UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

THE STATE OF PLAY OF THE CLEAN DEVELOPMENT MECHANISM

Review of barriers and potential ways forward

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Contents

1 Introduction

1.1 The climate challenge

At the beginning of the twenty-first century, the global community faces the formidable dual challenge of simultaneously addressing the tasks of ensuring sustainable development for all – in line with the commonly agreed Millennium Development Goals (MDGs) – while systematically transforming our economies onto a low-carbon pathway in order to avoid runaway climate change.

In its latest report, the Intergovernmental Panel on Climate Change (IPCC; 2007) notes that up until 2050, substantial global emission reductions are required, by at least 50 per cent below 1990 levels, with additional global emission reductions beyond 2050, towards a zero carbon economy by the end of the century. Recent climate science suggests that even lower greenhouse gas (GHG) stabilization levels – and subsequently tougher emission reductions – will be required, as compared to the concentration levels of 450–550 ppm often cited at climate negotiations (see annex 1).

The United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol of 1997 provide the framework for a collaborative and multilateral effort to combat climate change, based on the principle of common but differentiated responsibilities among its parties.

Under the Kyoto Protocol, industrialized countries are required to reduce their GHG emissions by an average of 5.2 per cent below 1990 levels over the 2008–2012 period. This is only the starting point for the required global emission reductions. The ongoing negotiations under the Bali Action Plan aim to strike a global deal in Copenhagen by the end of 2009 and to provide a clear international framework for sharing the responsibilities for mitigation and also adaptation.

The Protocol, which came into force in 2005, provides the industrialized countries ("annex 1" countries) with the possibility of meeting their emission reduction commitments through a variety of measures. The Clean Development Mechanism (CDM) is one of the three "flexibility mechanisms" identified in the Kyoto Protocol. This mechanism was established for two purposes, namely to assist non-annex 1 parties (developing countries) in achieving sustainable development and contributing to GHG mitigation, and to assist annex 1 parties in achieving compliance with their quantified emission limitation and reduction commitments.[1]

It is also required that each CDM project should result in real, measurable and long-term emission reductions, additional to any that would occur in the absence of the project. Moreover, although the CDM does not have an explicit technology transfer mandate, it may contribute to technology transfer by financing emission reduction projects using technologies currently not available in the host countries. While the CDM has only been fully operational for a relatively short period – since the Kyoto Protocol came into force in early 2005 – the experiences so far provide a sound basis for a review of the key challenges, lessons learned and potential ways forward for the CDM in the future climate policy architecture.

In 2007, Governments at the international level agreed to step up their efforts to combat climate change. With the Bali Road Map, Governments are looking to reach agreement on a number of questions, including the Bali Action Plan – the UNFCCC negotiations on long-term cooperative action – which is

[1] CDM enables project cooperation between the industrialized and developing countries. The greenhouse gas emissions reductions from CDM projects can be sold as credits (CERs) to industrialized countries, and in this way, CDM allows investor countries to meet their GHG reduction targets at lower cost by taking advantage of the lower marginal cost of reducing GHG emissions in developing countries.

centred on the four thematic "building blocks" of adaptation, mitigation, technology transfer and deployment, and financing. It is clear that 2009 will prove to be the most challenging year for climate change negotiations in over a decade, as the results in Copenhagen will set the stage for global action on climate change for many years to come.

1.2 Aim and structure of this report

The basic framework of the international CDM regime was established in Marrakesh in 2002, when the first commitment period begun. Since the registration of the first CDM project on 18 November 2004, the number of CDM projects has risen quickly, from about 50 in February 2005 to over 4400 by February 2009, in nearly 80 countries.[2]

The CDM forms one of the central components of the rapidly evolving international carbon markets, and of efforts to establish a carbon price (see chapter 2.1). Altogether, the emerging carbon markets, which were valued at $64 billion in 2007, have stimulated innovation and carbon abatement worldwide. The CDM saw transactions worth almost $13 billion in 2007 alone, and has been estimated to have leveraged $33 billion in additional investment for clean energy.[3] In 2008 the growth continued, and the value of carbon markets exceeded $100 billion.

However, with regard to global emission reductions, the CDM has been accused of serving primarily as a zero sum game. In addition, most developing countries, in particular the least developed countries (LDCs), have faced a significant challenge in taking a proactive approach to participating as equal and reliable partners in the CDM. Brazil, China, India and Mexico have formed the leading host countries, with a share of 75 per cent of the CDM project pipeline, whereas, for instance, only a few per cent of the currently registered CDM projects are taking place in Africa.

Against this background, the UNCTAD Climate Change Programme[4] has convened the Expert Meeting on Trade and Climate Change: Trade and Investment Opportunities and Challenges under the Clean Development Mechanism, for 27–29 April 2009. This report serves as a background document for the expert meeting, and aims to present the state of play of the CDM streams and show how different countries and technologies are represented in the CDM pipeline. A particular focus of this document is to present the barriers that developing countries report having encountered when taking full advantage of potential investment, technology transfer and sustainable development gains associated with CDM projects.

Chapter 2 provides an introduction to the carbon markets, placing the CDM into the international carbon market framework, and presenting the state of play of the CDM. The CDM status review identifies past, present and predicted CDM streams up until 2012 – with the Certified Emission Reductions (CERs) that have been issued so far, and those expected by 2012. It provides a review of the geographical distribution, project size, types and technological choices, and of CER price and demand evolution.

Chapter 3 presents the key barriers and challenges encountered so far by the CDM in contributing to its two main objectives, i.e. enhancing sustainable development in the host country, and producing additional emissions reductions. Based on an analysis of the state of play, chapter 3 notes some of the key challenges related to a more equitable geographical distribution of CDM projects, to a more transparent, efficient and effective operation of the CDM system, and to the contribution by the CDM to technology transfer.

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[2] http://www.cdmpipeline.org/ Status overview, February 2009.
[3] Ambrosi C (2008). State and Trends of the Carbon Market 2008. World Bank, May 2008.
[4] Paragraph 100 of the Accra Accord requests UNCTAD, within its mandate and without duplicating the ongoing work of other organizations, to consider climate change in its ongoing work of assisting developing countries with trade-related and investment-related issues in development strategies.

It also presents suggested improvements to the CDM mechanism, as well as potential ways forward in the post-2012 period.

Chapter 4 presents the conclusions of the report, highlighting the importance of carbon markets as one central component of a future ambitious international climate regime, with a reformed and improved CDM presenting considerable opportunities for speeding up investments towards a more sustainable low-carbon economy.

The report is based on an extensive literature review, analysis of the latest CDM statistics,[5] and UNFCCC documentation regarding CDM developments, and also on discussions with selected climate negotiators, developing-country CDM stakeholders (Designated National Authorities (DNAs)), project developers, and other actors in the carbon market.

[5] The United Nations Environment Programme Risø Centre's "CDM Pipeline" (this report covers updates until February 2009) formed a central source of material for the analysis in this report. See: http://www.cdmpipeline.org.

2 Clean Development Mechanism: the state of play

2.1 The CDM on the carbon markets

Increasing consensus is gathering around the need to systematically introduce a carbon price into the markets and thereby internalize the evident market externalities and harness the market mechanism to actually speed up a comprehensive transformation of how our societies produce, consume, move, interact and trade; in a word – develop.[6]

In 2008 carbon trading volumes grew rapidly, and by early 2009 a multitude of countries (including European Union (EU) countries, Switzerland, Australia and New Zealand)[7] had entered the carbon markets and chosen carbon trading as a central component in their climate policies, while many other countries (including Canada, Japan and the United States) are contemplating doing so in the near future.

Carbon transaction can be broadly grouped into two main categories (see also tables 1 and 2):

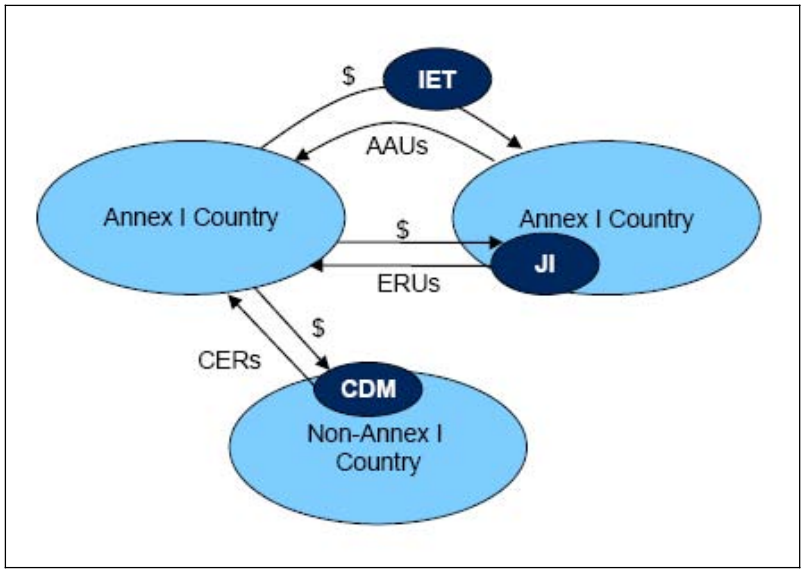
- **Allowance-based transactions,** in which the buyer purchases emission allowances created and allocated (or auctioned) by regulators under cap-and-trade regimes, such as Assigned Amount Units (AAUs) under the Kyoto Protocol, or European Union emission allowances (EUAs) under the European Union's Emission Trading Scheme (ETS). Such schemes combine environmental performance (defined by the actual level of caps set) and flexibility, through trading, in order for mandated participants to meet compliance requirements at the lowest possible cost;

- **Project-based transactions**, in which the buyer purchases emission credits from a project that can verifiably demonstrate GHG emission reductions compared with what would have happened otherwise. The most notable examples of such activities are under the CDM and the joint implementation (JI) mechanisms of the Kyoto Protocol, generating CERs (Certified Emission Reductions) and ERUs (Emission Reduction Units) respectively.[8]

Under the Kyoto Protocol, industrialized countries have the possibility of limiting their greenhouse gas emissions through reducing domestic emissions (e.g. through standards, taxes, subsidies, carbon trading), trading emission permits (AAUs) among governments, or purchasing emission reductions credits from CDM and JI projects (fig. 1). Through the European Union's Emission Trading Scheme (ETS), which is the cornerstone of EU climate policy, member States allocate a part of their efforts to meet their Kyoto commitments to the entities in the private sector responsible for those emissions.

[6] See, for example, Stern (2006). Stern Review on the Economics of Climate Change.
[7] The New Zealand scheme has already come into force, but it currently only covers the forestry sector.
[8] Ambrosi C (2007). *State and Trends of the Carbon Market 2007*. World Bank.

Figure 1. The Kyoto flexibility mechanisms[9]



So far, the European Union's ETS has dominated the carbon market. The EU ETS regulates carbon dioxide (CO_2) emissions from energy-intensive installations, which represent approximately 40 per cent of all EU emissions.[10] Sectoral extension, in particular to aviation and maritime transport, is under active consideration. Mandated installations – in a similar fashion to governments under the Kyoto Protocol – may internally reduce emissions, purchase EU allowances (EUAs), or acquire CERs and ERUs from CDM or JI projects respectively (see table 1)[11].

