Chapter 2
General Overview of the Clean Development Mechanism (CDM)

Abstract The CDM is an important flexible mechanism of the Kyoto Protocol. Understanding general overview of the CDM is critical to dealing with CDM forestry. The CDM regulators, CDM project cycle, sustainable development issues of the CDM are the important common issues of the CDM. This chapter discusses these issues importantly. Present global status of CDM projects also have been described here.

2.1 Introduction

Article 12 of the Kyoto Protocol introduces the Clean Development Mechanism (CDM) as one of the three 'flexible' mechanisms. The CDM is an instrument under the authority of the COP and supervised by an Executive Board (EB). CDM projects typically involve Annex I countries as investors and Non-Annex I countries as hosts, essentially joint ventures between developed and developing countries. The formulations of this mechanism have twofold objectives, i.e., reducing greenhouse gases and contributing to the sustainable development in the host countries (Olsen and Fenhann 2008). It also assists Annex I countries in achieving their emission reduction targets in a cost-effective manner. This chapter deals with the general overview of the CDM.

2.2 The CDM Regulators

The COP/MOP, EB, Designated Operational Entity (DOE), Host Party, and Donor Party are the important regulators for the CDM. The responsibility of the COP/MOP is to accredit the standards for and designation of the DOE. It reviews the regional/subregional distribution of the CDM project activities. It also oversees the rules and procedures of EB. The EB is responsible for approving the methodologies for baselines and monitoring plans and project boundaries. It maintains the registry of CDM. It also accredits the DOEs. The COP/MOP designates and the EB accredits

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the DOE. They are responsible for validating project design document (PDD). They also verify and certify the ERs (Emission Reductions). Host Party is certainly a country which is in the Non-Annex I list and ratified the Kyoto Protocol. They are responsible for creating a Designated National Authority (DNA) for the CDM. The Donor Party must be in the list of Annex I parties that ratified the Kyoto Protocol. They must have the targets of emission reductions as Article 3 of the Kyoto Protocol. They should also have the national system for estimating sources and sinks of GHG as Article 5 of the Kyoto Protocol.

2.3 The CDM Project Cycle

To attain the CERs (Certified Emission Reductions) in the host countries, the CDM project must have to maintain the specific procedures agreed in the Marrakech Accords. The Project Participant (PP), the Host Party, must have to create an idea of the CDM Project which is called Project Design Document (PDD). It requires the validation by the DOE, preferably by the Designated National Authority (DNA). It is then sent to the EB for registration. After registration, the project can run in the host country. According to the approved plan, monitoring is also a required step for measuring ERs. The DNA then verifies and certifies the ERs which are finally issued by the EB. The PP receives the certificate of CERs at this stage which can be sold out in the carbon market (Fig. 2.1).

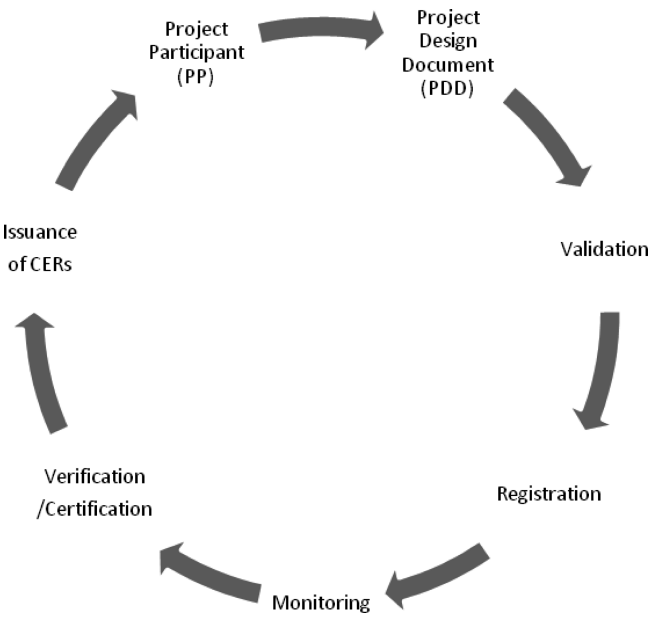

Fig. 2.1 Project cycle of the CDM

However, the PDD needs to fulfill all of the requirements, i.e., definition of project boundaries, assessment of country context, assessment of additionality, definition of crediting lifetime, projection of baseline scenario, monitoring of project, calculation of ER, correction of leakage, and uncertainty in the ER.

