% of the total sample size will come from n_1 and 55% from n_2. Whilst this is relatively easy to administer and ensures that all groups are represented in the final analysis, it does not allow for detailed within-strata analysis in the case that sample sizes for some strata are particularly small. Since this study includes strata of various scales and the smallest strata account for less than 1% of the total population, proportional sampling is an inappropriate strategy.

Optimum stratified sampling is used to identify the optimal sample sizes for each stratum when information about the variance within each stratum is known. When variance values are excluded from the equation, or given an arbitrary value of '1' for every stratum, this method produces the same result as proportional sampling. Variance levels cannot be estimated in advance for this study, and therefore this strategy is also inappropriate.

Disproportional stratified sampling allows for individual strata to be over or under-sampled in order to achieve sample sizes necessary for within-strata analysis (Daniel 2012). For example, Swartz, Lurigio, and Weiner (2004) use disproportionate sampling to study the perceptions of prison inmates to HIV. Due to the very low numbers of some groups of interest (e.g. women account for just 0.7% of inmates in the facility under study), oversampling is used to gain an accurate representation of the perceptions within all interest groups, with the results weighted accordingly for an analysis of the overall population.

For the approach of this study, the need for within-strata analysis and the low sample size of many strata mean that disproportional stratified sampling is the most appropriate strategy. Important considerations are therefore the selection of sample size, and the issue of weighting.

Sample sizes of strata

Sample sizes of strata within a population may be chosen manually, or determined through the process of equal allocation, during which all strata are assigned either the same sample sizes or sample sizes that produce the same statistical power of confidence (Daniel 2012). Through this approach, the cost constraint can be set (e.g. maximum number of projects to be sampled in total) in order to determine the best statistical power of confidence attainable. This is an appropriate strategy to determine the individual sample sizes for each strata in this study, since resource constraints pre-determines the overall sample size of this study to approximately 1,300 projects.

The selection of the sample size for each specific substratum is determined by the following equation (Israel 1992):

$$n \geq \frac{\frac{z^2 pq}{e^2}}{1 + \frac{\frac{z^2 pq}{e^2}}{N}}$$

n = Sample size
N = Total size of substrata
z = Confidence level (90% = 1.645, 95% = 1.96)
e = Confidence interval (5% =0.05, 20% = 0.20)
p = Data variation (proportion of elements with a particular attribute)
q = 1-p (proportion of elements without a particular attribute)

Eq. 1

Since not enough is known about the data, p must be set to 0.5, which represents the maximum possible variation. Using this formula, values for z and e can be entered in order to find the optimum combination that produces an overall sample size of 1300 for all projects combined.

At the point of recalculating the confidence level and confidence interval of particular results ex-post, the value for p may be adjusted according to the results found.

Varying degrees of the actual confidence interval

a) Substrata level

Although the confidence interval is explicitly specified in the formula that determines the sample size of each substratum, the final sample numbers must be integers and must always be rounded up in order to guarantee that they meet the confidence interval standards. Effectively, this means that most substrata exhibit a higher confidence interval than that which is specified. For example, a substrata with a population of 10 projects requires a sample size of 7.06 when the formula is applied with the values e=0.20 and z=1.96. However, since 7.06 is not possible, this is rounded up to 8, meaning that the confidence interval is significantly improved. Rearranging equation 1 gives us an approach to calculate the actual confidence level of each substratum:

$$e = z\sqrt{\frac{pq}{n} - \frac{pq}{N}}$$

Eq.2

By applying this formula to each substratum, it is possible to draw conclusions with higher confidence intervals than that which were originally selected in the process of defining the sample size.

b) Primary strata level

Furthermore, actual confidence intervals for primary strata are significantly improved for two reasons:

1. Improvements in the confidence interval of each substrata (discussed above)
2. A much larger sample size than would otherwise be required, due to the stratification of the strata into substrata.

The standard error (SE) of a stratified population with differing confidence interval values across strata can be calculated by substituting equation 4 (Higgins & Green 2011) into equation 3 (NSS 2013) to obtain equation 5:

$$SE = \frac{\sqrt{SE_1^2 N_1^2 + SE_2^2 N_2^2 + SE_3^2 N_3^2}}{N} \qquad \text{Eq.3}$$

$$SE = \frac{e}{z} \qquad \text{Eq.4}$$

$$e = z \,.\, \frac{\sqrt{\frac{e}{z_1}N_1 + \frac{e}{z_2}N_2 + \cdots + \frac{e}{z_n}N_n}}{N} \qquad \text{Eq.5}$$

n = number of strata

Table 4 presents an example of the effect of this calculation, where the primary stratum has an actual confidence interval of 0.13, despite an input of 0.20 at substrata level. Here, numbers of projects are given for substrata (cells) of one primary stratum (the column – project type 08.2). Numbers in the left hand column refer to the total number of projects, whilst the subsequent columns represent the sample sizes calculated and the actual confidence interval in each case. The table shows that although the minimum value for e has been set at 0.20 for sub-strata sampling, the actual confidence level of each substrata is normally better, and the confidence interval for the strata overall is significantly improved, at 0.13.

Table 4 also demonstrates the effect of the sampling approach on the largest populations. For example, as it can be seen in the table, China and Vietnam end up with very similar sample numbers of 24 and 21, although the original project substrata population numbers are very different, at 747 and 129 respectively. Whilst this significantly reduces the burden of sampling large substrata, it also means that results must be carefully weighted in order to conduct analysis at the population or primary strata level.

Table 4: Actual confidence intervals of strata and substrata

	PT08.2		Confidence Interval (e)
	Projects	Sample size	
Brazil	41	16	0.19
Chile	21	12	0.19
China	745	24	0.20
Colombia	9	7	0.17
India	93	20	0.19
Indonesia	12	9	0.16
Israel	0	0	-
Malaysia	3	3	0
Mexico	4	4	0
Peru	27	13	0.20
South Africa	3	3	0
South-Korea	11	8	0.18
Thailand	2	2	0
Vietnam	129	21	0.20
Central America	28	13	0.20
SS Africa	7	6	0.15
TOTALS	**1135**	**161**	**0.13**

Weighting

When using disproportional sampling, weighting must be applied to the collected data to restore proportionality before analysis at the population level can take place. The weighted mean of indicators from *n* strata (1, 2, …, n) can be calculated as follows:

$$\bar{x} = \frac{N_1 \overline{x_1} + N_2 \overline{x_2} + \cdots + N_n \overline{x_n}}{N}$$ x = indicator mean $N = N_1 + N_2 + \cdots + N_n.$ Eq.6

This re-weighting methodology is not affected by the final response rate as it is calculated based on the mean indicator result for each substratum and the overall population size of each substratum. However, the response rate for each substratum does affect the confidence interval of the indicator mean. For strata and substrata with less than a 100% response rate, confidence intervals are calculated by adjusting the value n to the final response rate in Equation 2.

Equations 1 – 5 have been used to select the sampling parameters for this study, which are presented in section 2.5. Equation 6 is used at later stages when analysing the data collected.

2.5 Project selection

As discussed in previous sections, projects are bundled in specific project subtype and country combinations and treated as substrata. It is from these substrata that samples are taken.

Selection of sampling parameters

We previously identified Equation 1 as the method for determining sample size:

$$n \geq \frac{\frac{z^2 pq}{e^2}}{1 + \frac{\frac{z^2 pq}{e^2}}{N}} \qquad \text{Eq 1}$$

The value *p* is the measure of homogeneity across the sample. For proportional testing, a value closer to zero or one may be selected if the population is known to be very homogeneous. Since this study measures a variety of variables, it is not appropriate to attempt to assess the homogeneity of specific characteristics across the population. *p* is therefore assigned a value of 0.5, which is the value that accommodates maximum variance.

The confidence level is set at 95%, which gives a corresponding *z* value of 1.96. A confidence level of 99% would produce a total sample size that is far beyond the capabilities of this research, whilst a confidence level of 90% is deemed insufficient considering the wide confidence interval (*e*) used in some cases.

The confidence interval, *e*, has been selected to give the best possible outcome within the constraints of the study. The sampling constraint has been identified as a total sample size of 1,300 projects. Setting a minimum value of $e = 0.20$ is considered the largest possible meaningful confidence interval; this entails an error margin for all results of ±20%, and anything beyond this begins to produce meaningless results. As Table 6 shows, using this parameter leads to an overall sample size of 1,310 and exceeds the defined constraint by an insignificant amount only.

Section 2.4 describes how using a minimum confidence interval value actually produces improved confidence interval values for substrata, strata and the population due to the rounding up of sample numbers and the compilation of substrata samples for strata level observations. The minimum value of $e = 0.20$ is therefore not considered excessively vague, with it producing confidence levels of around 0.10 at strata level and 0.06 at the population level, as shown in Table 7.

Overview of selected projects, countries, and sample sizes

The following pages present an overview of the overall population of registered CDM projects that are within the focus of this research (Table 5), the actual sample sizes (Table 6) and the respective confidence intervals (Table 7) calculated for each substratum and stratum.

Table 5: Total number of registered CDM projects per selected project type and country combinations

	01.1	01.2	01.3	02.1	03.1	04.1	04.2	05.1	06.1	06.2	07.1	07.2	08.1	08.2	09.1	09.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	13.1	13.2	14.1	
	Agric. / Forest Residue	Bagasse power	Palm oil waste	Clinker replacement	CMM	Household Stoves	Household Lighting	EE Industry	Coke oven gas / Iron Steel heat	Cement heat	Oil to NG fuel switch	New NG plant	Micro Hydro	Hydro 2<20MW	Landfill gas flaring	Landfill gas power	Methane Flaring	Methane power	Composting	Domestic manure	Adipic acid	Nitric acid	HFC23	Solar PV	Solar water heating	Wind	TOTAL
Brazil	16	27							2		6			41	23	15	60	3	1		1	4		1		51	251
Chile	8												2	21	11	4	6	1				3		7		18	81
China	131	2		5	60	4	15	4	78	106	1	20	3	745	1	62	19	40		30	2	44	11	138	1	1487	3009
Colombia	2	1									1			9	13	3	1	3	1			2				1	37
India	182	49	3	13		30	33	58	46	5	6	13	9	93		3	5	12	1	9		8	5	81	7	573	1244
Indonesia	7		7	1				5		1		4	2	12	6	3	18	44	9			2					121
Israel	1							1			1				2	5	1	2				4		7		2	26
Malaysia	9		29					3				1	1	3	3	6	20	36	27								138
Mexico	6					1	1	4	1					4	9	15	66	33				1	1			28	170
Peru	1	1									1		3	27	3	1	1	1						5		1	45
S. Africa	3					1	3	2	4					3	1	6		3				5		7	5	12	55
S. Korea											4		4	11		5		1			1	4	1	32	1	13	77
Thailand	16	3	3							3				2		6	4	65						26		3	131
Vietnam	7	1					1	1		1			2	129	1	2	4	16		1					1	5	172
C. America	4	2	2			1							5	28	1	2		11	1							11	68
SS Africa	1	2				5	6							7	1					3				1		5	31
TOTAL	394	88	44	19	60	42	59	78	131	116	20	38	31	1135	75	138	205	271	40	43	4	77	18	305	15	2210	5656

Table 6: Sample sizes of selected project types and country combinations

	01.1	01.2	01.3	02.1	03.1	04.1	04.2	05.1	06.1	06.2	07.1	07.2	08.1	08.2	09.1	09.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	13.1	13.2	14.1	
	Agric. / Forest Residue	Bagasse power	Palm oil waste	Clinker replacement	CMM	Household Stoves	Household Lighting	EE Industry	Coke oven gas / Iron Steel heat	Cement heat	Oil to NG fuel switch	New NG plant	Micro Hydro	Hydro 2<20MW	Landfill gas flaring	Landfill gas power	Methane Flaring	Methane power	Composting	Domestic manure	Adipic acid	Nitric acid	HFC23	Solar PV	Solar water heating	Wind	TOTAL
Brazil	10	13							2		5			16	12	10	18	3	1		1	4		1		17	113
Chile	7												2	12	8	4	5	1				3		6		11	59
China	21	2		5	18	4	10	4	19	20	1	11	3	24	1	18	11	16		14	2	16	8	21	1	24	274
Colombia	2	1									1			7	9	3	1	3	1			2				1	31
India	22	17	3	9		14	14	17	16	5	5	9	7	20		3	5	9	1	7		7	5	19	6	24	244
Indonesia	6		6	1				5		1		4	2	9	5	3	11	16	7			2					78
Israel	1							1			1				2	5	1	2				4		6		2	25
Malaysia	7		14					3				1	1	3	3	5	11	15	13								76
Mexico	5					1	1	4	1					4	7	10	18	14				1	1			13	80
Peru	1	1									1		3	13	3	1	1	1						5		1	31
S. Africa	3					1	3	2	4					3	1	5		3				5		6	5	9	50
S. Korea											4		4	8		5		1			1	4	1	14	1	9	52
Thailand	10	3	3							3				2		5	4	18						13		3	64
Vietnam	6	1					1	1		1			2	21	1	2	4	10		1					1	5	57
C. America	4	2	2			1							5	13	1	2		8	1							8	47
SS Africa	1	2				5	5							6	1					3				1		5	29
TOTAL	106	42	28	15	18	26	34	37	42	30	18	25	29	161	54	81	90	120	24	25	4	48	15	92	14	132	1310

Table 7: Confidence intervals (±) according to the sample sizes given in Table 6

	01.1	01.2	01.3	02.1	03.1	04.1	04.2	05.1	06.1	06.2	07.1	07.2	08.1	08.2	09.1	09.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	13.1	13.2	14.1	
	Agric. / Forest Residue	Bagasse power	Palm oil waste	Clinker replacement	CMM	Household Stoves	Household Lighting	EE Industry	Coke oven gas / Iron Steel heat	Cement heat	Oil to NG fuel switch	New NG plant	Micro Hydro	Hydro 2<20MW	Landfill gas flaring	Landfill gas power	Methane Flaring	Methane power	Composting	Domestic manure	Adipic acid	Nitric acid	HFC23	Solar PV	Solar water heating	Wind	TOTAL
Brazil	19%	20%							0%		18%			19%	20%	18%	19%	0%	0%		0%	0%		0%		19%	8%
Chile	13%												0%	19%	18%	0%	18%	0%				0%		15%		18%	7%
China	20%	0%		0%	19%	0%	18%	0%	20%	20%	0%	20%	0%	20%	0%	19%	19%	19%		19%	0%	20%	18%	20%	0%	20%	11%
Colombia	0%	0%									0%			17%	18%	0%	0%	0%	0%			0%				0%	8%
India	20%	19%	0%	18%		19%	20%	20%	20%	0%	18%	18%	17%	19%		0%	0%	18%	0%	17%		13%	0%	20%	15%	20%	10%
Indonesia	15%		15%	0%				0%		0%		0%	0%	16%	18%	0%	18%	20%	13%			0%					8%
Israel	0%							0%			0%				0%	0%	0%	0%				0%		15%		0%	4%
Malaysia	17%		19%					0%				0%	0%	0%	0%	18%	20%	19%	20%								8%
Mexico	18%					0%	0%	0%	0%					0%	17%	18%	20%	20%				0%	0%			20%	9%
Peru	0%	0%									0%		0%	20%	0%	0%	0%	0%						0%		0%	12%
S. Africa	0%					0%	0%	0%	0%					0%	0%	18%		0%				0%		15%	0%	16%	4%
S. Korea											0%		0%	18%		0%		0%			0%	0%	0%	20%	0%	18%	9%
Thailand	19%	0%	0%							0%				0%		18%	0%	20%						19%		0%	11%
Vietnam	15%	0%					0%	0%		0%			0%	20%	0%	0%	0%	19%		0%					0%	0%	15%
C. America	0%	0%	0%			0%							0%	20%	0%	0%		18%	0%							18%	9%
SS Africa	0%	0%				0%	18%							15%	0%					0%				0%		0%	5%
TOTAL	11%	12%	13%	12%	19%	14%	12%	15%	14%	18%	8%	12%	5%	13%	8%	9%	9%	7%	13%	14%	0%	11%	11%	11%	7%	14%	6%

Sampling procedure

The procedure for extracting the actual sample was based on Microsoft Excel's RAND() function, which generates a statistically random number between 0 and 1. The following steps were taken:

Step 1: Organise data into sample groups

In the master data sheet, which includes all projects in the population as defined in Section 2, a new data field called *substratum* was added. This field organises projects into categories according to which substratum they belong to. The substratum codes which are referred to within this study are comprised of a combination of the host country's two-digit ISO identifier and the project type code. For example, a clinker replacement project (project type 02.1) in China (ISO code CN) is assigned to the CN02.1 substratum.

Step 2: Assign a random number to each project

Another new field was added to the master data sheet and the value "=RAND()"entered into every project row in this field to produce a random number between 0 and 1 for each project.

Step 3: Sort the data in two stages - *Substratum* then *Random Number*

Step 4: Select the first *n* projects from each substratum.

Once the data was sorted according to the random numbers, the first n projects were taken from each substratum, where n is the required sample size for each substratum according to Table 6.

Since the ranking of projects as detailed in the steps above is dependent on randomly generated numbers, the selection is also random.

Composition of sample projects

Table 8 shows the composition of the extracted sample compared to the original project population with regards to project registration dates, project scales, types and credit issuance success. The purpose of the comparison is to confirm that the sample does not deviate significantly from the characteristics of the original population.

Most of the data in Table 8 shows that the sample represents a fair representation. Noteworthy differences can be seen from the proportion of PoA and small-scale projects, which is significantly larger in the sample than in the original population. This is most likely due to the tendency for PoA and small-scale projects to be located in smaller substratum, for example those pertaining to less active countries, where a higher percentage of the population must be sampled in order to meet the confidence criteria, as outlined in Section 2.4.

Table 8: Composition of the final sample compared to the original population

	Population		Sample	
	Number	Percentage	Number	Percentage
All	5656	100%	1310	100%
Registration year				
2004	1	0.0%	0	0.0%
2005	45	0.8%	21	1.6%
2006	339	6.0%	135	10.3%
2007	346	6.1%	136	10.4%
2008	343	6.1%	98	7.5%
2009	469	8.3%	134	10.2%
2010	624	11.0%	102	7.8%
2011	860	15.2%	162	12.4%
2012	2629	46.5%	522	39.9%
Type				
Normal	5528	97.7%	1236	94.3%
PoA	128	2.3%	74	5.7%
Credit Issuance (UNEP Risø pipeline of 01 September 2013)				
Yes	1968	34.8%	464	35.5%
No	3688	65.2%	846	64.5%
Scale				
Large	3134	55.4%	637	48.6%
Small	2522	44.6%	673	51.4%

Structure and treatment of data

With the final list of sampled projects obtained, two databases were created to store project data and manage communication with project representatives.

The project data database stores all project information extracted from the UNEP Risø pipeline documents, as well as any data captured for analysis from the questionnaires and surveys.

The contacts database lists contact information for all identifiable participants of the selected projects, along with data pertaining to the status of communication with each participant and the status of the overall data capture process.

3 Evaluation

During the evaluation phase of this research, the focus was on a thorough analysis of information regarding the current status of the registered CDM projects sampled. To gather the required project information, the research utilised multiple steps and approaches. This included the use of a web-based online questionnaire, and a proactive research for projects where no information was received from the distributed questionnaire. Both approaches and their subsequent sub steps are described in the following sections. Thereafter, section 3.2 gives insights in the success rates of both approaches and outlines further characteristics of the collected data, while section 4 presents quantitative and qualitative results.

3.1 Data collection

3.1.1 Online questionnaire

In line with the objectives of the research, a set of more than 30 questions, each with a predefined menu of possible answers, was developed and provided via an online survey portal. The survey address was provided only to the identified project contacts and not distributed openly, in order to avoid responses from projects not in the sample or from contacts who are not clearly allocated to individual projects. The first two questions in the survey were obligatory for participation (cf. Table 9). These included the identification of the CDM project for which the responses are submitted and the identification of the role of the respondent. All remaining questions could be skipped, with no response given, or, in case applicable, the answer *"I don't know"* could be chosen. This flexibility was offered to avoid answers being given for questions where the respondent lacked sufficient knowledge, and to avoid the possibility of potential respondents refraining from answering the survey due to specific questions that they could not, or did not want to, answer. It needs to be noted in this respect that although the targeted respondent was the project owner (with hopefully full access to all project information), alternative contacts were also approached (e.g. project developer, consultants, buyers, DOEs, DNAs, etc.) who might have had knowledge to answer a limited subset of questions only. In cases where several responses from different parties were collected for the same project, the responses from project owners were given preferential treatment. Where such responses appeared less consistent compared to alternatives, respondents were individually approached to clarify the validity of responses.

The questionnaire was initially developed in English and then translated into other languages (Spanish, Chinese, and Portuguese) to increase the response rate across several host countries. This was also to accommodate the study's preference for responses from project owners located in remote areas and not directly linked to the international carbon market arena.

A pilot survey was conducted in February 2014 targeting a test group of 100 project focal points. The immediate response rate of this test group was slightly better than expected, with 10 complete

responses and 16 more page views. 11 email addresses were found to be no longer valid, as the emails sent to them were returned by the server. Based on this trial application of the questionnaire and the evaluation approach for a limited number of registered CDM projects, further information on the practical feasibility of the evaluation approach and its questions was derived. Particularly encouraging and useful for the overall approach was the high quality of the 10 complete responses. Following this trial application, the questionnaire was finalised for distribution to the overall sample group. The final questionnaire contained questions covering 5 different evaluation topics (see Table 9), and was available from March to October 2014.

Table 9: Survey questions per evaluation topic

Identification of project and interviewee role (Mandatory information)
1. Please enter the reference number for the CDM project to which your answers refer to: ____ (e.g. 1234)
2. What is your role with regards to this CDM project activity?
A. Project status
3. What is the current technical implementation status of the CDM GHG mitigation activity?
4. What technical implementation status of the CDM GHG mitigation activity do you expect for the next 12 months?
5. What is the current operational status of the CDM component of the GHG mitigation activity?
6. What operational status of the CDM component of the GHG mitigation activity do you expect for the next 12 months?
7. Despite the recent drop in CER prices, what are the reasons to continue with the CDM GHG mitigation activity?
8. What is expected to happen with the CDM project / the GHG mitigation equipment after the end of the crediting period?
9. What is the implementation status of the CDM monitoring system (measurements required for the CDM only)?
10. Was the CDM project design (GHG mitigation technology) changed after CDM registration, deviating from the CDM requirements and/or the description in the PDD?
B. ERPA situation / CER marketing approach
11. Did the project ever sign an Emission Reduction Purchase Agreement (ERPA) with a CER buyer?
12. To which group would you allocate the buyer?
13. What is the current status of the initially agreed ERPA?
14. What is the current CER marketing approach?
15. Do plans exist to convert the CDM project activity into another project scheme?
16. What is the status of these plans?

17.	Does the project take into consideration to marketing CERs to a CER purchase facility or governmental fund that purchases credits above market prices (e.g. The World Bank Carbon Initiative for Development (Ci-Dev), NEFCO Norwegian Carbon Procurement Facility (NorCaP), Swedish CER purchase facility, etc.)?
18.	Was the project accepted for the programme?
C. Verification & Issuance	
19.	What was the initial verification & issuance approach?
20.	Was the initial verification & issuance approach changed due to the recent drop in CER prices?
21.	What are the reason(s) for the project to not request initial issuance yet?
22.	What CER price level is required by the project to continue verification & issuance activities?
23.	What is your best estimate on the total costs per verification & issuance cycle until successful CER issuance is achieved (e.g. costs for verifier, internal labour costs)?
D. Barriers	
24.	Which barriers still exist that hinder the project implementation or operation?
25.	What type of immediate support is required for project continuation in addition to financial support?
26.	To what extent does the project activity benefit from further revenues or cost savings additional to the sale of CERs (e.g. revenues from sales of electricity or heat, savings from reduced fuel or fertiliser use)?
27.	Have you received a positive return on your total initial project investment?
28.	Do you still expect to receive a positive return on your total initial project investment?
29.	Apart from the recent drop in CER prices, what are the reasons or barriers that would hinder you to aim for registering a similar CDM project again?
E. Support	
30.	Was the CDM project registration supported or initiated by external (public) funders (e.g. World Bank, KfW, Asian Development Bank, etc.)?
31.	What type of support has the GHG mitigation project received on national level (e.g. direct support or through support schemes such as feed-in tariffs, white certificate schemes, renewable energy or energy efficiency support policies, etc.)?
32.	When was this type of support made available?
33.	Would you consider a cancellation of the CDM registration in case feasible and a precondition to receive support or participate in alternative project schemes?

The establishment of a **contacts database** was initiated from the list of focal point contact data provided by the UNFCCC. The completeness and timeliness of the data in this list was however worse than expected and included many gaps and outdated information. This is due to the fact that updates to the contact data at the UNFCCC need to be triggered by project participants themselves when updating their Modalities of Communication (MOC) details. Projects with no recent issuance activities however do not see the need to update their MOCs despite changes in personnel responsibilities. With the termination or expiration of many Emission Reduction Purchase Agreements (ERPAs) by the end of 2012, this situation holds for the majority of projects. Gaps in the contacts database were therefore manually closed by using PDD contact details and further contact information collected during the research.

Using the contacts database, several emailing campaigns were conducted at different points in time for the dissemination of the questionnaire and to maximise the survey response rate. The emailing campaigns distributed customised emails per contact and project(s) from which no response was received previously. One contact per project was selected to receive our initial communications. Where delivery to the specified contact failed, an alternative contact, if available, was selected. This led to responses for approximately 30% of the projects in our sample by the end of the first research phase. The information received via this route was often detailed, complete and presumably of high quality. Non-responsive projects were then dealt with on an individual basis through the proactive research method (section 3.1.2).

3.1.2 Proactive research

Although responses were received from approximately 30% of the sample on the back of the email campaigns and online questionnaires, this would have been insufficient for drawing conclusions for the CDM as whole. In order to allow answers to the fundamental research questions to be obtained, it was necessary to gain knowledge about projects that did not respond in the first instance. This was particularly difficult because contact data from projects that had left the CDM was more likely to be outdated, and interest in survey participation from such (previous) project stakeholders was potentially more limited. However, with a response rate close to 100% required in order to answer the fundamental research questions for the CDM as a whole under the confidence intervals targeted and the sampling approach as described in section 2.4, efforts were necessary to overcome these difficulties.

Further proactive activities were therefore carried out to get into contact with project stakeholders and collect information on the remaining share of the sample projects, ultimately raising the total response rate to 82%. These activities aimed to further increase the number of responses via the online questionnaire, or provide assistance to feed information into the evaluation in a more efficient way. Where perceived to be useful, information was also collected that extended the questions in the survey. Such approaches are described in the following paragraphs.

Multiple project contacts

Project developers, project consultants, CER buyers and further individuals listed as contacts for a portfolio of multiple projects – approximately 1/3 of our sample – were identified and approached at an organisational level. Through the use of detailed emails, telephone calls and personal meetings, these "multiple project contacts" agreed, where possible, to contribute with information for all the projects in their portfolio which fell within our sample group. This was facilitated in many cases by individual spreadsheets making submission of information on multiple projects more effective.

Although this group of contacts was identified as a very promising source of information during the planning phase, fundamental changes worsened the situation for the research. International project developers, project consultants and CER buyers are often listed as project focal points in MOCs due to the language barrier and the knowledge required to deal with UNFCCC requirements and institutions. Although having being a supportive approach in recent years, this has subsequently become problematic with the massive decline in CDM business activities of this group. Where many companies abandoned or drastically reduced their business activities, often only a single employee without any detailed knowledge now handles the remaining projects. CER buyers to a large extent terminated the remaining ERPAs by the end of 2012 and since then have lost contact with their previous projects. As said before, outdated MOC information is usually updated in anticipation of issuance activities, which are suspended in most projects.

Institutions to the CDM

Institutions with an official role in the CDM, such as host country DNAs, DOEs and also UNFCCC Regional collaboration centres, were considered as valuable sources of information for a larger group of projects. While all DNAs and Regional collaboration centres were centrally approached, contact to DOEs could only be established in some cases. Furthermore, before and during the evaluation period, several DOEs either reduced or terminated their CDM activities and services. However, information received from these institutions was often extremely helpful to fill data gaps from projects where no direct project contact could be reached, despite the answers provided being mostly limited to fundamental questions only. Likewise, many of the DNAs are still active in host countries and they were able to provide the research with recent contact information for various registered CDM projects, as well as valuable inputs on the country level.

Project-by-project approach

For all remaining projects, where neither information based on the emailing campaigns or on the above approaches towards multiple project contacts and institutions could be gathered, a manual project-by-project approach was applied. This included reaching out via telephone to all available contacts. A starting point of this task consisted of taking the UNFCCC contact database and complementing and contrasting the information with that available in each of the PDDs and other online sources, such as organizations' websites. Although very labour intensive due to the low rate of completeness and timeliness of the initial contacts database, this approach led to the acquisition of much useful project information, and also led to many further completed online surveys being collected. It is this that is finally responsible for the outstanding high overall response rate. Direct contacts to project owners and project developers allowed further explanation of the purpose of the

CDM evaluation and an opportunity to convince stakeholders to participate. Key to the success of this approach was the involvement of native speakers to the greatest extent possible. Although the CDM is an international mechanism and all the official documents are in English, reaching out to contacts in their native language was essential to get detailed information of high quality. In particular, the approach to attempt direct contact with many project owners in English represented a barrier for the survey in some cases, which should also be a reflection of the challenges faced by project owners who are left alone with their CDM mitigation activities after international parties left the business. The research team which was involved in the data gathering process represented the following list of countries, including their respective languages and knowledge about local conditions: China, India, Colombia, Mexico, Ethiopia, Indonesia, and Brazil.

In some cases, difficulties to convince the contact to participate in the survey remained due to high levels of disappointment regarding the developments of the CDM. Many contacts refused to support any research on the CDM and referred to their lost investments. Alternatively, some – mostly larger – companies were not willing to share their data, which they classify as sensitive or confidential.

Using all these proactive research approaches, information significantly beyond the initial number of questions was gathered. A document containing the minutes of more than 50 interviews was compiled, including valuable information about the interpretation of the gathered data. Further face-to-face interviews were held at events such as the Carbon Expo 2014 in Cologne, Germany and the Latin American and the Caribbean Carbon Forum 2014 held in Bogota, Colombia. In addition, these became a platform for arranging personal meetings with stakeholders, such as project owners and official DNA representatives with whom the research team had previously communicated and who were highly interested in the study. Both venues allowed the research team to draw the attention of event participants to the research activity and receive further support to enrich the already acquired knowledge.

3.2 Data characteristics

3.2.1 Response rate

The final number of responses is 1,075, representing 82.1% of the original sample. Table 10 presents the response rates per country and project type. 100% data collection has been possible in some countries where the project-by-project approach has been particularly successful. Generally speaking, Latin American stakeholders showed a strong will to engage and provide information via direct dialogue in Spanish language, whilst a number of DNAs in the region were also particularly cooperative. 100% data collection has also been possible for the Sub-Saharan Africa group, where the amount of projects in the sample was small compared to the time and effort invested by the research team. A 100% response rate in Vietnam is the result of a particularly supportive DNA that provided at least basic project information for all projects with gaps in the sample.