Table 1. Classification of carbon markets by transaction type and Kyoto compliance

	Trade in emission allowances	**Project-based transactions**
Kyoto-compliant	Trade in carbon offsets under EU ETS United Kingdom Emissions Trading System	All Clean Development Mechanism (CDM) and Joint Implementation (JI) projects
Voluntary, not for compliance under Kyoto	Trade in emission reductions on Chicago Climate Exchange New South Wales Greenhouse Gas Abatement Scheme	Voluntary reduction projects, such as carbon sequestration projects in Africa

Source: Jindal, Swallow and Kerr (2006).

[9] JI and IET have no sustainable development mandate/requirement, with CDM being the only flexibility mechanism that involves developing countries. *Guidebook to Financing CDM Projects.* EcoSecurities. UNEP project CD4CDM. UNEP Risø Centre. 2007.

[10] Key sectors covered by the EU ETS are power and heat, minerals (cements, glass and ceramics), metals (steel production facilities), oil and gas industries. From 2008 onwards, the EU ETS has covered installations located in other countries of the European Economic Area, including Iceland, Liechtenstein and Norway.

[11] The so-called EU Linking Directive allows for the import of CDM emission reduction credits from activities located in developing countries.

The value of CDM transactions reached almost $13 billion in 2007, making them the second key component on the carbon markets (see table 2).[12] The last years have also seen an interesting and rapid growth in the voluntary carbon market, which, however, still remains a minor component of the overall carbon market.

According to the latest estimates, the total value of the carbon markets continued its rapid growth in 2008 and reached a total value of over $122 billion in 2008, with a doubling of the market value despite the global economic slowdown. With regard to volume, some 4.9 billion tons of CO_2 equivalent changed hands in 2008, up by 83 per cent from 2007.[13]

In 2008, the EU ETS continued to dominate the carbon markets, accounting for two thirds of the total carbon market volume and three quarters of its value. Around 3.1 billion CO_2 allowances were bought and sold in the ETS during 2008, with a total value of €67 billion. With regard to United Nations-backed carbon credits – generated from the Kyoto Protocol's CDM – some 1.6 billion changed hands in 2008, with a value of €24 billion. The secondary market for CDM credits (known officially as certified emissions reductions (CERs)), totalled 1 billion tons in 2008, corresponding to two thirds of the total CER market volume. Overall, the value of the CER market in 2008 increased by 70 per cent, compared to the 2007 figures.[14] Other carbon markets continued to emerge in the United States, Australia and Canada in 2008.

Table 2. Carbon markets, volumes, and values[15]

	2005		2006		2007	
	Volume ($MtCO_2e$)	**Value (MUS$)**	**Volume ($MtCO_2e$)**	**Value (MUS$)**	**Volume ($MtCO_2e$)**	**Value (MUS$)**
Allowances						
EU Emissions Trading Scheme	324	8 204	1 104	24 436	2 061	50 097
New South Wales Greenhouse Gas Abatement Scheme	6	59	20	225	25	224
Chicago Climate Exchange	1	3	10	38	23	72
United Kingdom Emissions Trading System	0	1	NA	NA		
Subtotal	332	8 268	1 134	24 699	2 109	50 394
Project-based transactions						
Clean Development Mechanism	359	2 651	562	6 249	791	12 877
Joint implementation	21	101	16	141	41	499
Other compliance and voluntary transactions	5	37	33	146	42	265
Subtotal	384	2 789	611	6 536	874	13 641
Total	717	11 057	1 745	31 235	2 983	64 035

Note: MtCO2e = megatons of carbon dioxide or equivalent. MUS$ = millions of United States dollars.

As already stated, by early 2009, a multitude of countries have chosen carbon trading as a central component in their climate policies – as a means of catalysing and guiding funding towards cost-efficient mitigation measures. While the growth in the CDM – and more broadly, carbon market volumes and value – has been impressive, it is crucial to note the overall market transformation and investment challenges still ahead of us, with regard to climate change mitigation and also adaptation. While several recent studies indicate multiple benefits from climate policies – not to mention the avoidance of effects

[12] Ambrosi C (2008). *State and Trends of the Carbon Market 2008. World Bank.*
[13] *Point Carbon News.* Vol. 4, issue 1. 9.1.2009.
[14] *Point Carbon News.* Vol. 4, issue 1. 9.1.2009.
[15] Ambrosi C (2008). *State and Trends of the Carbon Market 2007 and 2008.* World Bank. May 2008.

from dangerous levels of climate change – [16] national and global mitigation and adaptation efforts will require considerably increased and sustained economic investments.

With regard to mitigation, the Stern Review estimates funding needs at $1 trillion per year by 2050, UNFCCC estimates $380 billion per year by 2030, the European Commission estimates some $225 billion per year by 2020,[17] OECD estimates up to $3 trillion per year by 2050, while the International Energy Agency (IEA) estimates that transformation of the energy sector onto a low-carbon pathway would require some $400–1100 billion by 2050. While preliminary estimates of the funding required for adaptation can be considered less certain (and very much dependent on mitigation success), the Stern Review estimates adaptation funding needs at $4–37 billion per year, UNFCCC estimates $49–179 billion per year by 2030, and UNDP estimates $86 billion per year by 2016.[18]

The difference in the estimates is large, but it clearly indicates the magnitude of funding required for mitigation and adaptation in the coming years. It also highlights the need in the ongoing climate negotiations to establish a solid international policy framework that will attract sufficient public-sector, but in particular, private-sector funding for the required mitigation and adaptation measures. The carbon markets can play a central role in catalysing the required funding. Since the registration of the first CDM project in November 2004, the carbon market has witnessed a rapid boom in CDM projects, and valuable experiences have been gained with regard to harnessing the market mechanism to advance emission reductions and sustainable development objectives. Several potential ways forward and different roles for the CDM in future climate policies have been suggested (see chapter 3).

2.2 The Clean Development Mechanism: status review

This chapter provides a concise CDM status review, presenting CERs issued so far and expected by 2012, a review of the geographical distribution, project size, types and technological choices, as well as CER price and demand evolution. (For an analysis of the challenges and outcomes of CDM projects, key bottlenecks, and potential ways forward, see chapter 3.)

In February 2009 (see table 3) the CDM pipeline[19] contained 4,474 CDM projects (excluding the 87 rejected and 25 withdrawn projects), of which 1370 had been registered, and a further 324 were in the process of registration (for a description of the CDM project cycle, see annex 2).

The annual number of new projects in the CDM pipeline had increased from 840 in 2006, to 1,429 in 2007, to 1,561 in 2008. (For a complete list of country- and region-specific projects, see annex 4).

The number of new projects in the CDM pipeline had increased from 39 per month in 2005, to 70 per month in 2006, to 119 per month in 2007, and then to 130 per month in 2008. In January 2009 a slight decrease could be noted, with 110 new CDM projects added to the pipeline, and the average number of new projects in the most recent quarter totalling 111, compared to a monthly average of 130 in 2008.[20]

[16] Recent work on mitigation costs indicates that meeting the 2°C target could be achieved with GDP losses of at most 2.5 per cent by 2050 (reducing annual growth by at most 0.05 per cent per year), and with lower costs for earlier years. When taking into account co-benefits in terms of air pollution reduction, net costs could be significantly lower. The costs of actions to mitigate climate change are small when compared to the relative costs of impacts due to inaction. In the Stern review (2006), for example, the costs of inaction were estimated in the range of 5–20 per cent of GDP.

[17] i.e. €175 by 2020. See: *Towards a comprehensive climate change agreement in Copenhagen.* COM (2009) 39 final. Brussels. 28 January 2009.

[18] When looking, for example, at the UNFCCC figures separately, although large in absolute terms, these figures for additional required investments are small in comparison with projections of global GDP (0.3 – 0.5 per cent) and total global investment (1.1–1.7 per cent) in 2030.

[19] Fenhann (2008). As part of the validation process, the project design document of a proposed project must be posted for public comment. A project that has reached this stage is said to be in the CDM pipeline.

[20] UNEP Risø. February 2009.

Table 3. CDM status as at February 2009[21]

Status of CDM projects	Number
At validation	**2 780**
Request for registration	93
Request for review	132
Correction requested	82
Under review	17
Total in the process of registration	**324**
Withdrawn	25
Rejected by the Executive Board	87
Registered, without issuance of CERs	905
Registered, CER issued	465
Total registered	**1 370**
Total number of projects (including rejected and withdrawn)	4 586

Geographical distribution

While the CDM project aims to bring together industrialized countries' demand for certified emission reductions and all developing countries' demand for sustainable technologies, in practice the CDM pipeline has centred strongly on a small group of developing host countries (including Brazil, Chile, China, India, Malaysia, Mexico, and the Republic of Korea).

Asia and Latin America together have a share in the global CDM project pipeline of approximately 95 per cent. Sub-Saharan Africa has only a few projects, and most of these are in South Africa. Of all the projects in the pipeline, by February 2009 Asia and the Pacific had 77 per cent, Latin America had 19 per cent, Africa had 2 per cent, the Middle East had 1.2 per cent, and Europe and Central Asia had 1 per cent (see table 4).

While this distribution in part reflects existing economic endowments and institutional capacities in host developing countries, as well as the demand for low-cost CERs by industrialized countries, several CDM-specific explanations can be identified for this skewed distribution of projects entering the CDM pipeline and advancing towards issuance of CERs (see chapter 3 for this analysis).

