# “CDM projects and their impact on sustainable development: A case study from Kenya”

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| **ARTICLE INFO** | Brenda Nyambura and Godwell Nhamo (2014). CDM projects and their impact on sustainable development: A case study from Kenya. *Environmental Economics*, *5*(1) |
| **RELEASED ON** | Thursday, 27 March 2014 |
| **JOURNAL** | "Environmental Economics" |
| **FOUNDER** | LLC “Consulting Publishing Company “Business Perspectives” |

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# CDM projects and their impact on sustainable development: a case study from Kenya


## Abstract

This paper documents the Kyoto Protocol's clean development mechanism's (CDM) contribution to sustainable development in Kenya. The aim of this research is to determine how much the CDM contributes to sustainable development in Kenya. Specifically, the objective of the paper is to assess the relationship between CDM project characteristics and their contribution to sustainable development in the country. To assess how much CDM contribution there is, the sustainable development indicators involving four parameters (environmental, social, economic and technology) were used. These criteria were informed by Multi-Attributive Assessment model utilizing data and information from registered CDM project design documents (PDDs) from the country. The key findings were that none of the 14 CDM projects had an average score of one (1), which would be the ideal score if a CDM project contributed to all the sustainable indicators used in the evaluation. The highest scoring project was the Nairobi River Basin Biogas CDM Project, the only biogas project in Kenya, with a score of 0.8 and represents 7% of the projects. About half of the CDM projects got a score of 0.6, which is just slightly above the average.


**Keywords:** CDM, Kenya, sustainable development contribution.
**JEL Classification:** Q56.

## Introduction

As indicated in the Kyoto Protocol, the CDM is flexible mechanisms set out to assist developing countries achieve sustainable development whilst those from the developed world attain their greenhouse gas (GHG) emission reduction quotas (Schneider & Grashof, 2007). With Kenya's aspiration to be a newly industrialized country by the year 2020, there is realization that industrial development will inevitably be accompanied by environmental degradation unless sustainable development is taken into account (NEMA, 2005). In its development blueprint 'Vision 2030', Kenya has identified the CDM, with a target of five new CDM projects every year, as a strategic thrust to achieve sustainable development (Republic of Kenya, 2007). As of April 2013, a total of fourteen CDM projects were registered in Kenya as from the UNEP Risoe Center website (www.cdmpipeline.org). This research is set to find out how the registered CDM projects have contributed to sustainable development (including environmental sustainability, poverty eradication and jobs creation) in Kenya.

CDM projects also have additional outcomes, among such, a need to address the negative impacts associated with climate change like weather related disasters. Kenya is not isolated from the extreme weather disasters and is in fact one of the countries that is severely affected by these disasters (Republic of Kenya, 2007). While adaptation measures to climate change are crucial and urgent, mitigation measures are nonetheless important. Therefore the CDM, as a mechanism towards a sustainable development is part of Kenya's developmental journey. In principle, the CDM has potential to contribute to sustainable development (Boyd et al., 2009) although other writers notice the CDM's failure to reach its potential in contributing to sustainable development objectives (Schneider and Grashof, 2007; Boyd et al., 2009). Given such resentments, the focus of this research paper is to evaluate the contribution of CDM projects in achieving the objectives of sustainable development in Kenya.

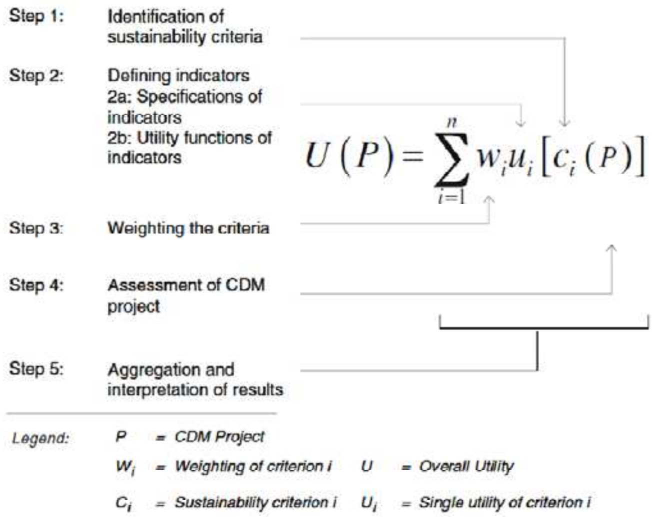
This paper firstly explains the methodological approach of the empirical evaluation and choice of sample to be employed. Secondly, it focuses on sustainable development, its criteria in Kenya and the future of CDM in Kenya. It then takes a look at the empirical literature of the CDM while sampling some of the findings. Lastly, it presents key findings of the research and gives the conclusion.