2.4 Small-Scale CDM

As the carbon benefits from the small-scale CDM (SSC) project are comparatively shorter than the standard CDM project, small-scale CDM project is attractive in the developing countries like Bangladesh. In the COP8 in 2002, India, a report on streamlined modalities for small-scale projects was produced by the expert group. The differences between the small-scale and standard CDM project lie in baseline methodologies assigned to the project types. Time spent on the baseline formulation in the small-scale CDM is dramatically reduced. If suitable baseline is unavailable, then a proposed approach can be submitted to the EB for approval. Correction for leakage is not necessary in the small-scale CDM project. Additionality is expressed mainly based on the barriers they face. The calculation of the ER is very simplified and the transaction cost becomes so lowered. Environmental Impact Assessment (EIA) is not necessary in this smaller CDM. There are three types of SSC projects approved by the EB. The type I project activities, such as renewable energy project activities, shall have a maximum output capacity of 15 MW or an equivalent (IGES 2009). The type II project activities are relevant to the improvements in energy efficiency, which reduce energy consumption on both the demand and supply side. But the maximum output is limited to 60 GWh[1] (or an appropriate equivalent) per year. The type III projects are defined as projects other than that of type I and type II. The ER should be less than or equal to 60 kt[2] CO_2 equivalent annually. In type I, projects can be electricity generation by user/household, mechanical energy for the user/enterprise, thermal energy for the user, and electricity generation for a system. In type II, supply-side energy efficiency improvement in transmission and distribution, supply-side energy efficiency improvement in generation, demand-side energy efficiency programs for specific technologies, energy efficiency and fuel switching measures for industrial activities, and energy efficiency and fuel switching measures for building can be important. Agriculture, forestry, switching fossil fuels, emission reductions in the transport sector, and methane recovery are important fields for type III projects.

[1] 60 GWh is equivalent to 4,000 h of operation of a 15 MW plant or 60×3.6 TJ $= 216$ TJ. TJ = terajoules.

[2] Kiloton.

2.5 Sustainable Development Issues in the CDM Projects

The major target of the CDM project is to generate sustainable development (SD) in the developing countries. Misana and Karlsson (2001) and Olmos (2001) found a strong relationship between the CDM project and SD in the developing countries. Begg et al. (2000) proved that small-scale CDM projects in the domestic sector of LDCs (Least Developed Countries) can have significant SD benefits, such as freeing up time and energy for other activities, e.g., economic, cultural, and educational. It also can save money and improve the living standards. However, indicators can be used to prioritize projects on the basis of SD criteria. Olsen and Fenhann (2008) analyzed the sustainability issues of the CDM projects using 744 PDD submitted for validation by May 3, 2006. Analyzing all the PDDs, they found the most common five benefits of CDM projects in the developing countries. These are employment generation, economic growth, a better quality of air, access to energy, and welfare improvement. The generation of SD benefits varies from project to project. Their analysis confirmed that few SD benefits are generated from HFC and N_2O projects. CDM projects on energy efficiency in the industrial sector also have few SD benefits, especially a higher contribution to the improved air quality. Olsen and Fenhann (2008) also found that renewable energy generation, especially biomass energy, did not find so much SD benefits. But wind and hydro projects had comparatively higher SD benefits (employment, welfare, growth, and access to energy) than that of the biomass energy. They found that CH_4 reduction projects contribute slightly higher number of SD benefits than the renewable energy categories. They found that cement projects contributed with so many SD benefits, with 82% of all the projects contributing to better air quality and conservation. They also found that small-scale projects delivered comparatively higher SD benefits than that of the large-scale projects.

