Application of the CCQI methodology for assessing the quality of carbon credits

This document presents results from the application of version 3.0 of a methodology, developed by Oeko-Institut, World Wildlife Fund (WWF-US) and Environmental Defense Fund (EDF), for assessing the quality of carbon credits. The methodology is applied by Oeko-Institut with support by Carbon Limits, Greenhouse Gas Management Institute (GHGMI), INFRAS, Stockholm Environment Institute, and individual carbon market experts. This document evaluates one specific criterion or sub-criterion with respect to a specific carbon crediting program, project type, quantification methodology and/or host country, as specified in the below table. Please note that the CCQI website Site terms and Privacy Policy apply with respect to any use of the information provided in this document. Further information on the project and the methodology can be found here: www.carboncreditquality.org

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Sub-criterion:	**1.1.3 Financial attractiveness**
Project Type	**Commercial afforestation**
Date of final assessment:	**21 February 2024**
Score:	**2**

Assessment

Application of the scoring methodology in the context of this project type

The methodology assesses the financial attractiveness of the individual project or project type to estimate the likelihood that economic actors would normally not pursue the respective mitigation activity in a given market and policy environment without carbon market revenues. The assessment considers three indicators that are important for determining financial attractiveness: The financial attractiveness without carbon credit revenues, the change in financial attractiveness due to carbon credit revenues, and the financial attractiveness with carbon credit revenues. The following steps should be applied to derive the score:

Step 1:   Decide whether to apply the methodology to an individual project or at the level of a project type. If the methodology is applied at the level of a project type, clearly define the project type and the geographical scope for the assessment (e.g., global, region, country). Project types may be further differentiated into sub-categories, e.g., considering the project size (e.g. classes of wind turbine sizes), the type of project technology (e.g., on-shore or off-shore wind power), or other project features.

Step 2:   Collect the relevant data. Where the methodology is applied to an individual project, data provided by the project may be used, as long as this data can be reasonably verified. Where the methodology is applied at the level of the project type, different data sources could be used, including literature information or a sample of individual projects for which the necessary data is available. To the extent possible, the sample should represent different investment conditions and locations within the geographical scope.

Step 3:   Define the carbon credit price used in the calculation of the change in financial attractiveness due to carbon credit revenues. The methodology recommends using the current prices of the relevant markets the project is developed for. Assumptions made by the project proponent on expected carbon prices may be used if they are plausible. In absence of further information, the methodology recommends using a consistent proxy for all projects.

Step 4:   Identify for each project the respective value for:

    a.   The equity IRR without carbon credit revenues (IRR);

    b.   The change in equity IRR due to carbon credit revenues (ΔIRR); and

    c.   The equity IRR with carbon credit revenues, calculated as the sum of equity IRR without carbon credit revenues and the change in equity IRR due to carbon credit revenues (IRR+ΔIRR).

Step 5:   Identify for the project the relevant project category in the CDM Methodological Tool for Investment Analysis (CDM TOOL 27).

Table 1 Project categories under the CDM Methodological Tool for Investment Analysis

Group	Categories
1	Energy Industries; Energy Distribution; Energy Demand; Waste handling and disposal
2	Manufacturing industries; Chemical Industries; Construction; Transport; Mining/Mineral production; Metal production; Fugitive Emissions from fuels; Fugitive Emissions from production and consumption of halocarbon, and Sulphur hexafluoride; Solvent use; Carbon capture and storage of CO_2 in geological formations
3	Afforestation and reforestation; Agriculture

Source: CDM Methodological Tool for Investment Analysis (TOOL27)

Step 6: Retrieve for each project the country-level expected return on equity (ROE) in the CDM methodological tool for investment analysis for the respective group identified in step 5 (The respective table can be found on page 12 of version 08.00 of CDM TOOL 27).

Step 7: Determine for each project the three indicators, by putting the IRR, the ΔIRR, and the sum of IRR and ΔIRR in relation to the expected return on equity (ROE).

Step 8: If the methodology is applied to a project type, calculate the average values for Indicator 1.1.3.1, Indicator 1.1.3.2, and Indicator 1.1.3.3 for the sample of projects.

Step 9: Apply the scoring approach in the methodology to determine the score for indicator 1.1.3.1.