## 1. Methodology and sampling frameworks

Data for analysis was collected from publicly available documents from the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Programme Risoe Centre (UNEP-Risoe) and Kenya's National Environmental Management Authority (NEMA) websites. CDM project design documents (PDDs) were used since they appropriately provide the necessary information as to the potential sustainable development contribution of the CDM project at the time of validation. The UNEP Risoe CDM website provided a database of 34 CDM projects for Kenya as on April, 2013 of which a sample of 14 were registered projects, whose PDDs were also obtained from the UNFCCC website.

The question raised to inform this paper deserves a more detailed quantitative review of the actual contribution the 14 CDM projects made to sustainable development. An assessment of the performance of the CDM projects was done from the PDDs of all the active CDM projects in Kenya. The model used to analyze the raised question was considered after closely reviewing several studies, and of particular importance, one by Sutter and Parreno (2007) that utilizes the Multi-Attributive Assessment – MATA-CDM (MATA-CDM) model. The MATA-CDM methodology is utilized for quantitative assessment of CDM projects in as far as their contribution to sustainable development is concerned. This model (Figure (1)) involves five crucial steps that we used for a comprehensive analysis of the 14 PDDs of the active CDM projects.

From Sutter and Parreno (2007, pp. 77), the MATA-CDM model (Figure (1)) aims "to generate a holistic overview assessment of the sustainable development contribution of CDM projects rather than a strictly scientific evaluation of single parameters". The model unifies different disciplines (economics, social sciences and natural sciences) and is prepared to assist decision makers in being accurate and remaining practical at the same time. There are no fixed sets of assessment criteria as these are to be identified in the first step. As such, evaluators should be aware of the normative nature of criteria selection. The MATA-CDM presents the weighted sum of utilities of the selected assessment criteria and remains a simplified construction of reality and results must be interpreted accordingly. "The concept of utility allows the quantities to be normalized with different units and aggregated into a single value. All indicators are measured against a reference case – the so-called "baseline" (Sutter and Parreno, 2007, p. 78). For our study, the base line scenarios defined in PDDs were used.




Source: Sutter and Parenno (2007, p. 78).

**Fig. 1. Steps in MATA-CDM and equation to compute overall utility of CDM projects**

In order to adequately assess the contribution of the CDM project, the first step identifies the sustainability criteria. This is done according to the broad sustainable dimensions, namely, environmental, social, economic, and in addition, technological so as to get a generalized assessment of the CDM project. Although technology does fall under the economic criterion, we thought it best to evaluate the CDM projects by assessing the type of technology introduced by the projects. For the purposes of this study, proxies for the aforementioned different but correlated sustainable development criteria are used. This is represented in Table 1.

Table 1. Sustainable development criteria, indicators and their classification

| Criterion | Proxy | Classification |
|---|---|---|
| Economic | Certified emissions reductions (CERs) returns distribution | Semi-quantitative |
| Technology | Technology transfer | Qualitative |
| Social | Employment creation | Quantitative |
| Environment | Local air quality | Qualitative |

In Step 2 indicators are defined followed by weighting criteria in Step 3. In order to make the utility function more manageable for decision makers, their values are rated with three letters: A, B and C. Employment plays a great role in improving the social welfare of a country's population and contributes to poverty eradication. To this end our study uses employment as a proxy for the economic criterion and the CDM projects are evaluated in terms of employment opportunities for the locals created during construction and/or implementation. Due to the fact that PDDs do not specify the number of job opportunities created either directly or indirectly, there is no specific indicator that can measure employment quantitatively. Hence, in our view, a CDM project obtained a value of '1' and rating of 'A' if it creates both direct and indirect employment both during construction and implementation phases; value of '0.5' and rating of 'B' if it creates indirect jobs during construction or implementation and value of '0' and rating of 'C' if the PDD does not mention job opportunities created.

