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Application of the Oeko-Institut/WWF-US/ EDF 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

Sub-criterion:	1.1.3 Financial attractiveness
Project type:	Wind power (onshore)
Date of final assessment:	31 January 2023
Score:	2.23

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Assessment

Relevant scoring methodology provisions

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) according to the following table:

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

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).

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 Voluntary Registry Offsets Database v5, Goldman School of Public Policy, University of California Berkeley. https://gspp.berkeley.edu/faculty-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database

2 CDM Database for PAs and PoAs, Data accessed 30 July 2022. Downloadable as excel spreadsheet under https://cdm.unfccc.int/Projects/projsearch.html

3 CDM Project Search. Data accessed on 30 July 2022 https://cdm.unfccc.int/Projects/projsearch.html

4 The Verra Registry – Verified Carbon Standard, Data accessed on 30 July 2022 https://registry.verra.org/

5 World Development Indicators – Lending interest rate (Indicator: FR.INR.LEND), Data accessed on 19 May 2022. https://databank.worldbank.org/source/world-development-indicators

6 World Development Indicators – Real interest rate (Indicator: FR.INR.RINR), Data accessed on 19 May 2022. https://databank.worldbank.org/source/world-development-indicators

7 Tax Foundation – Corporate Tax Rates around the World, 2021. Data accessed on 19 May 2022. https://taxfoundation.org/publications/corporate-tax-rates-around-the-world/

8 CDM TOOL27 Methodological tool: Investment analysis – Version 11.0 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v11.0.pdf

9 World Development Indicators – Inflation, GDP deflator: linked series (Indicator: NY.GDP.DEFL.KD.ZG.AD), Data accessed on 19 May 2022. https://databank.worldbank.org/source/world-development-indicators

Assessment outcome

The project type is assigned a score of 2.23.

Justification of assessment

Step 1: Decide whether to apply the methodology to an individual project or at the level of a project type

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

"Installation of a new onshore wind power plant. The electricity is fed into a national or regional electricity grid.The project type reduces emissions by displacing more greenhouse gas intensive electricity generation."

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 wind power:

- UC Berkeley Voluntary Registry Offsets Database v5 (Source 1; in the following referred to as "UC Berkeley database"), which covers projects registered under the programmes ACR, CAR, Gold Standard and 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 analyze 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.

In the CDM database (Source 2), wind energy projects are listed under the project type "wind" with the sub-type "wind". As of November 2022, the CDM database contains 2563 entries with active reference numbers for the project sub-type wind. Searching the UC Berkeley database (Source 1) yielded 996 projects of the project type wind registered under the programmes ACR, Gold Standard and VCS. We could not find any projects of the relevant project type registered under the programme CAR. With regard to the programmes CDM, ACR, Gold Standard and VCS, the degree of information available for each project varies considerably between the programs. ACR, Gold Standard and VCS generally do not make public detailed information on the financial analysis conducted by the project proponent. This is relevant for the ability to use project data for the assessment.

The CDM database 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 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.

Due to the high number of wind projects, a sample of projects must be drawn to serve as the basis for the analysis of the indicator. Because the CDM database contains the most comprehensive financial analysis data available among carbon credit programs, the sample was formed from CDM projects only. The projects are unevenly distributed across different country sub-regions, as shown by table 1:

Table 1 Distribution of CDM wind projects by country sub-regions

	Number of projects in region (g)	Proportion (p)
Regions		
Eastern Asia	1557	0.607
Southern Asia	764	0.298
South America	124	0.048
Central America	44	0.017
Southern Africa	16	0.006
Northern Africa	14	0.005
South-Eastern Asia	12	0.005
Western Asia	11	0.004
Caribbean	8	0.003
Eastern Africa	6	0.002
Southern Europe	6	0.002
West Africa	1	0.000
Total # of projects	**2563**	**1**

Source: Own compilation.

For further assessment, stratified random sampling was used as a method to draw a random sample from these projects, taking into account the unequal representation of country sub-regions. Stratified random sampling is a sampling technique that is suitable when the population under study consist of varying sub-populations as it allows for a proportional representation of the individual sub-groups in the total sample. The population is first divided into smaller subgroups, or strata, based on common characteristics of the individuals, and then the required number of elements from each stratum is randomly selected to form the final sample. The stratum size, i.e., the number of sample elements per stratum represents the weight of the stratum in the total population.