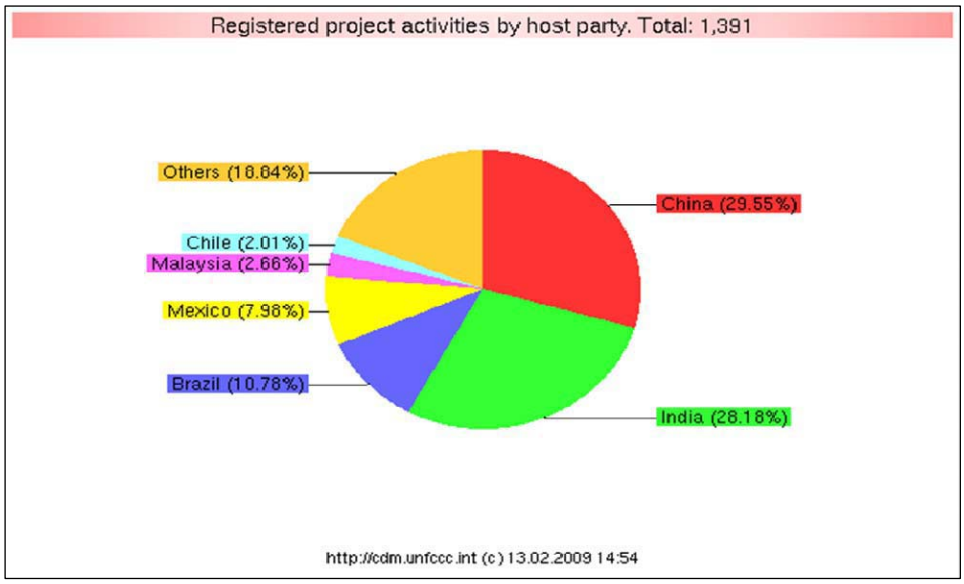
Table 4. Latin America and Asia and the Pacific host 96 per cent of the projects in the CDM pipeline[22]

Total in the CDM pipeline	Number		kCERs	2012 kCERs		Population	2012 CER per capita
Latin America	849	19.0%	81 647	432 192	14.8%	449	0.96
Asia and the Pacific	3 436	76.8%	497 120	2 330 423	80.1%	3 418	0.68
Europe and Central Asia	43	1.0%	3 874	17 679	0.6%	149	0.12
Africa	91	2.0%	19 065	92 649	3.2%	891	0.10
Middle East	55	1.2%	8 366	37 981	1.3%	186	0.20
Developing countries	4 474	100%	610 073	2 910 925	100%	5 093	0.57

With regard to the geographical distribution of projects that have already advanced in the CDM pipeline and been registered, the dominance of a few main host countries can be identified: 392 of the registered CDM projects were in India, 404 in China, 150 in Brazil and 111 in Mexico (see fig. 2). In comparison, the number of registered projects in South Africa totalled 14, while in Kenya, Uganda, and the United Republic of Tanzania, only one CDM project had been registered for each country by February 2009.[23]

[21] UNEP Risø. February 2009.
[22] UNEP Risø. February 2009.
[23] http://cdm.unfccc.int/Statistics/index.html

Figure 2. Distribution of registered CDM projects, figures as at 13 February 2009[24]



While the CDM market has been dominated by a few main countries, the overall global distribution has improved during the last months, and the number of countries that have developed their capacity to the level of hosting CDM projects has risen over the last year from 67 to 76.

Project types

So far, the CDM projects are primarily renewable energy projects, from hydroelectric and wind to solar and geothermal. In terms of project types, by the end of 2008, renewable energy technologies had a leading share of the pipeline with 63 per cent, methane emission reduction projects accounted for 16 per cent, and supply-side energy efficiency accounted for 10 per cent (fig. 3).

Hydropower was the dominant CDM project technology, accounting for over 25 per cent of the projects (i.e. 1174 projects).25 Two thirds of those projects were located in China. India was hosting over 110 hydropower projects, and Brazil was hosting 70. Biomass-based energy projects had a 15 per cent share and wind energy projects had a 14 per cent share in the pipeline.

The share of industrial gas abatement projects continued to decrease in 2008, reflecting the exhaustion of existing opportunities under the current methodology. Projects for the destruction of hydrofluorocarbon 23 (HFC23) have continued to decrease too, from a 67 per cent share of the CDM market in 2005, to 34 per cent in 2006, to 8 per cent in 2007. Projects for the mitigation of nitrous oxide (N_2O), another potent GHG with high global-warming potential, started to appear in the transaction database in 2006. N_2O projects captured a 13 per cent share of volumes transacted in 2006, and 9 per cent in 2007, reflecting the exhaustion of existing opportunities.[26]

Afforestation and reforestation CDM projects represented 10 per cent of the projects in Africa, whereas these types of projects were much less represented in Latin America (1.1 per cent) and Asia (0.4 per cent). Regarding energy efficiency (end-use), only 18 energy-demand projects have been registered to date, in only five different countries, accounting for 1.5 per cent of all CDM projects and an even smaller share of the CERs issued. This level of performance stands in obvious contrast to mitigation scenarios (see, for

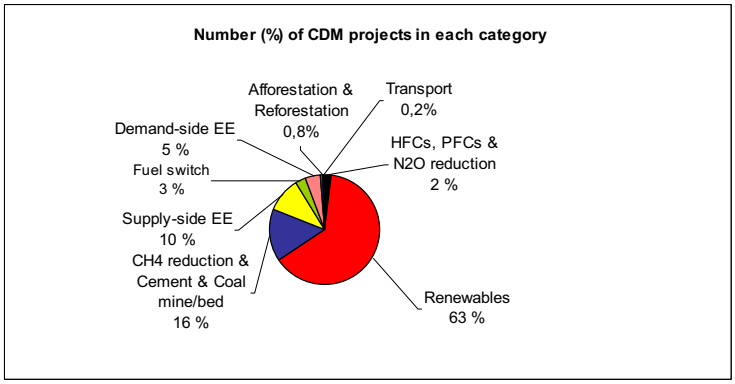
[24] For the latest updates, see http://cdm.unfccc.int/Statistics/index.html

[25] Approximately one third of the small-scale CDM projects can be found in the category of hydropower. The dominant host countries in the category of renewable energy small-scale projects are India (with approximately 700 projects) and China (with over 400). In India, these projects are mainly in the field of hydropower, wind power, and biomass energy. In China, most of these projects are hydropower activities. See also figure 7.

[26] For example, in China (the largest supplier of CERs), 90 per cent of the CERs issued have come from industrial HFC projects, but the situation is changing.

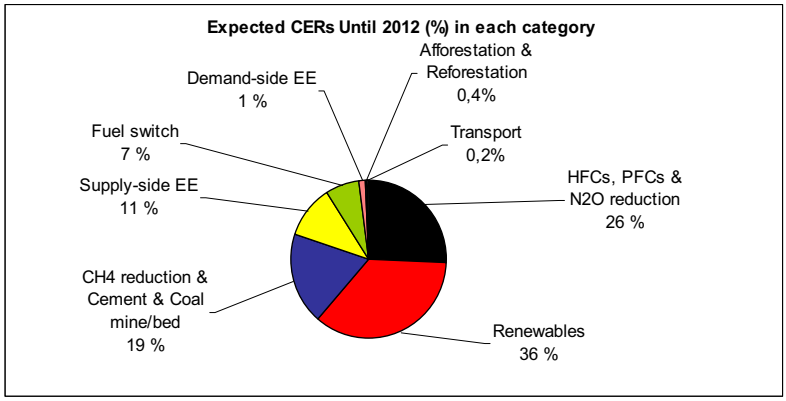
example, the IPCC or IEA scenarios), which typically ascribe a dominant share of mitigation in the coming decades to end-use efficiency.[27]

Figure 3. Number of CDM projects in the CDM pipeline, by project type, as at February 2009[28]



With regard to the expected CERs by project type, the comparison of different types of projects gives different results (see also annex 3: The CDM pipeline according to project type, February 2009). Only 22 hydrofluorocarbon (HCF) emission-reduction CDM projects are responsible for 17 per cent of the total expected emission reductions up to 2012. Similarly, the expected emission-reduction amount of only 65 N_2O emission-reduction CDM projects is 9 per cent of all expected CERs. The share of hydropower CDM projects is only 17 per cent of the expected CERs, up to the year 2012 (fig. 4).

Figure 4. Number of expected CERs by project type, up until 2012. Although in terms of quantity, 63 per cent of the CDM projects fall into the category of renewables, they produce only 36 per cent of the CERs expected.[29]

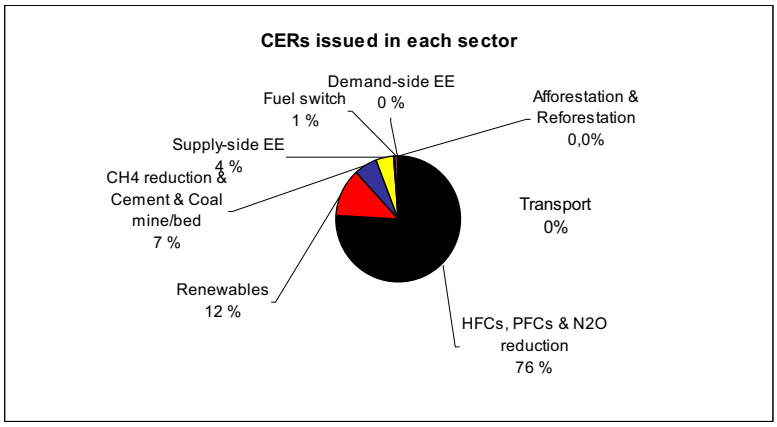


A majority of the emission-reduction projects with a high global-warming potential are in Asia. Therefore, the share of Asian countries in the project pipeline in terms of CERs is even larger than the number of projects (approximately 80 per cent, versus 76 per cent).

China alone is expected to deliver about half of all CERs currently in the pipeline. India is a leading country in CDM project categories such as biomass energy, wind power and energy efficiency in industry, but these have generally lower CO_2 equivalent emission reductions of HFC and N_2O. India's share of the expected CERs is smaller than its share of the number of projects (15.6 versus 26.8 per cent). The three hydropower projects in Bhutan represent more than 55 per cent of the expected CERs from all the projects in LDCs.[30]

[27] The amount of cumulative CERs expected to be issued through 2012 from the end-use energy efficiency projects that had been registered by the end of 2008 under the CDM remained at around 10 million CERs. In contrast, the International Energy Agency has issued a series of 25 energy efficiency policy recommendations, which could save around 8.2 $GtCO_2$ annually by 2030 (IEA, 2008).
[28] UNEP Risø. February 2009 update. CDM pipeline.
[29] UNEP Risø. February 2009. CDM pipeline.
[30] The State of Play with the CDM, ENTTRANS: EU sixth framework programme. November 2008.

Figure 5. CERs issued according to project type[31]



Experience shows that some CDM projects perform worse than expected, while some have outperformed expectations. In early 2009, the overall CER issuance success rate (i.e. the amount of CERs issued, in comparison to CERs foreseen in project design documents) has been approximately 98 per cent, but there are large differences between the categories. HFC and N_2O emission reduction projects have performed better than expected, while projects such as geothermal energy, landfill gas recovery, methane capture, and agriculture and transport sector projects have had a success rate less than 50 per cent of initially expected CERs (table 5).