An important aspect of sustainable development is environmental protection and this involves management and protection of elements of environment such as air. The MATA-CDM model utilizes local air quality as a proxy for environmental criterion. CDM projects were evaluated by their contribution to improved air quality such that, those projects that listed direct and indirect reduction of major local air pollutants were rated 'A' (with utility value of 1). Those that did not mention effects on air quality were assumed to have no effect on local air quality and were rated 'B' (utility value of 0.5). Those projects that listed negative impacts to air quality for example the emission of gaseous matter but with elaborate measures on how to counter these effects were rated 'C' (utility value of 0).

The MATA-CDM model utilized the distribution of CERs from the CDM project returns as a proxy for social equity (Thorne et al., 1999). Hence a project would be rated 'A' (utility value of 1) if a large fraction of its CER returns would be to the poor in the host country, 'B' if it had a fraction of CER returns to the poor of the host country, and 'C' if project did not mention the flow of CER returns to the poor in the host country.

Transfer of environmentally sound technology that includes equipment, experience and know-how that is introduced by the CDM projects into the country was also considered. Some projects are small-scale projects utilizing and introducing new and/or imported environmentally-safe technology into the host country and not necessarily contributing much CER returns. The evaluation was done as to whether the technology introduced was new, innovative and sustainable. A project obtains a rating of 'A' if the technology introduced is new and sustainable in the long-term coupled with training of locals. A rating of 'B' is given to projects that do not mention technology transfer in their PDDs.

In Step 4 each CDM project was rated for each of the sustainable development indicators according to the method described herein. Under the study synthesized the individual scores of each of the sustainable development indicators.

## 2. Theoretical underpinnings

The UNFCCC, signed in 1992 by 192 countries worldwide was a treaty aimed at stabilizing GHG emissions and taming climate change. This later led to the adoption of the Kyoto Protocol, an international and legally binding agreement which was brought into force in 2005 to operationalize the UNFCCC. The UNFCCC covers six GHGs namely: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. The Kyoto protocol was set on two main objectives: to set binding targets for 37 countries and the EU, historically the biggest emitters of GHG, for reducing GHG emissions and to create a mechanism to achieve the quota of 5.2% on average based on 1990 GHG emission levels as base year during the first commitment period being 2008-2012 (UNFCCC, 2012).

**2.1. Fundamentals in the Kyoto Protocol.** Under the Kyoto Protocol, national emission limit setting is performed by a government agency that decides on a cap of GHGs that can be emitted which is consistent with its Kyoto reduction target. This quantity is then allocated, via permits, to major carbon-emitting industries. Individual organizations may then choose to use their carbon allowances to validate their own GHG production, or to implement new technologies to reduce their GHG emissions and sell their permits. To help reduce the costs of the treaty, there are three market-based mechanisms under the protocol namely: Emission Trading, Joint Implementation and the CDM. The focus of this paper is the CDM as this is the one applicable to developing countries like Kenya (World Bank, 2011).

The Clean Development Mechanisms (CDM) works on a project by project basis where a developed country invests in a GHG reducing project in a developing country. When this happens, the UNFCCC CDM Executive Board validates and verifies the carbon credits known under the system as Certified Emissions Reductions (CERs). Each CER represents one tonne of emissions, expressed as a carbon equivalent (tCO2e) of GHG emission. Developed countries pay for projects in developing countries that reduce GHG emissions by purchasing CERs. Through this, the host country obtains additional revenue streams (Mutia, 2010).

**2.2. Sustainable development and its criteria in Kenya's CDM.** Sustainable development is defined in the popular report Our Common Future as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987, p. 43). This is probably the most commonly cited definition of all time. Despite the absence of a universal operational definition, it is agreed that sustainable development entails three different but mutually reinforcing pillars, namely: economic development, social development and environmental protection (UNFCCC, 2012). Under the Kyoto Protocol, a governmental Designated National Authority (DNA) in the host country sets the sustainable development criteria for evaluating CDM project. Such classification focuses on the three common pillars addressing environmental, social and economic sustainability (Schneider and-Grashof, 2007). Based on this, the DNA therefore plays a fundamental role in securing the realization of national development benefits of CDM projects. Simply put, the DNA can use the sustainable development dimension to evaluate, create and maximize synergies of key linkages between national development goals and CDM projects (Olhoff et al., undated). In addition, better environmental protection through CDM projects may constructively alter policy priorities and compel governments to address sustainable development (Ogola et al., 2012). The DNA in Kenya is the National Environmental Management Authority (NEMA) established in 2002 under the Ministry of Environment and Mineral Resources. NEMA has developed specific sustainability criteria based on the unique conditions and sustainable development targets of Kenya (Table 2).