Step 10: Apply the scoring approach in the methodology to determine the score for indicator 1.1.3.2.

Step 11: Apply the scoring approach in the methodology to determine the score for indicator 1.1.3.3.

Step 12: Apply the scoring approach in the methodology to determine the overall score for sub-criterion 1.1.3.

If a project or project type does not have revenues or cost savings other than carbon market revenues, an IRR cannot be calculated. As these projects fully rely on carbon market revenues, they are not financially viable without carbon market revenues and are therefore assigned a score of 5.

Information sources considered

1 UC Berkeley Voluntary Registry Offsets Database, Version 8.0
https://gspp.berkeley.edu/research-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database

2 CDM project search https://cdm.unfccc.int/Projects/projsearch.html

3 CDM TOOL27 Methodological tool: Investment analysis – Version 08.0
https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v8.pdf

4 Cubbage et al. (2020) Comparative global timber investment costs, returns, and applications, 2020 https://www.forest-journal.com/index.php/JFBR/article/view/global-timberland-investment-returns

5 Chudy and Cubbage (2020) Research trends: Forest investments as a financial asset class
https://www.sciencedirect.com/science/article/pii/S1389934120304214

6 Cubbage et al. (2020) Global timber investments, 2005 to 2017
https://www.sciencedirect.com/science/article/pii/S1389934119302564

7   Damodaran Online – Return on Equity decomposition by Industry
     https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/roe.html

8   Maraseni et al. (2018) Financial returns for different actors in a teak timber value chain in Paklay
     District, Lao PDR
     https://www.sciencedirect.com/science/article/abs/pii/S0264837717313236?via%3Dihub

9   Pisotto et al (2009) Silvicultural and economic aspects of pure and mixed native tree species
     plantations on degraded pasturelands in humid Costa Rica
     https://link.springer.com/article/10.1007/s11056-009-9177-0

10   Maraseni et al. (2017) Comparing the financial returns from acacia plantations with different
     plantation densities and rotation ages in Vietnam. Forest Policy Econ. 83, 80–87.
     https://www.sciencedirect.com/science/article/abs/pii/S1389934117300941

11   Tahovonen and Rautiainen (2017) Economics of forest carbon storage and the additionality
     principle https://www.sciencedirect.com/science/article/abs/pii/S0928765517302208

Assessment outcome

The project type is assigned a score of 2.

Justification of assessment

Step 1: Decision whether to apply the assessment on the project or project type level.

The assessment is applied at the level of the project type. The project type is here defined as follows:

"Establishment of a planted forest on non-forest land areas that are ecologically appropriate for forests, excluding naturally non-forested biomes, semi-natural grasslands, as well as the boreal region due to albedo-effects. Since the forest may be used for commercial purposes such as timber harvesting, the tree species composition may differ from the natural forest type in the area. This project type neither includes the establishment of agroforestry and marine coastal ecosystems, such as mangroves, nor the management of the project area through community forestry. The project type removes greenhouse gases by increasing forest carbon stocks and possibly carbon stored in harvested wood products."

Step 2: Collect the relevant data

The assessment is conducted at the project type level which requires the construction of a data sample composed of several projects to determine the financial attractiveness of the project type. For this, the following databases were searched for projects related to commercial afforestation:

- UC Berkeley Voluntary Registry Offsets Database v8 (Source 1); in the following referred to as "UC Berkeley database"), which covers projects registered under the programmes American Carbon Registry (ACR), Climate Action Reserve (CAR), Gold Standard (GS) and Verified Carbon Standard (VCS).

- CDM Database for PAs and PoAs (Source 2), which covers CDM projects.

Basing the assessment only on projects that were submitted to carbon crediting programs might be subject to a selection bias because it is likely that projects that are economically viable without carbon credits do not apply for registration. However, a key purpose is to analyse how much carbon credits

contribute to clearing the hurdle rate for the specific project type. Using project samples from carbon crediting programs is therefore still a viable source for conducting the assessment.

The ACR, CAR, GS and VCS generally do not publicly provide detailed information on the financial analysis conducted by the project proponent. This is relevant for the ability to use project data for the assessment. Hence, it was not possible to include projects from these registries in the analysis.