Table 5. Issuance success, by project type[32]

Issuance success comparison	All CDM projects		Small-scale projects	
	Number projects	Issuance success	Number projects	Issuance success
Afforestation	0	0 %	0	0 %
Agriculture	39	45 %	1	39 %
Biogas	7	63 %	5	78 %
Biomass energy	103	86 %	61	84 %
Cement	7	66 %	0	0 %
CO2 capture	1	191 %	0	0 %
Coal bed/mine methane	2	41 %	0	0 %
Energy distribution	0	0 %	0	0 %
EE households	0	0 %	0	0 %
EE industry	21	85 %	15	85 %
EE own generation	29	89 %	0	0 %
EE service	1	61 %	1	61 %
EE supply side	4	76 %	3	92 %
Fossil fuel switch	16	88 %	6	93 %
Fugitive	3	112 %	1	97 %
Geothermal	2	29 %	0	0 %
HFCs	16	107 %	0	0 %
Hydro	85	95 %	55	90 %
Landfill gas	32	34 %	1	50 %
N2O	10	124 %	0	0 %
PFCs	0	0 %	0	0 %
Reforestation	0	0 %	0	0 %
Solar	1	18 %	1	18 %
Tidal	0	0 %	0	0 %
Transport	1	47 %	0	0 %
Wind	85	76 %	25	87 %
Total	465	97,9%	175	85,9%

EE = energy efficiency

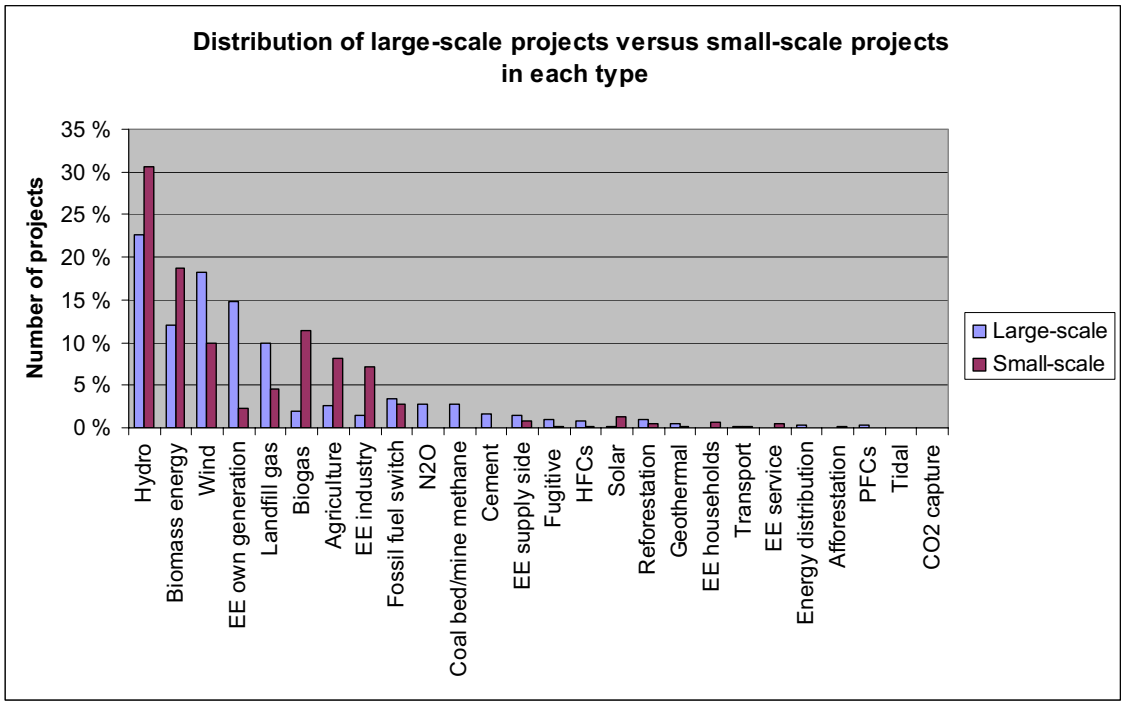
[31] UNEP Risø. February 2009. CDM pipeline.
[32] UNEP Risø. February 2009. CDM pipeline.

Project size

CDM projects can be considered small-scale projects if they are either renewable energy project activities with a maximum output capacity up to an equivalent of 15 MW, or energy efficiency improvement projects reducing energy consumption (both supply and demand side) by up to 60 GW/h per year, or other projects reducing annual CO_2 equivalent emissions by 60k tons at maximum.

Many authors have argued that many small-scale activities cannot be implemented cost-effectively, because the transaction costs related to project design, validation and verification are too high to be compensated by the project revenues. In addition, small-scale projects have had a slightly lower success rate than the overall average (86.3 versus 95.5 per cent).[33] However, simplified accounting procedures can be used for small-scale projects, contributing thereby to reduced transaction costs during the project preparations (project preparation, monitoring, validation and certification). As at February 2009, 46 per cent of all the CDM projects (2,049 out of 4,474) in the pipeline were small-scale CDM projects (fig. 6). These are expected to generate around 10 per cent of the CERs until 2012.

Figure 6. Distribution of small-scale/large-scale projects in each project type[34]



Despite the challenges mentioned above, small-scale projects have had a significant role in the CDM pipeline thus far. In particular, a few elements have been highlighted as reasons for the increasing popularity of small-scale projects.[35] Firstly, while large-scale methodologies must be proposed by project developers and approved by the CDM Executive Board in a bottom-up process, small-scale methodologies are approved in a top-down process. This has triggered the emergence of small-scale projects in sectors for which small-scale methodologies – but no large-scale methodologies – had been approved. This has been the case in particular for the 626 hydroelectric projects and 382 biomass projects, which together could yield over 160 million CERs by 2012. The simplified methodologies for small-scale projects also improve their cost-efficiency, and thereby facilitate securing of the required funding.

Secondly, the characteristics of the projects and the political and technical environment in the host country seem decisive. Some projects, such as HFC, N_2O and landfill gas projects are by their very nature large-scale, while other projects, especially in the renewable energy sector: wind, solar, hydropower and

[33] The State of Play with the CDM, ENTTRANS: EU sixth framework programme. November 2008.
[34] UNEP Risø. February 2009. CDM pipeline.
[35] Fenhann J (2008). Why are there so many small-scale projects? *Carbon Finance*. 19 May 2008.

biomass, are small-scale. In this context, the political environment (e.g. clarity and continuity of policies, specific strategies for different renewables) and the technical environment (e.g. availability of expertise, technologies, relevant infrastructure) in the host country seem to play a major role. Thirdly, in some cases, CDM stakeholders have also noted a certain preference on the part of buyers for small-scale projects with a potentially higher sustainability dividend.

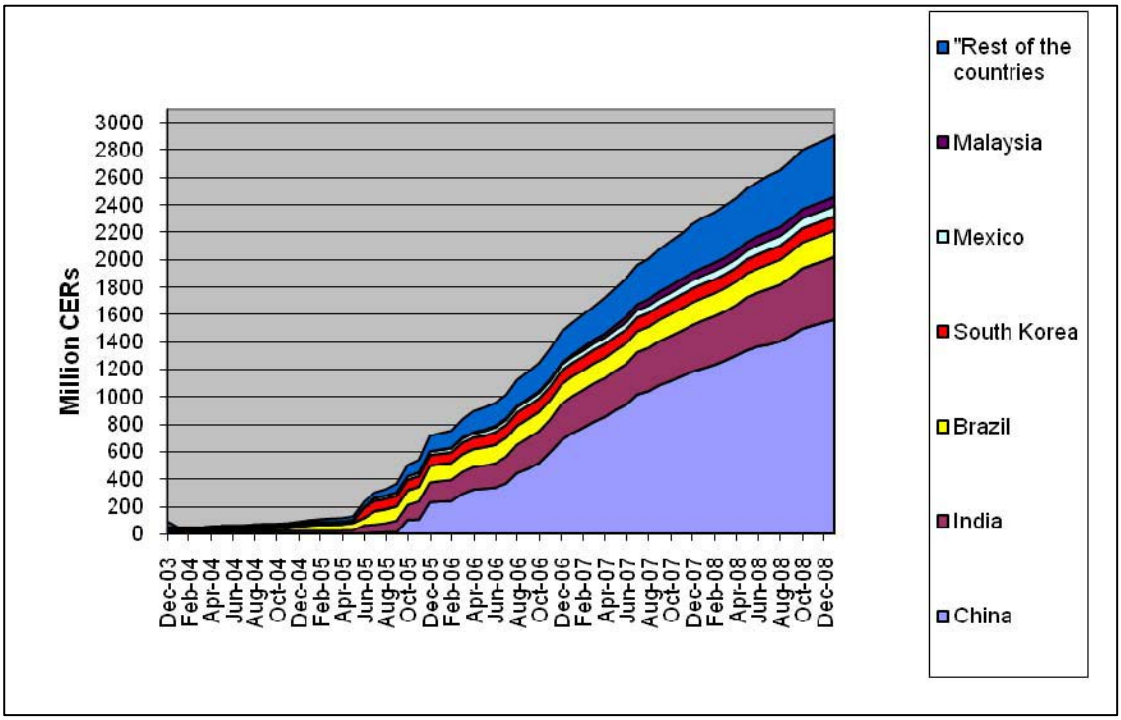
Of the over 200 small-scale wind projects being developed in the world, the majority are hosted by India. The majority of the more than 600 small-scale hydro projects are hosted by China; and of the 382 small-scale biomass projects, over 200 are Indian, over 40 are Brazilian, and over 20 are Malaysian. Malaysia has also developed approximately 30 projects for composting oil palm residues. Some of the reasons for the rapid growth of CDM projects and the emergence of clusters of small-scale projects in these countries (as well as the lack thereof in other countries) are discussed in chapter 3.[36]

In order to enhance project development in countries lacking CDM activities, and also to scale up CDM projects, the CDM mechanism has recently been extended to allow programmatic activities. Programmatic CDM allows the development of many smaller projects as part of a larger CDM programme, coordinated by a coordinating entity. The programmatic approach can be of special interest for LDCs, since these countries often have potential for smaller scattered projects, such as biogas for households, rural electrification etc. Programmatic projects are still few in number, but they may provide a way to increase the attractiveness of the mechanism in underrepresented regions and thereby help to scale up GHG emission reductions and the sustainable development benefits of the CDM (also see annex 5).[37]

Amount of CERs and price evolution

The total amount of CERs expected from the CDM projects currently in the pipeline exceeds 2.9 billion. As noted above, the CDM pipeline – with regard to the total number of projects as well as the expected CERs – has been dominated by a few leading developing countries, including Brazil, China, India, Malaysia, Mexico and the Republic of Korea (fig. 7).

Figure 7. Development between key host countries of expected CERs from the pipeline projects[38]



[36] Fenhann J (2008). Why are there so many small-scale projects? *Carbon Finance*. 19 May 2008.
[37] UNEP Risø. February 2009. CDM pipeline.
[38] UNEP Risø. February 2009. CDM pipeline.

Projections of the number of CERs that will have been issued by the end of 2012 have decreased during recent months, reflecting the global economic downturn. For example, the United Nations Environment Programme's Risø Centre has decreased its estimate from 1,518 mCERs (million CERs) in the January pipeline to 1,431 mCERs, due to the lower number of new projects in the last three months and to delays to projects at the stages of validation and requesting registration.