Table 2. Kenya's sustainable development criteria

| Broad criteria | Specific Indicators |
|---|---|
| Social development indicators | *Poverty alleviation*<br>♦ Contribution to eliminate unemployment/ Creation of new jobs<br>♦ Creation of new activities<br>♦ Impacts on local community |
| | *Gender equity*<br>♦ Women empowerment<br>♦ Wealth equitable distribution |
| Environmental development indicators | *Global environment*<br>♦ GHG emissions reduction<br>♦ Leakages (qualify) |
| | *Local environment*<br>♦ Local environment improvement (air, water, soil, etc.)<br>♦ Efficient resource utilization (impact on intra-generational equity as well) |
| Economic development indicators | *Macro-economic indicators*<br>♦ Contribution to reduce foreign expenditures<br>♦ Contribution to national debt reduction<br>♦ Long term effects |
| | *Micro-economic indicators*<br>♦ Cost effectiveness |
| | *Energy related indicators*<br>♦ Contribution to energy source diversification<br>♦ Impact on supply security<br>♦ Contribution to energy efficiency/saving |
| | *Technology transfer*<br>♦ State of the art technology transfer<br>♦ Effective transferability of technology |

**2.3. Evidence on the sustainability impact of CDM projects.** Several studies have been conducted with the aim of assessing the sustainability impact of CDM projects. These include TERI (2012), Alexeew et al. (2010), Boyd et al. (2009), Sutter and Parreno (2007), Olsen and Fenhann (2008), Michaelowa and Castro (2008), Michaelowa and Michaelowa (2007), Sirohi (2007), Brunt and Knechtel (2005). The similar aspect about these research studies is their use of sustainability criteria and indicators to assess the contribution of CDM projects to sustainable development (UNFCCC, 2012).

Most studies have used PDDs for the analysis of sustainable development contribution of CDM projects in terms of economic, environmental, social and technological benefits. Text analysis of PDDs has been used by studies such as UNFCCC (2011; 2012), Sutter and Parreno (2007), Boyd et al. (2009). Other studies have used software programs for text analysis such as Olsen and Fenhann (2008) who used a software program known as Nvivo7 and Lee and Lazarus (2011) who used Atlas.ti Version 6.2 software. Subbarao (2010), Castro and Michaelowa (2008) have followed textual analysis of PDDs by case studies to complement information in the PDDs.

Boyd et al. (2009) conclude, from an assessment study of 10 CDM projects according to their sustainable development benefits that, they did not achieve the benefits spelt out upfront at their conceptualization. Similarly, Olsen and Fenhann (2008) have evaluated the contribution of the CDM by reviewing 744 PDDs and come to the conclusion that if left to market forces, the CDM makes no significant contribution to sustainable development. Sirohi (2007) examined 65 PDDs in India and concluded that the projects did not contribute to poverty eradication, particularly to the rural poor. Further, the study found that PDDs merely offered 'lip-service' and did not quite reflect the actual contribution to sustainable development (see also Michaelowa and Michaelowa, 2007; Monceau et al., 2011).

Haites et al. (2012) find that frequency of technology transfer differs significantly by project type and the UNFCCC (2010) found that only a low number (39%) of the CDM projects in the pipeline in 2010, were explicitly claiming transfer of either knowledge or equipment in the PDDs. Further, that technology transfer is claimed most by large projects and those with foreign participants (Seres & Haites, 2008; UNFCCC, 2010; Das, 2011). TERI (2012) notes that since technology transfer is not an explicit requirement by the CDM, most projects which do not claim this benefit in the PDDs may nevertheless involve technology transfer.

Olsen and Fenhann (2008) found that employment generation and economic growth are the most claimed benefits followed by improved air quality benefits. UNFCCC (2011) finds that job creation and reduction of pollutants are the most claimed benefits. Lee and Lazarus (2011) from an analysis of 77 biomass CDM projects found that claims of economic and environmental benefits exceeded social benefits. Alexeew et al. (2010), found biomass projects, along with hydropower and wind projects, to have on average higher sustainable development benefits and contribute to all sustainable development dimensions. Similarly, TERI (2012) finds that sustainable development benefits are mentioned more by small scale projects than large scale projects. A probable reason, Bhardwaj (2004) writes, that small-scale projects contribute more to local benefits like poverty alleviation and employment generation, is that these projects are generally more decentralized in nature.