The CDM database (Source 2) contains comprehensive information for each project, such as its reference number, name, methodology, status, location etc. In addition, key financial information is available in the database. This includes the estimated internal rate of return (IRR) benchmark, the estimated IRR excluding certified emission reductions (CERs) and the estimated IRR including CERs. Aside from this database, detailed documentation for each project is available when opening individual project entries in the CDM project search (Source 3). This includes the project design document (PDD) which is often complemented by spreadsheets containing the financial analysis for the project. What information is retrieved from each program is outlined in the following paragraphs.

In the CDM database, commercial afforestation projects are listed under the project types "afforestation" and "reforestation" As of 23 October 2023, the database contains 40 entries with active reference numbers for these two project types. Eleven of these projects performed a benchmark analysis for their investment analysis. All eleven projects were transferred into the initial data sample for this assessment.

The structure of the CDM database was used for building the initial data sample, as its header exhibits the most comprehensive of information categories.

As the CDM operates exclusively in Non-Annex I countries, a category under the United Nations Framework Convention on Climate Change (UNFCCC) that excludes most industrialized countries, relying only on CDM data would leave out countries such as the U.S., where commercial afforestation projects are also implemented.

To remedy this gap, a second dataset, containing information on timber investment trends, was assessed (Source 4). The dataset includes IRR data for combinations of different countries and tree species. Researchers collect this data by sending a survey every three years to local foresters in participating countries. They did this since 2005 and the latest data is available for 2020 (Sources 5-7).

In 2020, the analysis includes data for 16 countries across all continents – both industrialized and developing countries. For some countries like e.g., the United States there is data for several different tree species. Counting all combinations of countries and tree species there is a total of 47 data points available for 2020. For other years, sometimes less data points are available and the authors stress that they deliberately refrain from presenting the data in a time series format and recommend avoiding using their data for time series comparisons.

Nonetheless, the dataset provides sufficient granularity to perform at least some of the methodological steps of the CCQI methodology as outlined above.

The following describe the steps taken for both datasets, starting with the CDM dataset.

CDM dataset

The methodology uses the following three indicators to assess financial attractiveness:

1.1.3.1   The internal rate of return (IRR) without carbon credit revenues, in relation to the relevant IRR benchmark

1.1.3.2   The change in IRR due to carbon credit revenues, in relation to the relevant IRR benchmark

1.1.3.3   The IRR with carbon credit revenues in relation to the relevant IRR benchmark

The data sample was therefore further consolidated by removing projects for which neither of the following information was available:

- IRR without carbon credits (information required for calculating indicator 1.1.3.1 and 1.1.3.2)

- IRR with carbon credits (information required for calculating indicator 1.1.3.2 and 1.1.3.3)

- IRR benchmark (information required for all three indicators

For most projects, all three above parameters are available as entries in the CDM database. Two projects that did not include all information were removed.

Table 2   Number of projects used to calculate the three indicators for financial attractiveness

	All indicators
Total # of projects	9
Regions	
Eastern Asia	3
Eastern Europe	1
Eastern Africa	2
South-Eastern Asia	1
South America	2

Source: Own compilation

For each indicator the assessment was conducted following the steps in the methodology as described below.

Step 3: Define the carbon credit price used in the calculation of the change in financial attractiveness due to carbon credit revenues

As the assessment relies on the estimated carbon price by the project proponent, no further adjustments to the data sample are required

Step 4: Identify for each project the respective value for:

       a. *The equity IRR without carbon credit revenues (IRR);*

       b. *The change in equity IRR due to carbon credit revenues (ΔIRR); and*

       c. *The equity IRR with carbon credit revenues, calculated as the sum of equity IRR without carbon credit revenues and the change in equity IRR due to carbon credit revenues (IRR+ΔIRR).*

The IRR with carbon credits was integrated into the data sample using the process outlined in step 2 above.

Step 5: Identify for the project the relevant project category in the CDM Methodological Tool for Investment Analysis (CDM TOOL 27):

This step is not required for the assessment as it relies on the benchmarks by the project proponent.

Step 6: Retrieve for each project the country-level expected return on equity (ROE) from the CDM methodological tool for investment analysis for the respective group identified in step 5 (The respective table can be found on page 12 of version 11.0 of CDM TOOL 27).

This step is not required for the assessment as it relies on the benchmarks by the project proponent.