Table 10: Response rates per country and project type (%)

	01.1	01.2	01.3	02.1	03.1	04.1	04.2	05.1	06.1	06.2	07.1	07.2	08.1	08.2	09.1	09.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	13.1	13.2	14.1	
	Agric. / Forest Residue	Bagasse power	Palm oil waste	Clinker replacement	CMM	Household Stoves	Household Lighting	EE Industry	Coke oven gas / Iron Steel heat	Cement heat	Oil to NG fuel switch	New NG plant	Micro Hydro	Hydro 2<20MW	Landfill gas flaring	Landfill gas power	Methane Flaring	Methane power	Composting	Domestic manure	Adipic acid	Nitric acid	HFC23	Solar PV	Solar water heating	Wind	TOTAL
Brazil	70	62	NA	NA	NA	NA	NA	NA	100	NA	100	NA	NA	88	75	80	6	67	100	NA	100	75	NA	100	NA	65	65
Chile	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100	100	100	100	100	100	NA	NA	NA	100	NA	100	NA	100	100
China	81	50	NA	60	78	75	20	25	79	70	0	82	33	67	100	94	73	75	NA	100	100	50	88	86	100	83	74
Colombia	100	100	NA	NA	NA	NA	NA	NA	NA	NA	100	NA	NA	100	100	100	100	100	100	NA	NA	100	NA	NA	NA	100	100
India	77	94	100	44	NA	100	100	65	88	80	60	89	71	80	NA	67	100	100	100	100	NA	100	60	84	100	96	85
Indonesia	83	NA	50	100	NA	NA	NA	80	NA	100	NA	100	100	67	60	100	100	63	57	NA	NA	100	NA	NA	NA	NA	76
Israel	100	NA	NA	NA	NA	NA	NA	100	NA	NA	100	NA	NA	NA	100	100	100	100	NA	NA	NA	100	NA	67	NA	100	92
Malaysia	71	NA	86	NA	NA	NA	NA	100	NA	NA	NA	100	100	100	67	80	100	93	92	NA	NA	NA	NA	NA	NA	NA	89
Mexico	100	NA	NA	NA	NA	100	100	100	100	NA	NA	NA	NA	75	71	100	94	93	NA	NA	NA	100	0	NA	NA	77	89
Peru	100	100	NA	NA	NA	NA	NA	NA	NA	NA	100	NA	100	92	67	100	100	100	NA	NA	NA	NA	NA	100	NA	100	94
S. Africa	33	NA	NA	NA	NA	100	100	100	100	NA	NA	NA	NA	100	100	60	NA	67	NA	NA	NA	100	NA	83	80	89	84
S. Korea	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25	NA	75	88	NA	40	NA	0	NA	NA	100	75	0	7	0	56	44
Thailand	100	67	100	NA	NA	NA	NA	NA	NA	100	NA	NA	NA	100	NA	100	25	89	NA	NA	NA	NA	NA	77	NA	0	81
Vietnam	100	100	NA	NA	NA	NA	100	100	NA	100	NA	NA	100	100	100	100	100	100	NA	100	NA	NA	NA	NA	100	100	100
C. America	100	100	100	NA	NA	100	NA	NA	NA	NA	NA	NA	100	100	100	100	NA	100	100	NA	NA	NA	NA	NA	NA	100	100
SS Africa	100	100	NA	NA	NA	100	100	NA	NA	NA	NA	NA	NA	100	100	NA	NA	NA	NA	100	NA	NA	NA	100	NA	100	100
TOTAL	84	81	82	53	78	96	76	73	86	77	67	88	83	88	83	88	73	86	83	100	100	79	67	73	86	83	82

Greyed NA boxes apply to categories where no projects exist in the sample. A red gradient colour code is used to highlight areas where data collection has been less successful; categories with a 0% response rate are highlighted in strong red whilst those with a 100% rate are white.

Obtaining information for projects in China and India was initially very difficult, but resources with local background knowledge were used to focus efforts on these countries and their response rates consequently increased to 74% and 85%, respectively. Brazil and South Korea proved to be the most difficult countries for data collection, with a 65% and 44% response rate respectively. Language issues were the major barrier in these countries, with the response rate for Brazil increasing once we obtained resources to use Portuguese as a communication and data collection language. A detailed overview of reasons for success and remaining barriers for each country is provided in Table 11.

Table 11: Reasons for success and remaining barriers to data collection in each country

Country / response rate (%)		Comments
Brazil	65	• Telephone interviews in Portuguese was key to obtaining data. High share of small scale farming operations in rural areas. • High share of former AgCert projects (methane avoidance), where current official and functional ownership of the CDM component is not always clear. • Questionnaire translation to Portuguese was of limited help.
Chile	100	• Spanish language survey was useful, providing 78% of responses. • Great disposition from different stakeholders to share information. • DNA very supportive.
China	74	• Chinese survey translation made little initial impact, but telephone interviews in Chinese increased the response rate significantly. Answers received through telephone interviews mostly covered basic questions only. • Project owners difficult to contact directly when no mobile phone number was available. Difficult to identify and access other stakeholders. • Fair share of remote micro hydro projects in the remaining gaps in the data. • Little interest in, or resistance towards, the evaluation.
Colombia	100	• Stakeholders very cooperative in Spanish language interviews. • Good availability of project owners, who provided 81% of answers.
India	85	• Use of local language for telephone interviews was very important. • Remote projects very difficult to contact. • Some stakeholders were reluctant to cooperate. No DNA support.
Indonesia	76	• Difficult to contact most projects due to poor contact information available. • Significant amount of project closure or ownership change, with few possibilities to track the current responsible person.
Israel	92	• Project-by-project approach was largely successful. • Only two unresponsive projects with no further contact opportunity.
Malaysia	89	• Project-by-project approach was largely successful. • Difficult to identify the responsible party for most remaining projects due to project closures or takeovers.
Mexico	89	• Project owners from former AgCert and Ecosecurities' projects were difficult to identify or contact. • DNA was very supportive but has its own difficulties to establish project contact. • Telephone interviews in Spanish were key; 61% of answers in Mexico were obtained outside of the online survey.
Peru	94	• High rate of survey interaction (Spanish version). • Some projects owned by companies in Spain and were easily reached.
South Africa	84	• Project-by-project approach was partly successful. • Remaining projects could not be reached or would not cooperate.

Country / response rate (%)		Comments
South-Korea	44	• Significant language barriers. Project-by-project approach had low success. • Email contact information is rarely available in this country. • Difficult to conduct desk research as most websites are in Korean-language.
Thailand	81	• Language barriers for many of the projects. • In some cases where communication was possible, only basic information could be obtained.
Vietnam	100	• DNA was very supportive and provided 59.6% of the responses (mostly basic information only). • Below average share of detailed responses.
Central America	100	• Spanish language survey and telephone interviews very important. • Relatively easy to track the changing ownership of projects due to the low number of projects in the region. • Guatemala DNA provided recent information for many projects.
Sub-Saharan Africa	100	• Projects of a younger vintage, and contact details relatively good. • Local DNA and other supporting organisations have good knowledge of each project due to low volume of projects in the region.

According to Table 10, data collection for each project type was also in some cases 100% successful - such as Domestic manure (PT10.4) or Adipic acid (PT11.1) – while further categories showed completeness close to 100%. Since the data collection process was mainly organised from a country level, different response rates cannot be linked to specific reasons inherent in the data collection approach. It can however be observed that lower response rates are linked to project types which are usually integrated in larger industry structures, such as Clinker replacement (PT02.1), Energy efficiency industry (PT05.1), Oil to NG fuel switch (PT07.1) and HFC23 (PT12.1). Respondents from these groups more often referred to the confidentiality of their data. Although the data collection for HFC23 is listed as 67%, it needs to be considered that the research team received only two complete responses while for another eight projects only the basic information could be collected. For a further five HFC23 projects, no information was received (cf. Table 13). In order to protect the identity of the two respondents we cannot present nor draw broader conclusions based on these responses.

Furthermore project types that are more likely to be in remote locations (e.g. methane avoidance, bagasse power) were also more difficult to contact. The availability of project developers to provide information was much lower for these project types, and the research effort consequently relied much more on the identification of other connected stakeholders.

Important for the interpretation of the data is an additional understanding of the composition of the received responses. Differences appear when, alongside the total number of responses, the subset of complete and partial responses is also analysed in further detail. Table 12 indicates the final status of the data collection process: 1,075 responses overall, of which 538 include detailed data and 537 include partial or basic information. In this context, responses were considered to contain the basic data when at least the implementation status and operational status of the projects was provided, and were considered detailed when the majority of the questions were answered.

Table 12: Data collection status of projects

	Number	Percentage
All projects in sample	1310	100%
Total projects with data collected	1075	82%
Detailed responses collected	538	41%
Basic data collected	537	41%
No data collected	235	18%*

Table 13 presents this data for each project type and country group and shows how the level of response detail for some groupings deviates from the average. Chile, South Africa, and Sub-Saharan Africa, for example, have a high proportion of detailed answers, whilst some countries – notably India – demonstrate the opposite trend. In particular, Table 13 shows that the absolute number of responses for some project types is particularly low, especially for cement, CMM and HFCs. Where the number of responses for particular questions are too low to be significant, the presentation of project type specific data in section 4 is omitted.

Table 13: Detail level of responses, by countries and project types

Project type	Detailed responses	Basic responses	No response	Country	Detailed responses	Basic responses	No response
Biomass energy	69	77	30	Brazil	44	29	40
	39%	44%	17%		39%	26%	35%
Cement	4	4	7	Chile	49	10	0
	27%	27%	47%		83%	17%	0%
CMM	7	7	4	China	86	118	70
	39%	39%	22%		31%	43%	26%
EE households	28	23	9	Colombia	19	12	0
	47%	38%	15%		61%	39%	0%
EE industry	8	19	10	India	66	142	36
	22%	51%	27%		27%	58%	15%
EE own generation	23	36	13	Indonesia	35	24	19
	32%	50%	18%		45%	31%	24%
Fossil fuel switch	11	23	9	Israel	14	9	2
	26%	53%	21%		56%	36%	8%
HFCs	2	8	5	Malaysia	25	43	8
	13%	53%	33%		33%	57%	11%

Project type	Detailed responses	Basic responses	No response
Hydro	102	63	25
	54%	33%	13%
Landfill gas	70	46	19
	52%	34%	14%
Methane avoidance	103	111	45
	40%	43%	17%
N_2O	18	24	10
	35%	46%	19%
Solar	34	45	27
	32%	42%	25%
Wind	59	51	22
	45%	39%	17%

Country	Detailed responses	Basic responses	No response
Mexico	26	45	9
	33%	56%	11%
Peru	15	14	2
	48%	45%	6%
South Africa	30	12	8
	60%	24%	16%
South Korea	18	5	29
	35%	10%	56%
Thailand	37	15	12
	58%	23%	19%
Vietnam	22	35	0
	39%	61%	0%
Central America	30	17	0
	64%	36%	0%
Sub-Saharan Africa	22	7	0
	76%	24%	0%

3.2.2 Respondent profile

Knowledge about the source of the project information received is important for the interpretation of the data. Figure 3 indicates that those closest to the projects (project owners and project developers) make up the majority of the respondents, indicating that the quality of data is likely to be high. Since these roles could be understood differently, the questionnaire defined the role of the CDM project developer as service provider with a project performance-based remuneration, and the role of a CDM consultant as service provider with a fixed remuneration per service. Project owners are seen as majority shareholders whose main business is in most cases different from operating CDM projects.

As Table 14 shows, this composition of respondents is a fairly consistent picture across all countries, with the notable exception of Mexico and several countries in the South-East Asia region where the DNAs were particularly proactive in their cooperation and therefore account for a more prominent share of the answers. This distribution of respondents is also in line with our preferential treatment given to respondents closest to the projects in case several responses from more than one party were collected.

The figures given in Figure 3 and Table 14 represent the re-weighted statistics according to the sampling methodology detailed in section 2.4, rather than the absolute figures.

Question 2: What is your role with regards to this CDM project activity?

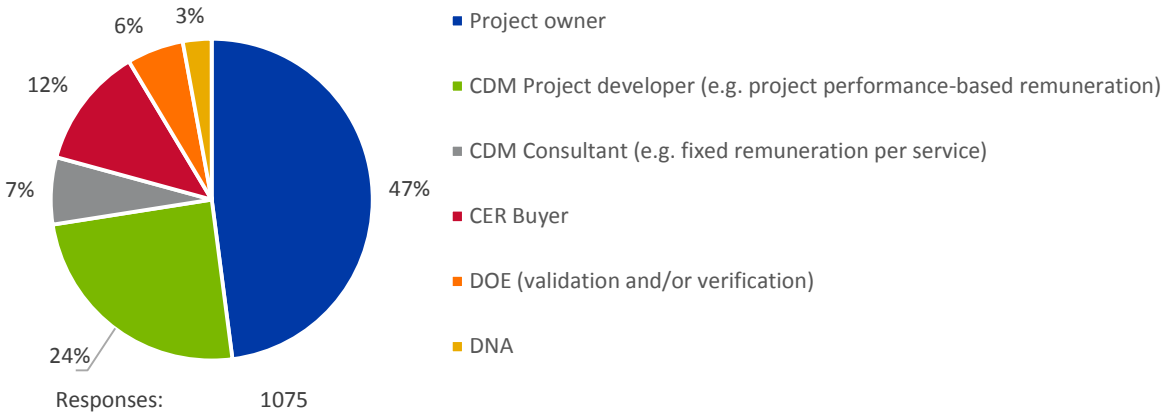


Figure 3: Role of respondent (mandatory information)

Table 14: Proportion of responses from project owner, by project type and country

Project Type	Proportion of responses from *project owner*	*Country/region*	Proportion of responses from *project owner*
N_2O	78%	Colombia	83%
HFCs	69%	Chile	76%
Cement	69%	Peru	73%
Landfill gas	63%	South Africa	72%
Biomass energy	60%	Central America	63%
EE own generation	54%	Sub-Saharan Africa	58%
EE households	53%	Indonesia	51%
Wind	51%	China	49%
Fossil fuel switch	51%	Israel	48%
CMM	50%	India	47%
EE industry	49%	South Korea	46%
Solar	44%	Brazil	35%
Hydro	34%	Thailand	33%
Methane avoidance	27%	Mexico	31%
		Malaysia	25%
		Vietnam	10%

3.2.3 Supplementary information on responses and gaps

This section provides supplementary background information on the responses and the data gaps. Readers may find it useful to refer to this section and consider the response background alongside the interpretation of results in section 4.

Analysis of projects not evaluated

A clearer picture of the likely status of projects not evaluated may be possible through the testing of various different hypotheses and assumptions.

The first hypothesis proposed at the beginning of the evaluation period was that the ease with which projects could be contacted would correspond fairly well with the status of the project. We expected to see that projects for which data could be collected within the first weeks of the evaluation period would have the highest rates of operation, whilst this rate would gradually decrease as further efforts were necessary to reach projects less forthcoming with their information. It was assumed that an analysis of such a trend might allow for extrapolation of the trend to speculate on the status of the remaining projects. However, the analysis of the final dataset, when compared with previous interim preliminary analyses, did not confirm this assumption and produced analysis results that are significantly similar to different early data sets.

With this in mind, the research team consider the possibility of three hypothesis scenarios:

1. **The characteristics of the non-evaluated projects do not differ significantly from the evaluated projects**
   As discussed, the analysis of the current data set when compared to preliminary analyses of the data during interim periods suggests that the less accessible projects are similar in characteristics to the more accessible projects, supporting the hypothesis that the non-evaluated projects are also similar to the evaluated projects.
2. **The non-evaluated projects have a share of implemented and operational projects that is below average**
   Considering that eight months of data collection, which included exhaustive attempts to contact projects through various means and multiple languages, was not sufficient to contact anybody who knows about the project status, an assumption that these projects are non-operational may hold.
3. **The non-evaluated projects have a share of implemented and operational projects that is above average**
   No initial indications were found to suggest that the non-evaluated projects may have a particular high share of operational projects.

Table 15 compares key information about the non-evaluated projects with that of the evaluated projects. For a more detailed understanding of these projects, they are further split into four distinct categories, which are also displayed in the table and analysed separately.

Group 1a Contact established with an associated person but data could not be obtained
Group 1b Contact established with a responsible person but cooperation was refused
Group 2a Contact could not be established and the validity of the contact details cannot be determined
Group 2b Contact could not be established and all available contact details are confirmed to be invalid

Table 15: Key characteristics of non-evaluated projects

	Number	Proportion of sample	Proportion with monitoring report submitted	Proportion with credit issuance achieved	Proportion registered in 2012
Evaluated projects	1075	82%	47%	36%	40%
Non-evaluated projects	235	18%	43%	32%	38%
Subgroups of non-evaluated projects					
Group 1a	75	6%	55%	44%	32%
Group 1b	25	2%	64%	52%	24%
Group 2a	67	5%	37%	24%	42%
Group 2b	68	5%	26%	21%	47%

Although the basic data presented in Table 15 refers to past, as opposed to current, activities, it is an indication that the non-evaluated projects have a share of operational projects that is below the average (hypothesis 2), since the signs of project activity in terms of monitoring report submissions and credit issuance are slightly lower for non-evaluated than for the evaluated projects. However, as the difference between the two sets of projects is only marginal, there is also some support for hypothesis 1: that the characteristics of non-evaluated projects do not differ significantly from the evaluated projects. Certainly, the comparison in this table provides no indications that would support hypothesis 3: that the non-evaluated projects might have a higher share on operational projects than the average.

Furthermore, Table 15 confirms the assumption that the identified subgroups differ considerably in their characteristics. They should therefore be analysed individually in order to obtain the clearest picture on the status of non-evaluated projects.

Group 1a Contact established with an associated person but data could not be obtained

For 75 projects, contact has been established with an associated person yet project information has not been obtained. For most of these cases, the person contacted did not have sufficient knowledge to provide project information and could only offer further contact information. Great efforts were made in an attempt extract information in these cases.

On the basis that contact with an associated person was possible, one might assume that the company or entity responsible for the facility operation is unlikely to have been entirely dismantled. This does not, however, offer any indications regarding the operation of the specific CDM component of the project activity.

The information in Table 15 shows that project activity rates for this group, in terms of monitoring report submissions and the achievement of credit issuance, are similar, although slightly higher, than the evaluated group of projects. This might be explained however by the smaller proportion of projects registered in 2012. Projects that have held their registration for a longer time are more likely to have submitted a monitoring report at least once, or have achieved issuance. This does not however allow for any conclusion to be drawn regarding the current implementation or operational status.

In addition, 23% of projects in group 1a correspond to methane avoidance projects from Brazil. Brazil is one of the countries where the company AgCert used to have their highest investments. The general demise of AgCert's projects is described in Box 1, section 4.1. According to information received from contacts in Brazil, the Brazilian projects – unlike Mexican projects – are likely to be continued, but no longer in conformity with the CDM.

Summarising the information for projects in this group support mostly hypothesis 1, that **the characteristics of this subgroup do not deviate significantly from the group of evaluated projects**.

Group 1b Contact established with a responsible person but cooperation was refused

25 project contacts explicitly declined to participate in the survey when they were contacted. In these cases, no project details could be obtained.

Usually, these responses came either due to a lack of capacity to engage, a lack of willingness to engage – resulting from a feeling of disillusion in the CDM process, or concerns over confidentiality. Except perhaps for the second reason, these three possibilities provide no ground to make assumptions about the status of the project. The only potential indication of project status is that responsible people from these projects were reachable, and the projects may therefore be less likely to have been dismantled.

The information in Table 15 shows that the activity rates for this group of projects in terms of monitoring reports and credit issuance is significantly higher than the average. However, the significance of this difference may be questionable due to the relatively low number of projects in this subgroup.

Non-validated information for a handful of these projects was obtained from media reports and discussion with DNAs. This information suggests the continued operation of these projects.

Overall, these considerations – the high activity rates in particular – provide some support for hypothesis 3: that the **share of implemented and operational projects is above average** for this subgroup.

Group 2a *Contact could not be established and the validity of the contact details cannot be determined*

It has not been possible to establish contact with 67 projects, and it is uncertain that the contact information for these projects is still valid. However, message delivery failures were not received for email communications.

This group includes a high share of projects where the validation of contact details was hindered by language barriers. Alternatively, it is possible that communication difficulties persisted with these projects because a higher proportion of them are no longer operational. The information in Table 15 shows that the activity rates in terms of monitoring reports and issuance are considerably below the average.

This evidence provides some support for hypothesis 2, that the subgroup **has a share of implemented and operational projects that is below average.**

Group 2b *Contact could not be established and all available contact details are confirmed to be invalid*

Contact data is missing for at least 68 projects. For these projects, attempts to contact UNFCCC focal point contacts or other entities potentially related to the project by email or telephone have been exhausted. In these cases, all contact email addresses no longer exist and attempts to make contact via telephone have also been unsuccessful.

It is possible that the difficulties in communicating with these projects stems from their having been dismantled. For some projects in this group, information was found showing that the implementing companies went bankrupt. The information in Table 15 also shows that the activity rates in terms of monitoring reports and issuance are far below the average, although this may be partly explained by the higher rate of projects registered in 2012.

The available information and considerations for this subgroup also support hypothesis 2, that the subgroup **has a share of implemented and operational projects that is below average.**

Summary of analysis of non-evaluated projects

In general, the available information on the 18% of projects that could not be evaluated points towards a scenario that falls somewhere between hypothesis 1 and hypothesis 2. The status of the group is assumed to not deviate much from the status of the evaluated projects, although it is likely that the rate of implementation and operation is slightly lower than for the evaluated projects.

Only one subgroup gives any indication that the group might have a rate of implementation and operation which is higher than average. However, the reliability of this indication is limited, due to the low number of projects within this group.

Comparability of detailed and basic responses

Whenever project contact was established via proactive research approaches (cf. section 3.1.2), the share of responses with only basic information is increased, as well as the share of "I don't know" answers. This is due to the fact that the share of alternative project contacts – who may have had only partial knowledge on the project – and the share of contacts who were unwilling to spend more time than absolutely necessary, was increased. We however found no indication that this led to differences in content between the partial and complete answers. Additionally, no suggestion was found that information from respondents that indicated "I don't know" deviated from the overall average of received responses.

Figure 4 demonstrates that no significant differences in project profile exist between those projects for which detailed information was obtained, and those for which only basic details could be established; the size of the two groups are shown to be remarkably similar. Furthermore, the research found a deviation of less than 1 percentage point in the implementation status of projects with detailed and basic responses.

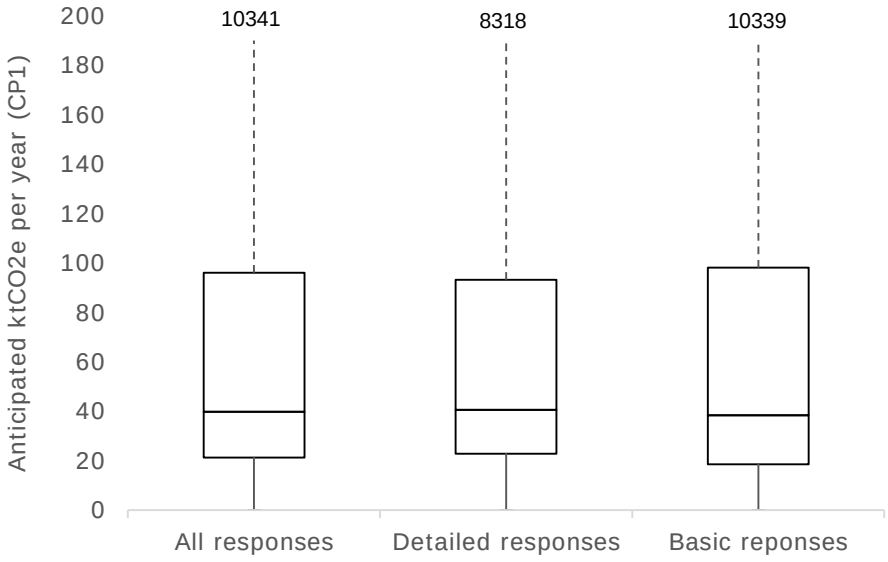


Figure 4: Comparison of project profiles according to level of response detail

Supplementary information on project types

Figure 5 provides further supplementary information about the differences between the project types in order to aid interpretation of the results in section 4. The graphics demonstrate the broad differences in the sizes of projects according to project type. In particular, HFC projects are generally many scales larger than all other project types. For the sake of clarity, the *fossil fuel switch* project type has been broken down into its subtypes: the figures show that the *new natural gas plant* subtype is also scales larger than the *oil to natural gas* subtype, highlighting the importance of considering these subtypes individually for some of the evaluation questions.

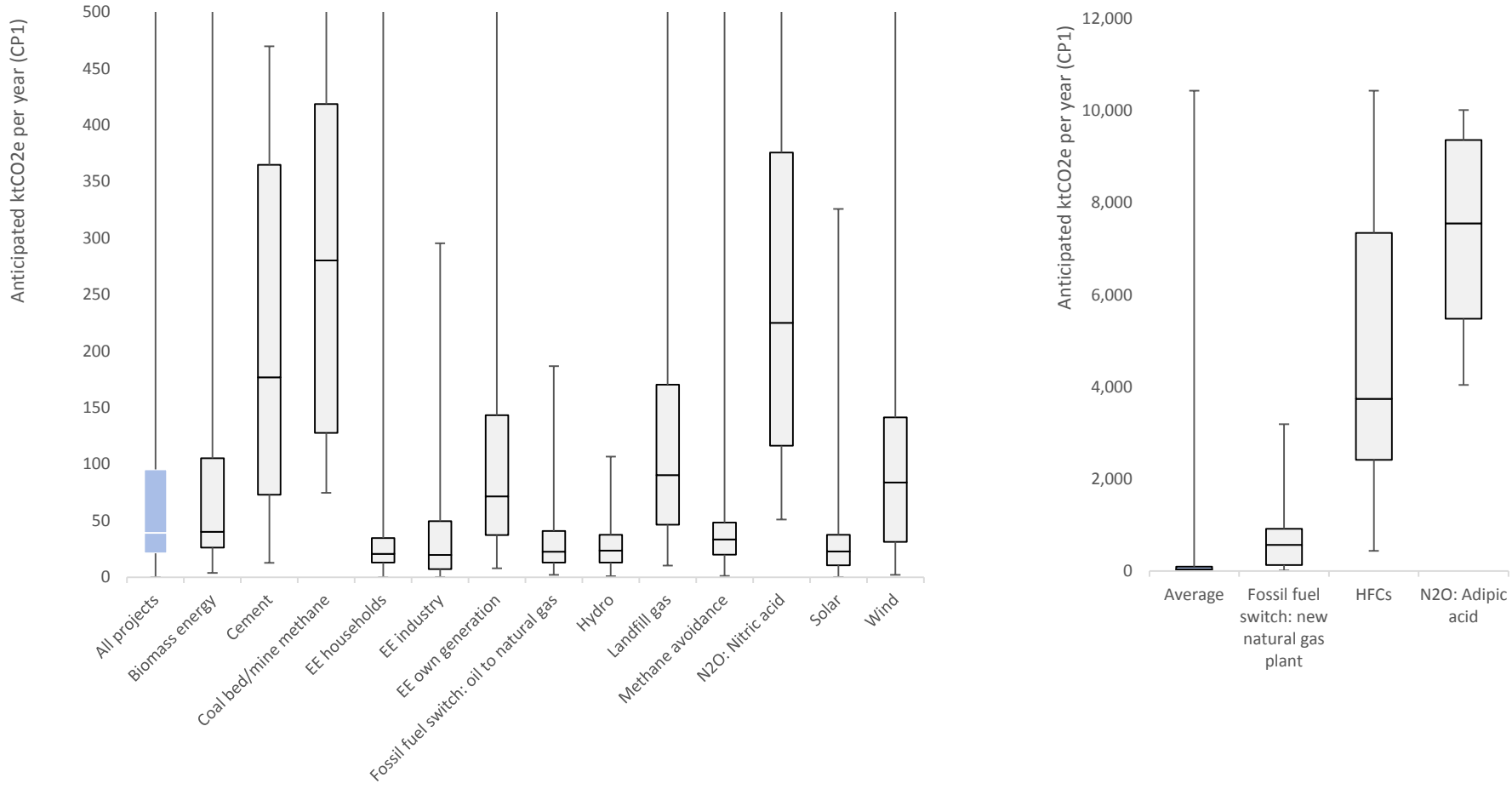


Figure 5: Comparison of project size for responding projects, between project types

4 Results

This section presents the data extracted from responses to every research question. For each of the questions, the data is at first presented aggregated at the sample level in the form of graphs. Notable findings and exceptions for specific countries and project types from each question are highlighted thereafter. This often is in the form of detailed tables. Other forms of graphical representations are also used where useful.

As Table 12 indicates, a full response for all questions exists only for half of the 1,075 projects for which data was obtained. Therefore, the number of responses for each question is different and is indicated below each chart.

Since the sample for this study includes a disproportionally high share of projects from countries and project types that have fewer projects (see methodology section 2.4), data has been reweighted to match the composition of the entire CDM project portfolio. As a result, statistics and conclusions presented in this section are applicable to the entire CDM population (for the countries and project types including in this study) rather than to the sample alone, unless explicitly stated otherwise. For each question, the calculated error margin is given within the major charts of the global data and with a 95% confidence level. It should be noted that such error margins and confidence levels apply only to the global data, and that the error margins for results associated with specific country and project level data may differ due to the lower number of responses and the specific distribution of responses over different substrata. Cases are explicitly mentioned in which such deviations are substantial.

At times, results are given in the form of ranges. These ranges take into account projects for which responses were not received, on the assumption that the rates of implementation and operation of the non-responding projects did not exceed that of the 1,075 responding projects, for the reasons discussed in section 3.2.3. Analysis of the non-evaluated projects in section 3.2.3 indicates that the upper ends of the ranges given are more likely. Once the data from the substrata are re-weighted in order to provide results relevant to the whole CDM, the significance of the non-responsive projects increases marginally from 17.9% to 18.7%. For all questions where ranges are not presented, and for all statistics related to specific countries or project types, non-responsive projects are not considered in the statistical data.

As indicated in section 3.2, the total number of responses for South Korea, as well as for the project types cement and HFC, are very low. These groups are therefore sometimes excluded from the statistical tables in the presentation of results. When included, cautious interpretation of the presented data should be made with this limitation in consideration.

It should also be recognised that the presentation of results from the subtypes methane avoidance and landfill gas deviates from the intended mode of analysis. Project activities that include power generation are not differentiated in the data presentation from those which only flare gas, despite the recognition that the conditions of these different types of projects might vary considerably. This is

due to significant limitations in the objective categorisation of projects. Attempts were made to categorise methane avoidance projects at the beginning of the sampling process, according to the methodologies used and the PDD contents. However, the categorisation was uncertain and unreliable, since a large portion of these projects use methodologies that allow for an electricity generation component to be added to the mitigation activity, either upon implementation or at a later stage. It is not possible to objectively identify those projects which continue to only flare gas, and those which have added electricity generation capacities, without asking each project participant directly. An attempt to conduct this categorisation through analysis of PDDs and UNEP Risø data was made during the sampling phase, but analysis of the collected data leads the research team to conclude that the categorisation was not sufficiently accurate to produce significant results. Although landfill gas projects are already split between 'power generation' and 'flaring' by the UNEP Risø pipeline, it is believed that this categorisation suffers to an extent from the same limitations.

The results section begins with question 3, since question 1 was to indicate the project registration number, and question 2 was to indicate the role of the respondent, as presented in section 3.2.2.

4.1 Project status

Section highlights:

- Between 69% and 85%* of registered CDM projects have full technical implementation.
- Between 64% and 79%* of registered CDM projects have regular operation of the CDM component of the GHG mitigation activity.
- Excluding China and India, between 45% and 53%* of registered CDM projects are in regular operation.
- The CDM monitoring system is in regular operation for between 39% and 67%* of the registered projects.
- Asian countries tend to forecast a decline in the number of operational projects over the next 12 months, whilst other regions still forecast an increase.
- CER revenues are sufficient for fewer than 3% of fully implemented projects.
- Irreversible investments is the most common reason for continuance of CDM project operations.
- Only 36% of registered projects will aim for renewal at the end of the crediting period, whilst approximately half of projects will be continued outside of the CDM - especially those projects which expect support through other mechanisms.

* Analysis of the non-evaluated projects in section 3.2.3 indicates that the upper ends of the ranges given in this box are more likely.

Question 3 & 4: What is the technical implementation status of the CDM GHG mitigation activity, now and in 12 months?

These questions establish the technical implementation status of the CDM GHG mitigation activity at the time of the data collection, as well as the status forecast for 12 months later. These questions refer to the implementation of the specific mitigation component of the activity included in the CDM project design document. For project types where the CDM mitigation component is only a part of the overall constructed facility or implemented alongside other emission reduction measures, only the implementation of the specific CDM component is assessed.

Figure 6 provides a graphical overview of the technical implementation status of projects' abatement activities, according to the number of projects in each implementation stage.