However, large scale projects are more economically attractive than small scale projects. This is due to the fact that they utilize economies of scale and the transaction costs are just a small fraction of the total project cost. Although in absolute terms the transaction costs of small scale projects may seem low, they account to a large percentage of the project cost. Consequently, foreign investors find small scale projects uneconomic and unattractive and they prefer large scale projects where accruing CERs will lead to a profit (Kumar, 2002). Agosto et al. (2007) further observes that since large scale projects in a host country are usually where the technology is not yet diffused, they often pick up the best sites among the whole national territory and thereby end up being more economically sound.

## 3. Key findings

How much do CDM projects contribute to sustainable development in Kenya? This was the question raised in the methodology as central to this paper. Since the major challenge was that most CDM projects in Kenya were in the construction phase, and therefore no 'real' sustainable development benefits had been achieved, data and information was mined from using information given in the PDDs of 14 registered CDM projects. The findings of the four proxies used for the different sustainable development criteria previously mentioned in the methodology section are now discussed in turn in the next sub-sections.

**3.1. Employment creation.** Assessment was done of all the 14 registered CDM projects' PDDs to find out how many projects claimed employment as one of the sustainable development benefits. Employment was taken to mean creation of new jobs and employment opportunities including income generation. Ninety-three percent of the CDM projects were rated 'A' as they mentioned creation of both direct and indirect jobs both during construction and implementation phases. Seven percent which represents only one of the fourteen CDM projects had a 'B' rating as it claimed indirect jobs during construction and implementation phases (Table 3).

Table 3. Estimated employment creation for CDM projects ($n$ = 14)

| Employment creation | Utility | Rating |
|---|---|---|
| 35 MW Bagasse Based Cogeneration Project | 1 | A |
| Karan Biofuel CDM Project | 1 | A |
| 60 MW Kinangop Wind Park Project | 1 | A |
| Lake Turkana 310 MW Wind Power Project | 1 | A |
| Aberdare Range Kibaranyeki Small Scale A/R Project | 1 | A |
| Abardare Kamae-Kipipiri Small Scale A/R Project | 1 | A |
| Abardare Kirimara-Kithithina Small Scale A/R Project | 1 | A |
| Nairobi River Basin Biogas Project | 1 | A |
| Olkaria II Geothermal Expansion Project | 1 | A |
| Olkaria III Phase 2 Geothermal Expansion Project | 1 | A |
| Redevelopment of Tana Hydro Power Station Project | 0.5 | B |
| Optimization of Kiambere Hydro Power Project | 1 | A |
| Corner Baridi Wind Farm | 1 | A |
| Kipeto Wind Energy Project | 1 | A |

Overall, all the CDM projects claimed employment as one of the benefits in one way or another. In comparison, this observation echoes the conclusions in the reviewed literature that most project participants seem to give more emphasis to the economic pillar of sustainable development.

**3.2. CERs returns distribution.** Since most of the CDM projects in Kenya are still in the construction phase and have not successfully generated CERs, the analysis for CERs returns distribution was done for those projects that mentioned in their PDDs the use of CER returns for community development programs. This rating draws from Sutter and Parreno's (2007) rating. An 'A'-rating was given to projects that mentioned the flow of a large fraction of CERs returns to the local community. 'B'-rating was given to projects that mentioned the use of part of the CERs returns for community programs. Projects that did not at all mention the use of CERs returns for community programs were rated 'C'. Table 4 shows the details.

Table 4. Estimated CERs returns distribution ($n$ = 14)

| CERs returns distribution | Utility | Rating |
|---|---|---|
| 35 MW Bagasse Based Cogeneration Project | 0.5 | B |
| Karan Biofuel CDM Project | 0 | C |
| 60 MW Kinangop Wind Park Project | 0 | C |
| Lake Turkana 310 MW Wind Power Project | 0 | C |
| Aberdare Range Kibaranyeki Small Scale A/R Project | 0.5 | B |
| Abardare Kamae-Kipipiri Small Scale A/R Project | 0.5 | B |
| Abardare Kirimara-Kithithina Small Scale A/R Project | 0.5 | B |