The equation to calculate the required sample size was derived from the CDM “Guideline: Sampling and surveys for CDM project activities and programmes of activities” (Version 03.1) and is as follows:

$$n \geq = \frac{1.645^2 NV}{(N-1) \times 0.1^2 \ + 1.645^2 \ V}$$

Where:

n = Sample size

N = Total number of projects (2563)

V = $\frac{SD^2}{\bar{p}^2}$ = $\frac{overall\ variance}{\bar{p}^2}$

$\bar{p}$ = Overall proportion

1.645 = Represents a confidence level of 90%

0.1 = Represents a precision level of 10%

The proportional allocation of the sample is obtained as follows:

$n = \frac{g_i}{N} \times n \quad where\ i = 1,\ldots k$ and k is the number of projects in the country subregion.

Where:

g_i = Size of the i_{th} group where i=1,…,k

N = Population total

The overall variance and overall proportion of projects is calculated as follows:

$$SD^2 = \frac{(g_a \times p_a(1-p_a)) + (g_b \times p_b(1-p_b)) + (g_c \times p_c(1-p_c)) + \ldots + (g_k \times p_k(1-p_k))}{N}$$

$$\bar{p} = \frac{(g_a \times p_a) + (g_b \times p_b) + (g_c \times p_c) + \ldots + (g_k \times p_k)}{N}$$

Where g_i and N are as above and p_i is the proportion for the i_{th} group subregion); i=1,…,k

Substituting the values from the table into the above equations for SD^2 and $\bar{p}$ gives:

$$SD^2 = \frac{\begin{array}{c}(1557 \times 0.607(1-0.607)) + (764 \times 0.298(1-0.298)) + (124 \times 0.048(1-0.048)) \\ +(44 \times 0.017(1-0.017)) + (16 \times 0.006(1-0.006)) + (14 \times 0.005(1-0.005)) \\ +(12 \times 0.005(1-0.005)) + (11 \times 0.004(1-0.004)) + (8 \times 0.003(1-0.003)) \\ +(6 \times 0.002(1-0.002)) + (6 \times 0.002(1-0.002)) + (1 \times 0.000(1-0.000))\end{array}}{2563} = 0.21$$

$$\bar{p} = \frac{\begin{array}{c}(1557 \times 0.607) + (764 \times 0.298) + (124 \times 0.048) + (44 \times 0.017) \\ +(16 \times 0.006) + (14 \times 0.005) + (12 \times 0.005) + (11 \times 0.004) \\ +(8 \times 0.003) + (6 \times 0.002) + (6 \times 0.002) + (1 \times 0.000)\end{array}}{2563} = 0.46$$

Therefore:

$V = \frac{SD^2}{\bar{p}^2} = \frac{0.21}{046^2} = 0.99$

and substituting V in the sample size equation gives:

$$n \geq = \frac{1.645^2 \times 2563 \times 0.99}{(2563-1) \times 0.1^2 + 1.645^2\ 0.99} = 242.40$$

The minimum total sample size required is thus 242 projects. This number is now divided according to the number of projects in the individual country subregions, resulting in the following strata sizes:

Sample Eastern Asia: $n_{EA} = \frac{1557}{2563} \times 242 = 147.24$

Sample Southern Asia: $n_{SA} = \frac{764}{2563} \times 242 = 72.25$

Sample South America: $n_{SAM} = \frac{124}{2563} \times 242 = 11.73$

Sample Central America: $n_{CAM} = \frac{44}{2563} \times 242 = 4.16$

Sample Southern Africa: $n_{SAF} = \frac{16}{2563} \times 242 = 1.51$

Sample Northern Africa: $n_{NAF} = \frac{14}{2563} \times 242 = 1.31$

Sample South-Eastern Asia: $n_{SEA} = \frac{12}{2563} \times 242 = 1.13$

Sample Western Asia: $n_{WA} = \frac{11}{2563} \times 242 = 1.04$

Sample Caribbean: $n_{C} = \frac{8}{2563} \times 242 = 0.76$

Sample Eastern Africa $n_{EAF} = \frac{6}{2563} \times 242 = 0.57$

Sample Southern Europe: $n_{SEU} = \frac{6}{2563} \times 242 = 0.57$

Sample Western Africa: $n_{WAF} = \frac{1}{2563} \times 242 = 0$

Rounding up the country subgroup strata sizes gives the number of projects to be sampled for each country subgroup: 147 for Eastern Asia, 72 for Southern Asia, 12 for South America, 4 for Central America, 2 for Southern Africa, 1 each for Northern Africa, South-Eastern Asia, Western Asia, Caribbean, Eastern Africa, and Southern Europe. No sample is built for projects in Western Africa. The total sample thus consists of 243 projects.