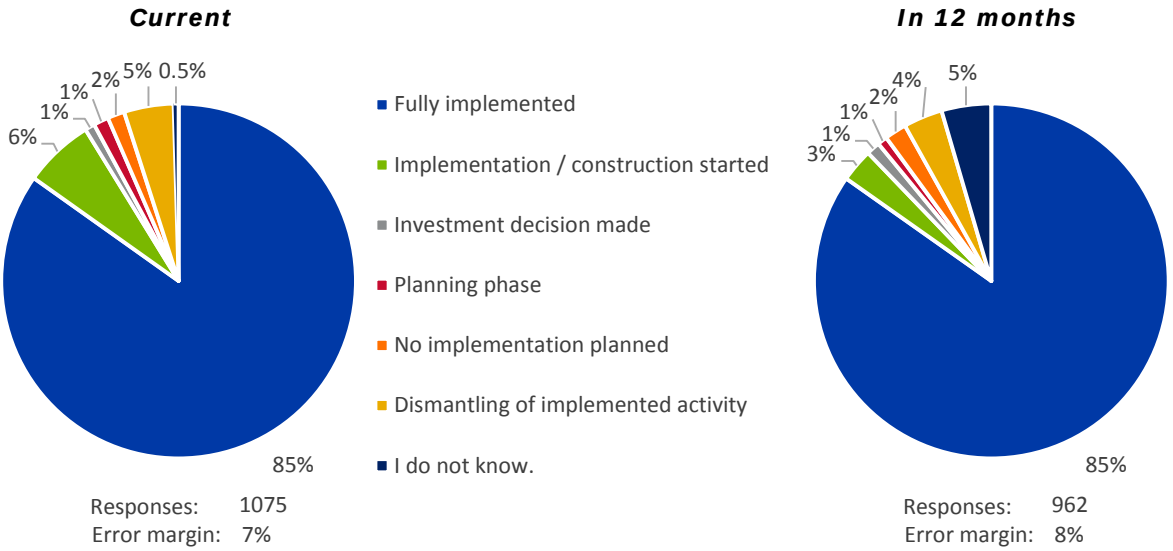


Figure 6: Technical implementation status, currently and expected in 12 months

In addition to the data portrayed in Figure 6, Figure 7 presents the same question including the 18% of projects for which contact was not possible. This makes a significant difference to the interpretation of the results, dependent upon what assumptions are be made on the status of these projects (see section 3.2.3). Note that the 18% of projects from the sample that could not be reached account for 19% once the data from substrata is re-weighted for population level statistics.

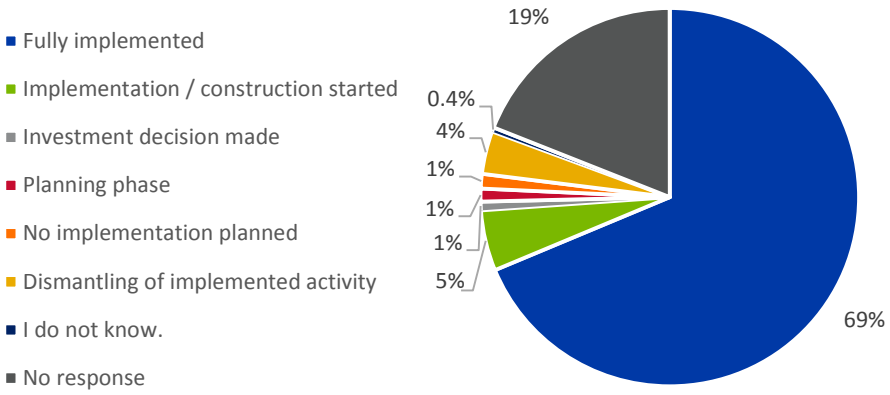


Figure 7: Implementation status, including projects for which no response was received.

- The data indicates that between 69% (Figure 7) and 85% (Figure 6) of registered CDM projects[4] are fully implemented, assuming that the implementation rate of non-responsive projects is not above that of responsive projects.[5]
- On the same assumption, between 74% and 91% of registered CDM projects are fully implemented or in the stage of implementation.[6]
- Excluding China and India, the two major CDM host countries, between just 54% and 68% of registered CDM projects are fully implemented.[7]
- Significant uncertainty about near future is evident from Figure 6, with the number of "I don't know" responses for the status in 12 months' time significantly higher than for the current situation.
- Regional variation is significant: 91% of projects in China and 88% of projects in India are fully implemented, whilst for the Sub-Saharan Africa grouping this figure remains at 46%. Although not part of the Sub-Saharan Africa group, South Africa reflects this continental trend, with just 52% project implementation and 11% of projects unable to forecast the situation in 12 months.
- In Thailand, 97% of respondents report full implementation. The forecast project implementation for 12 months' time stands at 100%, while no projects have been dismantled.
- Respondents from Vietnam report that no projects have been dismantled, or will be dismantled in the next 12 months. This, however, needs to be treated carefully, as only 10% of the responses in this country were directly received from project owners.

[4] "CDM projects" refers to the entire CDM population considered for this study (5,656 projects). See section 2 for full details on the project types and countries that are included and excluded from the study.
[5] Analysis of the non-evaluated projects in section 3.2.3 indicates that the upper end of this range is more likely.
[6] See footnote 4
[7] See footnote 4

- Mexico shows a very high rate of project dismantling (62%), with just 28% of projects having been fully implemented. This is largely due to the extreme influence of a single project type, with only two of thirty responding methane avoidance projects reporting full implementation (the Mexican situation does also significantly affect the global implementation rate for methane avoidance (72%), which would otherwise be 86%). The majority of these projects were failed investments from AgCert and Ecosecurities (see Box 1). Indeed, the data for Mexico does not deviate far from the average if this project type is not considered.

Table 16: Proportion of fully implemented projects, by project type and country

Project Type	Proportion of *fully implemented* projects	*Country / region*	Proportion of *fully implemented* projects
EE own generation	96%	South Korea	98%
Fossil fuel switch	96%	Thailand	97%
Wind	93%	China	91%
Solar	86%	India	88%
CMM	86%	Indonesia	76%
Hydro	83%	Brazil	75%
Cement	82%	Vietnam	74%
EE industry	82%	Central America	70%
Biomass energy	81%	Malaysia	68%
Methane avoidance	72%	Israel	61%
HFCs	69%	Chile	59%
Landfill gas	63%	Peru	58%
N_2O	62%	Colombia	55%
EE households	60%	South Africa	52%
		Sub-Saharan Africa	46%
		Mexico	28%

- Table 16 shows that, by project type, fossil fuel switch and own generation energy efficiency projects report the highest rate of full implementation, at over 96%. For both of these project types, it may be speculated that this is in part due to the irreversibility of sunk costs, and also the receipt of alternative sources of revenue. Such projects usually feature large technological investments integrated in larger operations. In such cases, the CDM only makes up a part of the overall investment structure, with revenues from energy sales as well as savings from increased efficiency a significant part of the business model. This explanation is supported by a closer look at the fossil fuel switch subtypes: new natural gas plants, which involve major sunk investments, report a 100% implementation rate, whilst the much more easily reversible oil to natural gas conversion project type has a 13% dismantling rate. This speculation may be cross-checked with the results from questions 7 and 26, which show that both fossil fuel switch and own generation energy efficiency projects report high rates of

irreversible investments and alternative revenue receipts. Further detail is given in the presentation of these specific questions later in this section and in section 4.4

Box 1: AgCert and methane avoidance projects

AgCert International Limited, registered in Ireland, was created to develop animal waste management system projects for the generation and sale of CERs in the CDM. The company invested in mitigation equipment for hundreds of rural farms in Latin America, particularly in Brazil and Mexico. The land owners at the actual site of project implementation were not required to make any investment in the technologies and AgCert maintained responsibility for the implementation and Monitoring, Reporting and Verification (MRV) and the issuance of CERs. CERs and the profit generated from them accrued to AgCert, whilst the local farmers were allowed to keep the biogas that was produced by the activities. However, the company began to experience technical difficulties with its projects, as well as financial difficulties, and was sold to AES in 2008. After the international market price for CERs plummeted, AgCert officially entered into administration in June 2012, leaving its entire network of mitigation infrastructure in the hands and ownership of the local farmers, who had been taught very little about its practical use.

Most of these project activities abandoned the use of mitigation equipment immediately (93% of methane avoidance projects in Mexico are dismantled, compared to a global average of 2% excluding Mexico), although some larger farms continued to mitigate due to the benefits of using the biogas in other applications.

- Biomass energy projects report an implementation status that is close to the average. This is an interesting result since our research suggested a number of difficulties within this project type. On further inspection, it appears that this result is heavily influenced by conducive conditions for biomass projects in China. Excluding China, the average implementation status of biomass projects drops to 58%.
- Table 16 shows that solar projects report a slightly above average rate of project implementation. However, this statistic hides a great variation between subtypes: 87% of solar PV projects are fully implemented, compared to just 49% of solar water heating (SWH) projects, Furthermore, the implementation rate of PV projects looks set to continue increasing: 77% of projects in the sample were registered in 2012, with the cost of the technology prohibitive previous to this, and a number of projects remain in the planning phase or have only recently started implementation. The number of SWH projects in the sample is comparatively lower, and so the result is significantly influenced by singular investment decisions: for example, of the 14 projects in the sample, three were discontinued when the implementing company RWE backed out of the projects. Furthermore, only 20% of the sampled SWH projects have had credit issuance due to the difficulties these projects face

regarding monitoring and verification: just 43% of these projects continue to operate their CDM monitoring practices.

- Landfill gas and methane avoidance projects both report below average rates of full implementation and a high rate of dismantling in the first 12 months, at 14% and 19% of projects, respectively. Analysis of our qualitative data shows that these projects present operational and monitoring difficulties, often being small projects in remote areas and not integrated in larger industry structures. Our findings from many countries suggest that the end users of mitigation equipment and intended mitigation practices were often poorly trained, and that – in the absence of intervening government legislation – project activities were often quickly abandoned as CER prices dropped. For many projects, especially in Latin America, mitigation equipment and practices were abandoned on local sites when the larger companies which previously owned them went bankrupt (see Box 1, for example). Landfill gas power projects demonstrate a significantly higher implementation and operational status than flaring projects, despite evidence from the qualitative data that many projects were only able to generate CERs from their flaring activities. This is chiefly explained by the revenues from electricity sales, which proved a much more significant income source than CERs as the market price dropped. Indeed, some larger landfill gas flaring projects reported that they continued mitigation activities without further considering the CDM, whilst installing electricity generation equipment and selling energy.
- Household energy efficiency projects demonstrate the poorest rate of project implementation at 60% (71% for cooking stoves and 52% for lighting). A high proportion of household energy efficiency projects are projects with a registration date in 2012 and/or PoAs, and a number of projects are therefore still in the planning and implementation phases. However, there are also a number of projects being discontinued and dismantled, even amongst the 2012 registrations. The investment conditions for these projects types with regards to CER credit issuance appear particularly bleak: by December 2013 just three out of 34 household lighting projects in the sample had achieved credit issuance, whilst not a single one of the 26 cooking stove projects had received issuance. Only projects from India and China have indicated that they have been discontinued; others continue to strive towards operational status. These other projects express high interest in alternative programmes, international support, and credit purchase facilities (see section 4.5).

As Figure 8 indicates, the proportion of fully implemented projects is lower for projects with a registration date in 2012. However, this appears to reflect only the time delay between project registration and implementation rather than significant differences in the ability of the projects to eventually reach full implementation: Figure 8 shows that there is no difference in the proportion of projects that are either fully implemented or in implementation between the two sets of registration dates.

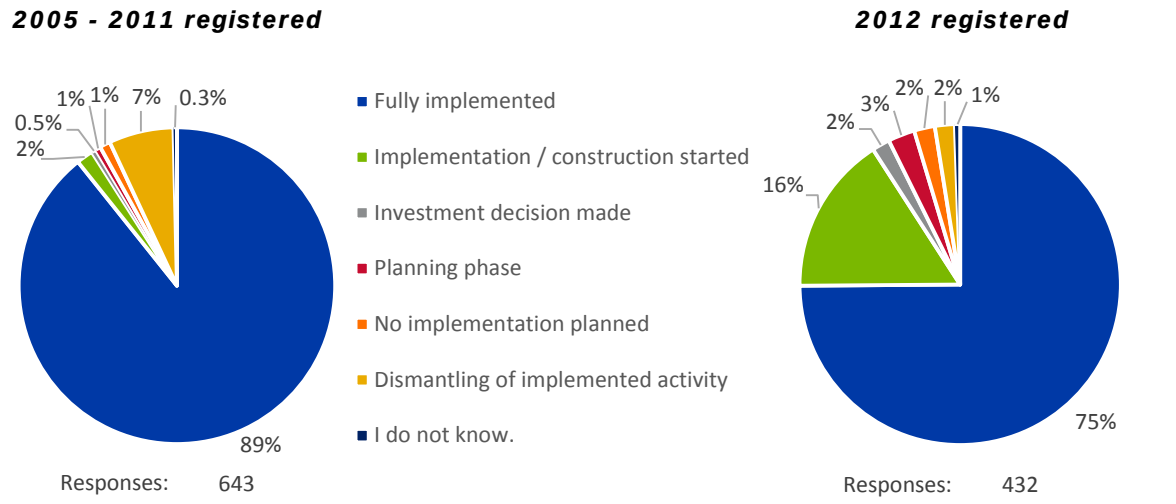


Figure 8: Comparison of implementation status of projects with registration date in and before 2012

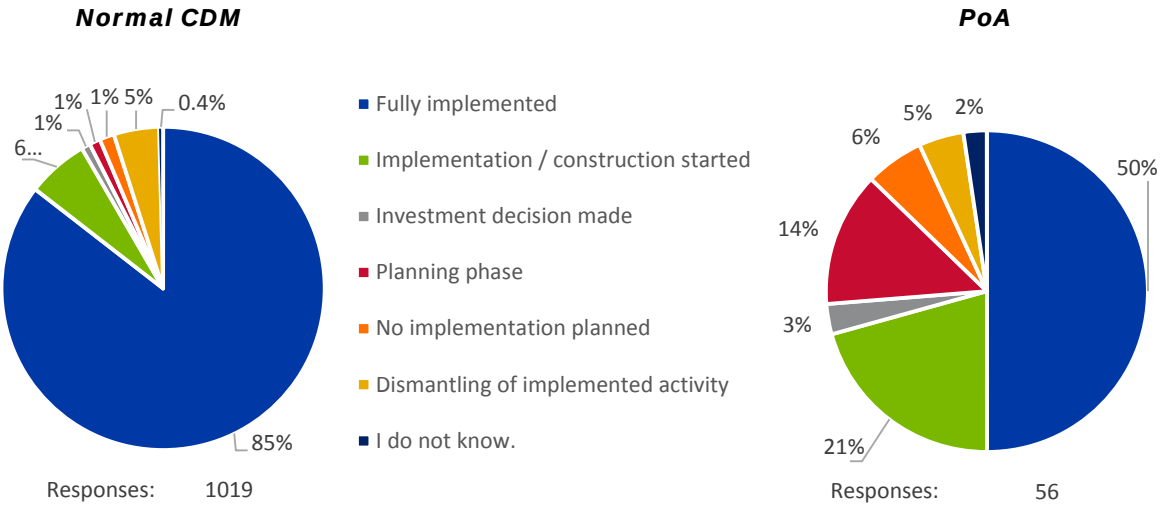


Figure 9: Comparison of implementation status of normal CDM projects and PoAs

Figure 9 presents the differences in implementation status of projects according to their modality: normal CDM or PoA. It should be considered that the reported differences between the implementation status of normal CDM projects and PoAs could potentially be caused by inconsistency in the understanding of this question: PoAs may have understood the answer *fully implemented* to mean the *full implementation of all intended component project activities (CPAs)*, which was rarely the case. Retrospective investigations were conducted to better understand how PoAs had interpreted

this question. These investigations found that the issue was not relevant to approximately half of the PoAs sampled, since these had only one CPA and were not in the process of developing others. For PoAs with more than one CPA, the research team identified mixed interpretations of the question, with a small number of participants choosing not to select fully implemented unless all individual CPAs were implemented.

Figure 9 shows that a significant difference exists in the implementation status of normal CDM projects and PoAs. Given that the misinterpretation issue applies to only approximately half of the PoA sample, and that only a handful of these projects potentially misinterpreted the question, it is reasonable to assume that although the rate of full implementation for PoAs should be slightly higher than the statistics shown in Figure 9, this is not likely to be high enough to nullify the significant difference seen between normal CDM projects and PoAs. This difference is partly due to the fact that the PoA population is very young – the vast majority of projects were registered in 2012 – whereas normal CDM projects show a more balanced vintage spread. Despite this, the difference in the rate of full or expected implementation between registered CDM projects and PoAs (Figure 9) is much higher than that of different vintages (Figure 8). Alternatively, Figure 9 shows that a relatively large proportion of PoAs remain in the planning phase and are still yet to make an investment decision. Indeed, it might be expected that the planning phase and implementation of PoAs takes longer than normal CDM projects. In fact, if the proportion of projects in planning or implementation phases are combined, then very little difference exists between PoAs (87% in planning, with investment decision, beginning implementation or fully implemented) and normal CDM projects (93%). However, the difference widens for the 12 month forecast: 23% of PoAs reported “unsure”, “dismantling” or “no implementation planned”, compared to 10% of normal CDM projects.

The results shown in Figure 8 and Figure 9 cast light on some of the regional differences identified above. Since the vast majority of Sub-Saharan African projects were registered in 2012, and this group also including a larger proportion of PoAs than the sample average, the above patterns go some way to explain the lower proportion of full implementation in this region. In contrast, Asian countries tend to find themselves at the upper end of the implementation range, due in part to their early engagement in the CDM and the low proportion of PoAs.

Question 5 & 6: What is the operational status of the CDM component of the GHG mitigation activity, now and in 12 months?

These questions assess the operational status of the *CDM component* of the GHG mitigation activity for projects that are fully implemented, and therefore only applies to projects who indicated full implementation in the previous question. Projects not reporting full implementation were automatically assigned the answer *NA: Mitigation activity not technically implemented* and these answers are included in the total number of responses indicated. In addition to the data portrayed in Figure 10, Figure 11 presents the same question but including the projects for which contact was not possible.

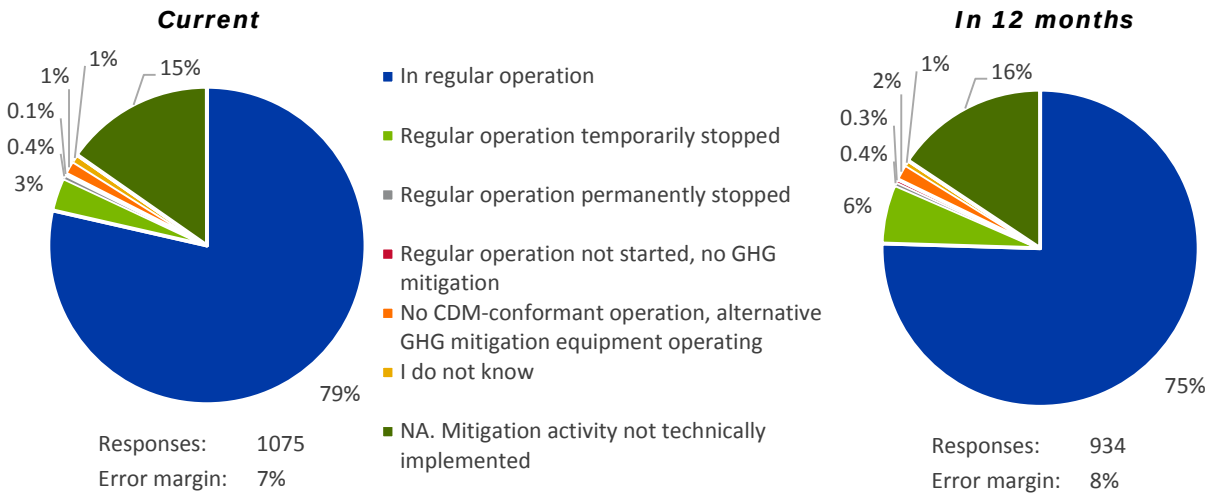


Figure 10: Operational status, currently and expected in 12 months

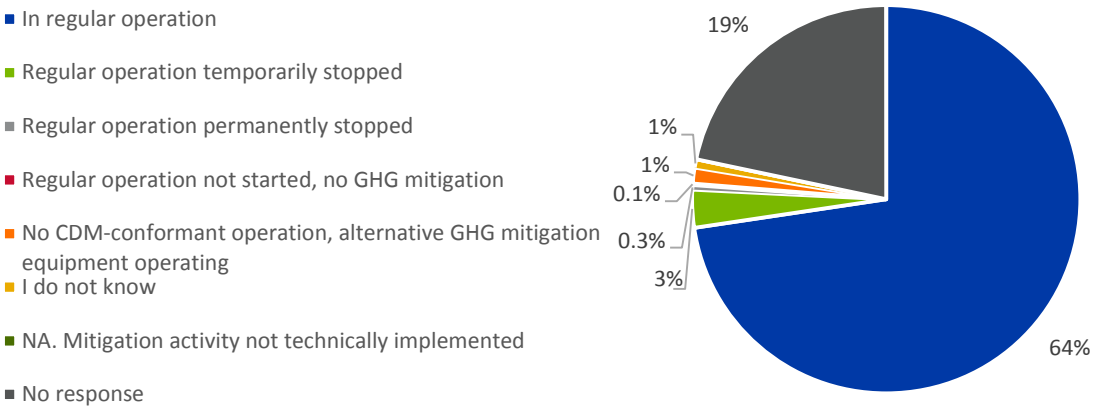


Figure 11: Operational status, including projects for which no response was received

Table 17: Proportion of projects in regular operation, by project type and country

Project Type	Proportion of projects in *regular operation*	*Country / region*	Proportion of projects in *regular operation*
EE own generation	93%	China	89%
Wind	92%	India	81%
Fossil fuel switch	81%	Vietnam	73%
Hydro	81%	South Korea	73%
Solar	80%	Thailand	71%
Cement	74%	Central America	69%
EE industry	72%	Malaysia	58%
CMM	71%	Indonesia	58%
HFCs	69%	Chile	55%
Biomass energy	63%	Peru	53%
EE households	58%	Israel	53%
Landfill gas	54%	Colombia	45%
N_2O	49%	Brazil	39%
Methane avoidance	48%	Sub-Saharan Africa	36%
		South Africa	35%
		Mexico	26%

- Between 64% and 79% of projects are in regular operation, assuming that the rate of regular operation for non-responsive projects does not exceed that of responsive projects.[8]
- According to respondents' forecasts, the rate of regular operation of registered CDM projects globally could decline by 5% (4 percentage points) over the period of 12 months following the evaluation.
- Excluding China and India, the two major CDM host countries, the rate of regular operation of registered CDM projects in the rest of the world is between just 45% and 53%.[9]
- A similar pattern for regional variation exists as for the implementation status; just 36% of projects in the Sub-Saharan Africa group are in regular operation, whilst the Central America group reports 69% in regular operation.
- A very large variation between project types is clear, as depicted in Table 17. Following the trend in implementation status, energy efficiency own generation, fossil fuel switch and renewable electricity generation projects (wind, hydro and solar) demonstrate very high rates of operational status, whilst landfill gas and methane avoidance have low rates. Energy efficiency projects for households also have a very low proportion of projects in regular operation, perhaps reflecting the difficulties these types of projects face with the monitoring and verification of emission reductions.

[8] Analysis of the non-evaluated projects in section 3.2.3 indicates that the upper end of this range is more likely.
[9] See footnote 7

- The rate of regular operation is relatively high (at least 70% of projects) for India, Thailand, Vietnam and China. In the cases of China, Thailand and Vietnam, this may be partly due to the fact that the proportion of projects that were able to agree ERPAs is far above the global average (see section 4.2). However, the outlook for these countries varies considerably: whilst in Vietnam and Thailand respondents report an above-average (albeit still very low) rate of satisfaction with CER prices or non-financial benefits afforded by the CDM, and a majority of projects from these countries indicate that they will aim for a renewed crediting period, the situation in India and China is the opposite. In these countries, a large majority of projects stated that they continue operations only due to irreversible investments or expectations of receiving alternative support outside of the CDM, and the proportion of projects aiming for a renewed crediting period is lower than the global average.

Table 18: Proportion of projects in regular operation according to vintage

Year of registration	Proportion of projects in regular operation	
	At present	In 12 months
2012	72%	69%
2004-2011	81%	74%

Table 19: Forecast changes in technical implementation and operational status over 12 months

Percentage points difference between technical implementation and operational status now and forecast status in 12 months' time.					
Asian countries			Rest of the world		
	Technical implementation	Operational		Technical implementation	Operational
China	+3	-1	Central America	+14	+8
India	-2	-5	SSA	+4	+6
Indonesia	-8	-9	South Africa	+5	+10
Thailand	+3	-5	Peru	+14	+13
Vietnam	-14	-25	Brazil	+2	-1
Malaysia	-15	-16	Chile	+1	+4
South Korea	-7	+10*	Israel	+2	+4
			Colombia	+4	-2
			Mexico	no change	no change

*As discussed at the beginning of section 4, caution should be taken with results for South Korea due to the low number of responses

The figures shown in this table are the percentage point differences between the proportion of respondents identifying full technical implementation and regular operation in the present (questions 3 & 5) and the proportion forecasting full technical implementation and regular operation in 12 months' time (questions 4 & 6). For example, 15% fewer projects are forecasted to be in full implementation in 12 months' time in Malaysia.

- Table 18 compares the proportion of projects in regular operation according to their registration dates. Projects from 2004-2011 show a notably higher proportion of regular operation (9 percentage points higher). This is mostly due to the time delay between the two groups, and this difference is highlighted in the forecast status for 12 months' time. The respective proportions in 12 months' time are more similar, suggesting that the conditions faced by newer projects are not remarkably different.
- Asian countries tend to forecast a decline in the number of operational projects over the next 12 months, while other regions still forecast an increase. This might be related to the vintage of the project, as Asian countries have a higher proportion of pre-2012 projects, which are more likely to end regular operation of the CDM component of their mitigation activities in the next 12 months, as indicated by Table 18. This trend is not necessarily related to older projects coming to the end of their natural lifetime, since the vast majority of projects in all regions remain in a relatively early phase of their technical lifetimes. Rather, it may be linked to experiences with, and expectations of, the CDM in this region. Table 19 presents data suggesting that the Asian region are on the other side of the hill to the rest of the world in terms of CDM participation: all of the Asian countries listed in the table indicate a reduction in their CDM activities over the 12 month period, whilst almost all of the other evaluation countries indicate the opposite trend. For countries showing a reduced implementation/operation status in 12 months' time, this reduction is mostly made up of projects that will be dismantled within this time period. Although also partly attributable to a marginal increase in the number of respondents selecting that they "do not know", this latter factor should not affect the trend portrayed in the Table as is also accounts for an equally negative effect in regions reporting a positive change within the next 12 months.

Question 7: Despite the recent drop in CER prices, what are the reasons to continue with the CDM GHG mitigation activity?

This question sets out to establish whether projects that continue to operate in the CDM do so because of the benefits afforded directly by the mechanism, or if their continuation is due to other reasons such as irreversible investments, regulation or legal contracts, or expectation to receive alternative support. The question was only made available to those projects who indicated in questions 5 and 6 that they are either in regular operation now, or expect to be within 12 months.

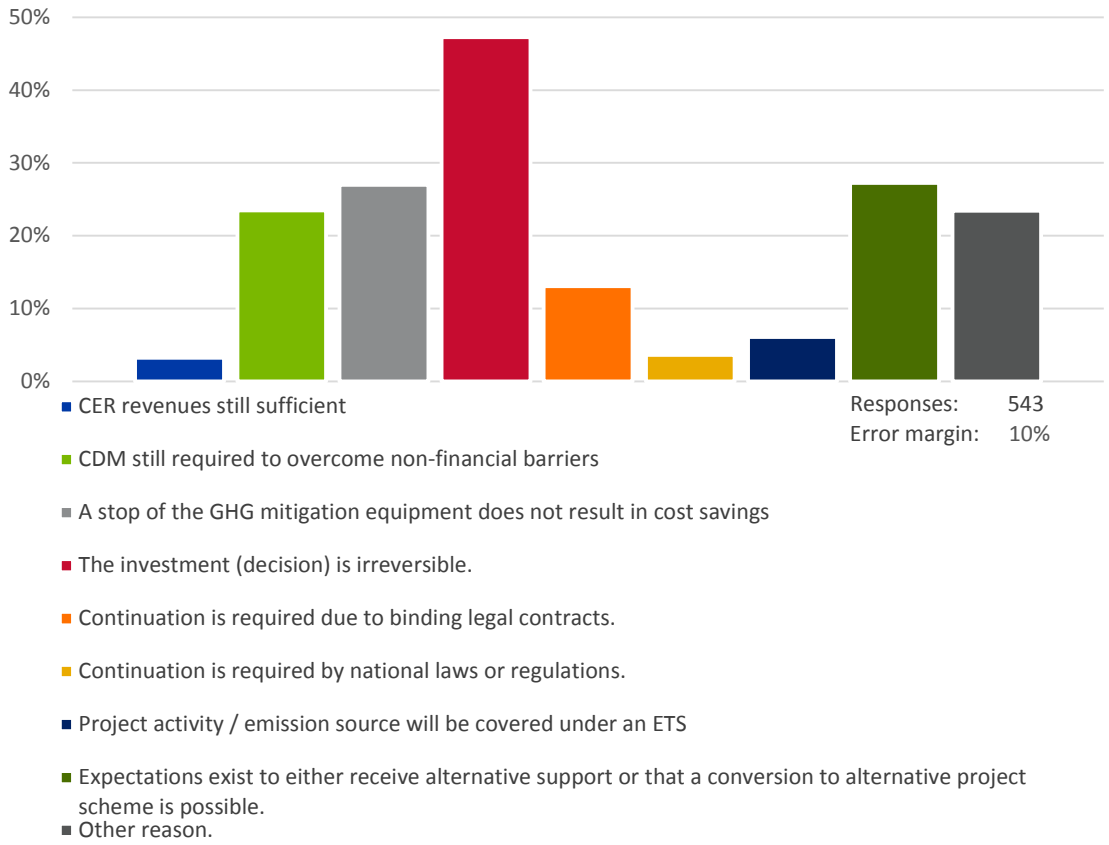


Figure 12: Reasons to continue with the mitigation activity

Table 20: Reasons for project continuation according to project type

Project Type	CER revenues are sufficient	Stop of mitigation equipment results in no cost savings	The investment is irreversible
Biomass energy	11%	25%	54%
CMM	0%	0%	43%
EE households	2%	7%	20%
EE industry	14%	39%	20%
EE own generation	0%	5%	61%
Fossil fuel switch	2%	40%	78%
Hydro	2%	20%	27%
Landfill gas	8%	22%	31%
Methane avoidance	9%	4%	26%
N_2O	0%	33%	15%
Solar	3%	45%	63%
Wind	1%	37%	61%

Cement and HFC are omitted from the table due to insufficient response numbers. Only a selection of the reasons, which are seen to vary significantly across project types, are included in this table. For CMM projects, other reasons were also notably important: namely continuation due to legally binding contracts, and expectations of receiving alternative support.

Table 21: Reasons for project continuation according to country

Country	Continuation due to national regulations	Activity will be covered under an ETS	Expectations exist for alternative support or conversion
Brazil	10%	0%	30%
Central America	4%	0%	21%
Chile	1%	7%	22%
China	4%	7%	33%
Colombia	0%	0%	23%
India	2%	4%	13%
Indonesia	0%	5%	41%
Israel	15%	0%	7%
Malaysia	0%	1%	6%
Mexico	0%	0%	71%
Peru	7%	0%	5%
South Africa	16%	7%	39%
South Korea	0%	28%	16%
Sub-Saharan Africa	0%	23%	20%
Thailand	0%	1%	20%
Vietnam	1%	13%	30%

Table 22: Comparison of the profile of projects reporting sufficient CER revenues

		Percentage of projects reporting that CER revenues are sufficient
Registration date	2005-2011	8%
	2012	10%
ERPA status	ERPA signed	12%
	No ERPA signed	8%

The statistics in this table relate to proportion of the sample. They are not re-weighted to represent a finding that is accurate for the entire CDM population. The use of the statistics here is to highlight the trend, rather than the precise statistics for the population.