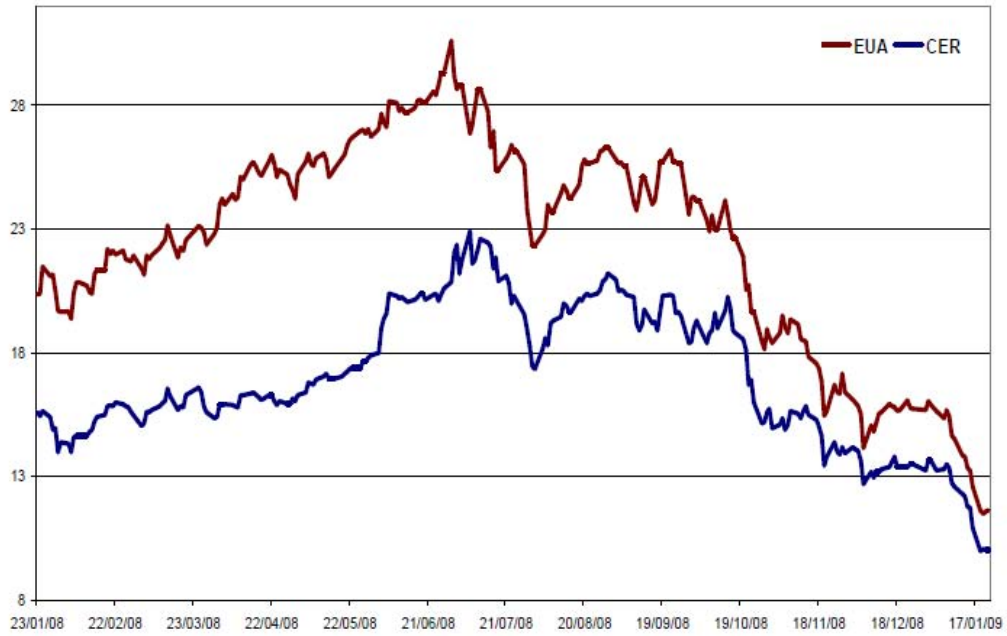
The cumulative total amount of CERs issued by February 2009 was 251 million. Observing the number of CERs issued in respect of the top countries, it can be seen that China, India, the Republic of Korea, and Brazil, as well as Mexico, clearly dominate the market, while Viet Nam, Chile and Egypt represent small shares of the market (see table 6).

Table 6. Top countries by number of CERs issued[39]

Top countries by number of CERs issued	mCERs	Share	Accumulative Share
China	106.0	42.3%	42.3%
India	57.1	22.8%	65.1%
Republic of Korea	36.2	14.5%	79.5%
Brazil	28.6	11.4%	91.0%
Mexico	5.0	1.8%	92.7%
Viet Nam	4.5	1.2%	93.9%
Chile	2.9	1.2%	95.1%
Egypt	2.4	0.9%	96.0%

Falling oil price and signs of worldwide recession have caused a general decline in carbon market prices. European Union carbon prices for EUAs fell from €28 in June 2008 to €14 in early December 2008, recovered towards the end of December 2008 to around €20, and then fell again in early 2009, temporarily touching the €10 level. While the plunging values for EUAs are at the heart of failing prices in the CDM market, the CER price (so-called secondary CERs) has simultaneously dropped temporarily to levels below €10 (fig. 8). At the same time, within the overall decline on the European carbon market, the spread between EUAs and CERs continued to narrow from €10 in June 2008 to under €2–3 in early 2009. Overall CER trading volumes have declined during recent months, from quite buoyant levels during November 2008.

Figure 8. EUA and CER price development, January 2008 to January 2009[40]



[39] UNEP Risø. February 2009. CDM pipeline.
[40] Point Carbon. Carbon Market Europe. 23 January 2009.

CERs can be traded in different stages of the CDM cycle. In November 2008, a realized emission reduction project with certified and issued CER (secondary CERs) was traded at around €15. CERs expected from registered CDM projects were traded at €12 to €15. CERs from projects still at the validation or registration process (so-called primary CERs/CDM credits) have prices of between €6 and €14 per CER. All these prices were for CERs achieved or expected to be achieved before 2012. Post-2012 CERs were traded at prices around €7 per CER.

Overall, prices at the higher end of that range typically reward projects that are further along in the CDM process (such as registered projects), projects that are being developed by experienced and established sponsors (with low credit risk and performance risk), and/or projects with high expected issuance yields. Prices for projects at an early stage of regulatory and operational preparation have transacted at around €8–10 (possibly even €7–11, depending on the country and the project), while registered projects with streamlined technology (for example, HFC with storage options) have attracted prices between €11 and €13. Projects demonstrating strong sustainability attributes and community benefits (such as those certified under the Gold Standard) could easily fetch a €1–1.5 premium; obtaining a price of €15 for Gold Standard CERs was not uncommon towards the end of the year.[41]

The economic downturn in the late 2008, combined with falling oil prices, has had an impact on the CER markets. In early 2009, lower CER prices have already led to a drop-off in transactions in CER primary markets. CDM projects relying on forward carbon revenues to get up and running are becoming uneconomic at the lower prices. This has already resulted in fewer financing deals being struck and projects being put on hold, as global economic developments are watched, business models are reassessed, and a recovery in carbon prices is hoped for.

Interviews with various carbon market players have indicated that the CER price is not expected to increase significantly in 2009. The lower price level highlights the flexibility of a cap-and-trade scheme, in automatically adjusting the price of carbon in the face of lower emissions. However lower price levels, and a looming surplus of supply over demand despite several bottlenecks in the CDM system, indicate (at least to this author) a market environment unfavourable for significant investment in new low-emissions technology or renewable energy sources in the short term. The importance of a clear, long-term post-2012 framework established by the ongoing climate negotiations cannot be overestimated, when looking at the potential of carbon markets to catalyse investments in low-carbon technologies.

Demand for CERs and the latest outlook towards 2012

The carbon market has so far been essentially a compliance-driven market, where buyers largely engage in carbon transactions because of carbon constraints (current or anticipated) at international, national or subnational levels. The Kyoto Protocol is the largest potential market, and EU ETS, a tributary cap-and-trade scheme, has spawned a thriving market for allowances and for project-based emission reductions.

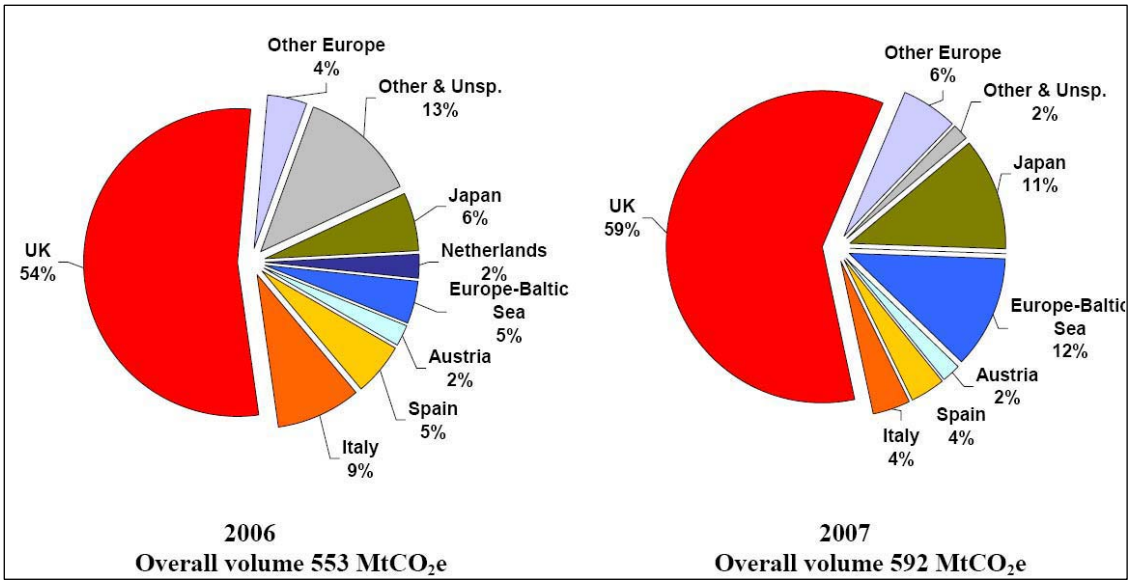
Since 2002, buyers from the European Union have accounted for cumulatively almost 75 per cent of the CDM market, and Japan[42] has accounted for about 20 per cent (see fig. 9). In 2007, the share of European buyers reached almost 90 per cent. The demand for the project-based emission reduction market may continue to be largely dependent on European markets in the immediate future. However, President Obama has already indicated his intention to establish a strong United States cap-and-trade system, which could create a considerable additional demand for CERs.

In December 2008, the Council of the European Union established a compromise decision on Energy and Climate Change, which confirms a continued EU market demand for CERs beyond 2012. It contains an important element on effort-sharing, and limits the maximum quantity of credits authorized per member State set at 3 per cent. Furthermore, the decision provides certain member States, under specific conditions, with an opportunity to use additional credits to 1 per cent of their verified 2005 emissions, for projects in least developed countries and small island developing States.

[41] Ambrosi C (2008). *State and Trends of the Carbon Market 2008*. World Bank. May 2008.

[42] Japanese companies with voluntary commitments under the Keidanren Voluntary Action Plan.

Figure 9. Primary CDM and JI buyers, as shares of volumes purchased, vintages up to 2012[43]



Strong growth in carbon markets and a quick increase in CDM projects during 2005 to 2008 indicate a firm momentum for the CDM. Also, the general political climate suggests broad support for the CDM, even though there are urgent needs for improvements in order to ensure that the mechanism fulfils its main objectives in an efficient manner (see chapter 3). Moreover, there is a widely agreed understanding that should the international negotiations in 2009 reach an ambitious agreement and set longer-term goals with clear incentives, developing countries could deliver large volumes of cost-effective and science-based emission reductions.[44]

Although in early 2009 concerns have been raised – for example related to delivery and issuance problems, higher perceived credit risks, continued uncertainty about CER demand, an increasing interest and shift towards voluntary carbon markets instead of the CDM, and the general economic downturn possibly leaving projects in poorer countries behind – the number of projects entering the project pipeline has not fallen dramatically, contrary to many expectations. For example, the UNEP Risø Centre's projections of CERs to be issued by the end of 2012 have been downgraded, but they still remain at around 1.4–1.5 billion. In line with this projection, UNEP's Risø Centre estimates that 235 million CERs will be issued in 2009 – up from 140 million in 2008 – and that the rate will increase to 275 million CERs in 2010, 350 million in 2011, and 420 million in 2012.[45] This projection is based, among other things, on the assumption that projects which have reached the stage of validation have already secured financing.

However, lowered CER prices have started to impact on the new generation of CDM projects in recent months. As such, CDM projects that rely on forward carbon revenues are becoming uneconomic at the lower prices. Some carbon market players expect that lower prices will particularly impact on project development in less experienced market areas, on smaller projects, and on projects that require extensive project preparations. Typically, this could have an impact on projects in Africa and LDCs. In addition, programmatic CDM may suffer if cash-strapped national or regional governments believe that they cannot afford to invest in schemes that cut greenhouse emissions.

[43] Ambrosi C (2008). *State and Trends of the Carbon Market 2008*. World Bank. May 2008.

[44] The potential for mitigation through agriculture in the African region is estimated at 17 per cent of the global total, and the economic potential (i.e. considering carbon prices) is estimated at 10 per cent of the total global mitigation potential. Similarly, Africa's forestry potential per year is 14 per cent of the global total, and the avoided-deforestation potential accounts for 29 per cent of the global total. International Food Policy Research Institute. Global Carbon Markets: Are There Opportunities for Sub-Saharan Africa? Written by Elizabeth Bryan, Wisdom Akpalu, Mahmud Yesuf, and Claudia Ringler (2008). IFPRI discussion paper 00832. December 2008.