In the next step, the subsamples were randomly selected from the CDM Database for PAs and PoAs. The projects in the database were divided by country sub-region into separate sheets. The RAND function was used to assign a random number to each project cell, and then the required number of cells was selected using an index ranking formula.

The resulting random sample of 243 projects was transferred for the further assessment of the projects. The structure of the CDM database was used for building the initial data sample, as its header exhibits an already comprehensive row of information categories. Additional information categories were added to the database for detailed analysis, such as IRR type, real or nominal terms, equity share of project financing, and underlying CER price.

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)

Furthermore, projects were removed from the sample that were withdrawn or rejected. This consolidation resulted in 236 projects. For most CDM projects, all three above parameters are available as entries in the CDM database. For CDM projects where this information was lacking, the project design documents, and key project information were searched.

Not all projects have information available on each of the three parameters listed above. Therefore, the number of projects that exhibit sufficient data for the calculation of the relevant indicator differs for each of the three indicators as summarized in Table 2 below. This approach of constructing a sub-sample for each indicator was chosen to ensure the maximum coverage of projects, programs, and regions for the respective indicator. In the following course of the analysis the sample is referred to as the *original sample*.

Table 2 Number of projects used to calculate the three indicators for the *original sample*

	Indicator 1.1.3.1	Indicator 1.1.3.2	Indicator 1.1.3.3
Total # of projects	**203**	**169**	**169**
Regions			
Eastern Asia	143	143	143
Southern Asia	46	19	19
South America	6	3	3
Central America	4	2	2
Eastern Africa	1	1	1
Southern Africa	2	1	1
Caribbean	1	0	0
South-Eastern Asia	0	0	0
Southern Europe	0	0	0

Source: Own compilation.

The methodology further suggests applying a single carbon price and an adjusted benchmark IRR for all projects when calculating the indicators. To be able to perform calculations for all projects with both a single carbon price and an adjusted benchmark IRR, detailed information on the financials of

a project[1] and its IRR type[2] is required to be able to reproduce the financial analysis with input data which differ from those that have been used by the project proponent. For each project in the consolidated data sample, key project documentation was reviewed for the availability of such detailed information. Comprehensive information that allows calculating each of the three indicators is available for79 projects of the sample. Each of these projects provides a separate spreadsheet file with detailed financial data. These sheets provide information on the IRR without carbon credits, the IRR with carbon credits, the carbon price used to calculate the latter as well as other cash-flow related data and calculations.

The approach of constructing a sub-sample for each indicator was chosen to ensure the maximum coverage of projects for the respective indicator, especially for indicator 1.1.3.1. The sample-technique applied here ensures that only the respective adjustments affect the final values of the indicators and not the change in the sample composition.
As this sample comprises adjusted carbon prices and adjusted benchmarks, it is henceforth referred to as *Sample AP/AB.*

For enhancing the sample size and thereby the robustness of the results, it was decided to also conduct the analysis with two adjusted samples by making the following adjustments:

- Adjusting for each project the underlying carbon credit price (resulting in *sample AP*) and
- Adjusting the benchmark IRR (resulting in *sample AB*).

Since for these samples only one input factor is changed at the time, there is only project data required on either the project's detailed financials (*Sample AP*) or its IRR type (*Sample AB*). Consequently, the respective sample size does not diminish as much as when adjusting both the benchmark IRR and the carbon credit price at the same time (see Table 3). Again, indicator 1.1.3.1 is not affected by adjusting the carbon credit price, which is why in *Sample AP* the sub-sample composition for this indicator does not deviate from the *original sample*.

Table 3 shows the number of projects in each sub-sample of the three additional samples. Compared to the *original sample*, the concentration with regard to CDM projects and projects in Eastern Asia is generally higher.

[1] In particular, the project documents need to contain information on the impact of a certain carbon credit price on the IRR of the project. Furthermore, it is critical to have the possibility of modifying the financials by hand (e.g., via an excel spreadsheet) in order to apply the single carbon price.

[2] The applicable benchmark depends on whether the project proponents based their investment analysis on an equity IRR or project IRR and on whether this is stated in nominal or real terms.