- The majority of operational projects have continued operating for one of two reasons:
    - they are locked into an irreversible investment decision and cannot cease to operate, or in doing so would not achieve cost savings. This is particularly true of project groups energy efficiency of own generation, fossil fuel switch, and power generation from wind and solar;
    - they expect to receive support from alternative sources, unlinked to CER revenues, or to convert their project for compliance with other programmes.
      This is particularly true of projects in Mexico, South Africa, Indonesia, and China, but notably less relevant in India despite the introduction of the PAT programme.
- Very few projects continue with their CDM operations on account of any benefits afforded by the mechanism itself. Only 2%–3% of registered CDM projects continue due to sufficient CER revenues, whilst between 11% and 23% of projects continue operations due to non-financial benefits afforded by the mechanism.
- This trend is very consistent across countries and project types, as portrayed in Table 20 and Table 21. Vietnam is a notable exception, where the irreversibility of investment appears to be of minor contribution and the ability of the CDM to overcome non-financial barriers is the most important reason. As said before, numbers from Vietnam need to be treated carefully though, since only 10% of the responses were directly received from project owners.
- The expectation of receiving alternative support is especially prominent in Mexico, as shown in Table 21. Further information obtained through the survey and personal interviews indicates that there are high expectations for the recently introduced plans for a domestic emissions trading scheme (ETS) and for the use of CERs for compliance with the carbon tax. Similar expectations exist for China due to its CCER system (China Certified Emission Reduction) and domestic ETS schemes; in Brazil for its emerging domestic markets; and in South Africa for the upcoming domestic carbon tax, which will launch in 2016 and allow the use of CERs as part of a flexibility mechanism. Expectations to receive alternative support in Peru, Israel and Malaysia are quite low (5%, 6%, and 7%, respectively) when compared to the global average (27%). These considerations are analysed further in section 4.2.

- The response from some projects in Sub-Saharan Africa regarding expectations for an ETS is a peculiar result, given that no advanced plans for an ETS exist in the region. An interpretation of this unexpected result is not possible in this research since the respondents did not provide any additional information to support their answers.
- The low proportion of projects indicating that continuation is required under domestic law or regulations is a clear indication that the CDM has achieved emission reductions beyond national requirements.
- No significant variation is observed for this question according to project vintage or registration type (normal CDM or PoA).
- Table 22 presents a comparison of projects that claim sufficient CER revenues with projects that do not. Slightly more projects with a registration in 2012 report sufficient CER revenues than those with a registration before this date. This trend may not be statistically significant, given the low number of projects to whom this status is relevant. Alternatively, it may be a reflection that projects with later registrations were more likely to be planned and developed with business models that foresaw the current market conditions. Projects with signed ERPAs are also slightly more likely to receive sufficient CERs than projects without. This is a logical result, since the agreements for credit purchases in ERPAs are highly likely to include prices that are more favourable than the current spot market conditions.

Question 8: What is expected to happen with the CDM project / the GHG mitigation equipment after the end of the crediting period?

This question assesses the expectations for the continuation of GHG emission reduction measures after the end of the CDM crediting period. Where mitigation measures will continue, the predefined answers allow the respondent to indicate whether the specific CDM component of the activity will continue to operate, or whether GHG emission reductions of the overall project activity will continue yet deviate from the specific CDM component requirements. For projects where the specific CDM component of the mitigation activity continues to operate, respondents can indicate whether operation is intended to continue within the CDM or outside the mechanism, with or without alternative support.

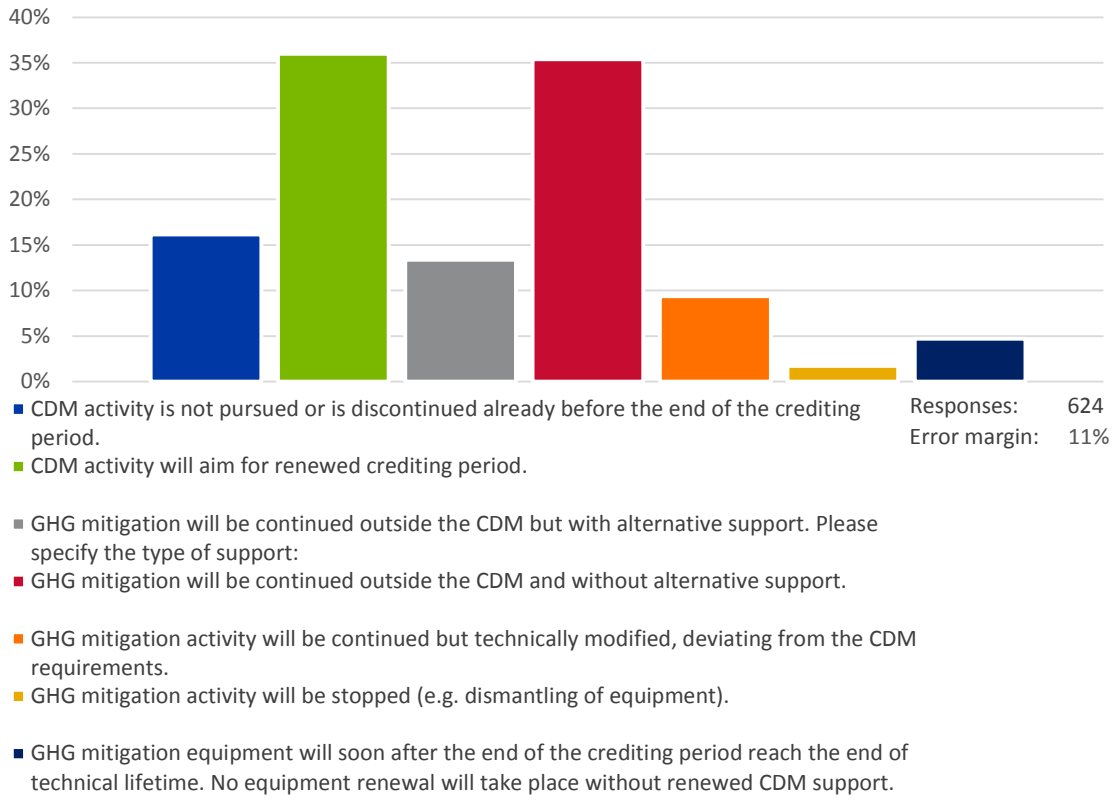


Figure 13: Status of registered CDM projects expected after the end of the crediting period

- Just 36% of projects will seek to renew their crediting period in the CDM.
- However, most projects indicate that they will continue the GHG mitigation activity, if not with a renewed crediting period then by continuing outside of the CDM, with or without alternative support.

- China, India and South Korea report a very high proportion of projects intending to continue operations outside of the CDM (60%-63%). In contrast, 64% of the Central America grouping aim for renewed crediting. In Central America, this may be linked to the fact that a relatively high proportion of projects report that stopping the mitigation does not result in cost savings, and that continuation of the mitigation is required for legal reasons. Furthermore, fewer projects in this region have expectations to receive alternative support or to convert to a new programme. Table 23 presents this data for all project types and countries.

Table 23: Status of projects expected after the end of crediting period, by project type and country

Project Type[1]	Discontinued before end of crediting period	Termination of mitigation activity before, upon or shortly after end of crediting period	Aim for renewed crediting period	Continue outside of CDM
Biomass energy	26%	53%	32%	45%
CMM	22%	22%	11%	67%
EE households	38%	55%	38%	14%
EE industry	28%	28%	39%	39%
EE own generation	12%	12%	16%	78%
Fossil fuel switch	9%	9%	47%	82%
Hydro	19%	21%	32%	51%
Landfill gas	31%	50%	28%	37%
Methane avoidance	23%	51%	26%	45%
N_2O	63%	81%	14%	10%
Solar	12%	22%	37%	57%
Wind	7%	7%	46%	55%

Country / region	Discontinued before end of crediting period	Termination of mitigation activity before, upon or shortly after end of crediting period	Aim for renewed crediting period	Continue outside of CDM
Brazil	17%	45%	38%	27%
Central America	9%	13%	64%	41%
Chile	21%	29%	49%	36%
China	15%	17%	35%	56%
Colombia	26%	37%	41%	28%
India	15%	25%	34%	54%
Indonesia	20%	45%	39%	31%
Israel	19%	24%	26%	57%
Malaysia	18%	44%	21%	49%
Mexico	54%	57%	21%	31%
Peru	26%	28%	46%	37%
South Africa	18%	48%	31%	41%
South Korea	4%	11%	39%	61%
Sub-Saharan Africa	11%	37%	46%	33%
Thailand	7%	25%	43%	61%
Vietnam	14%	32%	66%	33%

[1]) Project types HFC and Cement are excluded from this table since results are potentially not representative due to low number of responses to this question.

- Many household energy efficiency projects report that the technical lifetime of the mitigation equipment will end soon after the crediting period. This highlights a big difference between household energy efficiency projects and other project investments. Projects attached, for example, to large industrial facilities, will operate much longer than CDM crediting periods, whilst household lighting is quite likely to reach the end of the technological lifetime before the end of the crediting period.
- For energy efficiency in own generation and solar projects, a high proportion of projects (51% and 54%, respectively) report that they will continue outside of the CDM without alternative support. This result is slightly less prominent for other renewable energy generation projects (wind and hydro), which instead indicate a high proportion of projects aiming for a renewed crediting period under the CDM, as shown in Table 23.
- Table 23 shows that N_2O projects are at a high risk of discontinuation. This result is primarily relevant to Nitric Acid projects, as only two responses from Adipic acid projects were recorded for this question. This result is a primary concern, given the large impact these projects have on greenhouse gas emissions.
- Data from question 8 shows that PoAs and normal CDM projects with a registration date in 2012 are more likely to aim for a renewed crediting period than normal CDM projects and projects with a registration date before 2012. Indeed, in question 7, PoAs were more likely (although still in the large minority) to report that CDM revenues were sufficient or that the CDM helps to overcome other project barriers. This may be due to the increased likelihood of PoAs to receive international support or CER prices above the market price; section 4.2 and section 4.5 provide more detail on these considerations. The higher proportion of PoAs aiming for renewed crediting periods might also be a reflection of their younger age, and the higher level of optimism likely to be observed across these projects as compared to older projects.

Question 9: What is the implementation status of the CDM monitoring system (measurements required for the CDM only)?

This question assesses the status of the monitoring system for the CDM component of the project activity specifically. For projects where the CDM component was not technically implemented (question 3) the answer "*NA: CDM mitigation activity not technically implemented*" was automatically assigned. Figure 14 presents the results for registered CDM projects.

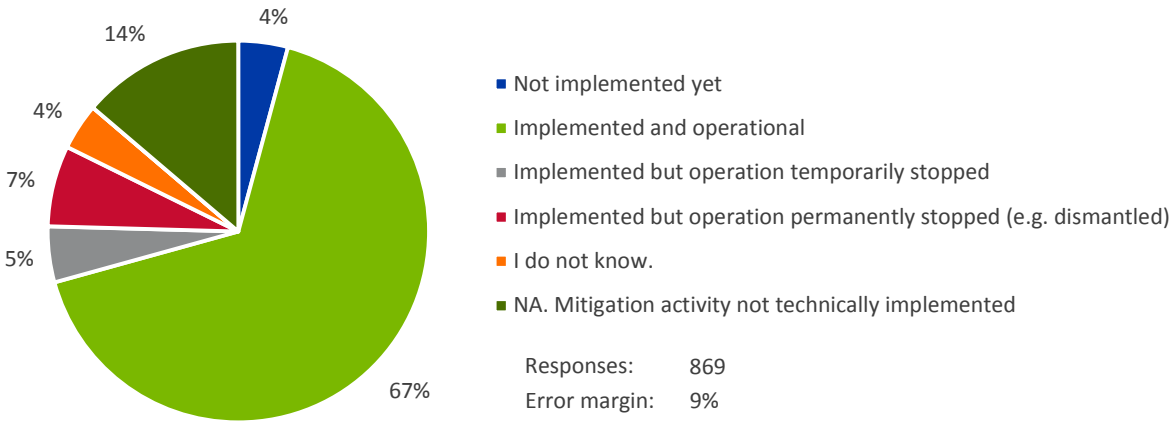


Figure 14: Implementation status of CDM monitoring systems

- Regular operation of the CDM monitoring system is in place for between 39% and 67% of registered CDM projects[10]. There is a broad difference between projects that have already issued credits, where the monitoring system is implemented and still operational in up to 82% of projects, and projects that have not yet issued credits, where the monitoring system is still operational in just up to 55%.
- It is remarkable that solar projects demonstrate a below average rate of implemented and operational monitoring systems (cf. Table 24), given that the monitoring process for solar PV in particular is considerably less demanding for this project type than for others. In this regard, there is also no significant variation between solar PV and solar water heating projects. This may also be linked to the result of question 8, which found that a relatively high rate of solar PV projects plan to continue activities outside of the CDM and *without* alternative support. Such projects may consider the value of a monitoring system to be limited, regardless of the ease of its operation. Subsequent sections of this report present evidence that solar projects' business models are beginning to deviate from CDM oriented models. For example, very few solar projects signed ERPAs, and the project type has received

[10] The lower range of 39% is calculated by inclusion of non-responsive projects. If the monitoring equipment of all these projects was non-operational, then the final rate of regular implementation of the monitoring system would be 39%. Analysis of the non-evaluated projects in section 3.2.3 indicates that the upper end of this range is more likely.

above average support from domestic sources and alternative revenues (for further details see section 4.2, section 4.4 and section 4.5).

Table 24: Implementation status of CDM monitoring systems, by project type

Project Type	*CDM monitoring system implemented and operational*
Wind	81%
EE own generation	80%
Cement	72%
Hydro	71%
Biomass energy	52%
EE industry	52%
Solar	51%
Coal bed/mine methane	50%
Landfill gas	46%
Fossil fuel switch	45%
Methane avoidance	39%
EE households	26%

HFCs are excluded from the table due to low response numbers to this question.

- Projects where monitoring systems were implemented but stopped, either temporarily or permanently, appear in general to now disregard the CDM. Just 25% of such projects from the sample continue with the regular operation of the CDM component of their mitigation activity (question 5), compared to the sample average of 62%. None of these projects report that CERs are sufficient, and only 5% continue with CDM conformant operations due to the ability of the CDM to overcome non-financial barriers. However, whilst the proportion of these projects that will dismantle is higher than the average, the proportion of those that will remain technically implemented in 12 months' time is not significantly lower than the average (64%, compared to 69%).
- Again, energy efficiency own generation and wind report the highest rates of monitoring system implementation at 80% and 81% respectively. Hydro projects also indicate above average rates of operational and implemented monitoring systems. The reasons are reported to be linked to the complexity of monitoring and the fact that, for renewable electricity generation projects, monitoring often consists simply of an electricity meter which is also required in the situation without CDM. Indeed, the proportion of hydro and wind energy projects which implemented and then subsequently stopped their monitoring processes is very low.

- During the design of the question, it was expected that projects generating renewable electricity only would have a monitoring system dismantling rate close to 0%. However, interviewed survey respondents reported that the real monitoring situation for renewable electricity projects is often more complicated than anticipated. CDM rules or DOEs dealing with ambiguous rules require a back-up meter on the side of the project owner and do not always accept the meter provided by the grid operator as a sufficient data source. Also, additional meters to separately measure subparts of the installations, or consumed electricity for project emissions, are often needed for compliance with the CDM, but not otherwise. These meters are therefore no longer maintained when participation in the CDM or future verification activities are abandoned.
- Project types biomass, coal mine methane, industrial energy efficiency and N_2O report a higher than average rate of monitoring activities being implemented but subsequently stopped. These technologies demonstrate the opposite conditions to those of renewable electricity generation projects, since the monitoring system is not required for non CDM operations and is therefore more likely to be stopped as market conditions deteriorate.
- For some technology types, no representative conclusion can be drawn since only a very small number of respondents answered this question. This applies, for example, to HFCs (3 responses) and cement (4 responses).

Question 10: Was the CDM project design (GHG mitigation technology) changed after CDM registration, deviating from the CDM requirements and/or the description in the PDD?

In this question, respondents could indicate whether changes had been made to the project design, specifically to the CDM component, since the registration of the CDM project. Where design changes were made, respondents indicated whether changes were made in anticipation of official UNFCCC acceptance, or in anticipation of discontinuation of the project's participation in the CDM. Figure 15 presents the results for registered CDM projects.

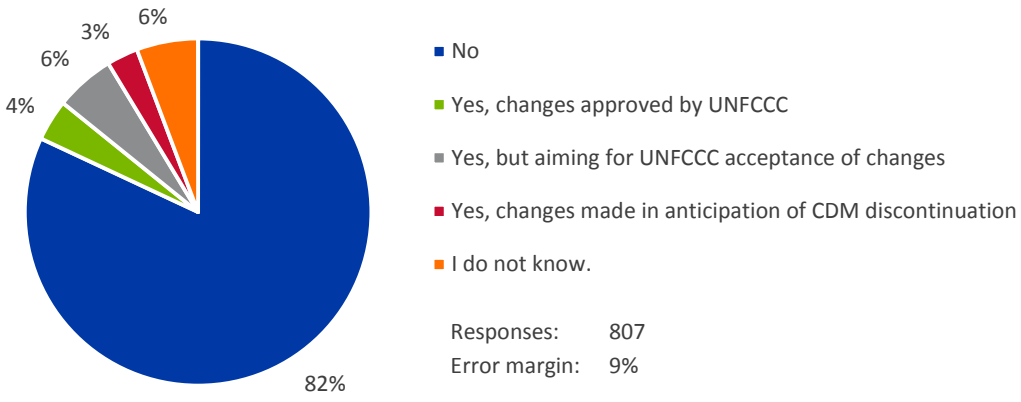


Figure 15: Changes made in PDD after CDM registration

- A very large majority of projects indicate that the CDM project design was not changed after CDM registration. Of those projects where changes did occur, over three quarters received approval from UNFCCC or continue to seek approval.
- India (86%) and China (82%) report a very high proportion of unchanged project designs.
- Malaysia and Thailand are notable exceptions, where the proportion of projects with changes made in anticipation of CDM discontinuation is five and seven times higher than the global average, respectively.

Table 25: Projects with no post-registration changes, by project type

Project Type	*Projects with no design changes*
Solar	95%
EE households	91%
Fossil fuel switch	88%
N_2O	87%
Hydro	84%
EE own generation	84%
Methane avoidance	82%
Landfill gas	80%
Wind	79%
Biomass energy	78%
EE industry	78%
CMM	75%

Cement and HFCs project types are omitted from the table due to low response rate for the question.

- Table 25 shows that there is significant variation in this data by project type. Project types with high complexity, or high levels of integration with larger processes –industrial energy efficiency, biomass energy, landfill gas and methane avoidance for example – are more prone to project design changes, since changes to the wider processes within which the project is integrated are likely to require PDD changes.
- Further project changes in methane avoidance projects including landfill gas and CMM projects can be explained by the uncertainty these project types have to deal with during their implementation phases. The exact volume and quality of the gas captured is unknown during the planning phase, only becoming available after the first parts of the investment program for the overall mitigation activity have been implemented. If the volume or the gas quality deviates from the expectations, the plans for the gas usage might have to be adapted (e.g. change in capacity for electricity generation, biogas used for heat instead of electricity, no gas usage at all, etc.).

- Most projects with changes were anticipating acceptance of the project design changes by the UNFCCC, and cross analysis with other survey questions shows that these projects report an increased burden from barriers related to CDM costs and procedures. 75% of projects from the sample with design changes report that costs or uncertainties related to CDM procedures and regulations was a major barrier to the continuation of project implementation or operation, compared to 35% of the entire project sample (see section 4.4 for further details).
- There is very little notable variation between PoA and normal CDM projects for this question.
- Projects with a registration date in 2012 are more likely to have made no project design changes (88%, compared to 75% of projects with a registration date before 2012). This may be explained by the higher implementation to date of projects with a pre-2012 registration.
- Projects with credit issuance are twice as likely to have made project design changes after registration compared to projects without credit issuance. This can be explained by the verification process which projects with credit issuance have successfully carried out. During the initial verification process, verifying DOEs check whether the project conforms with the implementation and operation as stated in the PDD. Discrepancies between the PDD and the reality need to be resolved before issuance can be requested. This rather late identification of discrepancies is also one of several reasons why only 1/3 of registered CDM projects successfully reaches issuance (Warnecke 2014).

4.2 ERPA situation / CER marketing approach

Section highlights:

- Approximately one third of registered CDM projects did not sign an ERPA with a CER buyer at any stage.
- Private sector buyers account for 62% of ERPA agreements, plus a further 25% when in combination with public entities.
- Just 40% of the initially agreed ERPAs are still valid and unchanged.
- Fewer than half of registered CDM projects continue to market CERs, either through ERPAs or alternative approaches.
- 30% of registered CDM projects intend to convert their activities to another programme or scheme.
- Just 5% of registered CDM projects have submitted, or are considering submitting, an application to a credit purchase facility, while 55% of registered CDM projects are unaware of credit purchase facility opportunities.

Question 11: Did the project ever sign an Emission Reduction Purchase Agreement (ERPA) with a CER buyer?

and Question 12: To which group would you allocate the buyer?

This question identifies whether the project signed an ERPA with a CER buyer at any point, regardless of whether the ERPA and its conditions were upheld. Question 12 was available to respondents who indicated in question 11 that an ERPA had been signed, and the question assesses whether the buyer was private, public, or a combination of both.

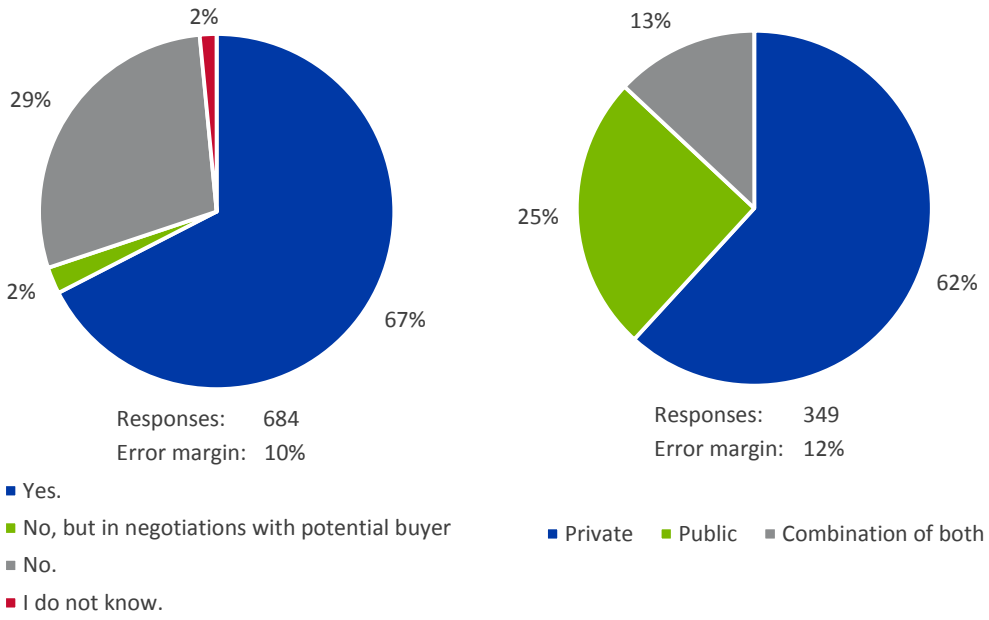


Figure 16: ERPA signed with a CER buyer

- Figure 16 shows that approximately one third of registered CDM projects did not sign an emissions reduction purchase agreement with a CER buyer at any stage.
- In this respect, the variation between countries and project types is very large, as demonstrated by Table 26. This table indicates that projects in China had very good access to agreements with CER buyers, with 89% of responding projects signing an ERPA at some stage (regardless of whether or not the ERPA and its conditions were upheld). In contrast, in several countries, including India and Brazil, less than half of projects signed an ERPA.
- The very high rate of ERPA signing in China may be due in part to the high rate of early CDM activities, a high level of effort for finding buyers and a larger attention by buyers during times when the CDM was still flourishing. However, the focus seemed to be more on sourcing cheap emission allowances rather than on sustainable development benefits. Information obtained during interviews with project participants has highlighted that there is a significant rate of unlawful termination of ERPAs by CER buyers in China as a result of the market price.

Many project owners have no direct contact with the CER buyers due to language and/or locational barriers, and legal action is considered too time consuming and expensive.

Table 26: Proportion of projects with ERPAs signed

Project type	Proportion of projects with ERPA signed	Host country	Proportion of projects with ERPA signed
CMM	100%	China	89%
Hydro	82%	Vietnam	83%
EE own generation	81%	Thailand	73%
Methane avoidance	74%	South Africa	65%
Wind	68%	Malaysia	61%
N_2O	64%	Sub-Saharan Africa	59%
Landfill gas	59%	Mexico	58%
Biomass energy	57%	Central America	48%
EE households	47%	Indonesia	45%
Fossil fuel switch	47%	Brazil	43%
EE industry	38%	Chile	32%
Solar	23%	Israel	32%
Project types HFC and Cement are excluded from this table since results are potentially not representative due to low number of responses to this question.		India	31%
		Peru	28%
		Colombia	28%
		South Korea	18%

- A notable outlier is India, which has a very low proportion of signed ERPAs and yet a high rate of projects in full implementation. It is unlikely that Indian projects were much worse off than projects in other countries regarding capacity to establish contact with potential buyers. Indeed, for question 25 (see section 4.5 for further details), the number of respondents indicating that direct marketing support would be of assistance was equal to the global average, and a very large proportion of Indian projects (51%, compared to China's 33%) reported that no immediate support was required for the continuation of project activities. It is understood from the conducted interviews that a large proportion of Indian projects were started as unilateral activities, without initially having an investing country or buyer on hand, and several interview participants reported that efforts to sign an ERPA, or indeed to find CER buyers, were not undertaken because the projects were able to generate enough alternative revenues – from electricity generation for example. This trend does not appear to hold for the entire Indian project sample however, as the proportion of Indian projects that reported no alternative source of income was higher (30%) than the average (19%). One explanation might be that Indian projects are more connected to credit purchase facilities: 12% of Indian projects have submitted applications to purchase facilities, compared to a global average of 5% and a value of just 2% in China where the proportion of ERPA signing was highest.

- Approximately half of sampled projects with ERPAs achieved credit issuance. Interestingly, approximately one-fifth of sampled projects without ERPAs also achieved credit issuance. In this case, it may be assumed that projects proceeded to request issuance without a buyer, with the intention to sell CERs on the spot market ex-post.

Table 27: ERPAs including public CER buyers, by country

Host country	Proportion of ERPAs that include public CER buyers alone or in combination with private sector
India	75%
Israel	73%
Thailand	72%
Malaysia	67%
Sub-Saharan Africa	63%
Peru	56%
Colombia	50%
Indonesia	48%
Brazil	44%
Chile	41%
Vietnam	36%
South Africa	22%
China	22%
Central America	19%
Mexico	17%
South Korea	4%

- Figure 16 also shows that the majority of CER buyers were private entities.
- Table 27 indicates that the availability of public CER buyers varies considerably across countries. Projects from India, Israel, Thailand and Malaysia are notable for having a high proportion of public CER buyers (over one half), whilst China, South Africa, Central America and Mexico report a high proportion of private buyers (over three quarters).
- Projects with a registration date in 2012 are less likely to have signed an ERPA (58%) than projects registered before this date (76%). This gap is only partly explained by the marginally larger volume of 2012-registered projects that are still negotiating potential ERPAs.
- Projects with signed ERPAs have a much higher occurrence of having achieved credit issuance to date. 85% of projects with credit issuance to date had initially signed ERPAs, compared to just 58% of projects without credit issuance. Indeed, the existence of a signed ERPA proved an instrumental incentive for the implementation of the CDM monitoring system: amongst the

projects sampled, only 52% of projects without ERPAs ever proceeded to implement the CDM monitoring system, compared to 80% of projects with ERPAs. Of the remaining 20% of sample projects with ERPAs who have not implemented the monitoring system, the majority of these are 2012 registered projects that are either still in the phase of planning or just starting implementation, and it is therefore likely that the majority of these projects will also implement their monitoring systems.

Question 13: What is the current status of the initially agreed ERPA?

This question was available to respondents only who indicated in question 11 that an ERPA had been signed. Multiple choice selections were allowed.

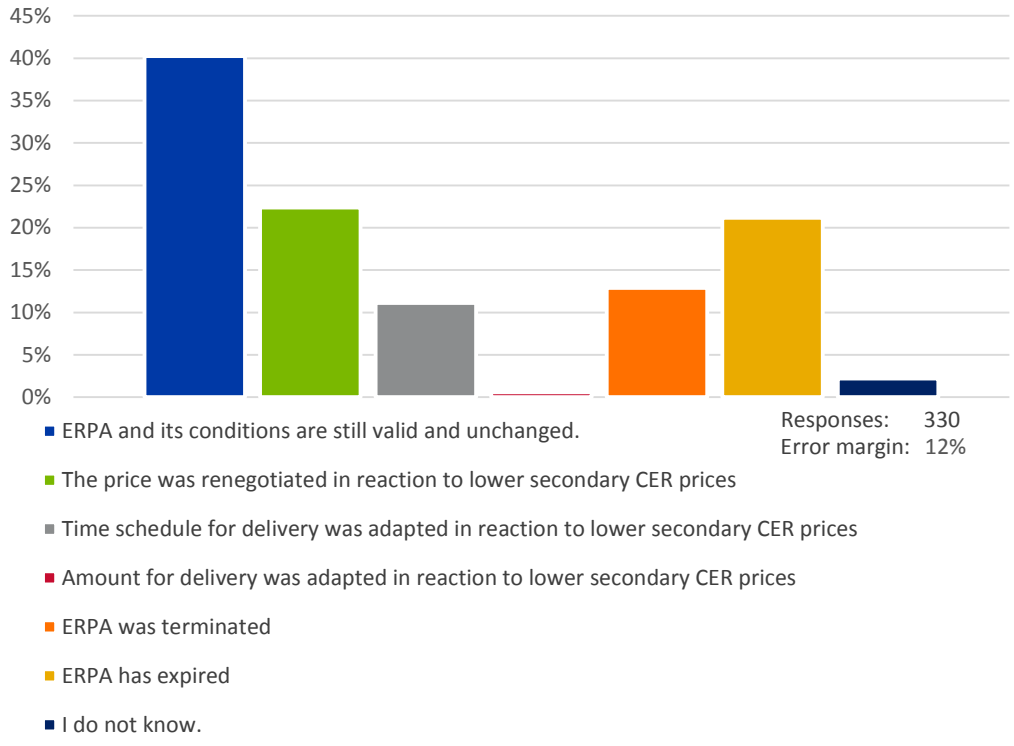


Figure 17: Status of initially agreed ERPA

- For projects where ERPAs were signed, the conditions remain unchanged in 40% of cases. The ERPA was modified or ended due to expiration or termination for over half of projects.
- This trend is typical across most countries, although there are notable exceptions:

- Mexico, Chile and Brazil have an ERPA termination rate of 59%, 42% and 40%, respectively.
- Just 26% of ERPAs remain valid and unchanged in India. This is especially notable when it is considered that India reported one of the lowest rates of signing ERPA agreements initially.
- In Sub-Saharan Africa and South Africa, 83% and 68% of ERPAs remain valid and unchanged respectively.

- Across the sampled projects, the rate of ERPA termination for projects with registrations in 2012 is less than half the rate for projects registered before this date. This highlights a high probability that CER buyers are more under pressure to terminate ERPAs when the initial price is significantly more favourable for sellers than the current market price.