[45] Fenhann J (2009). What will happen to CER supply in 2009? *Point Carbon News. CDM and JI Monitor.* Vol. 6, issue 25. 7 January 2009.

The wider geographical distribution of CDM projects means the proportion of projects hosted by Brazil, China, India and Mexico has fallen from 85 per cent in mid-2006 to 73 per cent in the last quarter of 2008. The contribution of the institutions active in the Nairobi Framework for increased CDM capacity development in Africa have played a role, since the number of projects in Africa has increased to 90 now, compared to 52 a year ago. It is also interesting to note that 30 per cent of afforestation/reforestation projects and half of the programmatic projects are hosted by African countries (see annex 5).

This also indicates the possibility that ongoing CDM reforms, as well as capacity-building activities, may open up for catalysing new CDM projects. The projected issuance could be increased, for example if the bottlenecks and delays in the system could be reduced, as highlighted by a multitude of stakeholders and noted at the climate negotiations in Poznan in December 2008.[46] In addition, as new compliance schemes are developed in different parts of the world, it is likely that CERs could act as the common ground contract, linking different cap-and-trade schemes, in the near future. The central bottlenecks encountered so far – as well as potential ways of streamlining and reforming the CDM mechanism in order to better achieve its key objectives – are presented in chapter 3, which follows.

[46] UNFCCC further guidance relating to the Clean Development Mechanism. Decision -/CMP.4 (2008).

3 CDM barriers and bottlenecks: potential ways forward

3.1 CDM experiences

Despite the evident benefits of the CDM mechanism, the results have not always been fully clear, or appreciated by all stakeholders. Among other things, the additionality of the emission reductions and the equitability and regional distribution of CDM projects between different developing countries have been questioned. In a similar manner, the sustainable development benefits have been challenged. This chapter notes some of the main experiences and outcomes so far regarding the sustainable development dividend and the additionality of emissions reductions, and also discusses CDM technology-transfer experiences and the funding catalysed by the CDM. (The issues related to geographical distribution have been discussed in section 2.2).

Sustainable development and additionality

The CDM has a double objective: to achieve sustainable development in the host country, and to assist annex 1 countries in achieving their emission reductions in a cost-efficient manner. While there is no agreed definition of sustainable development (specifically for the CDM), it is quite clear from the Marrakesh accords that the host-country government determines whether or not a CDM project assists the host country in achieving sustainable development. African sustainable development criteria typically contain requirements related to income generation, environmental sustainability, employment generation, capacity-building, and technological development.

Host countries assess the CDM project's contribution to sustainable development in many different ways. Host countries, through their Designated National Authorities (DNAs), can assess the sustainable development contribution through:

1. The use of specific lists of sustainable development criteria, when judging proposed CDM projects;
2. Assessment of whether projects meet the needs and priorities in terms of energy service and economic welfare improvement or poverty alleviation;
3. Assessment of projects with a view to possible negative environmental impacts and whether they are comply with national and/or local government legislation.

When using these categories, the former two require project participants to specifically address a number of criteria and/or specifically support national or local needs and priorities. In the latter case, the contribution of a CDM project to a government's strategy – for example, to phasing out the use of fossil fuels and to increasingly deploy renewable energy resources – may qualify as such. The third category refers to projects where the DNA assesses projects in a more passive way, by checking whether the CDM projects do not have negative environmental impacts in the countries, and whether they are in accordance with applicable legislation.[47] Based on a survey of over 40 CDM projects in 10 project categories, it could be concluded that of the 18 countries included for analysis, eight countries have published specific criteria for the sustainable development contribution that CDM projects must deliver. These include Brazil, China, Colombia, India, Indonesia, the Philippines, South Africa and Sri Lanka (see table 7).[48]

[47] The State of Play with the CDM. ENTTRANS: EU sixth framework programme. November 2008.

[48] These criteria can be found on the Internet sites of the countries' DNA (explicitly in the case of India, Indonesia and South Africa) or have been presented by DNA representatives at workshops and conferences.

Table 7. Example of a host country assessment of CDM projects in terms of contribution to sustainable development. This table summarizes the categorization of host countries' assessments of projects' sustainable development contribution, from most elaborate (left) to minimal application (right).[49]

Sustainable development criteria (Operational approach)	Needs and Priorities (Country-context specific)	Environmental Impact Assessment / national legislation (Compliance-driven)
←		
Brazil	Costa Rica	Argentina
China	Honduras	Chile
Colombia	Jamaica	Ecuador
India	Republic of Moldova	
Indonesia	Nepal	
Philippines	Nicaragua	
South Africa	Peru	
Sri Lanka		

Projects in Brazil, India, Indonesia, the Philippines and South Africa must meet economic criteria (e.g. job creation, lower dependency on fossil fuels, improvement of balance of payments, increased security of supply etc.), environmental criteria (improvement of local/national environmental circumstances), and social criteria (e.g. job-quality improvement, improvement of welfare of local communities, improvement of local infrastructure etc.). To this list, India and Indonesia have added technological development through the transfer of State-to-State technologies under CDM projects, which are suitable for the countries concerned and have replicability potential. In other countries, such as China and Colombia, reference is made to the optimization of the use of natural resources, adoption/transfer of cleaner energy technologies, poverty alleviation, and employment generation. Sri Lanka has indicated that projects must deliver new and proven technologies, and contribute to environment and welfare improvements.

While there is not yet available any international standard for sustainability assessment[50] – additional to national definitions – the overall assessment of the CDM mechanism's contribution to sustainable development is based on case-by-case studies or selected country overviews. Regarding project types, one central part of the criticism has been directed towards industrial gas projects, and their lack of sustainable development benefits.

This also highlights the often noted trade-offs on the "additionality and sustainable development" axis when looking at CDM projects. For example, HFC abatement in China clearly provides an additional cut in GHG emissions and would not have happened without the CDM, but at the same time, these projects have been strongly criticized for their low direct contribution to sustainable development. At the other end of the axis, for example, energy efficiency is obviously promoting sustainable development, but it is sometimes very difficult to prove its additionality. However, when looking at the number of currently registered CDM projects, the specific project type of industrial gases is clearly in decline and being replaced by projects with better potential to contribute to sustainable development in the host countries,

[49] The State of Play with the CDM. ENTTRANS: EU sixth framework programme. November 2008.
[50] Holm Olsen K, Fenhann J (2006). Sustainable development benefits of clean development projects. CD4CDM working paper series. United Nations Environment Programme Risø Centre. October 2006.

indicating several possibilities to realize relatively cheap GHG abatement and simultaneously foster sustainable development.[51]

With regard to broader sustainability benefits of the CDM, several stakeholders also note important indirect sustainable development benefits, in particular highlighting its contribution to increased awareness about climate change in developing countries among policymakers, businesses and citizens.

Technology transfer[52] and funding

In line with the twin objectives, the CDM projects are expected to fulfil the demand for annex 1 country emission reductions, and for developing countries' demands for sustainable (energy) technologies and other means of achieving their development goals. Consequently, although the CDM does not have an explicit technology transfer mandate, it should contribute to technology transfer by financing projects that use technologies that are not available at present in the host countries.

Some 39 per cent of all CDM projects (both registered and proposed) – accounting for 64 per cent of the annual emission reductions – claim to involve technology transfer, which usually involves both knowledge and equipment.[53] This could be considered quite a high ratio, indicating that the CDM has clearly promoted the transfer of technology to developing countries.

However, it should be noted that equipment imports account for most of the claimed transfers, and the extent of technology transfer is very heterogeneous across project types. Imports of equipment do not necessarily bring technology or know-how to the host countries, and clearly most of them occur on a normal commercial basis. Even without the CDM, equipment imports and any associated transfers of know-how would take place too.

In general, technology transfer has been more common in the case of larger projects, and projects with foreign participants. With regard to sectors, to cite some examples, the cement, coalbed/coalmine methane, fossil fuel switching, and transport sectors involve very little technology transfer, while almost all energy supply and household energy efficiency and solar projects claim technology transfer.[54]

Despite some forerunner host countries aiming to clearly define their sustainable development preconditions and criteria for CDM eligibility, including some criteria for technology transfer, actual CDM practice – despite several success stories – has shown rather mixed experiences related to technology transfer.[55] Where technology transfer is seen as a priority, host countries could have a stronger impact on the technology-transfer outcomes of the CDM by including it as a clear requirement for obtaining a letter of approval, and by surveying the fulfilment of the criteria in a stricter way.

The success of the CDM can also be assessed by looking at the investment flows into CDM projects. According to a 2007 UNFCCC report on investment and financial flows, the capital that will be invested in CDM projects registered during 2006 is estimated at about $7 billion, and the estimated investment in renewable energy and energy-efficiency projects of $5.7 billion is roughly triple the official development assistance (ODA) support for energy policy and renewable energy projects in the same countries. The

[51] Carbon contracts from energy efficiency and renewable energy accounted in 2008 for nearly two thirds of the transacted volume in the project-based market (see also fig. 4), appropriately reflecting the CDM's mission of supporting emission reductions and sustainable development. Bryan E, Akpalu W, Yesuf M and Ringler C. Global carbon markets: Are there opportunities for sub-Saharan Africa? International Food Policy Research Institute.

[52] The Intergovernmental Panel on Climate Change defines technology transfer as "a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private-sector entities, financial institutions, NGOs and research/education institutions".

[53] Seres S (2007). Analysis of technology transfer in CDM projects. Report to the UNFCCC Registration and Issuance Unit.

[54] Seres S (2007). Analysis of technology transfer in CDM projects. Report to the UNFCCC Registration and Issuance Unit.

[55] See, for example: Technology and knowledge transfer from annex 1 countries to non-annex 1 countries under the Kyoto Protocol´s Clean Development Mechanism (CDM) – an empirical case study of CDM projects implemented in Malaysia. CD4CDM working paper series. Working paper no. 5. October 2008. UNEP Risø Centre.

capital that will be invested in projects that entered the CDM pipeline during 2006 is estimated at over $25 billion. In comparison, the total investment leveraged through the Global Environment Facility (GEF) in the area of climate change since it started is $14 billion.[56]

The total capital that has been, or will be, invested in CDM projects that had entered the pipeline by early 2009 is in the range of $100 billion,[57] with most of the investment taking place in hydropower, wind, fossil fuel switching, biomass energy and industry energy efficiency projects. In line with the presentation of the typical CDM project types in section 2.2, relatively small total investments have occurred in transport, agriculture, and demand-side energy efficiency project types.

3.2 CDM barriers and bottlenecks

While the CDM has managed to catalyse a remarkable number of projects contributing to emission reductions and investment in cleaner technologies over a short period of time, several barriers to wider success have been encountered. In part, these barriers are connected with the enormous success of the CDM mechanism itself; in part, the barriers identified are linked with bottlenecks in the overall enabling environments in developing countries, but also in developed countries.

The geographical concentration of CDM projects has left least developed countries, small island developing States, and sub-Saharan African countries with a very thin slice of the carbon market. In response to the barriers and challenges identified, the Nairobi Framework[58] was initiated in 2006 by the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the World Bank Group, the African Development Bank, and the secretariat of UNFCCC, with the specific target of helping developing countries – especially those in sub-Saharan Africa – to improve their level of participation in the CDM.