2.6 Present Status of CDM Projects

Up to February 1, 2010, the total number of registered CDM projects is 2,029 (IGES 2010). Among them small-scale projects are 903 (44%) and the large-scale projects are 1,126 (56%) in number (Table 2.1). However, the CDM projects deal with the 1,785,802,000 t-CO_2e total emission reductions by 2012. Among them the small-scale projects deal with 135,013,000 t-CO_2e and the large-scale projects 1,650,789,000 t-CO_2e emission reductions by 2012. Most of the CDM projects, 27%, are on hydropower generation, reducing 209,171,000 t-CO_2e total emission reductions by 2012. Biogas, wind power, and biomass-based CDM projects represent 14.39, 13.95, and 12.47%, respectively, in the total projects registered. A/R CDM projects only represent 0.64% (Table 2.2). The distribution of CDM projects shows that 73.24% projects are distributed in the Asian countries followed by 22.38% in the Latin American countries (Table 2.3). China and India represent the greatest share of the CDM projects within Asia, 49.26 and 32.37%, respectively. In

the global perspective, they also have the greatest share, 36.08 and 23.37%, respectively. Bangladesh only has 0.13% CDM projects within Asia, with the expected 1,191,000 t-CO_2e total emission reductions by 2012.

Table 2.1 Small-scale and large-scale registered CDM projects up to February 1, 2010, in the developing countries

Size of the CDM project	Annual emission reductions (t-CO_2/year) (UNFCCC)	Number of CDM projects	Total emission reductions by 2012 (1,000 t-CO_2e)
Small scale	0–50,000	821	96,354
	50,000–100,000	67	19,089
	100,000–150,000	5	3,274
	150,000–200,000	2	3,596
	200,000–250,000	5	6,967
	250,000–300,000	2	3,518
	350,000–400,000	1	2,214
Small-scale subtotal		**903**	**135,013**
Large scale	0–50,000	213	41,564
	50,000–100,000	324	121,192
	100,000–150,000	227	127,748
	150,000–200,000	97	80,899
	200,000–250,000	44	44,891
	250,000–300,000	41	55,838
	300,000–350,000	29	41,813
	350,000–400,000	20	32,245
	400,000–450,000	12	24,122
	450,000–500,000	13	28,458
	500,000–550,000	9	19,889
	550,000–600,000	10	29,874
	600,000–650,000	6	17,413
	650,000–700,000	10	41,986
	700,000–750,000	1	3,125
	750,000–800,000	7	28,141
	800,000–850,000	4	16,732
	850,000–900,000	3	10,335
	900,000–950,000	7	26,822
	950,000–1,000,000	2	10,909
	>1,000,000	47	846,793
Large-scale subtotal		**1,126**	**1,650,789**
Total		**2,029**	**1,785,802**

Source: IGES (2010)

Table 2.2 Types of CDM projects registered up to February 01, 2010, and emission reduction by 2012

CDM project type	Number of CDM projects	Percentage of the CDM project among the total projects registered	Emission reductions by 2012 (1,000 t-CO_2e)
HFC reduction/avoidance	20	0.99	484, 567
N_2O reduction	60	2.96	252, 268
PFC reduction	3	0.15	1, 817
SF_6 replacement	3	0.15	2, 052
Cement	29	1.43	28, 626
Other renewable energies	31	1.53	13, 014
Biogas	292	14.39	64, 122
Biomass	253	12.47	89, 801
Methane recovery and utilization	163	8.03	214, 855
Methane avoidance	43	2.12	8, 166
Transportation	2	0.10	1, 963
Energy efficiency	75	3.70	18, 222
Afforestation and reforestation	13	0.64	2, 152
Hydropower	552	27.21	209, 171
Fuel switch	54	2.66	110, 751
Waste gas/heat utilization	152	7.49	156, 335
Wind power	283	13.95	126, 562
Leak reduction	1	0.05	1, 357
Total	2, 029	100.00	1, 785, 802

Source: IGES (2010)