Table 3 **Number of projects used to calculate the three indicators for *Sample AP/AB*, *Sample AP* and *Sample AB***

	Sample AP/AB			Sample AP			Sample AB		
Indicator	**1.1.3.1**	**1.1.3.2**	**1.1.3.3**	**1.1.3.1**	**1.1.3.2**	**1.1.3.3**	**1.1.3.1**	**1.1.3.2**	**1.1.3.3**
Global	173	79	79	**86**	**85**	**85**	**173**	**128**	**128**
Regions									
Eastern Asia	87	68	68	68	68	68	87	87	87
Southern Asia	71	8	8	13	12	12	71	33	33
South America	8	1	1	2	2	2	8	4	4
Central America	4	1	1	1	1	1	4	2	2
Eastern Africa	1	0	0	1	1	1	1	1	1
Southern Africa	1	1	1	1	1	1	1	1	1
Caribbean	1	0	0	0	0	0	1	0	0

Source: Own compilation.

For each indicator the assessment was conducted following the steps in the methodology, using the respective sub-sample.

Step 6 of the methodology suggests selecting the IRR benchmark from the country-level expected return on equity (ROE) outlined in the CDM methodological tool for investment (CDM TOOL 27; Source 8).[3] This benchmark does, however, only apply to projects that use an equity IRR in their financial analysis. For projects that use a project IRR as the financial indicator, the appropriate benchmark is the weighted average cost of capital (WACC).

There is no publicly accessible data base for WACC across industries and countries. The WACC for an individual firm can be calculated using the following formula:

$$WACC = r_e \times W_e + r_d \times W_d \times (1 - T_c)$$

Where:

r_e = Cost of equity
W_a = Percentage if financing that is equity
r_d = Cost of debt
W_d = Percentage of financing that is debt
T_c = Corporate tax rate

The most accurate way of calculating a WACC benchmark would be to build a peer group of companies active in a particular country and industry related to the project type and calculate the average WACC that applies among that group. This would require very comprehensive data. The second-best option is to calculate the benchmark by using country specific data for the parameters listed in the formula above. This option was used for the assessment.

The projects of the samples presented above do not uniformly incorporate inflation in their investment analyses.[4] This needs to be considered for calculating the respective adjusted benchmark.

The required data were sourced as follows:

- **Cost of equity:**
  The default values from the table in CDM TOOL 27 version 11.0 were used both as the adjusted benchmark for projects with equity IRRs and as part of the WACC formula above for projects with project IRRs. The host country of the project activity and the category the project type is assigned to determine the respective expected ROE (this is illustrated in step 5 below). Since these values are stated in real terms, they can only be taken as benchmarks for projects which incorporate inflation but need to be adjusted for projects which present their data in nominal terms.

[3] Since in this source the values of the country-level expected return on equity constitute the cost of equity values, in the context of CDM Tool 27 both terms will be used synonymously in the following course of the assessment.

[4] There is a considerable number of projects which do not even state whether they present their investment analysis in nominal or real terms. After consulting the CDM Secretariat, it was deemed justifiable to assume for CDM projects that these cases exhibit nominal values. For the purpose of consistency, this assumption was extended to projects of other carbon crediting programs as well.

This is done by adding the median of the country-specific annual inflation rates between 1990 and 2020.[5] The inflation data is retrieved from the World Bank series *Inflation, GDP deflator: linked series* (Source 9), which is part of the "World Development Indicators" database. Using this time series both provides consistency with the calculation of the *real interest rate* below and – in contrary to other inflation time series – allows to take into account price changes on the level of the whole economy instead of changes in the consumer prices.

- **Cost of debt:**
  The "World Development Indicators" also include a time series on the *lending interest rate* for meeting "short- and medium-term financing needs of the private sector"[6] (Source 5). Since the interest rates are expressed in nominal terms by this indicator, they were only used for projects with nominal numbers.

  For projects which present their data in real terms, the *real interest rate* time series (Source 6) from the same database was accessed. According to its metadata, this indicator "is the *lending interest rate* adjusted for inflation as measured by the GDP deflator", which ensures consistency with the approach of inflation adjustments for the cost of equity. For either time series, the combination of host country and starting year of the project activity determines the project's respective interest rate considered as benchmark value for the cost of debt. For some country-year combinations data on the respective interest rate are not available. Consequently, some projects were excluded from the analyses related to adjusted benchmarks.[7]

- **Corporate tax rate:**
  The Tax Foundation maintains a time series with the relevant data between 1980 and 2021 (Source 7). Again, the combination of host country and starting year of the project activity determines the applicable rate.