Table 4 (cont.). Estimated CERs returns distribution ($n$ = 14)

| CERs returns distribution | Utility | Rating |
|---|---|---|
| Nairobi River Basin Biogas Project | 0 | C |
| Olkaria II Geothermal Expansion Project | 0 | C |
| Olkaria III Phase 2 Geothermal Expansion Project | 0 | C |
| Redevelopment of Tana Hydro Power Station Project | 0.5 | B |
| Optimization of Kiambere Hydro Power Project | 0.5 | B |
| Corner Baridi Wind Farm | 0 | C |
| Kipeto Wind Energy Project | 0 | C |

None of the CDM projects got an ‘A’-rating as none mentioned the flow of a large fraction of CERs returns to a large population of the host country’s poor. Only 43% of the projects had a ‘B’-rating compared to 57% ‘C’-rating. All the projects that were rated ‘B’ had one thing in common; they had one local and foreign project participant. The local project participant was found to be either a private company, governmental organization or a non-governmental organization.

Of the projects that got a ‘C’-rating, three are owned by private project participants while three are jointly owned with foreign partners. Only one of these projects is owned by a Kenyan government institution and another by a transnational private company. In comparison, Sutter and Parreno (2007) found that 76% of the CDM projects they analyzed, got a ‘B’-rating and out of this, majority were owned by local private companies. They concluded that ‘A’-rated projects, which were few at only 0.3%, are the most likely to contribute directly to poverty reduction.

The results in this study show divergences in the relationship between project ownership types and rating outcome. Sutter and Parreno (2007) conclude that the ownership structure determines the distribution of CERs returns, and similarly, the results from this study and especially for ‘B’-rated projects show that ownership may to some extent influence CERs returns distribution.

**3.3. Technology transfer.** CDM projects were assessed from section A.4.3 of the PDDs where project participants described in detail how technology would be transferred to the host country. This study found interesting results. It was found that many more projects mentioned technology transfer in section A.4.3 of their PDDs. Sixty-four percent of the projects mentioned the transfer of technology to locals through training and were rated ‘A’. The projects rated ‘B’ included reforestation projects (21%) which did not mention technology transfer at all and other CDM projects that involved upgrading of existing projects and did not necessarily involve new technology (14%). Table 5 shows the details.

Table 5. Estimated technology transfer

| Technology transfer | Utility | Rating |
|---|---|---|
| 35 MW Bagasse Based Cogeneration Project | 1 | A |
| Karan Biofuel CDM Project | 1 | A |
| 60 MW Kinangop Wind Park Project | 1 | A |
| Lake Turkana 310 MW Wind Power Project | 1 | A |
| Aberdare Range Kibaranyeki Small Scale A/R Project | 0 | B |
| Abardare Kamae-Kipipiri Small Scale A/R Project | 0 | B |
| Abardare Kirimara-Kithithina Small Scale A/R Project | 0 | B |
| Nairobi River Basin Biogas Project | 1 | A |
| Olkaria II Geothermal Expansion Project | 1 | A |
| Olkaria III Phase 2 Geothermal Expansion Project | 1 | A |
| Redevelopment of Tana Hydro Power Station Project | 0 | B |
| Optimization of Kiambere Hydro Power Project | 0 | B |
| Corner Baridi Wind Farm | 1 | A |
| Kipeto Wind Energy Project | 1 | A |

Of the ‘A’-rated projects, four are wind projects, geothermal and biomass projects are two each and one biogas project. Seventy-eight percent of these are large scale projects while 22% are small scale projects. This is in agreement with reviewed literature such as Das (2011) who concludes that large scale projects are more likely to involve technology transfer. When project ownership is considered, 56% of these projects are jointly owned by local and foreign project participants and 44% are owned by a local private company or a government institution. This finding is in line with conclusions from Seres and Haites (2008) who find that projects that involve foreign participation are more likely to involve technology transfer.

Previous studies, including Seres and Haites (2008) and UNFCCC (2010), that analyze the relationship between the CDM and technology transfer have categorized technology transfer as the transfer of equipment, knowledge or both. However, this study could not ascertain the type of technology transfer involved since the information in the PDDs did not give details of the type of technology transfer.

While UNFCCC (2010) found that reforestation projects claimed transfer of knowledge, none of the reforestation projects reviewed by this study mentioned the transfer of knowledge. It emerges that most project participants did not necessarily mention technology transfer as one of the sustainable development benefits but they mentioned it in section A.4.3 of the PDD, a section which details how the CDM project will transfer technology to the host country.