Table 2.3 Countrywise registered CDM projects up to February 01, 2010

Region	Country	Number of CDM projects	Regional percentage of the CDM projects	Global percentage of the CDM projects	Emission reductions by 2012 (1,000 t-CO_2e)
Asia	India	481	32.37	23.71	255, 729
	Indonesia	43	2.89	2.12	21, 564
	Cambodia	4	0.27	0.20	604
	Singapore	1	0.07	0.05	74
	Sri Lanka	6	0.40	0.30	1, 343
	Thailand	30	2.02	1.48	10, 416
	Nepal	2	0.13	0.10	744
	Pakistan	4	0.27	0.20	7, 121
	Papua New Guinea	1	0.07	0.05	1, 834
	Bangladesh	2	0.13	0.10	1, 191
	Fiji	1	0.07	0.05	199
	The Philippines	40	2.69	1.97	6, 159
	Bhutan	1	0.07	0.05	4

Table 2.3 (continued)

Region	Country	Number of CDM projects	Regional percentage of the CDM projects	Global percentage of the CDM projects	Emission reductions by 2012 (1,000 t-CO_2e)
	Vietnam	20	1.35	0.99	9,483
	Malaysia	79	5.32	3.89	22,489
	Mongolia	3	0.20	0.15	386
	Lao PDR	1	0.07	0.05	19
	South Korea	35	2.36	1.72	95,470
	China	732	49.26	36.08	964,814
Asia subtotal		**1486**	100.00	73.24	**1,399,643**
Africa/Middle and Near East	Arab United Emirates	4	6.25	0.20	897
	Israel	16	25.00	0.79	8,811
	Iran	1	1.56	0.05	1,632
	Uganda	2	3.13	0.10	275
	Egypt	4	6.25	0.20	10,486
	Ethiopia	1	1.56	0.05	108
	Qatar	1	1.56	0.05	13,984
	Kenya	1	1.56	0.05	551
	Republic of Cote d'Ivoire	1	1.56	0.05	178
	Zambia	1	1.56	0.05	357
	Syria	2	3.13	0.10	501
	Tanzania	1	1.56	0.05	986
	Tunisia	2	3.13	0.10	3,741
	Nigeria	3	4.69	0.15	18,712
	Morocco	5	7.81	0.25	1,718
	Jordan	2	3.13	0.10	2,300
	South Africa	17	26.56	0.84	15,926
Africa/Middle and Near East subtotal		**64**	100.00	3.15	**81,163**
	Albania	1	4.00	0.05	44
	Armenia	5	20.00	0.25	1,169
	Uzbekistan	7	28.00	0.34	4,076
Others	Cyprus	5	20.00	0.25	507
	Georgia	2	8.00	0.10	1,642
	Macedonia	1	4.00	0.05	168
	Moldova	4	16.00	0.20	1,254
Others subtotal		**25**	100.00	1.23	**8,861**
Latin America	Argentina	16	3.52	0.79	27,359
	Uruguay	3	0.66	0.15	1,414
	Ecuador	14	3.08	0.69	3,835
	El Salvador	5	1.10	0.25	3,426

Table 2.3 (continued)

Region	Country	Number of CDM projects	Regional percentage of the CDM projects	Global percentage of the CDM projects	Emission reductions by 2012 (1,000 t-CO_2e)
	Guyana	1	0.22	0.05	222
	Cuba	2	0.44	0.10	2,463
	Guatemala	11	2.42	0.54	4,629
	Costa Rica	6	1.32	0.30	2,292
	Colombia	20	4.41	0.99	13,330
	Jamaica	1	0.22	0.05	455
	Chile	36	7.93	1.77	29,567
	Dominican Republic	1	0.22	0.05	299
	Nicaragua	4	0.88	0.20	4,666
	Panama	6	1.32	0.30	1,407
	Paraguay	1	0.22	0.05	24
	Brazil	168	37.00	8.28	136,379
	Peru	21	4.63	1.03	8,983
	Bolivia	3	0.66	0.15	2,503
	Honduras	15	3.30	0.74	2,162
	Mexico	120	26.43	5.91	50,720
Latin America subtotal		**454**	100.00	22.38	**296,134**
Total		**2029**		100.00	**1,785,802**

Source: IGES (2010)

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