In this chapter, some of the key barriers are highlighted – which the Nairobi Framework, and also other recent initiatives, have managed to provide some solutions to. Some of the barriers relate to the overall policy/legislative and enabling frameworks in the host countries, some are directly CDM-related national barriers in the host countries (e.g. related to institutional capacity, awareness of climate policy, carbon markets, and the CDM in particular), and some are related to financing and procedural challenges in the CDM system itself (such as procedural delays, unclear methodologies, and lack of capacity and resources).

Meanwhile, the uncertainty of the post-2012 regime itself forms a major overall challenge for CDM growth and future development (see section 3.3). When considering the barriers and potential solutions presented below, it is important to note that each country is a specific case of its own, and consequently requires a specific set of measures to harness its CDM potential and remove hurdles.

National-level policy and legislative barriers in host countries

The host country's legislative framework and existing policies establish the basic framework conditions for economic activities and most investment decisions. While there are different possibilities for ensuring the funding of CDM activities (unilateral,[59] bilateral and multilateral), the existence of clear and comprehensive energy and/or climate policies, a stable legislative environment, and predictable economic

[56] For details, see UNFCCC Dialogue working paper 8, paragraph 41, at http://unfccc.int/files/cooperation_and_support/financial_mechanism/financial_mechanism_gef/application/pdf/dialogue_working_paper_8.pdf and the carbon markets chapter of the background paper, at http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/potential_of_carbon_markets.pdf.

[57] Estimated investment numbers are based on the total investment as reported in the project design documents that entered the CDM pipeline in 2005–2008, and as extrapolated for those projects that do not report investment numbers.

[58] The Framework consists of five objectives, agreed to by the initiating agencies, considered to be key priority targets in order to move the CDM forward in the beneficiary countries: (a) build and enhance the capacity of DNAs to become fully operational; (b) build capacity in developing CDM project activities; (c) promote investment opportunities for projects; (d) improve information-sharing, outreach, the exchange of views on activities, and education and training; and (v) inter-agency coordination.

[59] i.e. involving no foreign investment

framework conditions (e.g. covering taxes, import/export frameworks, and ownership issues) form an enabling environment for host-country investment, but in particular, foreign investment. In general, investors prefer stable and unambiguous legislation, which is enforced in a transparent and systematic manner.[60] Obviously, these preconditions are also valid as regards investment in CDM projects, which in general have a considerably long lifetime.

The host country's national legislation and/or ownership arrangements may directly hamper the implementation of some CDM project types, such as energy efficiency and renewable energy production. For example, private-sector independent renewable energy producers might not be able to feed electricity into the grid.[61] As stated in the previous chapters, there is huge potential for the increased use of renewable electricity production and co-generation, as well as energy efficiency, as part of cost-efficient climate policy measures, with or without the CDM, in many non-annex 1 countries.[62]

Although investment decisions (including decisions about whether to develop a CDM project) in a country are seldom based solely on tax considerations, they can strongly encourage or discourage inward investment in some cases. For example, renewable energy systems are eligible for tax relief in several countries, including Malaysia and Mexico. Import duties can also influence the type of CDM projects that are developed in different countries. It is important to note that the availability of subsidies is another factor that can either encourage or impede investment in low-carbon energy solutions (including the CDM). For example, the provision of direct subsidies for fossil fuels will reduce the economic attractiveness of renewable sources of energy, while maintaining electricity tariffs below production costs will reduce incentives for private, small-scale renewable electricity providers.

With regard to the overall institutional framework and governance – for example, administrative practices – the speed of obtaining permits and authorizations, and also import procedures, are often perceived by investors as strong indicators of overall administrative efficiency and of host-country commitment to the investments in question. For example, customs procedures are sometimes seen as a major barrier to investment.[63] It is good to note that while import-related delays may not necessarily reduce CDM activity within a country, they may favour the development of unilateral rather than bilateral CDM development. Importing goods to India can take considerable time, but since many CDM projects that are being developed in India are unilateral (and may therefore not need imports); they may not be affected by customs-related delays.

In addition, the effectiveness of a country's legal system and protection of intellectual property rights are key factors influencing inward investments. Concerns about not being able to maintain intellectual property rights mean that some technology providers (whether in connection with CDM projects or not) may choose not export to particular countries. Lack of an effective appeals process in general, and issues related to project development and/or to allocating any associated CERs, can also act as a barrier to developing projects or participating in the CDM.[64]

CDM-related barriers in host countries

The specific CDM-related barriers in a host country may be connected with the overall CDM policy (or the lack thereof) in the host country, with its coherence, with its synergies with other relevant policy areas, with institutional capacity, and with awareness of climate change in general and of the CDM mechanism in particular.

Generally speaking, CDM activities require the cooperation of several different stakeholders in the host country. Consequently, the level and quality of cooperation and communication between public authorities on different levels and from different sectors, as well as that of key private sector partners, is a

[60] e.g. the enforcement of a legislated feed-in tariff can be crucial for estimation of the future benefits of a particular renewable energy project.
[61] Ellis J and Kamel S (2007). Overcoming barriers to Clean Development Mechanism projects. UNEP Risø Centre.
[62] See, for example: IEA Energy Technology Perspectives (2008). Scenarios and strategies to 2050.
[63] World Bank.. Doing Business: Trading Across Borders. Available at: http://www.doingbusiness.org/ExploreTopics/TradingAcrossBorders/
[64] Ellis J and Kamel S (2007). Overcoming barriers to Clean Development Mechanism projects. UNEP Risø Centre.

critical element for efficient CDM project development, implementation and approval. In order to increase the interest of project developers and investors, several countries have also conducted CDM-specific promotional activities. In addition, the lack of – or a weak position of – focal points (DNAs) in the government in many host countries acts as a disincentive for CDM development.

The lack of institutional capacity has regularly been identified as one of the key host country barriers to the CDM. The Designated National Authority (DNA) forms a central component of the so-called institutional capacity that needs to be formally in place, in order for countries to participate in the CDM. However, based on the overall functions that have been mandated to the DNA: staffing, overall budget (and its sustainability), equipment etc., the DNAs can vary greatly between different host countries. At a minimum, a DNA needs to be able to approve a proposed CDM project, and to confirm that participation in the project activity is voluntary and that the proposed project activity helps contribute to sustainable development, according to any criteria defined by the host country.[65] Unless a regulatory framework is in place for DNA operation and clear guidelines for its main tasks are available, the DNA will not be able to complete its tasks in a professional manner and will concretely become a barrier for CDM development and implementation.

Obviously, adequate staffing and training of DNA personnel are crucial success factors for DNA efficiency and responsiveness in approval processes. In particular, ability to make decisions regarding submitted project idea notes and/or project design documents in a timely manner, while also providing clear justifications to the project proponent in cases of rejection, are clear signals to CDM participants about the efficiency and responsiveness of the host country DNA.[66] The considerable amount of delays in national approval processes has clearly hampered the progress of CDM project development in certain countries. (Also see "CDM mechanism: procedural and international bottlenecks" on page 26.)

While the roles of DNAs vary in different host countries, as do the actual CDM approval processes, there is no one single way to organize and run a DNA. However, any lack of transparency in DNA operations and procedures (e.g. related to project reviewing, issuance of letters of approval) is bound to hamper the predictability and trust of investors in the CDM mechanism. While web-based information platforms have been identified as effective tools for increasing transparency, and also for promoting a host country as a CDM project destination, in least developed countries (e.g. in sub-Saharan Africa) it is still unlikely that a DNA will be able to set up a website unless it has received funding from an external source or a development agency. Some host countries have also used their DNA website as an investment promotion tool for the country, where projects at various stages of implementation that are looking for developers are posted. [67]

The websites can, in some cases, serve to increase awareness in the host countries, but in general, addressing the lack of information and knowledge about climate change, and in particular the CDM, requires systematic and long-term efforts. When looking at the key stakeholders who should be well informed on the CDM, three main groups can be distinguished, namely policymakers, bankers and financing stakeholders; but also individuals involved in technical and economic sectors, through which CDM projects could be identified and launched.

A lack of awareness and of subsequent policy leadership among policymakers hampers the active development of an enabling policy environment for the CDM, and in some cases has resulted in the introduction of laws that directly or indirectly hamper CDM development. In some cases, existing high import tariffs on renewable energy or energy efficiency technologies have hampered CDM development and negatively affected the economic viability of CDM projects. A lack of policy leadership also hampers the systematic mapping and assessment of mitigation potentials in different sectors. The establishment of this background information (starting with key sectors) is obviously quite a challenging task for all

[65] Once credits have been issued from a CDM project activity, the host country DNA will also need to forward CERs to the project participants. DNAs can also have many other functions, including establishing national sustainable development criteria, and promoting the country as a CDM host.

[66] Ellis J and Kamel S (2007). Overcoming barriers to Clean Development Mechanism projects. UNEP Risø Centre.

[67] Additionally, these sites have lists of local CDM consultants and institutions relevant to the CDM process in the country. For a more detailed analysis, see, for example: Ellis J and Kamel S (2007). Overcoming barriers to Clean Development Mechanism projects. UNEP Risø Centre.

countries, but it is a necessary precondition for participating actively and benefiting fully from the investments of carbon markets.

While several developing countries are already suffering from limited inward investment (including poor credit ratings, high sovereignty risk etc.), the importance of local/national financial intermediaries is accentuated. The lack of awareness of the CDM among host country bankers, loan officers and individuals working in local financial intermediaries is a serious barrier for the CDM in some countries – but in the opposite case, could partly compensate for and catalyse overseas financing for potential CDM projects.[68]

Awareness-raising and tailored capacity-building among national experts will be crucial cornerstones of any ongoing and future efforts to "make the CDM work better for all". These experts would include, for example, local consultants, academics, and engineers from the line ministries and government agencies such as the rural electrification authorities, and from the renewable energy agencies, as well as prospective CDM project developers from both private- and public-sector agencies.

Without well-informed local experts and project developers, it is not likely that new cost-efficient CDM projects and programmes of activities (as well as new methodologies) will be identified, processed and replicated in a systematic manner in non-annex I countries.

Finance-related barriers

A general lack of financing is one of the most common barriers inhibiting CDM project development, as is the case with many other investments. Financing constraints are also noted by many CDM project developers, particularly when it comes to projects that have high initial investment costs, such as renewable energy projects.[69] The high transaction costs associated with CDM project preparation and implementation represent another financing challenge for project developers (particularly smaller developers) in poor host countries.