**3.4. Local air quality.** To analyze the contribution of the CDM projects to local air quality, a review of the environmental impact section of the PDDs was done. Those projects that listed positive environmental contributions and particularly in relation to air quality including direct and indirect reduction of major local air pollutants were rated 'A' (Table 6). Those that did not mention effects on local air quality were assumed to have no effect on air quality and were rated 'B'. Those projects that listed negative impacts to air quality, for example the emission of gaseous matter, but with elaborate measures on how to counter these effects were rated 'C'.

Table 6. Estimated local air quality effect (*n* = 14)

| Air quality | Utility | Rating |
|---|---|---|
| 35 MW Bagasse Based Cogeneration Project | 0 | C |
| Karan Biofuel CDM Project | 0 | C |
| 60 MW Kinangop Wind Park Project | 0.5 | B |
| Lake Turkana 310 MW Wind Power Project | 0 | C |
| Aberdare Range Kibaranyeki Small Scale A/R Project | 1 | A |
| Abardare Kamae-Kipipiri Small Scale A/R Project | 1 | A |
| Abardare Kirimara-Kithithina Small Scale A/R Project | 1 | A |
| Nairobi River Basin Biogas Project | 1 | A |
| Olkaria II Geothermal Expansion Project | 0 | C |
| Olkaria III Phase 2 Geothermal Expansion Project | 0 | C |
| Redevelopment of Tana Hydro Power Station Project | 0.5 | B |
| Optimization of Kiambere Hydro Power Project | 0.5 | B |
| Corner Baridi Wind Farm | 0.5 | B |
| Kipeto Wind Energy Project | 0.5 | B |

Projects with 'B'-ratings and 'C'-ratings were the majority at 36%. One of the projects rated 'B' did not have requirements by Kenyan law under the Environmental Management and Co-ordination Act (1999) to conduct Environmental Impact Assessment (EIA) since the main project work consists of replacement of mechanical equipment within the plant. 'C'-rated projects which correspond to 'negative effects to local air quality but with mitigation measures' were biomass, geothermal and one wind project. While some mentioned increased emission of air pollutants during the construction phase only, others mentioned during both construction and implementation phases. All the CDM projects, however, had elaborate measures on how to mitigate these effects.

Projects rated 'A' accounted for 29% which corresponds to 'direct and indirect positive effect on local air quality.' Of these, three are reforestation projects and their direct benefits to air quality are due to the fact that they are carbon sink projects.

The other 'A'-rated project is a biogas project. Interestingly, the prevailing law in Kenya, the Environmental Management and Co-ordination Act (1999) does not require biogas project types such as the one mentioned above to undertake an EIA. However, the Nairobi River biogas project mentioned indirect reductions to air pollutants as one of the sustainable development benefits of the CDM project activity. For comparison purposes, none of the reviewed studies did a similar analysis of local air quality. However, Sutter and Parreno (2007) assessed local air quality improvement but did an assessment of CDM projects according to their contribution to CERs. A comparative analysis with the results obtained in this study was thus not possible.

After discussing the different evaluation criteria separately, this study summarizes the project ratings. Each project was given one of three ratings: A, B or C for the different sustainable development indicators used for assessment. To synthesize these findings, the four sustainable development indicators have been integrated according to Step 5 of MATA-CDM, using equal weightings as shown in Table 7. To obtain the total sustainable development rating for the CDM projects, this study used the additive approach in Step 5 of the MATA-CDM model. An average score was awarded to each project.

Table 7. Utility of different sustainable development indicators

| Project title | Air quality | | Technology transfer | | Cers returns | | Employment creation | | Average sustainable development rating |
|---|---|---|---|---|---|---|---|---|---|
| | Utility | Rating | Utility | Rating | Utility | Rating | Utility | Rating | |
| 35 MW Bagasse Based Cogeneration Project | 0 | C | 1 | A | 0.5 | B | 1 | A | *0.6* |
| Karan Biofuel CDM Project | 0 | C | 1 | A | 0 | C | 1 | A | *0.5* |
| 60 MW Kinangop Wind Park Project | 0.5 | B | 1 | A | 0 | C | 1 | A | *0.6* |
| Lake Turkana 310 MW Wind Power Project | 0 | C | 1 | A | 0 | C | 1 | A | *0.5* |
| Aberdare Range Kibaranyeki Small Scale A/R Project | 1 | A | 0 | B | 0.5 | B | 1 | A | *0.6* |
| Abardare Kamae-Kipipiri Small Scale A/R Project | 1 | A | 0 | B | 0.5 | B | 1 | A | *0.6* |
| Abardare Kirimara-Kithithina Small Scale A/R Project | 1 | A | 0 | B | 0.5 | B | 1 | A | *0.6* |
| Nairobi River Basin Biogas Project | 1 | A | 1 | A | 0 | C | 1 | A | *0.8* |
| Olkaria II Geothermal Expansion Project | 0 | C | 1 | A | 0 | C | 1 | A | *0.5* |