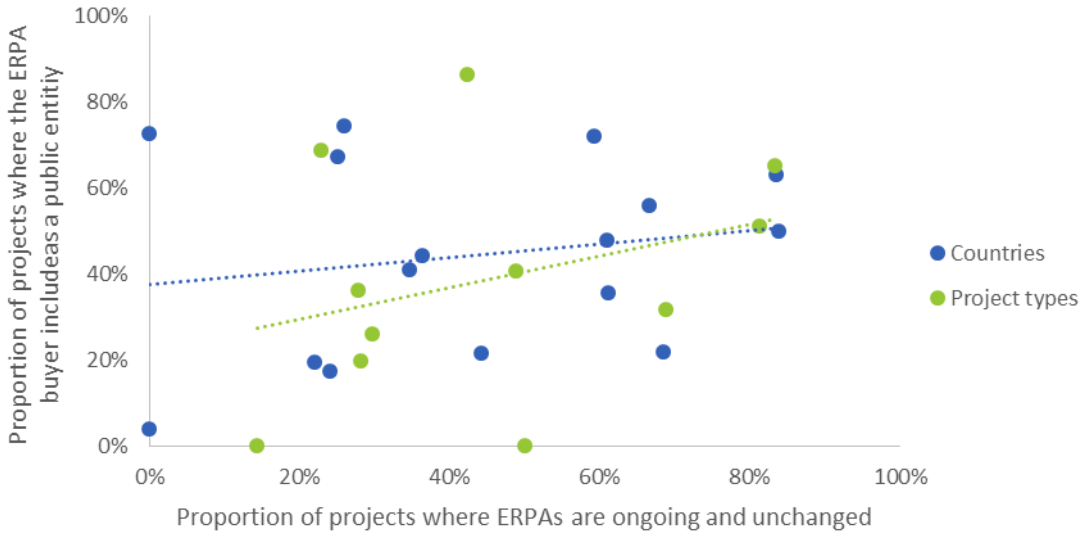


Figure 18: Weak correlation between the type of CER buyer and ongoing validity of ERPA

Figure 18 maps each country and project type grouping onto a scatter chart to explore the relationship between the CER buyer type and the proportion of ERPAs that remain valid and unchanged. While it might be expected that ERPAs with public buyers are more likely to remain unchanged, Figure 18 shows no significant correlation around such a trend.

Question 14: What is the current CER marketing approach?

This question identifies the current status of the project regarding their approach to the sale of CERs. The question was asked to all respondents and not only those that indicated previously that an ERPA had been signed at some point.

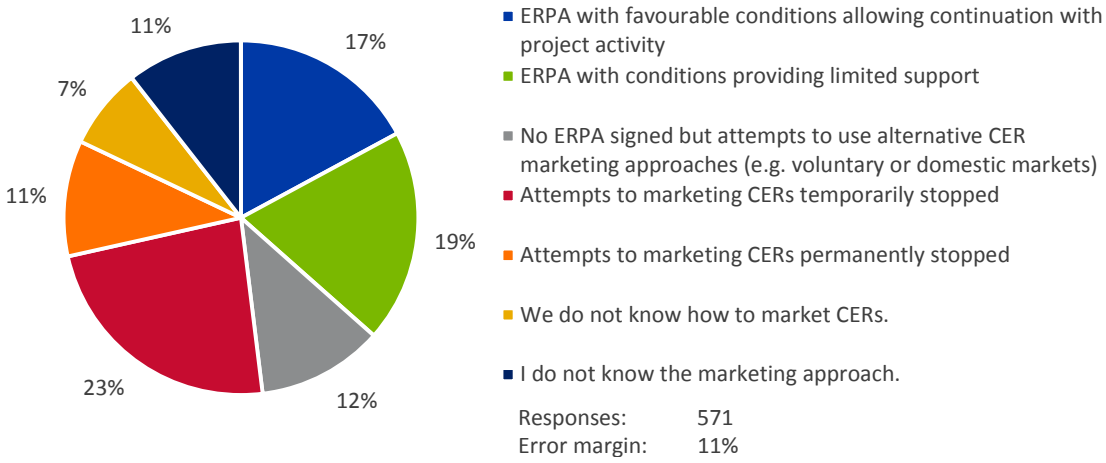


Figure 19: Current CER marketing approach

- From the global perspective, Figure 19 shows that less than half of projects are currently marketing CERs, or have already successfully done so, whilst a high proportion (at least 40%) have either stopped marketing efforts or do not have the procedural knowledge to start them.
- The Central America and Sub Saharan Africa groupings report a more positive marketing outlook, with 59% and 67% of projects reporting successful marketing efforts either through ERPAs or alternative marketing approaches. For Sub Saharan Africa, this may be explained by the above average engagement of public institutions in Africa and LDCs in particular: public sector buyers are involved in 63% of ERPAS in this region – 25% above average – although the vast majority of these ERPAs are public/private combinations. The same explanation does not extend to Central America, where the level of public engagement in ERPAs is more limited. Despite the generally positive marketing outlook in these country groupings, the proportion of projects that do not know how to market CERs, or who are uncertain about the marketing approach, is also comparatively high.
- Vietnam demonstrates the most positive marketing outlook, with 57% of projects operating on ERPAs with favourable conditions and the lowest rate of projects that have ceased marketing efforts either temporarily or permanently.

Question 15: Do plans exist to convert the CDM project activity into another project scheme?

and Question 16: What is the status of these plans?

Figure 20 presents respondents' indication of whether or not plans existed to convert the CDM project into another alternative project scheme or support mechanism, and what type of scheme or mechanism was under consideration. For projects that do consider conversion, Figure 21 presents the status of these plans at the time of data collection.

Figure 20: Plans to convert the CDM project into another scheme

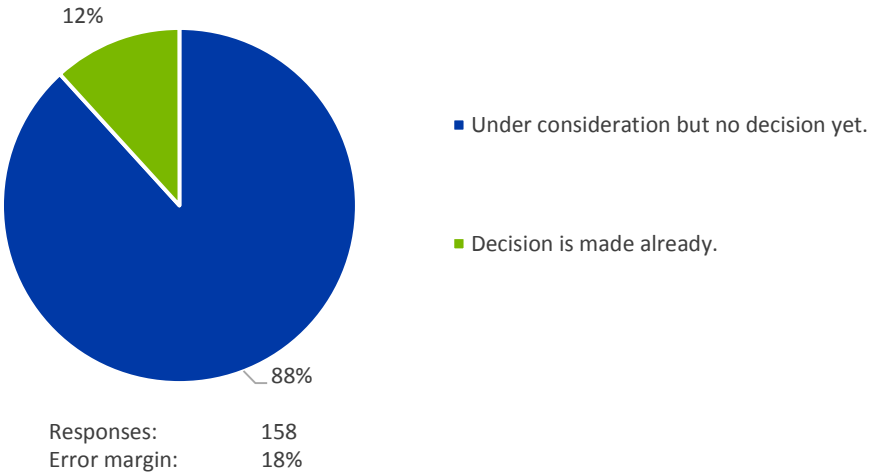


Figure 21: Status of plans to convert the project scheme

Table 28: Plans to convert the project into another programme, by country

Host country	Background context / country information	Survey data				
	Domestic schemes available or expected (World Bank 2014*)	Percentage of projects planning to convert to another scheme				
		Total	Voluntary market	Domestic scheme	International scheme	Other
Mexico	Partial carbon tax for fossil fuel sales with complementary scheme for offsetting; ETS for the energy sector in planning.	74%	20%	3%	3%	48%
South Korea	South Korea Emissions Trading Scheme	53%	0%	12%	41%	0%
China	Subnational ETSs; national ETS in design phase; China's Certified Emission Reduction (CCER) programme market.	37%	0%	28%	5%	4%
South Africa	Proposed (2016) South Africa carbon tax, with complementary scheme for partial offsetting.	23%	8%	8%	0%	8%
SSA		22%	18%	0%	4%	0%
India	Perform, Achieve, Trade programme (PAT); Carbon pricing schemes considered under the Partnership for Market Readiness (PMR).	22%	6%	0%	9%	7%
Thailand	Thailand Voluntary Emission Reduction (T-VER), Energy Performance Certificate Schemes (EPC), National ETS energy sector in planning.	21%	17%	0%	5%	0%
Colombia	Carbon pricing schemes considered under PMR.	18%	0%	0%	10%	8%
Chile	Santiago Climate Exchange; "Platform for the Generation and Trading of Carbon Credits from the Forestry Sector in Chile"; Proposed carbon tax; proposed ETS for the energy sector.	14%	10%	0%	3%	2%
Brazil	Subnational ETS in Sao Paulo (operational) and Rio de Janeiro (planning); Carbon tax considered under PMR.	13%	6%	1%	3%	4%
Vietnam	Carbon pricing schemes considered under PMR.	12%	8%	0%	3%	0%
Indonesia	Nusantara Carbon Scheme (NCS); Carbon pricing schemes considered under PMR.	12%	12%	0%	0%	0%
C. America	Costa Rican Voluntary Domestic Carbon Market.	11%	11%	0%	0%	0%
Israel		10%	0%	0%	0%	10%
Peru	Carbon pricing schemes considered under PMR.	8%	0%	0%	6%	2%
Malaysia		5%	3%	0%	0%	3%

Sources: Survey responses, interviewees, and World Bank (2014).

(*) Note: The grey column supports the interpretation of the data by providing background country information. It does not refers to the received responses on the schemes anticipated by respondents.

- 62% of registered CDM projects have no plans to convert the project activity into another project scheme. Such plans do exist for at least 30% of projects.
- Table 28 shows that expectations for domestic schemes are particularly low across most countries. China is a notable exception, where a large number of participants indicated plans for domestic ETS schemes and the Chinese Certified Emission Reduction (CCER) programme market. Except for China and South Korea, expectations for international voluntary markets are higher than those of domestic schemes.
- The zero score for domestic schemes in India provides further evidence that expectations for the PAT programme are low, especially in comparison to the external international perception.
- Major variations across project types were not recorded for this question. Notable results include that 44% of household energy efficiency projects are considering conversion to a voluntary standard, whilst 31% and 43% of solar and own generation energy efficiency projects respectively, consider conversion to a domestic standard.
- Table 29 presents further insight into the status of projects where plans exist to convert to another scheme. Of the projects sampled, those with plans to convert to other schemes were significantly more likely to continue with regular operation of the monitoring equipment. This suggests that alternative schemes could potentially encourage projects to continue to mitigate GHG emissions, and also suggests that these schemes should aim to build upon existing CDM practices and infrastructure, since the data shows that continuing to operate the CDM monitoring equipment is useful for assisting movement into alternative programmes/schemes.
- For projects with plans to convert to other schemes, just 15% of respondents indicated that a final decision had been made. However, the number of applicable projects for this question is too low for significant analysis on the country or project type level.

Table 29: Relationship between plans to convert to another scheme and regular operation of the CDM monitoring equipment

Do plans to convert to another programme exist?	Proportion of sample projects with regular operation of the monitoring equipment (question 9)
Yes	63%
No	48%

Question 17: Does the project take into consideration to marketing CERs to a CER purchase facility or governmental fund that purchases credits above market prices (e.g. The World Bank Carbon Initiative for Development (Ci-Dev), NEFCO Norwegian Carbon Procurement Facility (NorCaP), Swedish CER purchase facility, etc.)?

This question assess projects' awareness of, and engagement with, CER purchase facilities and similar public funds. It does not assess the eligibility of projects from specific countries or project types for such programmes. Respondents were asked to indicate if they were aware of the facilities, and also if they intend to apply for support. For projects where an application was submitted, question 18 (below) assesses the status of the support application.

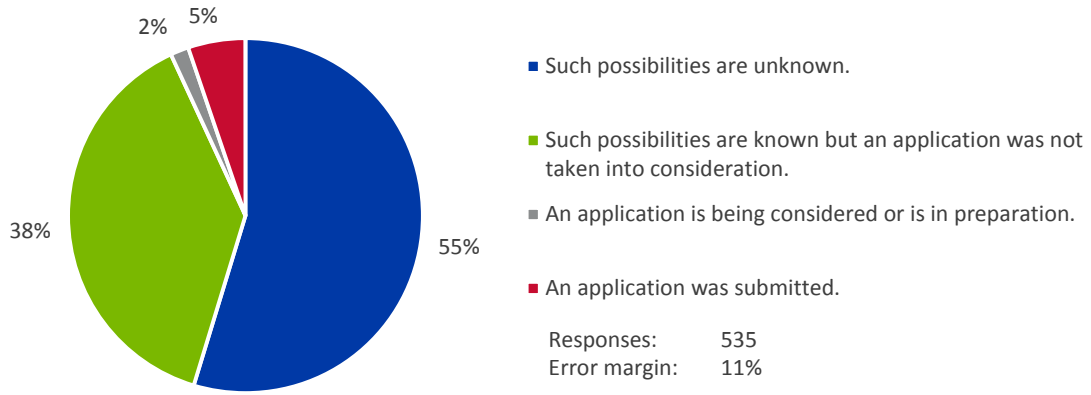


Figure 22: Use of CER purchasing facilities and governmental funds

- Only a limited number of projects are seeking support through CER purchase facilities or funds. 93% of projects were not considering applications, and 55% of registered CDM projects were unaware of the possibilities.
- This highlights a potential area of support for credit marketing: raising awareness of governmental funds and credit purchase facilities. Table 30 shows which countries are most in need of increased purchase facility marketing. Sub-Saharan African projects are the most "aware" by a considerable margin, reflecting the focus placed on Africa and LDCs by the purchase facilities. It is notable, however, that projects in Central America show little awareness of purchase facility opportunities, despite being made up of LDCs and being host to a relatively similar project portfolio. Awareness across the other countries varies considerably, and this might reflect the priorities set by the facilities, as some of the countries that might be considered to have the highest domestic resources or the most established experience in the CDM (e.g. South Korea, Chile, Brazil, Mexico) report low rates of engagement with the purchase facilities.
- The most well-known credit purchase facilities were NEFCO Norwegian Carbon Procurement Facility (NorCaP) and the Swedish CDM programme.

- It should be noted that purchase facilities have a specific focus – for example, on projects from vulnerable countries and project types such as landfill gas projects – and that these initiatives have limited funds. Previous questions have already identified that these project types report low rates of implementation and operation, whilst the data from this question shows that the volume of purchase facility applications from these project types was higher than average. Household energy efficiency projects report by far the greatest awareness of credit purchase facilities (just 19% of projects were unaware, and an estimated 89% of cooking stove projects have submitted applications), whilst rates of awareness were also above average for N_2O, biomass energy and landfill gas projects.

Table 30: Projects unaware of credit purchase facility opportunities, by country and project type

Proportion of projects that are not aware of credit purchase facility opportunities			
Host country		**Project type**	
South Korea	84%	EE industry	92%
Chile	80%	Fossil fuel switch	87%
Central America	66%	CMM	71%
Brazil	63%	Solar	71%
Mexico	62%	Methane avoidance	68%
China	58%	Wind	56%
Malaysia	55%	Hydro	49%
India	51%	EE own generation	47%
Israel	42%	Landfill gas	43%
Thailand	42%	N_2O	42%
Indonesia	39%	Biomass energy	41%
Peru	37%	EE households	19%
Colombia	33%	HFC and cement are omitted from the table due to low response numbers for this question.	
South Africa	30%		
Vietnam	22%		
Sub-Saharan Africa	7%		

Question 18: Was the project accepted for the programme?

This question was asked only to those respondents that indicated in question 17 that an application to a CER purchase facility or governmental fund had been submitted, and thus led to a relatively low number of total responses. Consequently, the error margin of the re-weighted data (Figure 23) is particularly high.

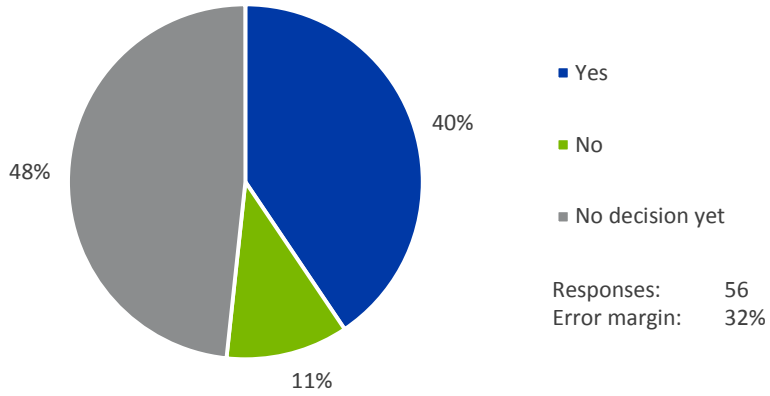


Figure 23: Acceptance of application for CER purchase facilities, reweighted to represent CDM population

- Figure 23 shows that 40% of project applications were accepted and 11% rejected when the data is re-weighted to the global level. The respective percentages from the non-weighted statistics of the sample are considerably lower, at 13% and 15% respectively.
- Although the volume of responses is too low for the statistics to be considered a reliable representation of the overall CDM population, Figure 23 indicates that are large proportion of projects that still await a decision on their applications to the credit purchase facilities. The differences between the weighted and non-weighted results regarding the proportion of yes and no decisions is too wide to draw conclusions on the outcomes of applications where a decision has already been taken.
- The volume of applicable projects is too low for analysis at the level of the country or project type.

4.3 Verification & Issuance

Section highlights:

- Fixed time duration MRV intervals is the most common approach to verification and issuance activities, especially for larger projects.
- The initial verification and issuance approaches were changed in at least 68% of registered CDM projects.
- Low CER prices and high MRV and issuance costs are the major issuance barriers mentioned by registered CDM projects that have not yet requested issuance.
- For 53% of projects, a CER price below €5 is sufficient to continue verification and issuance activities. For 82% of projects, a price below €10 is sufficient.
- 33% of projects report total costs per verification and issuance cycle of less than €10,000. 66% of projects report total costs below €25,000.

Question 19: What was the initial verification & issuance approach?

In this question, respondents were asked whether the initially envisaged approach to verification and issuance was based upon regular or irregular intervals. In the case of fixed intervals, respondents could indicate whether these intervals were determined by fixed time periods, or if the interval corresponded to fixed volumes of generated CERs. Figure 24 presents the results.

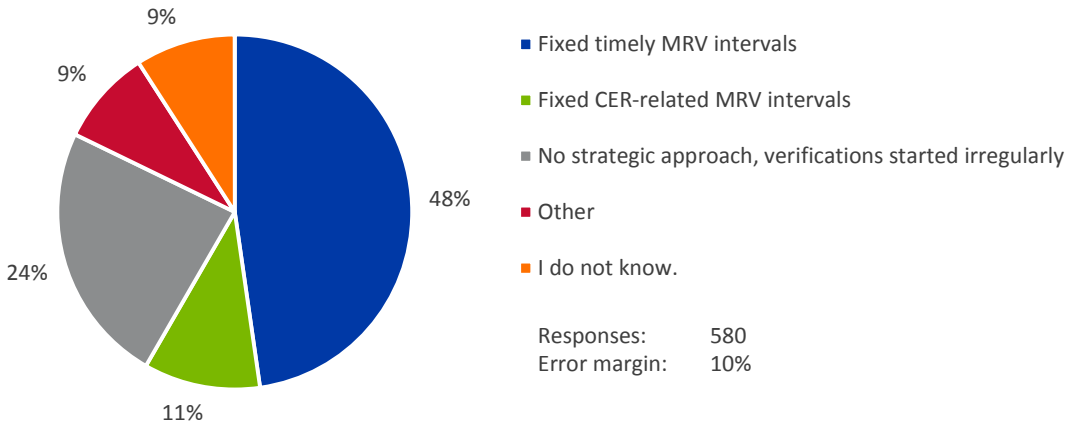
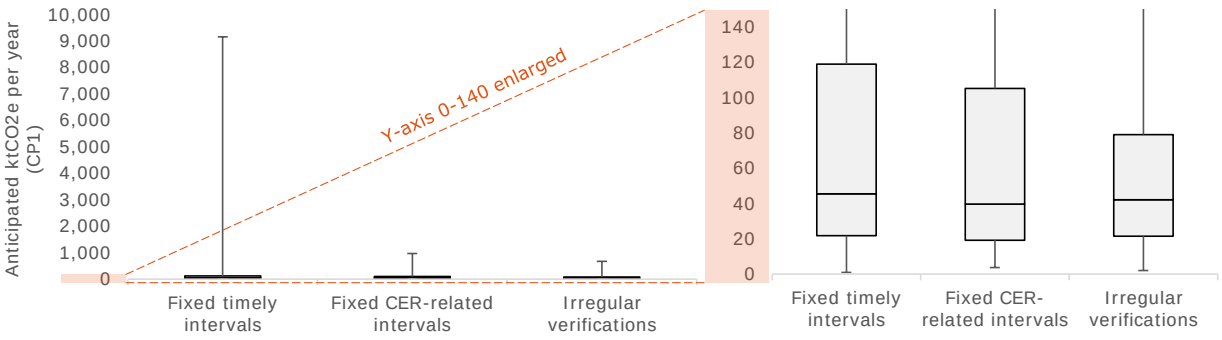


Figure 24: Initial verification & issuance approach

Table 31: Initial verification and issuance approach, by project type

Project type	Proportion of projects adopting the following initial approach		
	Fixed timely MRV intervals	Fixed CER-related MRV intervals	No strategic approach. Irregular verifications
Biomass energy	47%	14%	23%
Cement	100%	0%	0%
CMM	38%	13%	25%
EE households	68%	24%	3%
EE industry	42%	7%	42%
EE own generation	35%	5%	28%
Fossil fuel switch	43%	10%	14%
HFCs	100%	0%	0%
Hydro	59%	6%	16%
Landfill gas	46%	20%	27%
Methane avoidance	42%	14%	24%
N_2O	76%	10%	0%
Solar	16%	14%	15%
Wind	47%	10%	30%



This figure shows the initial approach for verification and issuance according to the size of the CDM project, in terms of the anticipated emission reduction. The scale on the left of the figure includes all the data points, including projects that anticipate up to nearly 10,000 ktCO2e emission reductions per year. The scale on the right zooms in to the portion of the y axis between 0 and 140, which contains the vast majority of the projects.

Figure 25: Comparison of CER production and verification and issuance approach, amongst sampled projects

- Figure 24 shows that, globally, a mixed approach to initial verification and issuance was adopted by projects. Three countries show a notably high share of time related MRV and verification approaches (South Korea – 83%, Colombia – 82%, Mexico – 67%).
- A trend based on the average size of projects in terms of the anticipated production of CERs, and thus a trend based on project types, is more likely than regional trends. Table 31 shows that HFC, cement and N_2O projects report very high proportions of fixed time duration reporting and verification intervals. This is a logical result, since these project types produce high volumes of CERs and are therefore in the best position to conduct regular (e.g. monthly or quarterly) reporting and verification cycles. They might also have chosen shorter intervals as part of their risk mitigation strategy. Projects with a smaller volume of CERs on the other hand may be more likely to base their processes on CER-related intervals in order to minimise the marginal transaction costs per CER. Indeed, the box plots of Figure 25 demonstrate this trend between the size of CER output and the choice of verification and issuance strategy, with the upper whiskers on the left had side of the box plot showing that the largest projects all selected fixed, time-based MRV intervals.

Question 20: Was the initial verification & issuance approach changed due to the recent drop in CER prices?

Continuing from question 19, which assessed the initially planned approach to verification and issuance intervals, in question 20, respondents indicated whether these initial plans had been changed. Figure 26 presents the results.

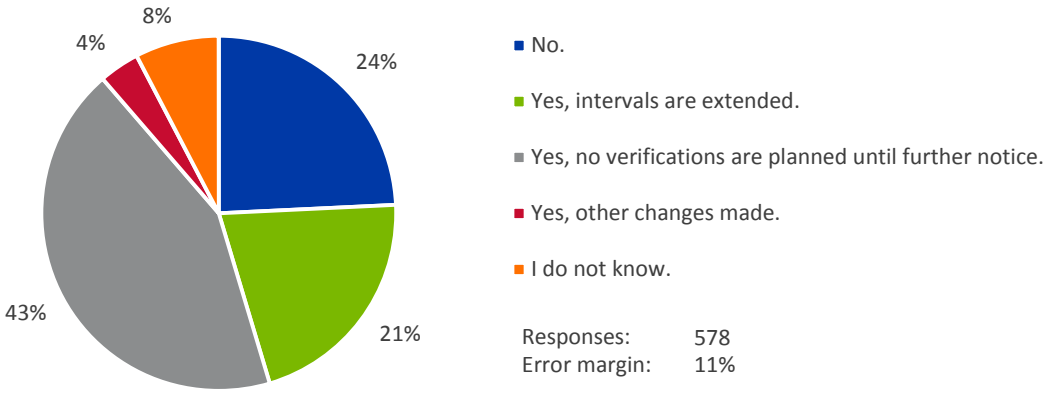


Figure 26: Changes made in verification & issuance approach due to drop in CER prices

- Figure 26 shows that changes were made to the initial verification and issuance approach in 68% of registered CDM projects, due to the drop in CER prices.

- Cross referencing the data for this question and question 19 (verification and issuance approach) shows a moderate relationship, such that projects where the verification and issuance approach has not changed are more likely to have unchanged conditions for the original ERPA agreement. This provides some evidence that buyers may have been fast to terminate ERPAs when strict verification and issuance schedules were affected by delays.
- No significant variation in the data is observed between projects that have achieved credit issuance and those that have not.
- This trend is fairly consistent across countries and project types.

Question 21: What are the reason(s) for the project not to request initial issuance yet?

This question allowed respondents to identify multiple reasons for having not requested initial issuance. Respondents who indicated that initial issuance had been requested were filtered out of the analysis for this question.

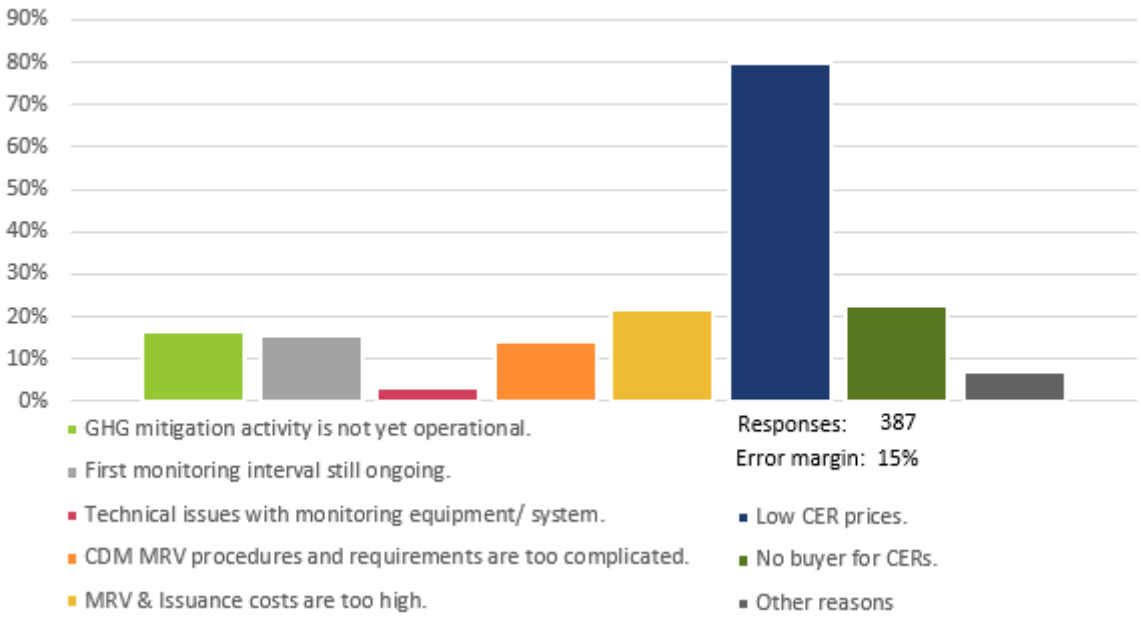


Figure 27: Reasons for not requesting initial issuance yet

- It can be observed from Figure 27 that the main reason across countries for not yet requesting issuance is low CER prices, followed by the high costs of MRV and issuance, the lack of buyers and the less advanced stage of some projects (in terms of not yet reaching operational status or finishing the first monitoring interval).
- It is notable that many respondents and interviewees highlighted that MRV costs are not especially high because of the monitoring processes themselves, but rather because of lack of domestic expertise and the high cost of hiring foreign experts to conduct the reporting and verification processes.
- Projects that submitted monitoring reports but did not achieve credit issuance were more than three times as likely as other projects to identify the barrier that CDM MRV procedures and requirements are too complicated. This finding fits with the commonly reported experience that complications at the issuance stage come as a surprise to many first-time CDM participants (cf. findings from question 10).
- Across project types, there is no major deviation from the average reported values for the reasons not to request initial issuance, with the following notable exceptions:
    - Whilst almost all project types report low CER prices and the poor availability of buyers as the major hindrance, this barrier is particularly pertinent for solar, industrial energy efficiency and own generation energy efficiency projects.
    - Biomass projects report above average difficulties with the CDM's procedures and costs for MRV and issuance.

Table 32: Reasons for not requesting initial issuance yet, by vintage and registration type, according to projects sampled

Project Type	Project vintage		Registration type	
	2004-2011	2012	CDM	PoA
GHG mitigation activity is not yet operational	7%	24%	14%	26%
First monitoring interval still ongoing	7%	22%	13%	24%
Technical issues with monitoring equipment/ system	7%	3%	5%	2%
CDM MRV procedures and requirements are too complicated	6%	5%	5%	12%
MRV & Issuance costs are too high	18%	24%	20%	29%
Low CER prices	33%	55%	43%	45%
No buyer for CERs	12%	19%	15%	17%

Percentages indicate the proportion of respondents from sampled projects who selected each answer. Multiple answers were allowed for this question.

- Much of the data presented in Table 32 is logical: younger projects are less likely to be operational or to have completed the first monitoring interval than older projects, for example. The same trend is clear for PoAs, which generally started later and also require more time for implementation. Similarly, older projects report a higher incidence of technical issues with the monitoring equipment, with many newer projects having not yet reached a stage where this problem would become evident, and the same trend holds true for registration type, for the same age-related reason.
- Despite not yet being at a mature enough stage to identify technical monitoring issues, PoAs showed a much higher tendency to identify procedural complications and MRV costs as barriers than normal CDM projects. This reflects the impression confirmed by interviewee respondents that the implementation of PoAs entails a considerably increased procedural burden. This is a pertinent result considering that the modality was designed partly as a means of streamlining CDM processes for similar projects. For a positive outcome in this regard, PoAs need to reach a critical mass of CPAs. However, most PoAs have not yet registered more than one or two CPAs.
- Table 32 also shows that older projects report less of a hindrance from low CER prices and availability of buyers. Indeed, it is possible that the market conditions were better at the points of initial issuance for many older projects.

Question 22: What CER price level is required by the project to continue verification & issuance activities?

In this question, respondents were asked what CER price level is required for the current continuation of verification and issuance activities, given the current circumstances. In interpreting the results of this question, it should be considered that the respondent could potentially have understood the question in two different ways. In one interpretation, the respondent might indicate simply the cost of the actual mitigation activity. In another interpretation, the respondent may have indicated only the price level required for a continuation of verification and issuance activities given the project's current circumstances, irrespectively of the initial sunk investment. The objective of the question was to find the latter, and this interpretation is more likely given the formulation of the question. Further evidence for this interpretation is the relatively high positioning of solar and wind projects in Table 33, which are typically expensive upfront investments yet relatively inexpensive to monitor and to run verification and issuance on. Figure 28 present the results for all registered CDM projects.