Step 7: Determine for each project the three indicators, by putting the IRR, the ΔIRR, and the sum of IRR and ΔIRR in relation to the benchmark IRR.

The calculations were performed for each indicator according to the methodology.

Steps 8-12: If the methodology is applied to a project type, calculate the average scores for Indicator 1.1.3.1, Indicator 1.1.3.2, and Indicator 1.1.3.3 for the sample of projects.

Average scores were calculated for each of the three indicators using the equations outlined in the methodology.

Timber investment trends dataset

The dataset only provides IRRs that are representative for a specific tree species in a specific country. Unlike the CDM dataset, it does not provide any project-level data that would allow calculating an IRR in a scenario with carbon credits. For this reason, the dataset only allows identifying the values for the IRR without carbon credits revenues (Step 4a) and comparing them to a country specific benchmark.

While being a second-best solution, this still allows making general conclusions about the financial attractiveness of timber investments and hence whether the activities implemented under this project type typically depend on further revenues through carbon credits or not.

The IRRs presented in the database however do not include land cost. As land cost typically is an important cost factor for timber investments, excluding them would make the analysis less meaningful. The results would also not be comparable with those of the CDM dataset. The researchers maintaining the dataset however have made an assessment how IRRs change when including land cost for a few country-species combinations. According to this analysis, the decrease in IRRs can be significant, ranging from three percentage points for loblolly pine in the U.S. South to eight percentage points for eucalyptus in Brazil (Source 6).

To account for land cost, the IRR data were adapted. For all tree species in the U.S. 3 percentage points were subtracted from the IRR values, for other countries 5.5 points were subtracted (as being the median value for the range of decrease between 3 and 8 percentage mentioned above).

Step 5: Identify for the project type the relevant project category in the CDM Methodological Tool for Investment Analysis (CDM TOOL 27)

Commercial afforestation falls within group 3 of CDM TOOL27, which is applicable for afforestation and reforestation projects as well as agriculture.

TOOL27 only contains data for developing countries. We therefore consulted an additional database to retrieve respective benchmark data for industrialized countries, using the expected return on equity for the paper and wood industry (Source 4).

As we assume that IRRs provided in the data set being project IRR, WACC was selected as the appropriate benchmark indicator. WACC values were calculated using the standard WACC formula.

The analysis assumes an equal distribution between equity and debt financing as data on the actual distribution for individual country-species combinations is not available.

For several country-species combination input data for calculating WACC such as cost of equity or lending interest rates were not available. They were removed from the original data sample. This left 25 country-species combinations for which full data was available.

Step 6: Retrieve for each project the country-level expected return on equity (ROE) in the CDM methodological tool for investment analysis for the respective group identified in step 5 (The respective table can be found on page 12 of version 08.00 of CDM TOOL 27).

For each combination of country and tree species data for the IRR and the respective benchmark have been entered in an excel database.

Steps 7-12: Perform the calculations for retrieving the CCQI-Scores

For each combination of country and tree species, the respective IRR was divided by the applicable benchmark. The resulting value was subsequently put into the scoring equation for indicator $I_{1.3.1.1}$ (see methodology for details on the scoring equations).

Conclusion of the assessment

For the CDM dataset, Table 3 summarizes the sample sizes and respective indicator scores for the indicators 1.1.3.1, 1.1.3.2 and 1.1.3.3. Inserting these values into the scoring formula results in an average score of 2.06 for the project type. Since there are not more than a few projects for each geographic region represented in the sample Table 2, differentiating the scores between the regions is not deemed robust enough to be considered.

Table 3   Results for sub-criterion 1.1.3 for the project type commercial afforestation

	Sample Size			Indicator scores			Score 1.1.3
	1.1.3.1	1.1.3.2	1.1.3.3	$I_{1.1.3.1}$	$I_{1.1.3.2}$	$I_{1.1.3.3}$	
Global	9	9	9	**3.45**	**2.85**	**3.08**	**2.06**

Source: Own calculation.

For the timber investment dataset, Table 4 below summarizes the results for the calculation of the score for the indicator 1.1.3.1. The results show a high variance in scores, with some country-species combinations being very unattractive investments (e.g., Pinus patula pulpwood in Colombia) and others yielding significant returns on investment that are well above respective benchmarks (e.g., Eucalyptus in China). There are also notable differences between countries when looking at the attractiveness of investments in a certain tree species. For example, while planting *eucalyptus grandis* in Colombia cannot be considered an attractive investment according to this analysis, planting the same species in China would yield returns well above the applicable benchmark rate.