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 either using the carbon price estimated by the project proponent if it can be considered as plausible or setting a single carbon credit price applicable to all projects. Here, both approaches are implemented and then compared.

For the *original sample* and the *Sample AB* the carbon prices set by the project proponents are not adjusted. The single carbon credit price for the assessment based on *Sample AP/AB* and *Sample AP* respectively is set at EUR 10 per ton/CO_2e. This value is chosen with the expectation that carbon credit prices will surge in the future and because the performance of projects at these higher values is of most interest when looking at the financial attractiveness of the project type. In principle different prices are possible, however the main objective is to apply a uniform price to all projects to enhance comparability of the results. The carbon price is an important input factor when calculating the

[5] Taking the median of long-term data, we intend to follow the approach used for calculating the default values in CDM TOOL27, which are "based on long term historical returns".

[6] Basing the country-specific cost of debt numbers on this dataset is in line with the provisions laid out in paragraph 24 of CDM TOOL27 version 11.0.

[7] This is already accounted for in the number of projects of the *Sample AP/AB* and *Sample AB* as presented in Table 2.

contribution that carbon credit revenues can make to a project clearing the financial hurdle rate. If a carbon price is used that is higher than what can reasonably expected this might skew financial calculations of a project. Choosing a uniform carbon price across all projects tries to mitigate this risk.

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

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

   The IRR without carbon credits was integrated into the data sample using the process outlined in step 2 above.

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

   The change in IRR was calculated by subtracting the value for the IRR without carbon credits from the value for the IRR with carbon credits.

c. The IRR with carbon credit revenues

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

Applying the single carbon credit price of EUR 10 per ton/CO2e instead of the value set by the project proponents, triggers changes in both b. and c. compared to the calculations of the projects.

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

This step is relevant for uniformly adjusting the benchmark of the projects within *Sample AP/AB* and *Sample AB*. Wind projects fall within project group 1 of the Methodological Tool for Investment Analysis since this project type is covered by the sectoral scopes 1 (Energy industries).

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 relevant for uniformly adjusting the benchmark of the projects within *Sample AP/AB* and *Sample AB*.

For projects which based their demonstration of additionality on equity IRRs, the country-level expected ROE is used as the appropriate benchmark. For projects which chose project IRR as the financial indicator however, the WACC is the appropriate benchmark. The respective values are retrieved for each project as outlined in Step 2 above.

For most projects no information is available in the project design document or other key project documentation on the distribution of debt and equity financing of the project. Where this information is lacking, the assumption was made that each source of financing accounts for a share of 50 percent. This assumption is guided by the respective recommendations in paragraph 25 of CDM TOOL 27. Where information on the share of equity and debt is available however, this is considered for calculating the project's WACC by using the formula presented on page 10.

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.

For each project the three indicators were derived by putting the respective IRR, ΔIRR and IRR with carbon credit revenues in relation to the respective benchmark.

In doing so, different combinations of benchmarks values (original or adjusted) and carbon credit price (original and adjusted) were used respectively. Table 3 below provides an overview of the scoring results for each combination.

Indicator 1.1.3.1 is not affected by changes in the carbon price, which is why here only two values were calculated; one based on the original benchmark (3.0) and another on the adjusted benchmark (3.28). For indicators 1.1.3.2 and 1.1.3.3 values for all four different combinations have been calculated.

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.

Indicator values were calculated for each project in each sub-sample using the combinations of benchmarks and carbon credit prices outlined in step 2. After this, the values were used to derive the scores for each indicator using the respective scoring formulas outlined in the methodology. Finally, average indicator scores were determined.

Table 4 summarizes the results of the analysis. The overall score for sub-criterion 1.1.3 varies between 2.16 and 2.42 when looking at the sample that includes only those 79 projects that provide information for all three indicators. When looking at sub-samples, scores are lower when applying the single carbon price of EUR 10 per ton/CO_2e, because most projects used higher prices in their investment analyses with an average of EUR 12.41 from projects which based their calculations on euro numbers.[8]

The overall score for sub-criterion 1.1.3 for the project type wind power (onshore) on a global level is 2.23 (applying the combination with the adjusted price and the adjusted benchmark).