Table 7 (cont.). Utility of different sustainable development indicators

| Project title | Air quality | | Technology transfer | | Cers returns | | Employment creation | | Average sustainable development rating |
|---|---|---|---|---|---|---|---|---|---|
| | Utility | Rating | Utility | Rating | Utility | Rating | Utility | Rating | |
| Olkaria III Phase 2 Geothermal Expansion Project | 0 | C | 1 | A | 0 | C | 1 | A | *0.5* |
| Redevelopment of Tana Hydro Power Station Project | 0.5 | B | 0 | B | 0.5 | B | 0.5 | B | *0.4* |
| Optimization of Kiambere Hydro Power Project | 0.5 | B | 0 | B | 0.5 | B | 1 | A | *0.5* |
| Corner Baridi Wind Farm | 0.5 | B | 1 | A | 0 | C | 1 | A | *0.6* |
| Kipeto Wind Energy Project | 0.5 | B | 1 | A | 0 | C | 1 | A | *0.6* |

None of the projects have an average score of one (1), which would be the ideal score if a CDM project contributed to all the sustainable indicators used in this study. The highest scoring project is the Nairobi River Basin Biogas Project, the only biogas project in Kenya, with a score of 0.8 and represents 7% of the projects. Fifty percent of the projects get a score of 0.6, which is just slightly above average. Of these, one is a biomass project, three are wind and three are reforestation projects. Thirty-six percent of the projects get a score of 0.5. The least scoring project is the re-development of Tana hydro power station project which obtains a score of 0.4. The most probable explanation for the below-average score is that this particular CDM project is an upgrading of the power station and the PDD stated that it did not involve technology transfer neither did it mention effects on local air quality.

While compared to reviewed literature such as Olsen and Fenhann (2008) and the conclusion in the reviewed literature that small scale projects claim more sustainable development benefits than large scale projects, the findings of this section differ. Large scale projects, 57% compared to 36% small scale projects got an above average score. However, the highest rated project is a small scale CDM project while the lowest rated project is a large scale project. Of the projects with an above average score, 71% of the projects are renewable energy projects and 21% reforestation. This is in agreement with the observation in the reviewed literature that renewable energy projects claim more sustainable development benefits. Wind projects contribute more to sustainable development as compared to other project types.

## Conclusion

This study concludes that none of the projects made a high contribution to all the sustainable development criteria as analyzed using the four proxies; technology transfer, CERs returns distribution, employment generation and air quality. While compared to projects that mentioned and listed technology transfer as one of the sustainable development benefits in section A.2 of the PDDs, many more projects (64%), in section A.4.3 of the PDDs, mentioned the transfer of technology. Large scale projects and those that involve foreign project developers contributed most to the transfer of technology. From the observations of this study under CERs returns distribution, 57% of the projects did not at all mention the use of CERs returns for community programs. None of the projects mentioned the flow of a large share of CERs returns to the poor population. Hence CDM projects in Kenya do not contribute highly to the welfare of the local population and poverty alleviation. Most CDM project developers pay more attention to the economic dimension of sustainable development than other dimensions. The study found out that under employment creation, a proxy indicator for economic sustainable development, 93% of the projects claimed the creation of direct and indirect jobs both during construction and implementation stages. With regards to the environment dimension of sustainable development, the study found out that under local air quality, a proxy indicator for environmental sustainable development, projects that made no reference to effects on local air quality and those that mentioned negative effects but with elaborate measures on how to mitigate the effects were the most at 36% respectively. It was also surprising to discover that some projects were not required under the prevailing Kenyan Law, the Environmental Management and Co-ordination Act (1999) to conduct Environmental Impact Assessments. Overall, when all the above indicators and their scores were aggregated, it was found that none of the projects scored 1, which would be the ideal score if a project met the sustainable development criteria satisfactorily.

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