There is also no clear difference in results between developing and industrial countries. While in the U.S., according to our results, most timber species seem to be attractive investments, some species such as e.g., mixed hardwoods, using even aged timber management, are not.

Table 4   Benchmark analysis for timber investments in selected countries

Country	Species	IRR	IRR w land cost	Value I$_{1.3.1.1}$	Score I$_{1.3.1.1}$
Argentina	Pinus taeda - Misiones	7.4	1.90	0.29	4.10
Argentina	Eucalyptus grandis - Average	20.6	15.10	2.32	1.00
Brasil	Pinus taeda sawtimber	11.8	6.30	0.48	3.31
Brasil	Eucalyptus urophylla pulpwod, W-Cen	8.6	3.10	0.24	4.29
China	Eucalyptus sp. - Pingxiang, Guangxi	28.6	23.10	3.99	1.00
China	Pinus massoniana	7.7	2.20	0.38	3.76
Colombia	Eucalyptus grandis	2.2	-3.30	-0.43	5.00
Colombia	Pinus patula sawtimber	11.0	5.50	0.71	2.17
Colombia	Pinus patula pulpwood	0.2	-5.30	-0.69	5.00
Colombia	Pinus tecunumanii	14.2	8.70	1.13	1.00
Mexico	Pinus gregii	11.8	6.30	1.06	1.00
Mexico	Eucalyptus grandis	21.0	15.50	2.61	1.00
Paraguay	Eucalyptus grandis/urograndi clones	22	16.50	1.67	1.00
Uruguay	Eucalyptus smitthii	14.6	9.10	1.81	1.00
Uruguay	Eucalyptus dunnii	11.6	6.10	1.21	1.00
Uruguay	Eucalyptus grandis pulp	14.1	8.60	1.71	1.00
Uruguay	Eucalyptus grandis sawtimber - faster	12.4	6.90	1.37	1.00
Uruguay	Eucalyptus grandis sawtimber - slower	4.3	-1.20	-0.24	5.00
USA	Pinus taeda / South-Wide Avg Growth	4.8	1.80	0.56	2.94
USA	Pinus taeda / Upper 1/6 South Growth	6.6	3.60	1.13	1.00
USA	Mixed Hardwoods, Even Age, Plant	2.9	-0.10	-0.03	5.00
USA	Pseudotsuga menziesii Site I	6.7	3.70	1.16	1.00
USA	Pseudotsuga menziesii Site III	5.8	2.80	0.88	1.17
Vietnam	Acacia Smallholder Northeast	26.0	20.50	2.52	1.00
Vietnam	Eucalyptus urophylla Northeast	21.9	16.40	2.02	1.00
	Average Score I$_{1.3.1.1}$				**2.2**

Sources: IRR-Data (Source 7); ROE Data (Source 2 and Source 4); IRR w land cost and score: own calculations. All values for 2020.

The average score of 2.2, which is computed using all 25 country-species combinations, is driven by many combinations that are clearly financially attractive (14 out of the 25 combinations receive a score of 1 as their IRR is well above the benchmark). Again, the results show no clear differences between developing and industrialized countries for these combinations. If only looking at the U.S., the average across all species of 2.2 is identical with the global average.

Unfortunately, there are no time-series data available that would allow analyzing how the financial attractiveness of the combinations in Table 4 would change over time. The results therefore only represent a snapshot, based on applicable investment conditions in 2020.

Scoring results

The timber investment dataset only allows calculating one out of the three indicators that usually build the score for this sub-criterion. The average score of 2.2 for I$_{1.3.1.1}$ is lower than the average score for this indicator in the CDM dataset, which is 3.45. This suggests that even if data for calculating the other two indicators would have been available, the overall score for the sub-criterion

would not be higher than the score derived from the CDM dataset. This is due to the inverse weighing formula applied when calculating the score for this sub-criterion that attaches more weight to scores that are far away from the maximum score of 5.

Considering this, and the score of 2.06 for the CDM dataset we assign an overall score of 2 for this project type.