Table 4 Scoring results for sub-criterion 1.1.3 for the project type wind

	Indicator Scores			Score 1.1.3
	1.1.3.1	**1.1.3.2**	**1.1.3.3**	
Original Sample	2.82	3.49	4.07	**2.41**
Sample AP/AB	3.05	3.11	3.84	**2.23**
Sample AP	2.82	3.24	3.84	**2.16**
Sample AB	3.05	3.41	3.78	**2.42**

Source: Own calculation

Conclusion of the assessment

We checked whether the results would be different, if the assessment was based on the largest number of projects with information for a respective indicator. The table below shows the results for

[8] Projects which calculated with numbers in US dollars used an average price of USD 14.29, which is still well above EUR 10 when considering the long-term EUR/USD exchange rate.

the indicators without need for full financial information for the two samples (indicator 1.3.1 e.g., only needs information on the expected IRR without carbon credits. Information on the estimated carbon price is not required. This information is however required for indicator 1.1.3.3, hence a project not providing this information can be used for indicator 1.1.3.1 but not 1.1.3.3). The overall score for indicator 1.1.3 stays within the same range compared with the sample that includes only the 79 projects for which information is available for all indicators.

Table 6 Final results for sub-criterion 1.1.3 for the project type wind

	Sample Size			Indicator Scores			Score
	1.1.3.1	**1.1.3.2**	**1.1.3.3**	**1.1.3.1**	**1.1.3.2**	**1.1.3.3**	
Original Sample	203	169	169	3.00	3.43	3.97	**2.46**
Sample AP/AB	173	79	79	3.05	3.11	3.31	**2.22**
Sample AP	86	85	85	2.83	3.17	3.74	**2.20**
Sample AB	173	128	128	3.28	3.26	3.60	**2.42**

Source: Own calculation

Regional differences exist for some of the scores. A regional differentiation of scores is however not deemed robust enough to be considered because of the low numbers of projects in the sample size for some of the regions. The same applies for the scale of projects (large scale, small scale) and the time period of registration (pre-2013, 2013-2021).

Table 5 below provides a detailed overview of the score distribution across the indicators when looking for each indicator at the largest number of projects.

Table 4 Scoring for sub-criterion 1.1.3 for the project type wind

Sub criterion 1.1.3	Original Sample				Sample AB				Sample AP				Sample AB/AP			
	1.1.3.1	1.1.3.2	1.1.3.3	**Score**	1.1.3.1	1.1.3.2	1.1.3.3	**Score**	1.1.3.1	1.1.3.2	1.1.3.3	**Score**	1.1.3.1	1.1.3.2	1.1.3.3	**Score**
Global	3.00	3.43	3.97	**2.46**	3.28	3.26	3.60	**2.42**	3.00	3.17	3.74	**2.20**	3.28	3.11	3.31	**2.22**
Regions																
Eastern Asia	2.81	3.54	4.10	**2.44**	3.05	3.44	3.82	**2.46**	2.80	3.37	3.97	**2.28**	3.09	3.22	3.35	**2.18**
Southern Asia	3.50	2.95	3.43	**2.30**	3.52	2.99	3.22	**2.26**	2.87	2.50	3.01	**1.37**	2.85	2.61	3.37	**1.56**
South America	3.64	2.59	3.03	**1.98**	3.73	2.31	2.47	**1.62**	3.26	1.77	2.11	**1.00**	3.26	2.33	1.75	**1.04**
Central America	3.24	1.98	1.58	**1.00**	3.19	2.09	2.36	**1.04**	4.06	1.94	1.45	**1.15**	4.06	1.75	1.16	**1.00**
Eastern Africa	2.78	3.62	4.30	**2.54**	2.78	3.62	4.30	**2.54**	2.78	2.25	2.96	**1.10**	2.78	-		
Southern Africa	1.58	2.23	3.56	**1.00**	2.15	2.23	3.56	**1.00**	2.15	1.82	3.20	**1.00**	2.15	1.94	4.15	**1.00**
Scale																
Large	2.92	3.47	4.02	**2.45**	3.18	3.30	3.70	**2.42**	2.81	3.26	3.86	**2.17**	3.08	3.16	3.29	**2.10**
Small	3.35	3.08	3.54	**2.33**	3.48	3.12	3.29	**2.36**	2.94	2.54	2.97	**1.44**	2.92	2.70	3.50	**1.73**
Registration period																
pre 2013	2.88	3.47	4.06	**2.44**	3.13	3.32	3.72	**2.40**	2.79	3.26	3.86	**2.16**	3.05	3.15	3.33	**2.09**
2013-2021	3.58	3.01	3.41	**2.39**	3.74	2.97	3.01	**2.32**	3.06	2.52	2.92	**1.49**	3.10	2.75	3.14	**1.77**

Source: Own calculation.