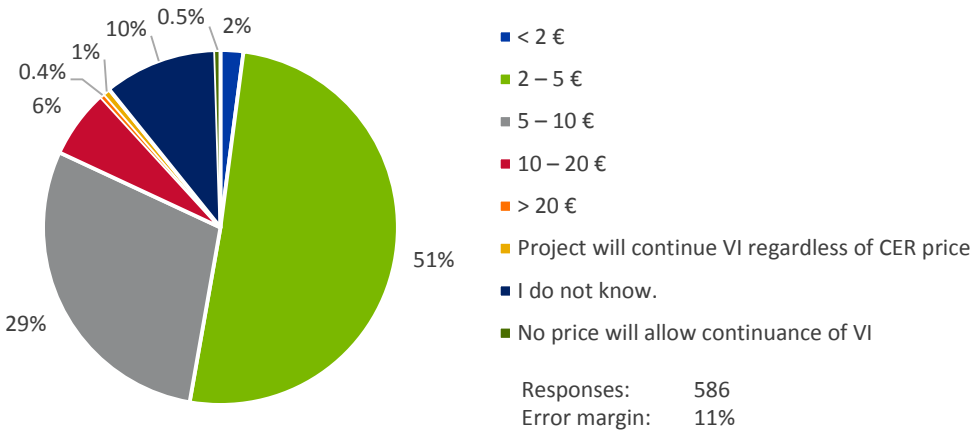


Figure 28: CER prices required to continue verification and issuance activities

- Figure 28 shows that CER prices below €10 would be sufficient for 82% of registered CDM projects, while a price of less than €5 would be sufficient for 53% of projects.
- Table 33 indicates that N_2O, solar, energy efficiency industry, HFC and wind projects should have a fair incentive to continue verification and issuance even with modest CER prices. In contrast, CMM and fossil fuel switch projects are the least likely to continue verification and issuance with CER prices lower than €5.
- Table 33 might also demonstrate a regional trend, as Asian countries appear somewhat more likely to continue with low CER prices than African and Latin American countries.
- The proportion of PoAs willing to continue with a credit price of less than €10 or €5 is somewhat lower than for normal CDM projects, despite the PoA modality being designed to

reduce transaction costs. However, this is partly due to the types of projects most applicable to PoA activities, which often entail higher costs for reporting and verification than some of the large scale, traditional CDM projects.

Table 33: Ability to continue on low CER prices, by project type and country

Project Type	< €5	< €10	< €20	*Country*	< €5	< €10	< €20
N_2O	77%	83%	83%	Vietnam	81%	83%	92%
Wind	74%	95%	96%	China	61%	88%	90%
HFCs	69%	100%	100%	Israel	55%	74%	82%
EE industry	61%	80%	96%	South Africa	50%	81%	84%
Solar	57%	69%	77%	India	48%	77%	87%
Hydro	46%	79%	85%	Malaysia	42%	73%	83%
EE own generation	39%	68%	76%	Thailand	40%	69%	88%
EE households	34%	87%	95%	Chile	39%	59%	80%
Landfill gas	34%	73%	82%	Peru	38%	84%	100%
Methane avoidance	30%	70%	83%	Indonesia	34%	69%	93%
Cement	24%	52%	100%	Central America	29%	55%	71%
Biomass energy	23%	66%	83%	Colombia	26%	67%	88%
CMM	14%	43%	57%	Mexico	22%	97%	98%
Fossil fuel switch	9%	74%	75%	Brazil	21%	48%	69%
				South Korea	19%	66%	82%
				Sub-Saharan Africa	8%	62%	89%

- The project scale is a key factor in the cost of verification and issuance: 72% of large scale projects report a required CER price of under €5, compared with 50% of small scale projects.
- Table 34 indicates a difference in perceptions on required CER price levels; project owners were more likely to report that CER prices below €5 were sufficient, than consultants or CER buyers. Furthermore, projects that had achieved credit issuance reported lower price level requirements than projects that had not. This may be an indication that projects which have not reached issuance overestimate the cost of doing so, or it may be a reflection that the most expensive projects do not reach the issuance phase.

Table 34: Comparison of required CER prices, according to implementation and credit issuance status

	Percentage of the sampled projects indicating the CER price level to be is sufficient					
CER price level	Response provided by project owner	Response provided by developer / consultant	Response provided by CER buyer	Projects without monitoring report submission	Projects with a monitoring report submission, but without credit issuance	Projects with a monitoring report submission and credit issuance
< €5	33%	21%	23%	24%	32%	32%
< €10	60%	61%	59%	54%	57%	68%
< €20	81%	80%	77%	76%	80%	83%

Issuance statistics according to UNEP Risø Pipeline September 2013
The monitoring report is taken as a parameter since this is the first and only sign that projects have considered undergoing reporting and verification processes. It is also assumed that these projects have gained initial experiences and have more knowledge than others.

Question 23: What is your best estimate on the total costs per verification & issuance cycle until successful CER issuance is achieved (e.g. costs for verifier, internal labour costs)?

This question assesses ongoing project costs for verification and issuance cycles. It does not include initial investments for project design and implementation.

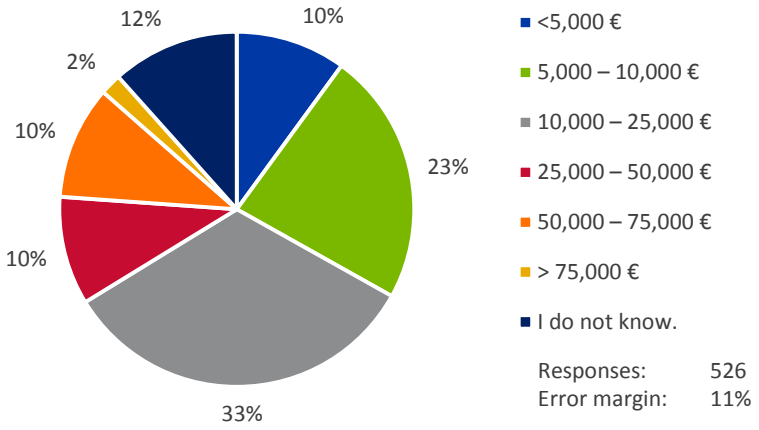


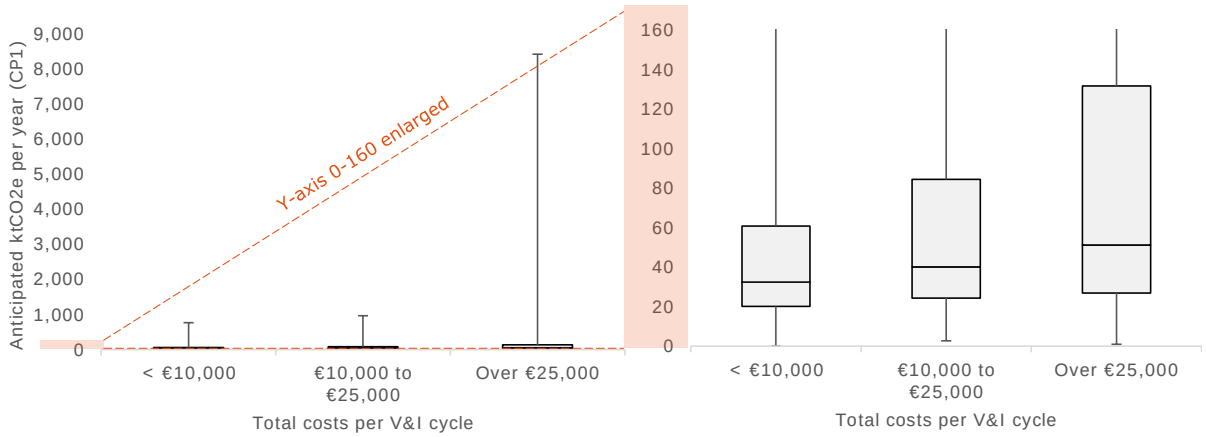
Figure 29: Total costs estimated for achieving successful CER issuance

Table 35: Estimated total costs (EUR thousands) per V&I cycle, by project type and country

Project Type	<10	<25	<50	<75	*Country*	<10	<25	<50	<75
EE industry	55%	95%	97%	97%	India	56%	96%	98%	98%
Biomass energy	45%	69%	86%	92%	Vietnam	43%	94%	94%	94%
Hydro	41%	80%	83%	83%	Indonesia	31%	58%	66%	84%
Solar	38%	55%	67%	69%	China	30%	59%	67%	83%
Wind	34%	62%	71%	93%	Central America	28%	48%	73%	79%
Landfill gas	30%	45%	66%	76%	South Africa	19%	41%	74%	90%
EE own generation	22%	75%	83%	83%	Thailand	18%	47%	79%	85%
Methane avoidance	13%	59%	76%	80%	Sub-Saharan Africa	15%	41%	51%	81%
Fossil fuel switch	12%	61%	61%	61%	Brazil	14%	37%	66%	69%
EE households	9%	67%	89%	93%	Israel	14%	58%	79%	79%
N_2O	8%	61%	81%	81%	Malaysia	13%	44%	80%	80%
					South Korea	12%	75%	75%	75%
					Colombia	10%	35%	54%	60%
					Chile	8%	30%	51%	66%
					Mexico	3%	66%	95%	98%
					Peru	0%	49%	87%	90%

Table excludes the project groups cement, CMM and HFCs, for which data is deemed insignificant due to low response numbers.

- Significant regional variation exists, as demonstrated in Table 35. This table shows that estimated costs are typically lower in the larger Asian countries, including China and India, than they are in Latin America and Africa. The difference in some cases is considerable: 96% of Indian projects estimate costs to be under €25,000, whilst the proportion of projects with the same cost range is less than half this in every Latin American country studied. This may be linked to local labour costs, as well as to the availability of local DOEs, which are more prominent in Asia than they are in Africa and Latin America.
- Total costs also vary considerably between project types. Estimated costs were below €10,000 for 55% of industrial energy efficiency projects and below €25,000 for 95% of these projects, whilst less than half of landfill gas projects have costs below €50,000. Above average costs for landfill gas projects might be explained by the complexities of monitoring in this project type. Figure 30 furthermore demonstrates through boxplots the difference in total costs according to the size of the project, in terms of anticipated CER production. The typical size of projects with total costs per cycle above €25,000 was significantly larger than for projects with lower costs, and all projects anticipating emission reductions of 1 $MtCO_2e$ per year or more fell into the bracket of total costs over €25,000. This information helps to explain some of the outliers in Table 35 – such as the high costs of N_2O projects, which despite not being incredibly complicated to monitor are very large in terms of CER output. Larger costs might also reflect larger investments for mitigating verification and issuance risks, which are more likely to be relevant for project with large CER volumes.



This figure shows the category of the costs per V&I cycle according to the size of the CDM project, in terms of the anticipated emission reduction. The scale on the left of the figure includes all the data points. The scale on the right zooms in to the portion of the y axis between 0 and 160, which contains the vast majority of the projects, to provide a clearer picture of the trend.

Figure 30: Comparison of CER production of projects sampled, according to V&I cycle costs

- Similar to Table 34 in the previous question, Table 36 shows that projects that have achieved credit issuance to date tend to report slightly lower costs than projects that have not. This may be an indication that projects which have not reached issuance overestimate the cost of doing so, or it may be a reflection that the most expensive projects do not reach the issuance phase.
- Table 36 shows a slight difference in the perception of the costs according to the type of respondent, as the project owners tend to report slightly higher total costs than the estimations of consultants and CER buyers. However, the difference is not large enough for its significance to be clear.

Table 36: Comparison of total estimated costs, according to information source and credit issuance status

	Percentage of the sampled projects indicating total costs					
Total costs	Response provided by project owner	Response provided by developer / consultant	Response provided by CER buyer	Projects without monitoring report submission	Projects with a monitoring report submission, but without credit issuance	Projects with a monitoring report submission and credit issuance
Below €10,000	26%	19%	19%	21%	23%	26%
Below €25,000	53%	59%	55%	51%	48%	61%
Below €50,000	74%	78%	72%	73%	72%	72%
Below €75,000	81%	84%	82%	81%	82%	92%

4.4 Barriers and costs

Section highlights:

- Low CER prices and high costs of CDM procedures are the major barriers that hinder project implementation and/or operation.
- The most commonly reported types of immediate support required are support for direct marketing of CERs and for identifying international support.
- 69% of projects receive financial contributions from additional revenue or cost savings associated with the mitigation activity.
- 26% of registered CDM projects have received a positive return on the initial project investment. A further 19% of registered CDM projects still expect to receive a positive return on their investment.
- Just 22% of registered CDM projects indicate that they would register a similar project with the CDM again. Of those that would not, the major barriers are the low net benefits of the CDM and the complicated nature of CDM procedures.

Question 24: Which barriers still exist that hinder the project implementation or operation?

All respondents were asked to identify which barriers still hindered the continuation of project implementation or operation. Multiple selections were allowed.

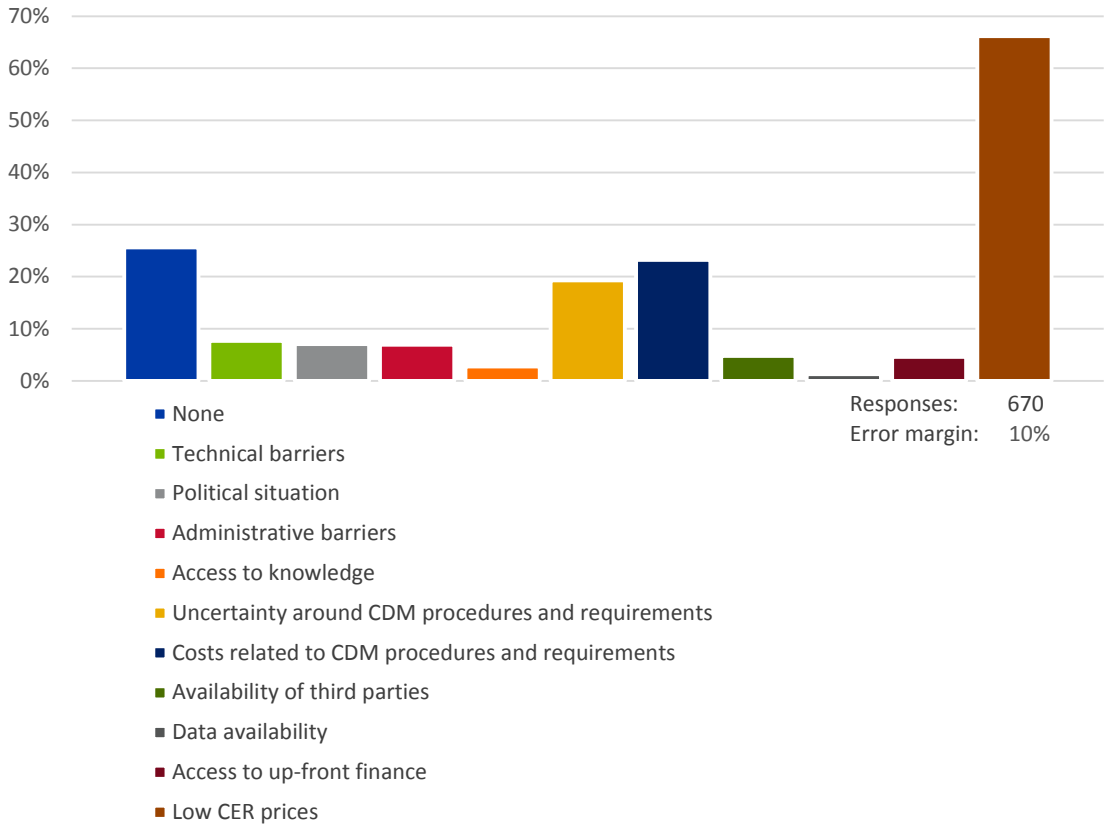


Figure 31: Barriers for CDM implementation and operation

- As anticipated, the data demonstrates that the major barrier faced by registered CDM projects is the low price of CERs, whilst difficulties associated with the costs and uncertainty of CDM procedures are also very significant barriers.
- This trend is fairly consistent across all countries. Israel is a notable exception, where around half of projects continue to experience no barriers and the cost of CDM procedures was given more importance than the low CER prices.
- The trend is also fairly consistent across project types. Household energy efficiency projects stand out slightly for frequently reporting hindrance by lack of upfront financing.

Question 25: What type of immediate support is required for project continuation in addition to financial support?

All respondents were asked to indicate what types of immediate support would be required for the continuation of the CDM component of the mitigation activity leading to insights for further barriers. Multiple selections were allowed.

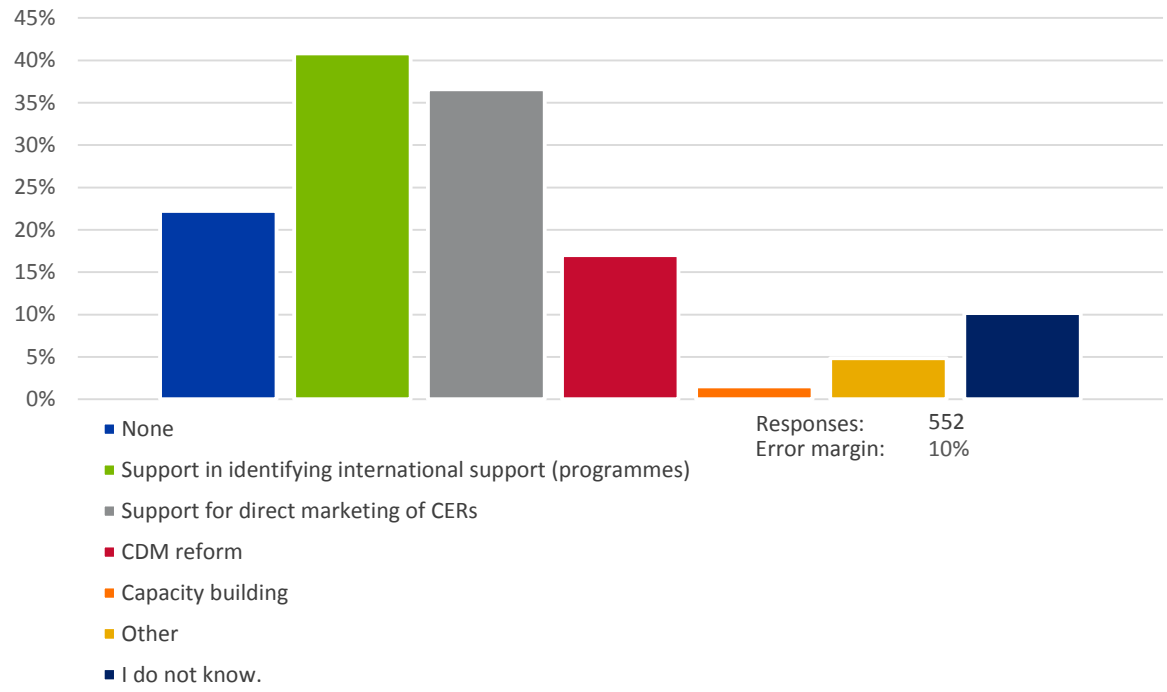


Figure 32: Immediate support required for project continuation

- The graphic shows that the large majority of respondents indicated a need for support in the direct marketing of CERs and the identification of international programmes where credit purchase agreements might also be established. From Figure 32, it can be identified that this is primarily a knowledge gap, rather than a general capacity gap.
- The requirement for capacity building support appears to be directly and closely related to the amount of CDM activity in the host country; large CDM countries including China, India and Brazil show little need for capacity building, whilst this is more important for the Sub Saharan Africa and Central America groups.
- The response trend is fairly consistent across different project types. Between countries, there is more deviation, as indicated by Table 37. The need for support with marketing of CERs is particularly variable between countries: 6% of South African projects identify this support requirement, compared with 92% of projects from South Korea. There is evidence of

some correlation between this result and question 17, which surveys engagement with credit purchase facilities. Both South Korea and Central America report low awareness of purchase facilities and high need for support for direct marketing of CERs, whilst the opposite trend holds for South Africa and Israel.

Table 37: Support required for project continuation, by country

Percentage of projects indicating immediate support requirements			
Identification of international support		**Support for direct marketing of CERs**	
Mexico	63%	South Korea	92%
Central America	53%	Colombia	60%
Thailand	52%	Central America	54%
Malaysia	50%	India	51%
China	48%	Malaysia	49%
Vietnam	44%	Peru	47%
Colombia	38%	Sub-Saharan Africa	47%
Brazil	32%	Chile	46%
Chile	30%	Indonesia	39%
Israel	29%	China	33%
India	24%	Thailand	32%
Indonesia	23%	Mexico	17%
Peru	22%	Brazil	16%
Sub-Saharan Africa	21%	Israel	16%
South Korea	20%	Vietnam	14%
South Africa	16%	South Africa	6%

Question 26: To what extent does the project activity benefit from further revenues or cost savings additional to the sale of CERs (e.g. revenues from sales of electricity or heat, savings from reduced fuel or fertiliser use)?

The objective of this question is to assess the contribution of alternative revenues and cost savings towards covering the basic ongoing operational costs that ensure the continuous operation of the GHG mitigation activity. The question does not assess the ability of alternative revenues and cost savings to generate a positive return on the initial project investment.

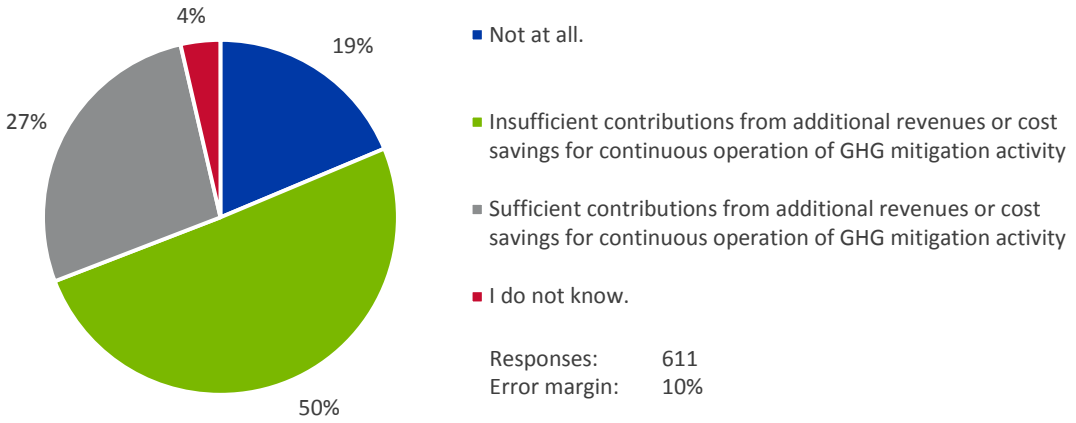


Figure 33: Extent to which projects benefit from further revenues or cost savings

Table 38: Benefits from further revenues or cost savings, by project type

Project Type	*Proportion of projects benefiting from further revenues or cost savings*		
	None	*Insufficient*	*Sufficient*
EE industry	4%	45%	51%
Solar	9%	42%	38%
Hydro	10%	63%	24%
EE own generation	10%	41%	32%
CMM	13%	75%	0%
Fossil fuel switch	14%	73%	11%
Wind	21%	52%	27%
Biomass energy	22%	54%	21%
Methane avoidance	25%	29%	41%
Landfill gas	30%	47%	10%
EE households	53%	6%	40%
N_2O	85%	6%	4%

Project types HFC and cement are excluded due to low response rate for the question.

- A fair majority of projects indicate contributions of some sort from further revenues or cost savings, although only 27% of projects receive additional benefits that are considered sufficient for the continuous operation of the GHG mitigation activity.
- Data is very variable by project type, as indicated in Table 38. Naturally, energy generating projects (e.g. biomass energy, wind, solar) and energy efficiency projects in industry and own generation are among those most likely to receive contributions from further revenues or cost savings. However, 53% of household energy efficiency projects report no additional revenues or cost savings at all. This is due to the typical design of household energy efficiency projects, as the cost savings of efficient lighting and cook stoves accrue to the owners of each household whilst the project owner who pays for the installation of the technology usually only receives revenue from CERs. Whilst the majority of projects across almost all project types report some sort of benefit from revenues or cost savings, N_2O projects report by far the lowest rate of benefit accrual at just 10% of projects.
- Nevertheless, it needs to be noted that household energy efficiency projects show a mixed picture, since further revenues or cost savings additional to the sale of CERs vary significantly between the types of household energy efficiency projects. For instance, 78% of the respondents revealed that, for lighting energy efficiency projects, they do not receive any additional benefits. For projects on stoves however, approximately 71% indicate that they get sufficient further revenues.
- As to be expected, a major difference exists for landfill gas flaring and landfill gas power projects. Only 17% of power projects report no further revenues or cost savings, compared to 55% of flaring projects.
- Fair variation exists between countries, but this appears to be linked again only to the project type, since the breakdown of project types within countries is also very variable - as indicated by Table 5, section 2.

Questions 27 and 28: Was a positive return on total initial project investment received or is still expected?

This question was split into two questions for survey participants. Question 27 asked for the current situation (*"Have you received a positive return on your total initial project investment?"*) while question 28 asked for the future expectations (*"Do you still expect to receive a positive return on your total initial project investment?"*). Question 28 was asked only to respondents who did not indicate in question 27 that they have already received a positive return. For the analysis, results from both question were combined into Figure 34. This combination takes the proportion of projects for which a positive return was already received from question 27 (26%), and distributes the situation of the remaining projects according to question 28 across the remaining 74%, as shown in Figure 34.

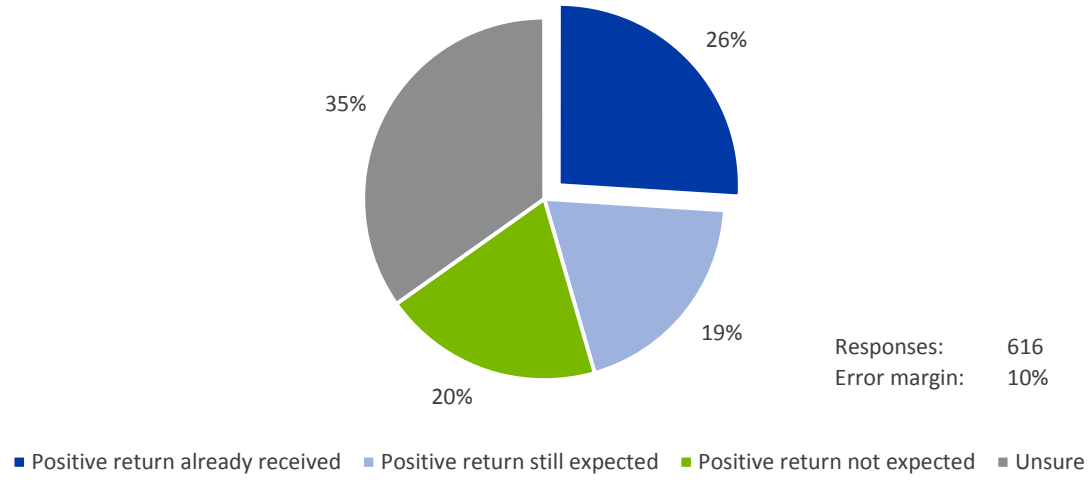


Figure 34: Positive return on initial investment

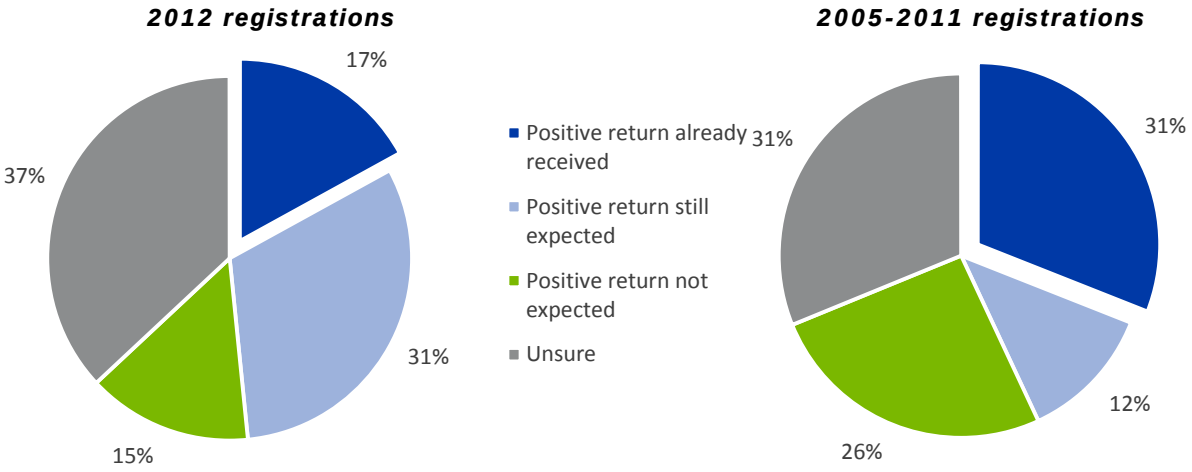


Figure 35: Difference in return on initial investment, according to project vintage

Table 39: Positive return on investment, by project type and country

Project Type	Positive ROI received	Positive ROI received or expected	*Country*	Positive ROI received	Positive ROI received or expected
HFCs	100%	100%	Israel	64%	71%
EE industry	70%	72%	Central America	44%	72%
N_2O	69%	81%	Chile	35%	65%
Hydro	34%	45%	South Korea	35%	97%
Cement	28%	52%	India	31%	49%
Wind	27%	43%	Peru	31%	59%
Biomass energy	21%	48%	Mexico	30%	51%
Fossil fuel switch	21%	27%	Malaysia	30%	57%
Solar	17%	61%	China	24%	39%
Methane avoidance	17%	43%	Thailand	24%	49%
CMM	13%	25%	Brazil	20%	46%
Landfill gas	12%	47%	Colombia	14%	42%
EE own generation	10%	55%	Sub-Saharan Africa	11%	65%
EE households	6%	54%	Vietnam	11%	59%
			South Africa	9%	76%
			Indonesia	7%	44%

- 26% of registered CDM projects have received a positive return on their total initial project investment. This figure still only rises to 45% when those still expecting to receive a positive return are included (see Figure 34). That said, the outlook for 35% of projects remains uncertain.
- High expectations still exist in specific regions. In South Africa and the Sub-Saharan Africa group, 76% and 65% of projects respectively, expect to receive positive returns, even though just 9% and 11% of these projects have received positive returns to date.
- Table 39 demonstrates great variation in the occurrence of positive return on investment between project types. Whilst most responding HFC, N_2O, and industrial energy efficiency projects have received a positive return on investment, most project types indicate a very poor return on investment, particularly energy efficiency of households and own generation.
- Figure 35 shows the difference between the positive returns of different project vintages. A notable difference is seen in the proportion of projects that have already received a positive return. As logically expected, due to the later commencement of operations, the proportion of projects registered in 2012 having received a positive return is slightly smaller than the proportion for projects registered before 2012. However, the outlook for this group remains

more optimistic than for the group of projects registered in 2005-2011, when the expectations of projects to still receive positive returns in the future are included in this consideration. In this case, it appears that the greater experience of the older project groups translates into reduced optimism for the project outlook. On this basis, it is possible that a large number of 2012-registered projects that still expect positive returns may actually fail to achieve this. On the other hand, it may also be that 2012-registered projects are based on business models that are more conducive to the current market conditions, which should have been more predictable during the phase of planning.

- Analysis of proportions from the sampled projects shows that the continued operation of monitoring equipment for the CDM activity is linked to expectations about return on investment, as would be expected. 55% of sampled projects that have not yet but still expect to achieve a positive return continue to operate the CDM-required monitoring equipment, compared to just 37% of the sampled projects who responded that they do not expect a positive return. Of the projects sampled that had already achieved a positive return on their initial investment, 62% continue to operate the monitoring equipment.

Question 29: Apart from the recent drop in CER prices, what are the reasons or barriers that would hinder you to aim for registering a similar CDM project again?

This question assesses whether or not projects would aim again for CDM registration, and, if not, what major reasons or barriers would hinder or discourage them from doing so. The question was asked to all projects regardless of the current project status, and multiple answers were allowed.

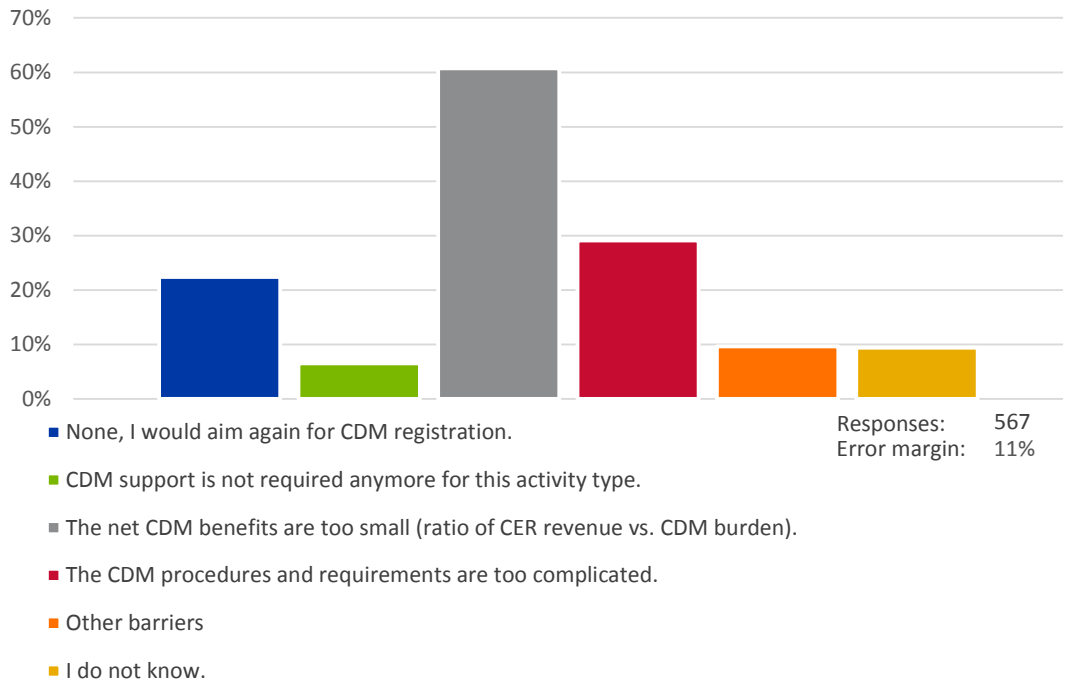


Figure 36: Reasons that hinder registration of a similar CDM project

- The clear disincentives for respondents to invest again in the CDM with new projects are the poor net benefits and the complicated procedures. This trend is very similar across countries.
- In the Sub-Saharan Africa grouping, which reported a higher than average requirement for capacity building support (see Figure 32), the complexity of the CDM procedures was considered a more significant barrier than the low net benefits. This may be due to the higher complexity of project types that are more prevalent in the region, such as household energy efficiency and other project types common under the PoA modality.
- Just 22% of respondents reported that they continue to experience no barriers and would aim again for CDM registration.
- For some project types, “other barriers” was a more popular selection, and ineligibility for EU ETS was often specified.

- Table 40 shows that the answer "CDM support is no longer required for this activity" was consistently insignificant across almost all project types, although slightly more relevant for N_2O, Hydro, and household energy efficiency.

Table 40: Reasons that would hinder the registration of a similar CDM project again, by project type

Project Type	Proportion of projects identifying reasons not to register a similar CDM project again			
	None, I would aim for registration again	CDM support no longer required for this activity	CDM benefits are too small	CDM procedures are too complicated
Biomass energy	19%	5%	69%	44%
CMM	25%	0%	25%	38%
EE households	28%	16%	54%	51%
EE industry	41%	0%	56%	28%
EE own generation	0%	1%	56%	59%
Fossil fuel switch	30%	0%	82%	25%
Hydro	18%	11%	65%	35%
Landfill gas	25%	0%	63%	36%
Methane avoidance	23%	2%	59%	55%
N_2O	48%	17%	30%	44%
Solar	11%	0%	64%	31%
Wind	28%	7%	59%	12%

Cement and HFC are omitted from the table since data is deemed insignificant due to low response numbers

- In contrast, dissatisfaction with procedures and requirements of the CDM was relatively consistent across almost all project type groups. Wind energy projects stand out here, with only 12% of projects identifying this reason.
- The low benefits of the CDM is the most commonly reported reason for almost all project types. N_2O and coal mine methane projects are exceptions, with just 36% and 25% of projects identifying this reason, respectively.
- For the answer "None, I would aim for registration again", the data is fairly consistent across most project types, with around 20% to 30% of projects selecting this answer. Major outliers include own generation energy efficiency projects, where almost no projects identified this answer, and N_2O projects, where 48% of the projects would consider a similar registration.

4.5 Support

Section highlights:

- 7% of project registrations were supported or initiated by external public funders.
- 71% of projects received no support on the national level. 4% of projects received direct financial support.
- Only 12% of projects that indicated receipt of national level support stated this was made available in reaction to diminishing CDM support.
- 56% of projects would consider a cancellation of their CDM registration if necessary to pursue alternative programmes, whilst a further 18% are unsure.

Question 30: Was the CDM project registration supported or initiated by external (public) funders (e.g. World Bank, KfW, Asian Development Bank, etc.)?

All respondents were asked to indicate whether the project registration was supported by external funders, in order to identify countries and project types where external support is particularly prominent.

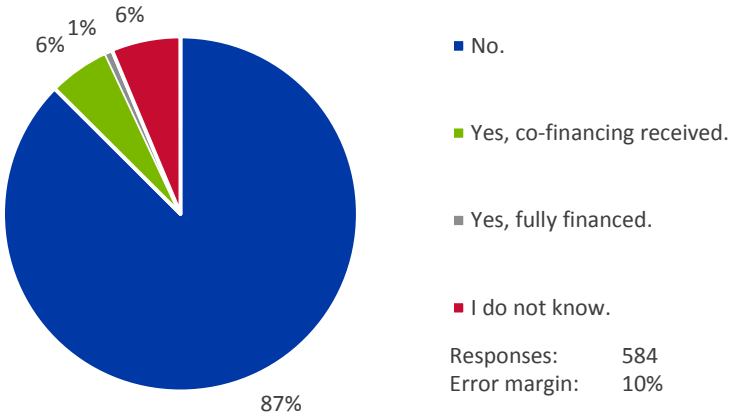


Figure 37: Provision of support for registration from external funders

- External public funding for CDM project registration has been available to only a limited number of projects: 7% of CDM project registrations have been supported by external funders, with just 1% being financed in full.

- Support has been more prevalent in some countries and for some project types:
    - 12% and 26% of project registrations in Mexico and Peru, respectively, were co-financed.
    - More than half of projects in the Sub-Saharan Africa group received financial support for registration.
    - Industrial energy efficiency received strong support, with 31% of projects being co-financed.
- Table 41 compares the projects sampled in this study and indicates that the implementation and operational status of projects that received external public support is tangibly better than those which did not. Survey data from questions 11 and 12 (section 4.2) suggests that these projects may have received support through ERPAs signed with the institutions that were identified as the support providers in question 30. Of the sampled projects that indicated receipt of support, 64% of these projects signed ERPAs at some point, compared to an average of 51% across the entire sample, and 80% of these ERPAs included a public CER buyer, compared to an average of just 40%. However, this may also be an indication that the question was understood differently to its intention. The question specifically asked for support during the registration process. Unfortunately without giving examples such as loans or financing of PDD development, respondents might have indicated "support received" when CERs were bought by the mentioned institutions above market prices.

Table 41: Implementation and operational status of sampled projects according to external support received

	Proportion of projects fully implemented	*Proportion of projects in regular operation*	*Proportion of projects with an ERPA agreed at some point*	*Proportion of projects where the initially agreed ERPA included a public CER buyer*
No support	71%	57%	52%	29%
Co-financed or fully financed by external public funders	77%	69%	64%	80%

Question 31: What type of support has the GHG mitigation project received on national level (e.g. direct support or through support schemes such as feed-in tariffs, white certificate schemes, renewable energy or energy efficiency support policies, etc.)?;

and Question 32: When was this type of support made available?

Question 32 was asked only to respondents who indicated in question 31 that they had received support. Although applicable to only a smaller subset of respondents, a relatively good response rate was recorded for question 32, giving an error margin around average.

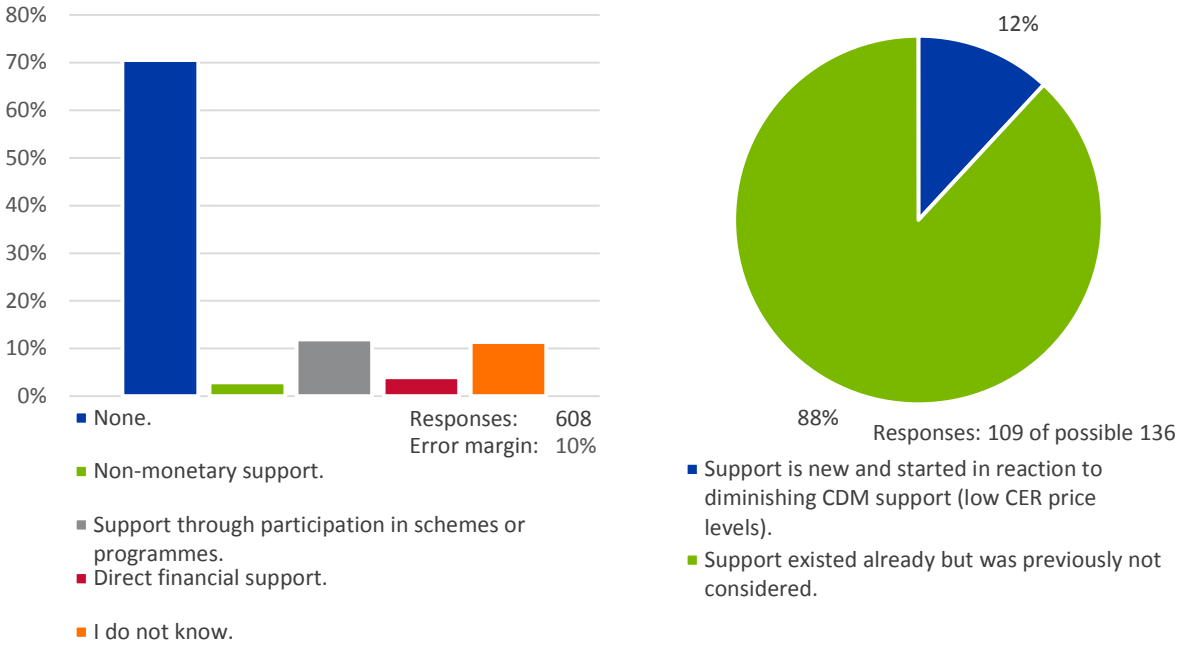


Figure 38: Provision of support on the national level

- The vast majority of registered CDM projects (71%) have not received additional support from national-level programmes and policies.
- Of the projects that did receive national level support, many respondents indicated that support came in the form of feed-in tariffs or mentioned favourable power purchase agreements. For this reason, it is not surprising to see that solar is the most supported project type on the national level, according to Table 42.
- The high rate of support registered for South Africa may be related to the country's renewable energy procurement programme (REIPPPP), since the South African portfolio includes a high proportion of renewable energy projects. Several respondents from South Africa mentioned feed-in tariffs specifically, but feed-in tariffs in South Africa were phased out in favour of the renewable energy procurement programme before they came into effect.

Wind projects and household energy efficiency projects also received more support in South Africa than in other countries.

- Whilst it might be expected that projects were more likely to receive domestic support in larger or wealthier countries, Table 42 indicates that this trend is not so clear, since projects in South Korea, India, Mexico and Brazil in particular have received little national level support.
- Respondents report in most cases that the support provided was already available, and not introduced in reaction to CDM conditions.

Table 42: Provision of national level support, by country and project type

Projects that received any type of support on national level			
By country		**By project type**	
Thailand	54%	Solar	42%
South Africa	52%	Hydro	30%
Israel	50%	Biomass energy	24%
Sub-Saharan Africa	38%	Landfill gas	23%
Peru	31%	Methane avoidance	23%
Malaysia	30%	CMM	14%
Vietnam	24%	N_2O	14%
Central America	22%	EE households	14%
China	19%	Wind	10%
Chile	17%	EE industry	9%
South Korea	16%	Fossil fuel switch	2%
Colombia	13%	EE own generation	0%
Indonesia	12%	Cement and HFC projects are omitted from the table due to insufficient response numbers.	
Mexico	12%		
India	12%		
Brazil	8%		

Question 33: Would you consider a cancellation of the CDM registration in case feasible and a precondition to receive support or participate in alternative project schemes?

This question assesses whether or not project respondents would consider an official cancellation of their CDM registration, in the case that this would be a precondition for eligibility for other programmes. The question seeks to find whether projects in some specific countries show more readiness and will to depart the CDM than others.

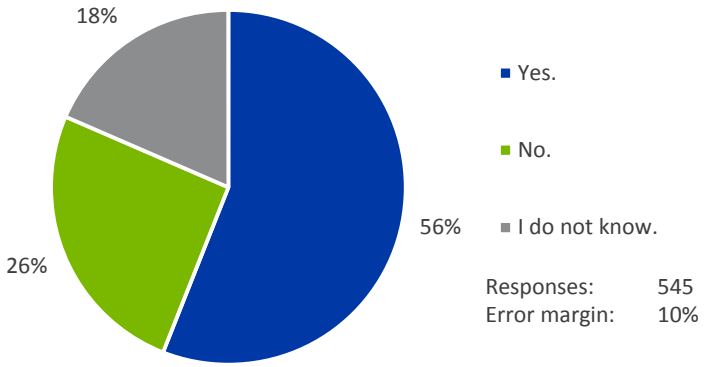


Figure 39: Cancellation of CDM registration to participate in alternative schemes

Table 43: Projects that would consider cancellation of their CDM registration, by country

Country	Percentage or projects that would consider cancellation
Mexico	81%
Colombia	72%
Peru	72%
China	67%
Sub-Saharan Africa	62%
Chile	57%
Indonesia	53%
South Korea	52%
South Africa	51%
Israel	51%
Central America	48%
India	39%
Brazil	38%
Vietnam	30%
Malaysia	24%
Thailand	24%

- Over half (56%) of CDM projects would consider a cancellation of their CDM registration. This is more than double the proportion of projects that would not consider a cancellation, whilst 18% are undecided.
- Table 43 shows that the data varies considerably by country. In China, 67% reported that they would consider a cancellation, compared to just 14% who would not, –likely due to the existence of the CCER system. Although the CCER system is designed to absorb previous CDM activities and link them to domestic markets, double registration or double issuance is not allowed. In contrast, 39% of Indian projects would consider a cancellation, whilst 50% would not.
- The spread of responses for this question across different project types is very small. Only in industrial energy efficiency would a large majority (84%) not consider cancellation of the registration.

5 Discussion

This section reviews the data evaluation and highlights some of the key discussion points. The information from the evaluation results opens up a great number of potential avenues for further analysis and discussion. Although this section considers some of the key quantitative findings, it is not an exhaustive discussion of all the findings from this research activity. Further detailed discussions (e.g. related to the general impact of the CDM) are deferred to other papers prepared as part of the overarching research project.

5.1 Trends in CDM project implementation and operation

Overall, the data from this study shows that the rate of implementation and operation of CDM projects is particularly high: between 64% and 79% of registered CDM projects are implemented and their CDM component of the GHG mitigation activity is in regular operation (cf. section 4.1)[11]. This highlights the continuous success that the CDM has had in building momentum on the operation of mitigation projects worldwide. However, the data shows that between just 10.4% and 16.6% of registered CDM projects continue to operate because of the ongoing benefits of the mechanism, financial or otherwise.

Technology trends

In this regard, the research has shown that the conditions and experiences of projects vary considerably according to project type. Table 44 demonstrates these differences, showing the rates of full implementation, regular operation and monitoring status of CDM projects. Obvious differences between project types have been highlighted for status indicator in section 4.1. However, Table 44 combines these status indicators and reflects the difficulties faced by project types and their different CDM–related stages, which also indicates their reaction to the low demand situation. The table also shows, by project type, the share of projects operating their monitoring system. Not operating a monitoring system can be seen as indication that these projects have, to a large extent, irreversibly left the CDM, and will be unable to generate a large number of reduction units once prices recover.

Table 44 loosely clusters groups of project types which show similar situations. This research has found that wind, hydro, cement and own generation energy efficiency projects have been, generally speaking, more tolerant to low CER price levels. All of these project types have been particularly successful during the crediting periods and show consistently high rates of operating monitoring systems, indicating that the CDM is still considered as revenue source. In addition, a high proportion of own generation energy efficiency projects intend to continue outside of the CDM without support. For this project type in particular, further research to uncover whether this is a genuine CDM success story or if this is influenced by other mitigating factors would be of interest. The research also suggests that renewable energy based projects have experienced above average resistance towards

[11] Analysis of the non-evaluated projects in section 3.2.3 indicates that the upper end of this range is more likely.

low price scenarios. On the other hand, more complex process activities such as landfill gas and methane avoidance have enjoyed less success either due to technical complexity or insufficient benefits and revenues outside the CDM. Household energy efficiency is one of the poorest performing project types under the CDM, with limited success throughout the crediting period and a very low rate of project continuation. This may be due to the limited technical lifetime of the equipment, in addition to the complexities inherent in this project type, as discussed elsewhere.

Table 44: Summary of project implementation, operation, and monitoring

Project Type	Proportion of projects where the CDM component of the mitigation activity is:		
	fully implemented	*in regular operation*	*with operational monitoring system*
Wind	93%	92%	81%
EE own generation	96%	93%	80%
Cement	82%	74%	72%
Hydro	83%	81%	71%
Fossil fuel switch	96%	81%	45%
EE industry	82%	72%	52%
Coal bed/mine methane	86%	71%	50%
Solar	86%	80%	51%
Biomass energy	81%	63%	52%
Landfill gas	63%	54%	46%
Methane avoidance	72%	48%	39%
HFCs	69%	69%	34%
EE households	60%	58%	26%
N_2O	62%	49%	25%

Activities that have clear financial benefits in terms of cost savings or revenue generation for the actual project owner have shown to be more likely to be both implemented and operated. The accrual of further revenues or cost savings by project type matches closely with the general trend of project implementation and operation, as seen in Table 44, above. High rates of operating monitoring systems for hydro and wind projects reflect that many of the renewable electricity project types have straightforward monitoring processes. These are not only for the benefit of the GHG emission reduction calculation, but also an essential component of the revenue generation system. It is therefore unlikely that these monitoring systems will be deactivated if they are already in place.

A notable exception from this logic, as highlighted in Table 44, are solar projects, where we see a relatively low proportion of projects with regular monitoring despite a high rate of regular operation. This is an unexpected result, since there is no significant variation between solar PV and solar water heating projects, and the monitoring process for solar PV in particular is considerably less demanding than for other project types. The research provides indications that solar project business models are

beginning to deviate from CDM oriented models. Such projects may consider the value of a monitoring system to be limited, regardless of the ease of its operation. Very few solar projects signed ERPAs, but instead report a high rate of the receipt of alternative revenues and support from domestic sources. A relatively high rate of solar PV projects plan to continue activities outside of the CDM without alternative support.

Industrial gas projects, such as N_2O and HFC, are clustered in a group with low implementation and operational status, and monitoring system operation far below average. This is on the one hand to be treated with caution, due to the low number of detailed responses from these project types. On the other hand these are alarming signals as these projects reduce large volumes of emissions. This particular topic is being further analysed in two research pieces on the impact of the CDM in general and the situation of industrial gas projects.

Despite the overall positive message delivered regarding the relatively high levels of CDM project implementation and continuous operation of the mitigation equipment, this research has also uncovered significant concerns related to the loss in trust for engaging in international carbon market mechanisms, and the ongoing operation of these mitigation activities in the near future. Section 4.1 highlighted a moderate decrease in the operational status of projects in the coming 12 months, from 79% to 75%. However, the outlook is considerably bleaker when one considers the proportion of projects that will discontinue mitigation activities before or at the end of the crediting period, the projects that claim they might seek a CDM registration cancellation, and the projects that would not consider registering similar projects again and continue to mitigate only because to do otherwise would not save costs or recover their irreversible sunk investments. It is widely understood that the extremely poor conditions of the carbon market and CER prices levels are a central cause of this issue. Through analysis of interviews with many stakeholders and comparison of project data related to status, barriers faced, and CER revenues, this research has reaffirmed this view. In the absence of substantial support to project continuation there is a significant risk not only of project activities returning to their pre-CDM conditions, but also of irreversible loss of the institutions and knowledge that has been developed through the positive growth of the CDM. Such institutions and knowledge already form a central part of emerging carbon pricing instruments worldwide and should also form a central part of any future global flexibility mechanisms.

Regional trends

A global aggregate presentation of the statistics masks some of the key issues on the status of projects, with the present situation and outlook of CDM projects varying enormously across regions.

China and India have enjoyed a particularly successful decade under the CDM. Such success is attributable not only to the first-mover advantage, but also to the investment and policy conditions in these countries. In return, in China particularly, the general success of the CDM has been a significant factor in the development of domestic industries for cleaner technologies and climate change policies. Roughly 90% of project documentation from projects registered in China in 2005 indicated that the project involved technology transfer from foreign countries, compared to approximately just 7% of projects registered in China in 2011 (UNFCCC 2012). Excluding China and India, between just 45% and 53% of registered CDM projects are in regular operation. Given the

situation of the carbon market presently, it is unlikely in the near future that other regions will reach a comparable level of success to China and India. Results from this research, as demonstrated in Table 45, indicate that modest increases in project implementation and operation are forecast in Africa and Latin America in the coming year, but that there is also a considerable degree of uncertainty surrounding the future of projects in the region. Countries in these regions have also generally shown very limited development of their domestic industries when compared to the example from China illustrated above (UNFCCC 2012). Furthermore, the increase in activities forecast by respondents in Africa and Latin America must be considered alongside the decrease in activity forecast in countries with generally higher levels of CDM experience like in Asia (see Table 45), who might be better informed on future prospects. Indeed, this research has highlighted that the expectations of project participants with less experience are more likely to be unrealistic about the future of their projects than those with more experience, due to technical and procedural complications that are not envisaged or fully appreciated during the planning phase.

Table 45: Comparison of regional trends

Region	*Projects in regular operation*	*12 month change forecast*
Asia	84%	- 3%
Africa	46%	+ 10%
Latin America and Caribbean	44%	no change

There are also intriguing differences between regions in the types of projects that have been successful. Judging by the proportion of projects that are in regular operation, wind and solar projects are two of the most successful project types in Asian countries, although they are the least successful projects in African countries. Solar is also one of the least successful project types in Latin American countries. This difference is likely due to better availability of locally manufactured renewable energy technology in the Asia region, as well as more conducive supporting policies for renewable energy projects. African countries, along with some parts of Asia, are largely reliant on imports of solar and wind technologies from China, where the domestic manufacturing capacities for these technologies are well developed. Often, project participants with imported technologies reported issues with the availability of local technical support, especially for maintenance.

In contrast to solar, methane avoidance, landfill gas, N_2O and household energy efficiency are relatively successful in Africa, although these project types are the least successful in Asia. This is likely due to the focus placed on these project types in Africa by the international support.

Programme of Activities (PoA) modality

Although the primary focus of this research was not on PoAs, PoAs were included in order to gain some preliminary insights into their status. The PoA modality was introduced in the CDM to, inter alia:

- Encourage the development of replicable projects with dispersed emission sources under the CDM.
- Enable projects with high sustainability benefits but low potential CER volumes to overcome prohibitive upfront transaction costs.
- Encourage a higher participation in the CDM amongst African countries, where a large volume of mitigation potential is accounted for by these types of projects.
- Speed up approval processes through management at the regional level.
- Provide a framework which involves individual project owners, who may be in remote areas and/or face language difficulties in communicating with the international community, in mitigation activities but does not require a direct engagement with them.

Table 46: Key comparisons between PoA and normal CDM projects

	Normal registered CDM projects	*Registered PoAs*
Full project implementation	85%	>50%*
Regular project operation	79%	>35%*
Project monitoring	68%	35%
Monitoring reports submitted	48%+	12%+
Issuance achieved	37%+	1%+
Required CER price for continued operation below €5	54%	39%
Verification and issuance cycle costs below €10,000	33%	21%
Positive return on investment received	26%	5%
Complexity of CDM procedures and requirements a major barrier	12%+	23%+
Registrations supported by external public funders	6%	13%

* Statistics for implementation and operation of PoAs may be slightly higher, due to misinterpretation of the question

+ Statistics with this marker refer to the proportion of the sample, whilst other statistics refer to the estimated proportion of the entire registered project population.

Table 46 presents a direct comparison of some of the key findings for PoAs compared to normal CDM projects. As the table shows, compared to normal CDM projects, PoAs have so far enjoyed limited success in the CDM. Although this is partly explained by the recent registration of most PoAs, the data suggests that the PoA modality has not yet delivered on some of its key objectives: the proportion of PoAs that can continue operations on a CER price below €5 is somewhat lower, and the total costs per verification and issuance cycles are also higher, usually without a sufficient mass of CPAs amongst which these costs can be shared. PoAs also report "Uncertainty around CDM procedures and requirements", "Costs related to CDM procedures and requirements" and "Access to up-front finance" as relevant barriers significantly more often than normal CDM projects. For these reasons, it is reasonable to assume that a high proportion of PoAs in the planning phase will not proceed to implementation, and to mitigate GHG emissions. For the 12 month forecast, 23% of PoAs reported "unsure", "dismantling" or "no implementation planned", compared to 10% of normal CDM projects.

The PoA modality did certainly play a major role in the development of CDM projects in underrepresented regions, especially in African countries, where these types of projects make up a considerable portion of the total project population. However, since the actual implementation of PoAs has been limited so far, and many PoAs in the sample have not expanded to include more than one CPA, this has not led to the positive and sustainable development of CDM activity in the region to the extent desired. Whilst the transaction costs and procedural complexities might be slightly larger for PoAs than for normal CDM projects, these costs and complexities are designed to be considerably reduced once shared amongst multiple CPAs. Some interview respondents reported that the non-expansion of CPAs under the PoA was due largely to the unattractive investment conditions of the CDM in general in recent years. Some others also reported institutional and informational deficiencies, and believed that more efforts should be expended to raise awareness of existing registered PoAs, and to make participation in these PoAs more attractive and available to disconnected potential CPA owners and developers. Furthermore, for some dispersed activities – such as light bulb replacement – alternative financial benefits such as cost savings do not accrue to the owner of the project activity. In these cases, the benefits for project continuation in the absence of substantial CER revenue are limited.

Other interview respondents, who are likely to be those benefiting from existing ERPAs guaranteeing sufficient CER prices above market levels, reported a different assessment of the situation. These PoAs cope with the situation despite the barriers and aim to expand their activities to further CPAs. Joining the umbrella of these PoAs is perceived in these regions as an attractive alternative to the registration of one's own PoA. These responses confirm the importance and the potential impact of international support, provided through, for example, purchase facilities.

5.2 Barriers for CDM project operation

As previously highlighted, this research has found major evidence that the current state of the CER market price and the uncertainty about the future are major barriers to the continuation and further development of GHG mitigation activities under the CDM. Investment decisions for most projects were based upon the assumption that CER prices would maintain a certain level. Furthermore, the poor state of the market and the uncertainty regarding the short, mid and long term outlook is a major deterrent to the development of new activities, including for new CPAs under PoAs. It may even drive a large number of projects to leave the CDM, either to go into other programmes and mechanisms, or to stop mitigating and revert to their pre-CDM conditions. This barrier is widely recognised and discussed in the broader literature. Its further analysis is not within the main scope of this report, but it is notable that the findings of this research also identify it as the major limitation.

Aside from this key issue, the most commonly identified barriers were the complexities, uncertainties and costs entailed by the CDM's procedures and regulations. These were reported very consistently across almost all regions and technology types. In particular, projects that required changes to their design reported an especially prohibitive burden from CDM processes. This is another widely recognised barrier in the CDM, and revisions to CDM processes designed to alleviate this burden are regularly made by the CDM Executive Board. Some call for much more fundamental changes to streamline CDM processes. The counter argument to this call is based on concerns related to the integrity of the emission reductions achieved at the project level. For example, some concerns exist in the international community that some of the streamlined processes introduced under new and emerging domestic and regional mechanisms may compromise the basic principle of 'a tonne is a tonne'. In this regard, it is relevant to note the relative success of the CDM in its early years, under favourable market conditions, when private investment was successfully leveraged in several regions for the development and successful implementation of mitigation activities. This historical experience is an indication that, under relatively stable market conditions, with favourable CER prices and an attractive short- to mid-term outlook, CDM can function effectively. The complications of CDM procedures are therefore a burden that must be mitigated rather than a prohibitive barrier. This research finds overwhelming support for the simplification of CDM procedures to reduce transaction costs, particularly for verification and issuance processes, and for the ability for projects to respond dynamically to evolving contexts through post-registration project design modifications. Such actions alone, however, will never mitigate the barriers entirely without the improvement of market conditions or the provision of financial support.

Similarly, ongoing costs for MRV were reported as a major barrier for some project types. At first glance, this appears to be an unexpected result for some of the project types, which are known to have relatively straightforward monitoring procedures. However, interview respondents highlighted that in many cases the reporting and verification requirements, rather than the monitoring, drove the majority of the costs. In these cases, such expenses were usually linked to the lack of local availability of experts and the high cost of contracting foreign organisations. This highlights the need for the development of domestic institutions, capacities and expertise. This an area where international support could focus additional efforts to create significant gains in terms of reduced transaction costs for verification and issuance cycles. Furthermore, this lack of local capacity also

highlights the importance of protecting the capacities that have already been developed: projects in India and China reported notably lower costs and fewer problems with MRV procedures than other regions. This is clearly related to the growth and maturing of domestic industries alongside the development of the CDM over years. Such capacities will be of vital importance not only to the ongoing continuation of existing CDM activities, but also for the development of future mitigation activities operated outside of the CDM or under other market mechanisms.

Encouragingly, the findings of this research have indicated that project owners in the CDM have had little technical difficulty in creating a marketable mitigation "product" per-se, since knowledge, data availability and technical issues are shown to be relatively unimportant barriers. Instead, market conditions and the complexities of the CDM's methodologies, processes and framework have hindered the development of mitigation activities, which may have thrived under better conditions.

5.3 Engagement and integration with other mechanisms

In recent years, the development of domestic and regional carbon pricing mechanisms has gained considerable momentum; by 2014, 40 countries and over 20 subnational jurisdictions, covering approximately 12% of global greenhouse gas emissions, had implemented instruments that put a price on carbon (World Bank 2014). In some cases, the rationale for the development of such mechanisms was to provide alternate forms of support for CDM projects at risk of ceasing operations. This study has found that CDM project owners are aware of such opportunities and ready to engage with them: nearly a third of registered CDM projects already have plans to convert to other programmes or mechanisms, and over half of CDM projects indicate that they would consider a cancellation of their CDM registration if this were necessary to convert to new programmes or receive alternative support. Projects in Mexico, Indonesia, South Africa, South Korea and China demonstrate a particular interest in conversion to alternative mechanisms.

As might be expected, the engagement of projects with alternative programmes is highly related to the availability of such programmes in the respective countries. The Chinese Certified Emissions Reduction (CCER) programme seems to garner high expectations, as a relatively large proportion of Chinese projects indicated plans to convert to a domestic instrument. Although different in its nature, and offering no direct CDM project continuation, it is an interesting insight that there are no comparable expectations from Indian projects regarding the Perform Achieve Trade (PAT) programme. This is particularly interesting, as it shows that expectations for this programme within the country deviate considerably from the high interest demonstrated by the international community. For countries in Sub-Saharan Africa and Central America, anticipated engagement with domestic schemes is low, a reflection of the general lack of available programmes within these countries. A number of potential ideas, however, are under consideration and planning under the Partnership for Market Readiness (PMR). The interest of projects to convert to domestic schemes in countries where it is possible is an indication that the development of such schemes in Sub-Saharan Africa and Central America may play a role in supporting the continuation of mitigation activities in these countries. This particularly holds true for those projects which are not currently targeted for international support or participation in credit purchase programmes.

Another important insight from this study is the key role that CDM capacities can play in the continuation of mitigation activities outside of the CDM. Projects that seek to convert to alternative project schemes are more likely to continue to operate their monitoring procedures than projects which do not seek conversion. This is a reflection that project designs and processes built under the CDM are of high long-term relevance to the organisation of mitigation activities. It is also an indication that a number of the emerging instruments worldwide are taking the CDM as a blueprint for the design of not only framework and general processes, but also MRV processes. Such indications are positive for the prospects of development of local technical and institutional capacities that are globally consistent rather than fragmented in their approaches.

5.4 Support needs

This report has highlighted multiple areas of support needs for the continuation of mitigation activities under existing CDM projects. Section 4.5 demonstrated that a large majority of CDM projects still require support for the direct marketing of CERs, or the identification of international programmes where credit purchase agreements might be established. In contrast, few projects highlighted a need for capacity building and technical support. This reinforces the discussion point raised previously that project owners are not generally experiencing problems with the technical implementation of a marketable mitigation activity, but rather with the conditions of the market. This does not hold as strongly for countries evaluated in the Sub-Saharan Africa and Central America groups, where a larger need for capacity building was reported.

In general terms, two different types of support needs are identified. Firstly, in all regions, there is a significant and immediate risk of project discontinuation and the irreversible loss of the valuable capacities and institutions that have developed. Here, broader support must be provided on short-term through the cooperation of a coalition of credit-purchasing countries to restore conducive market conditions and rebuild trust amongst project owners and investors. Such market signals are needed to avoid the forecast loss of mitigation activity under the CDM in Asian countries, as well as to encourage the continued development of project implementation in many Central American and African countries, where activities have somewhat stalled.

Secondly, some specific countries and project types demonstrate a need for more targeted support. Current support varies considerably between regions: 29% of project registrations in Africa were co-financed by external public sources, compared to 12% in Latin America and just 5% in Asia. Furthermore, over two thirds of African projects are aware of credit purchase facilities, compared with around one third of projects in Asia and Latin America. This is a reflection of the focus that international support places on activities in African countries. Such support appears to make a profound difference, as there is a notable improvement in the rates of regular operation for project types with higher levels of external support in Africa. In contrast, some project types that are considered to be less in need of support due to their success in other regions – such as wind and hydro – are particularly unsuccessful in Africa. This highlights an important gap in the current provision of support to the region.

Targeted support could be provided through national support schemes, or international credit purchase facilities. The two major purchase facilities – those of the Swedish Energy Agency and the Nordic Environment Finance Corporation – have confirmed agreements to buy up a total of approximately 42 million CERs between 2014 and 2020 (Swedish Energy Agency 2012; NEFCO 2014), or, on average, 6-7 million per year, potentially enough to support the continuation of approximately 1% of total CDM mitigation action. Whilst these are truly commendable initiatives, their replication and considerable up-scaling is key to provide short-term solutions. This research has shown that credit purchase facilities have targeted activities in specific countries and project types, covering many of the projects this study has identified as in need of support. However, considerable gaps in support provision still remain. The study's findings have shown an especially high need for support for direct marketing of CERs in countries where the purchase facilities have been less active, particularly in Central America. This highlights great potential for a wider coalition of countries to replicate, build upon, and scale up the efforts of the existing purchase facilities. These short and mid-term measures can avoid the most extreme consequences of the current period with no market demand. It can, however, not replace high international mitigation ambition which is needed in the long run.

This research has also uncovered implications about the types of projects that are most effective to support in terms of the long term mitigation effect. That capital intensive projects generally report high levels of project continuation suggests that results-based financing through markets, for these project types, is very effective. In contrast, project types with more easily reversible investments – such as household energy efficiency projects – are less likely to yield long term mitigation impacts from short- to medium-term market financing, because they invariably do not continue after the payments stop.

6 Conclusions

This research has revealed a number of insights with important policy implications. Whilst some of these findings reflect and confirm the existing understanding of the market situation, others present unexpected results which require new avenues of domestic policy and international support to be pursued. The major results of the quantitative assessment are as follows:

- Between 64% and 79% of registered CDM projects have full technical implementation and regular operation of the CDM component of the GHG mitigation activity[12].
- Only 36% of registered projects will aim for renewal at the end of the crediting period, whilst approximately half of projects will be continued outside of the CDM.
- Approximately one third of registered CDM projects did not sign an ERPA with a CER buyer at any stage. Just 40% of the initially agreed ERPAs are still valid and unchanged.
- Low CER prices and high MRV and issuance costs are the major issuance barriers mentioned by registered CDM projects that have not yet requested issuance.
- For 53% of projects, a CER price below €5 is sufficient to continue verification and issuance activities. For 82% of projects, a price below €10 is sufficient.
- 26% of registered CDM projects have received a positive return on their initial project investment. A further 19% of registered CDM projects still expect to receive a positive return on their investment.
- 56% of projects would consider a cancellation of their CDM registration if necessary to pursue alternative programmes, whilst a further 18% are unsure.

In its early years, under stable market conditions, the CDM was very successful in sending price signals for carbon and building momentum for mitigation. This success was greatest for Asian countries, particularly China and India, although activities in these regions appear to have peaked and will likely begin to decline. Project participants demonstrated an ability to overcome technical and administrative difficulties to develop a mass of marketable mitigation activities under positive market conditions. In contrast, the development of CDM activities in other regions has not been as strong, both in terms of the number of activities and their operational status, and these regions are unlikely to go on to emulate the successes of Asia.

The current net benefits of the CDM do not provide sufficient incentive for the continuation of mitigation activities. Only 10.4% to 16.6% of projects continue to operate because of the benefits of the CDM, financial or otherwise. In current conditions, activities with alternative sources of revenue and cost-savings show greater resilience and a greater likelihood of continuing operation.

There is a great risk of substantial reduction in mitigation activity, as well as the irreversible loss of institutions and knowledge. Action is needed to support the continuation of

[12] Analysis of the non-evaluated projects in section 3.2.3 indicates that the upper end of this range is more likely.

mitigation activities and maintain developed capacities. Capacities and institutions developed under the CDM hold great relevance for future mitigation activities. The CDM has been taken as a blueprint for both the framework and MRV processes of many emerging domestic and regional mechanisms, playing a major role in avoiding the development of fragmented market approaches worldwide.

CDM processes and regulations must continue to be streamlined, but not to the extent of compromising environmental integrity. Project participants report the complexities of the CDM and the costs of MRV as major barriers, but favourable and stable market conditions can mitigate this administrative and technical burden. The restoration of such conditions should therefore remain the key priority of effort to revitalise the CDM. Concentrating support on the development of local technical capacities can also significantly reduce project transaction costs.

Broad support is needed to restore market conditions and trust. Isolated ambition from individual countries is not enough to restore market conditions and avoid loss of mitigation action. A broader coalition of countries must commit to substantially increasing demand for international credits, through the execution of short- and mid- term support measures, and by increasing international mitigation ambition in the long-run. The research shows a major dip in trust amongst project participants and a reluctance to engage in market mechanisms in the future. Trust must be rebuilt immediately, both to support CDM project continuation now, and to ensure buy-in and success for market mechanisms in the future. Continued assistance from the international community for the development of domestic carbon pricing mechanisms in Sub-Saharan countries can play a significant role in supporting the continuation of mitigation projects in this region.

Targeted support has been shown to have a profound impact and should be replicated and scaled-up. The pledged support of the major credit purchase facilities for 2014–2020 covers just 1% of CDM mitigation activity, but such pledges have had a profound impact on the activities that have been targeted so far. Considerable gaps in support needs remain: in particular, technologies that are not understood to require support due to their success in other regions – such as wind and solar – show a particular need for support in Sub-Saharan African countries. The development of these activities is critical due to their long-term and potentially transformational impact. Generally, projects with higher capital investments have demonstrated a larger potential mitigation impact from results-based financing, due to their likelihood to sustain mitigation in the future without continued support. Projects with much smaller capital investment requirements, on the other hand, have demonstrated less long term impact due to their likelihood to discontinue after the payments stop.

There is great potential impact from targeting international support to the continuation and expansion of activities under the umbrellas of existing PoAs. The PoA modality has successfully played a role in the development of projects in underrepresented regions. However, PoAs have generally started late and had not enough time to fully achieve the objectives of the PoA approach. This is largely apparent due to the slow inclusion of CPAs under PoAs, and PoAs with multiple CPAs report a much lower burden in terms of transaction costs and a higher resilience to low market prices. Now that a critical mass of PoAs exists in many countries, more effective support could be provided by targeting the exploitation of the mitigation potential under these umbrella PoAs and supporting the creation of new PoAs only as a secondary priority.

7 References

Daniel, J., 2012. *Sampling essentials: Practical guidelines for making sampling choices*, Los Angeles, [Calif.]; London: SAGE. Available at: http://www.worldcat.org/oclc/830948801.

Higgins, J. & Green, S., 2011. Cochrane Handbook for Systematic Reviews of Interventions. Available at: http://handbook.cochrane.org/front_page.htm [Accessed October 15, 2013].

Israel, G.D., 1992. *Determining Sample Size*, Available at: http://edis.ifas.ufl.edu/pdffiles/PD/PD00600.pdf.

Von der Lippe, P., 2011. Wie groß muss meine Stichprobe sein, damit sie repräsentativ ist?: Diskussionsbeitrag aus der Fakultät für Wirtschaftswissenschaften der Universität Duisburg - Essen. *Diskussionsbeitrag aus der Fakultät für Wirtschaftswissenschaften der Universität Duisburg - Essen*, pp.1–39. Available at: http://www.wiwi.uni-due.de/fileadmin/fileupload/WIWI/pdf/187_Diskussionsbeitrag.pdf.

NSS, 2013. National Statistical Service: Sample Size Calculator Stratification Examples. Available at: http://www.nss.gov.au/nss/home.NSF/pages/Sample+Size+Calculator+Stratification+Examples?opendocument [Accessed October 15, 2013].

Spalding-Fecher, R. et al., 2012. *Assessing the Impact of the Clean Development Mechanism: Report commissioned by the high-level panel on the CDM Policy Dialogue*, Available at: http://www.cdmpolicydialogue.org/research/1030_impact.pdf.

Swartz, J., Lurigio, A. & Weiner, D., 2004. Correlates of Hiv-Risk Behaviors among Prison Inmates: Implications for Tailored Aids Prevention Programming. *The Prison Journal*, 84(4), pp.486–504. Available at: 10.1177/0032885504269629 TS - CrossRef.

UNEP Risoe, 2013. UNEP Risoe CDM/JI Pipeline Analysis and Database. Available at: http://cdmpipeline.org/ [Accessed September 9, 2013].

UNFCCC, 2012. *Benefits of the Clean Development Mechanism 2012* G. A. Kirkman et al., eds., Available at: http://cdm.unfccc.int/about/dev_ben/ABC_2012.pdf.

UNFCCC, 2011. Framework Convention on Climate Change Conference of the Parties Report of the Conference of the Parties on its sixteenth session , held in Cancun from 29 November to Part Two : Action taken by the Conference of the Parties at its sixteenth session The Ca. *Part Two: Action taken by the Conference of the Parties at its sixteenth session*, (March), pp.1–31. Available at: http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf.

Warnecke, C., 2014. Can CDM monitoring requirements be reduced while maintaining environmental integrity? *Climate Policy*, 14(4), pp.443–466. Available at: http://www.tandfonline.com/doi/abs/10.1080/14693062.2014.875285.

World Bank, 2014. *State and Trends of Carbon Pricing*, Washington D.C. Available at: http://documents.worldbank.org/curated/en/2014/05/19572833/state-trends-carbon-pricing-2014.

Annex I: Status of the CDM Loan Scheme (December 2013)

The CDM Loan Scheme offers interest free loans to potential CDM project participants in countries with fewer than 10 registered CDM projects to cover costs for PDD development, validation, registration and verification. By December 2013, eight of the 36 supported projects were at validation stage and one had been registered and is included in the project sample for this study.

Table A-1: Projects registered and at validation supported by the CDM Loan Scheme (UNEP Risoe 2013)

Host country	Type	Emission reductions (1^{st} period $ktCO_2e$/yr.)	Credit start date
Belize	Landfill gas flaring	22	01-Jan-16
Cameroon	EE Households: Lighting	50	01-Sep-13
Cambodia	Methane Avoidance	27	01-Jun-11 (Registered)
Gambia	EE Households: Lighting	48	01-Jan-14
Iran	EE supply side	971	23-Sep-13
Malawi	EE Households: Stoves	37	01-Jul-13
Tanzania	EE Households: Lighting	10	01-Jan-14
Uganda	EE Households: Lighting	14	01-Jan-14
Zambia	Hydro: New dam	561	15-May-15

Table A-1 shows that the CDM Loan Scheme supported projects at validation stage are typically small scale. Figure A-2 shows that PoAs make up a very large proportion of the 36 projects supported, and Figure A-1 suggests that underrepresented countries are being successfully targeted, as the majority of the supported projects are found in Africa.

Table A-2: Breakdown of the 36 projects supported by the CDM Loan Scheme

Project type supported by Loan Scheme	
EE household (lightning)	4
EE household (stoves)	9
Landfill gas	3
Methane avoidance (domestic manure)	2

Project type supported by Loan Scheme	
Methane avoidance (waste water)	3
EE Service (water purification)	4
Solar PV	1
Geothermal	1
EE supply side	1
Hydro	3
Transport	2
Reforestation	1
Biomass Energy (bagasse)	1
EE Industry (building materials)	1

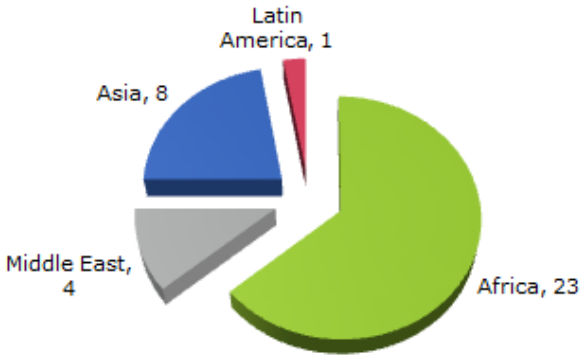


Figure A-1: Regional distribution of CDM Loan Scheme projects

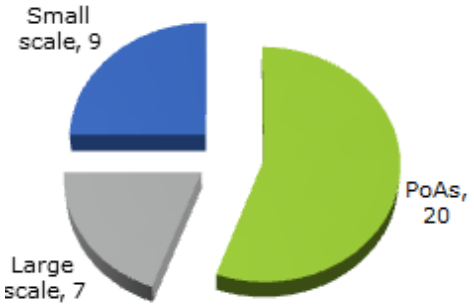


Figure A-2: Scale of CDM Loan Scheme projects

Annex II: Excluded project subtypes

Table A-3 shows an exhaustive list of all UNEP Risø project subtypes not selected for evaluation.

Table A-3: List of excluded project subtypes, according to UNEP Risø classification

Reason key: 1: Project type not a focus of the study.
2: Project numbers too small for a sample group and no grouping is possible.
3: Other reason, see section 2.3.

Project types	UNEP Risø project subtypes excluded	Reason
Afforestation	Afforestation, Mangroves, Irrigation, Rice crops	1
Agriculture	Irrigation, Rice crops	1
Biomass energy	Gasification of biomass, Biomass briquettes or pellets, Biodiesel, Biodiesel from waste oil, Black liquor, Palm oil waste, Industrial waste, Switch to piped biogas	2
CO_2 usage	CO_2 recycling	2
Coal bed/mine methane	Coal bed methane, Ventilation Air Methane, CMM & Ventilation Air Methane	2
EE Households	Appliances, Lighting & Insulation & Solar	2
EE Own Generation	Chemicals heat, Building materials heat, Carbon black gas, Glass, Glass heat, Iron & steel, Non-ferrous metals heat, Petrochemicals heat	2
EE Service	EE commercial buildings, EE new buildings, EE public buildings, EE Public Stoves, HVAC & lighting, Lighting in service, Street lighting, Water pumping, Water purification	1
EE Supply Side	Cogeneration, Power plant rehabilitation, Single cycle to combined cycle, Higher efficiency coal power, Higher efficiency oil power, Higher efficiency steam boiler, Higher efficiency: waste heat, Natural gas pipelines	2
Energy Distribution	Connection of isolated grid, District heating, Efficient electricity distribution, Replacement of district heating	2
Fossil fuel switch	New natural gas plant using LNG, Oil to electricity, Coal to natural gas	1, 2
Fugitive	Charcoal production, Natural gas pipelines, Non-hydrocarbon mining, Oil and gas processing flaring, Oil field flaring reduction	1, 2
Geothermal	Geothermal electricity, Geothermal heating	1
Hydro	Higher efficiency hydro power	2
Landfill gas	Gasification of MSW, Switch to landfill gas, Biogas from MSW, Solid waste management, Landfill aeration	2
	Combustion of MSW, Landfill composting	1
Methane	Aerobic treatment of waste water	2
Mixed RE	Solar & wind, Solar & wind & other, Wind & hydro	1, 2
PFCs and SF6	PFCs, SF6	1

Project types	UNEP Risø project subtypes excluded	Reason
N_2O	Caprolactam	2
HFCs	HFC134a	2
Reforestation	Afforestation, Mangroves, Reforestation	1
Solar	Solar thermal power, Solar lamps, Solar PV water disinfection, Solar thermal heat	2
	Solar cooking	3
Tidal	Tidal	2
Transport	Biodiesel for transport, Bus Rapid Transit, Cable cars, Mode shift: road to rail, More efficient vehicles, Motorbikes, Rail: regenerative braking	1

Annex III: CDM projects failing to achieve a registration in 2012

Certified Emission Reduction (CER) credits issued to CDM projects registered after 31 December 2012, outside LDCs are not eligible for trading in the EU ETS. In the absence of an ambitious international climate agreement post-2012, the continuation or start-up of projects that are unlinked from EU ETS demand could be an unattractive business proposition. This document presents a summary of findings, providing a brief look at the status of projects that failed to obtain a registration date before the 31 December 2012 deadline.

Requirements for a 2012 registration date

The effective date of registration in accordance with Decision 3/CMP.6 is "the date on which a complete request for registration has been submitted by the designated operational entity where the project activity has been registered automatically" (UNFCCC 2011). In this context, a 'complete request for registration' includes all required documents and the receipt of the registration fee, and it is 'automatically registered' if it passes the Completeness Check and the Information and Reporting Check requiring no corrections or clarifications. Where the COP decision is that the project requires corrections or clarifications, the issued registration date is the date that the latest revisions to the validation report or any other supporting documentation are submitted.

In summary, to obtain a registration date in 2012, project documentation and registration fees must have been received by 31 December 2012, and the project must be automatically registered without any need for further documents or letters for clarification.

Definition of the project population

Source

UNEP Risø CDM Pipeline[13] (October 2013) with updates from UNFCCC project cycle website[14]

Criteria

Date of registration request:	Between 01 January 2012 and 31 December 2012
Date of registration:	Registration dated in 2013 OR no registration
Status:	Rejected projects excluded
Host countries:	Least Developed Countries (LDCs) excluded
Project types:	Afforestation, reforestation, HFC23, N_2O from Adipic acid excluded

[13] Accessed 02 October 2013 at http://www.cdmpipeline.org/
[14] Accessed 28 October 2013 at http://cdm.unfccc.int/Projects/projsearch.html

Rejected projects are of no interest to this evaluation, as they are removed from the CDM project cycle for reasons not related to the 31 December 2012 registration deadline.

Projects hosted in LDCs are excluded, as their CERs are still eligible for EU ETS trading and the deadline, therefore, does not affect them. Similarly, HFC23, Adipic acid N_2O, afforestation and reforestation projects are not affected by the deadline and are therefore excluded, since these project types are not eligible for EU ETS trading in any case[15].

Of projects submitting a request for registration before 1 January 2012, only one project is still awaiting registration. All others were rejected, withdrawn, or have registration dates in 2012 or earlier. Those that were withdrawn are all projects that were initiated before 2009, so it can be reasonably assumed that their withdrawal is not only influenced by the 31 December 2012 registration deadline.

Overview of the projects failing to achieve a 2012-dated registration

A total of 123 projects fit the listed criteria, of which two projects are also listed as Gold Standard projects. None of the projects have had any credit issuance.

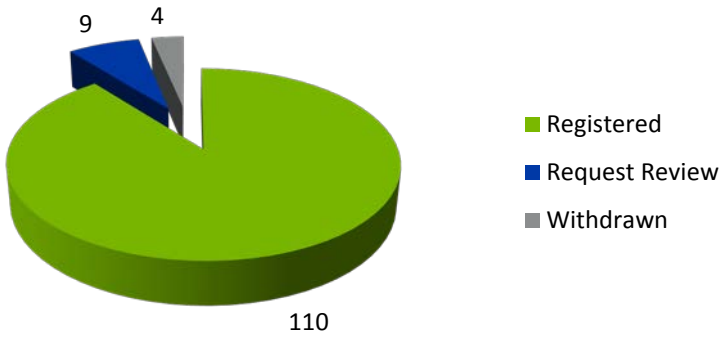


Figure A-3:Current status of CDM projects failing to achieve a registration date in 2012

Projects statuses

Figure A-3 shows that only four of the projects that failed to obtain a 2012 registration withdrew from the CDM process. These four projects were withdrawn after corrections were requested on their PDDs in February and March 2013, and it therefore appears that either the inability to address the requested corrections or the inability to secure a 2012 registration date was the reason for withdrawal. Nine projects remain under the stage of review request, and will either receive a registration in 2013 or will be rejected. 110 projects from our evaluation criteria have gone on to obtain 2013-dated registrations.

[15] See http://ec.europa.eu/clima/policies/ets/linking/faq_en.htm for full details on rules regarding eligibility of international credits.

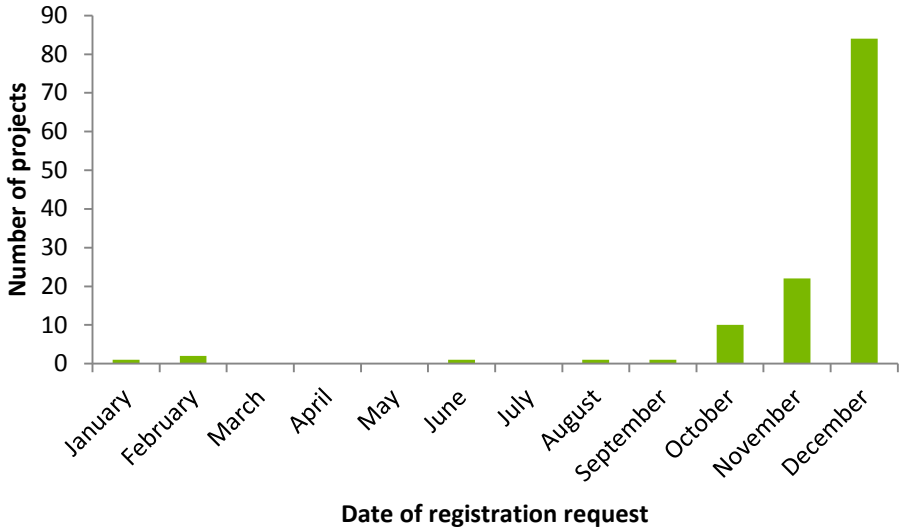


Figure A-4: Date of registration request for projects failing to achieve a registration date in 2012

It is striking that the vast majority of projects failing to achieve registration dates in 2012 began their registration request processes at a very late stage, as shown in Figure A-4. Indeed, 88% of the projects under evaluation began the process in November or December 2012, leaving very little time for document revisions before 31 December 2012 if required. These projects should have been aware that there was a very high risk that a registration dated in 2012 might not be achieved.

Issues affecting 2013-registered projects

Figure A-5 shows two clear categories of projects with a 2013 registration date. Of the projects that were registered in the first few weeks of 2013, almost all were automatic registrations. In these cases, the inability to obtain a 2012 dated registration is likely to be due to the late receipt of registration fees, since the application submission is only complete on the day that both the documents and the fee are received.

For the remaining projects, a sample analysis shows that corrections were requested in line with normal CDM procedures; submissions contained issues with document formatting, mistakes in the PDD such as missing sources or inconsistent calculations, or insufficient information on methodologies and additionality requirements.

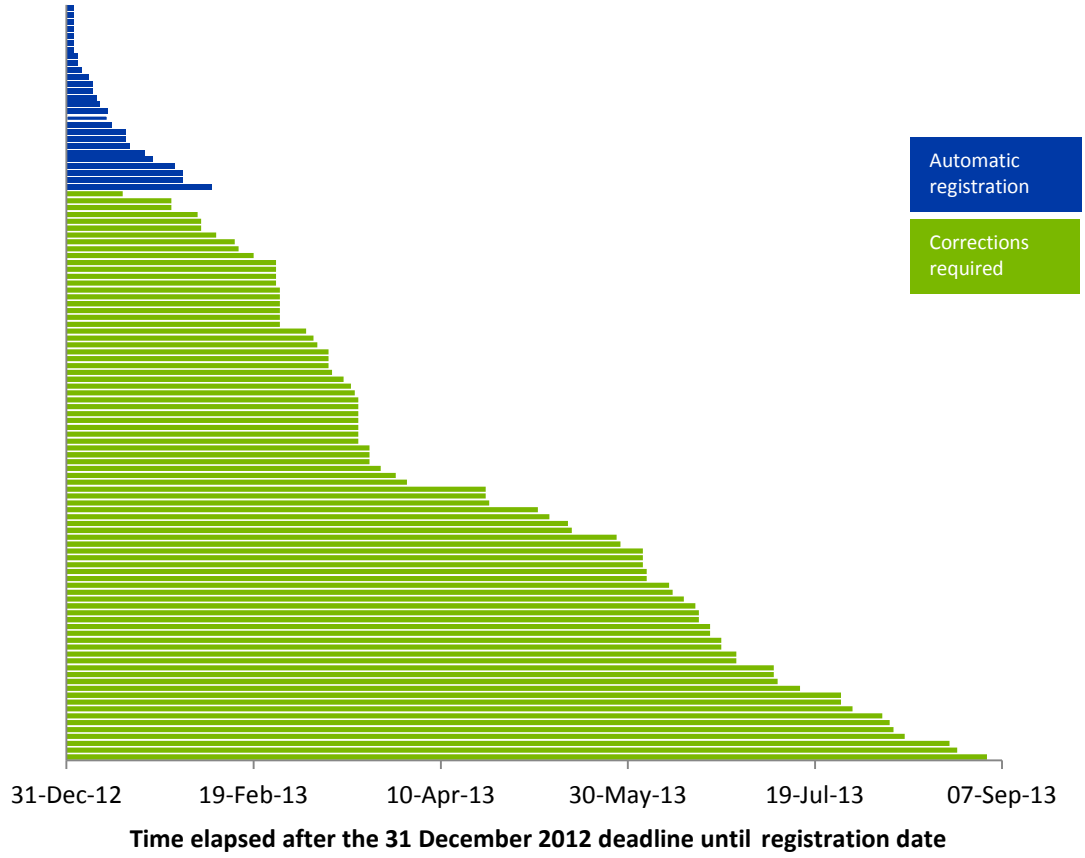


Figure A-5: Time elapsed after the 31 December 2012 deadline until project registration

Considering the ineligibility of their CERs on the EU ETS market, it is perhaps surprising to see that such a high number of the projects continued to resubmit corrections and obtain 2013 registrations. However, Figure A-6 shows us that over 50% of these projects first published PDDs and began the stakeholder participation and validation process less than one year from of the 31 December 2012 deadline.

The chart shows us that approximately 25% of projects struggled with long validation periods of over two years, but that most projects were initiated within 2012 and, given the clear risks of initiating project validation at such a late stage, may indeed be designed on business models that consider the high risk level or that are not completely reliant on EU ETS demand.

This may represent an optimistic outlook amongst these project participants on the future demand for post-2012 CDM CERs outside of the EU ETS. On the other hand, the high registration completion rate might simply be because PPs or PDD consultants considered that the resources required for submitting corrections and completing the registration process were at this stage of little significance, compared to the months or years of prior work.

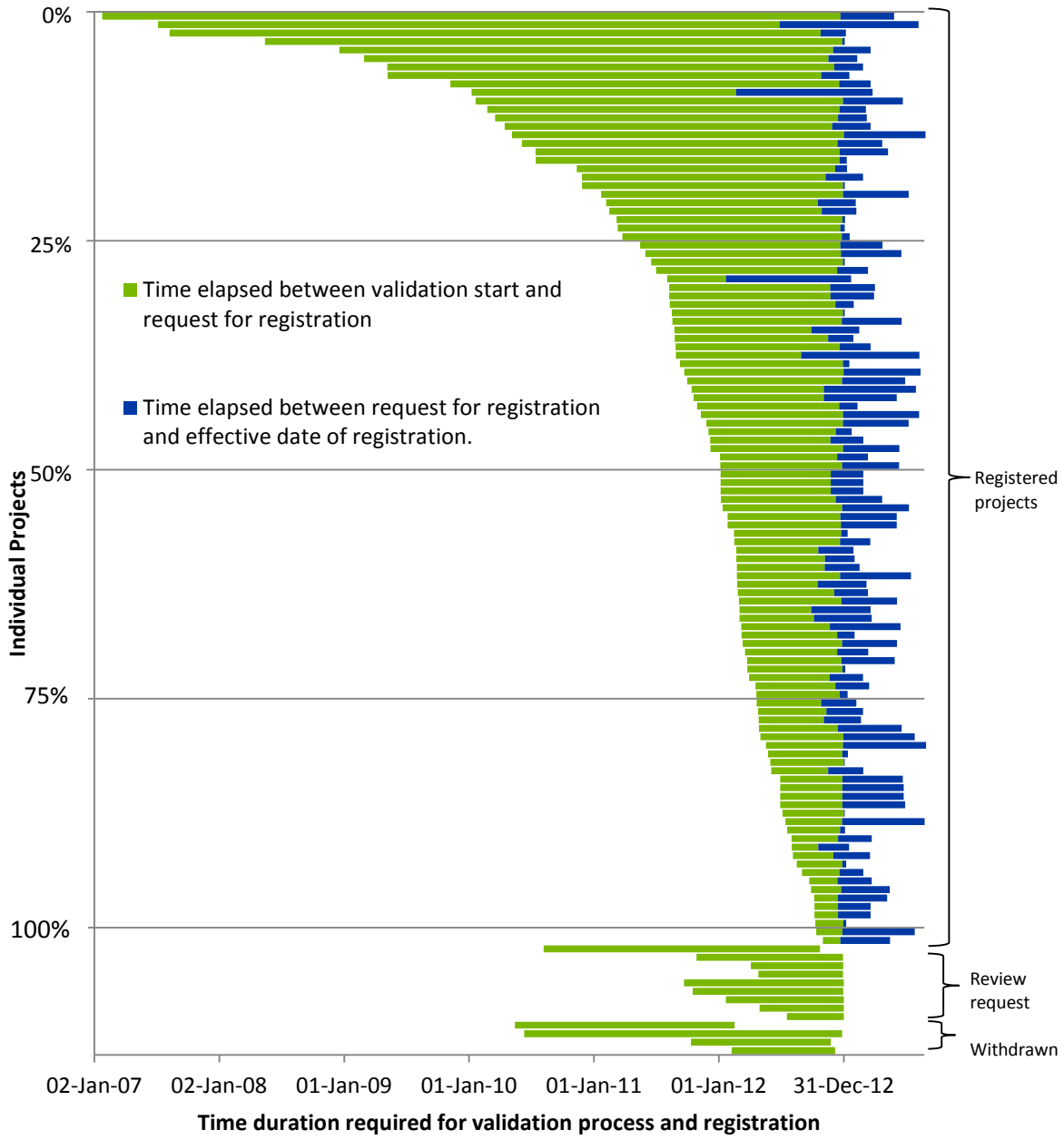


Figure A-6: Project cycle durations for 2013-registered projects

Summary of findings

- 123 projects that might otherwise have been eligible for CER trading under the EU ETS failed to achieve registration dates in 2012. Of these, only four projects were withdrawn, whilst 110 proceeded to a 2013 registration and nine remain under review.
- Of the 110 registered projects, 25% were automatically registered but did not achieve a 2012-registration, most-likely due to late receipt of registration fees, while 75% of projects required corrections or clarifications.
- Over 50% of the registered projects began their validation and stakeholder participation processes less than one year before the deadline, and it is therefore considered that these projects should have been aware of the high risk of not meeting the deadline and may have business models non-reliant on EU ETS demand.

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