Depending on project types and sizes, as well as whether or not the CDM costs encompass the entire project or just a CDM "add-on", the capital cost requirements of CDM projects can vary greatly. A stable and positive national investment climate can be considered a critical framework condition for attracting finance for development projects, such as the CDM. When looking at possibilities of scaling up the CDM in the future, in particular in the least developed countries, the importance of this enabling framework will be even more accentuated, as the need for inward investment is likely to grow.[70] In practice, this enabling financing environment means an enforceable contracts system, simple and transparent governance procedures, low levels of corruption, and in general, good access to financing.[71]

In addition to the conventional types of project risks (e.g. those related to political, counterparty, exchange rate, time overrun and capital cost overrun risks), there are risks that are specific to CDM projects (i.e. related to CDM methodology, host country approval, validation, registration, performance, monitoring, verification, review of issuance, transfer, market, post-Kyoto outlook).[72]

In order to assist project developers to overcome the hurdle of transaction costs, some emission reductions buyers – especially large institutional or national carbon funds – have been offering different types of in-advance payments to project developers. One option involves offering this advance payment

[68] Ellis J and Kamel S (2007). Overcoming barriers to Clean Development Mechanism projects. UNEP Risø Centre.
[69] A large number of potential small-scale CDM projects in poor host countries are unable to move forward due to this financing barrier. In addition, the challenge of securing financing for renewables projects is increased, due to the fact that the projects typically reduce CO_2 (rather than a high-global-warming-potential greenhouse gas), they involve a long lead time, and they are perceived by financing sources as high-risk projects compared to conventional power generation projects. Wuppertal Institute. Promoting renewable energy technologies through CDM. 2006.
[70] The share of unilaterally funded projects might decrease.
[71] Ellis J and Kamel S (2007). Overcoming barriers to Clean Development Mechanism projects. UNEP Risø Centre.
[72] EcoSecurities (2007). *Guidebook to Financing CDM Projects.* Capacity Development for CDM (CD4CDM) Project, UNEP Risø Centre.

as a grant, separate from the funds used by the buyer to purchase emissions reductions. Another option is to pay part of the price for the purchased CERs in advance, before the project's inception.[73]

The ongoing reform and improvements in the CDM mechanism and procedures (see also the next chapter) can reduce or remove some of the CDM-specific risks or facilitate the better management of some of these risks. However, specific efforts and new tools by funding organizations and multilateral agencies (e.g. investment guarantee approaches, insurance tools) will be further required in order to ensure increased funding to CDM projects beyond the ongoing global economic recession and low carbon market prices. The ongoing efforts to mainstream carbon finance into the operations of development banks can provide a positive overall impact on facilitating CDM project development in host countries – in particular, in specific geographical regions currently underrepresented, and also for specific CDM project types with considerable emission reductions and sustainable development potentials.

The CDM mechanism: procedural and international bottlenecks

The success of the CDM has put the system itself under strain: while the CDM pipeline contains projects with total emission reductions potential of some 3 billion tons of CO2, the actual supply by 2012 could be somewhere in the range of 1.4–1.8 billion tons of CO2. This reflects, in part, the fact that the CDM has been structured to provide strong assurance of environmental integrity (measured as additionality, real emission reductions and sustainability), rather than to maximize process (or transaction) efficiency. In part, it highlights some procedural bottlenecks, even though for a new market, the actual market structure and transaction rules have been rather clearly defined.

With regard to defining the additionality of emission reductions, more than 100 methodologies have been approved by the CDM Executive Board.[74] "Additionality" can be a challenging and cumbersome concept for project developers to assess, and incorrect or incomplete application of the rules to assess additionality is the main reason that project submissions are held up for review or rejected entirely. The new Validation and Verification Manual is expected to assist in reducing significantly the number of reviews and consequent delays (fig. 10).

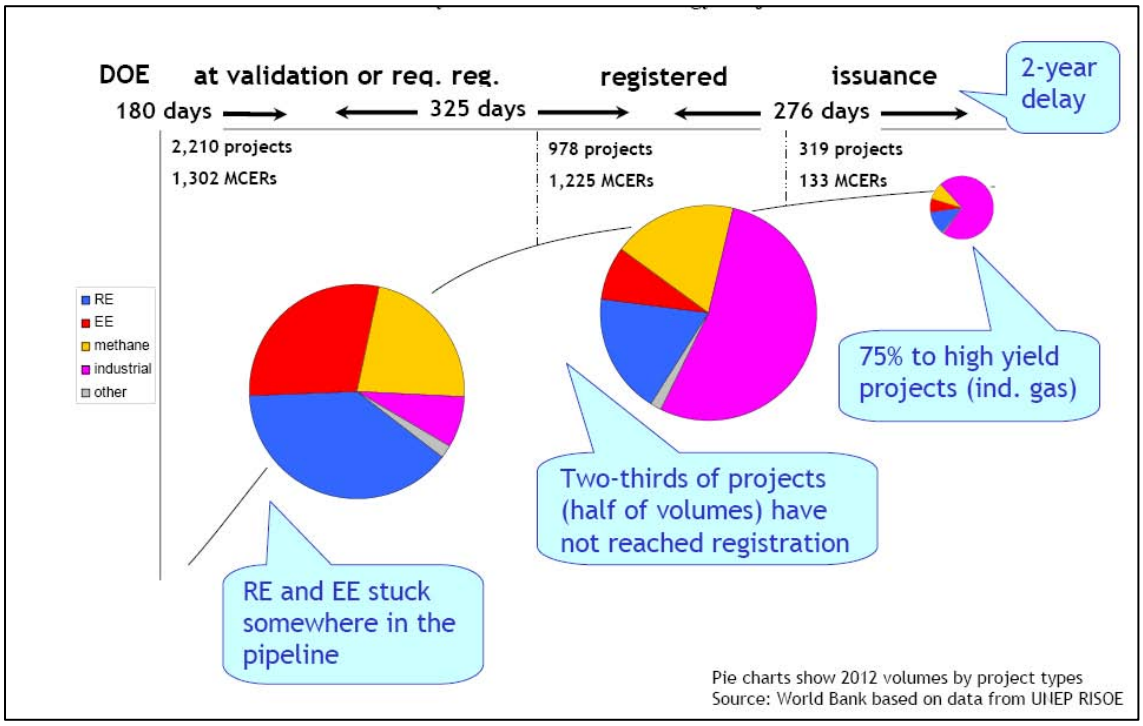
Currently, some 10 methodologies alone are expected to generate 80 per cent of the potential CERs. So far, abatement through the CDM has been focused on a relatively small number of technologies, often involving non-CO_2 greenhouse gases with potent global-warming potentials and potentially low abatement costs. Consequently, one of the recommendations by UNFCCC Parties in Poznan to CDM project participants was to submit methodologies for the transport, agriculture, afforestation and reforestation, and demand-side energy efficiency sectors with innovative approaches to determining baselines and facilitating monitoring. Streamlined and simplified methodologies for small-scale projects, programmatic approaches (programmes of activities), as well as new types of projects, could help to address some of the fast-growing emission sectors through the CDM, attract investment to energy efficiency measures, and also help balance the unequal geographical distribution of the CDM. Ongoing CDM reform already includes programmes of activities, which are intended to open the CDM market to

[73] Transaction costs associated with completing the CDM project cycle represent a common hurdle facing many project developers, especially for small-scale projects and in poor developing countries. This is because transaction costs are incurred up-front, while CDM revenue is only generated once the project's methodology
has been approved, the project has been registered and the credits have been issued. For example, the Austrian JI/CDM programme offers cover as a grant up to 50 per cent of project-related documents (baseline preparation, validation fees etc.), with a maximum of €40,000. Another example is the CAF – the Netherlands CDM Facility – which offers to cover up to 100 per cent of costs for project-related documents. See: Ellis J and Kamel S (2007). Overcoming barriers to Clean Development Mechanism projects. UNEP Risø Centre.

[74] The mechanism is overseen by the CDM Executive Board, answerable ultimately to the countries that have ratified the Kyoto Protocol. The Executive Board has regulatory as well as executive functions. As a regulatory body, it adopts material rules and procedural rules. In its executive function, the Board accredits Designated Operational Entities (DOEs), registers projects on the basis of DOE validations, issues CERs, governs the CER registry, and decides its own budget and support structure. To assist the Board in accomplishing its tasks, it has set up several subcommittees or panels (presently the Accreditation Panel, the Methodologies Panel, the Deforestation and Reforestation Working Group and the Small-Scale Working Group), as well as a Registration and Issuance Team.

replicable projects with low and physically scattered GHG emissions that would have been difficult and time-consuming to develop under the standard CDM model.[75] In 2008, for the first time, the Executive Board approved a new methodology that uses a benchmark approach to determine additionality and baseline level.

Figure 10. Example of delays in the CDM pipeline[76]



The delays and unpredictability of the CDM pipeline have been one of the central sources of criticism so far. The first bottleneck observed is the delay in project approval by the host country, and this delay has been increasing for several countries as the number of projects applying for approval increases.

The second bottleneck is the validation of the project by the Designated Operational Entities. Up to now, only about twenty organizations have obtained designation by the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (COP/MOP) to serve as Designated Operational Entities.[77] Taking into account that some 2,000 projects are still in the pipeline, and more than 1,100 projects have entered the stage of verification and certification, all the Designated Operational Entities have actually been overburdened with the validation and certification work for quite a long time. This causes delays[78] and sometimes poor quality of work, and consequently the loss of CERs for some projects with operation time before registration. In December 2008, the best estimate for duration of validation was 12–15 months. In 2008, the CDM Executive Board agreed to establish a revised, streamlined accreditation system, in order to increase the number and capacity[79] of Designated Operational Entities.

[75] A programme of activities (PoA) can be registered as a single CDM project activity, provided that approved baseline and monitoring methodologies are used, which – inter alia – define the appropriate boundary, avoid double-counting, and account for leakage, ensuring that the emission reductions are real, measurable and verifiable, and additional. Examples so far include rural lighting in India, energy retrofitting, and small community waste treatments.

[76] Ambrosi C (2008). *State and Trends of the Carbon Market 2008*. World Bank.

[77] Before a project can qualify to earn CERs, it must first be validated by an independent third-party certifier accredited by the Executive Board. These entities – companies that specialize in quality-standard assessment – are a key feature of the CDM. See also annex 2: CDM project cycle.

[78] Market participants report lead times of several – up to six – months to engage a Designated Operational Entity (DOE), causing large backlogs of projects even before they reach the CDM pipeline. Projects face an average wait of 80 days to go from registration request to actual registration. The Executive Board has requested a review of several projects received for registration, has rejected some of them, and has asked project developers to re-submit their projects using newly revised methodologies.

[79] DOEs are often understaffed and regularly lose auditors to project developers and CDM boutiques.

The Validation and Verification Manual should enable Designated Operational Entities to more effectively determine and establish their competence resources, and facilitate the assessment of these resources by the accreditation system.

Looking further down the CDM pipeline, the third bottleneck is the CDM Executive Board. It very often happens that projects have to wait about three months just for completeness checks by the secretariat, in the case of a request for registration. This may mean a significant loss of CER and income for the project proponents. It would help if the number of projects flagged for review could be cut from the present 70 per cent. If the Executive Board scraps the retroactive application of rules [80], as the Parties in Poznan requested, this percentage could be cut. Currently, it takes on average 2.6 years from the time that a project enters the CDM pipeline to when CERs are issued with credits.

As highlighted also in the previous chapters, issues of transparency,[81] certainty and predictability are crucial conditions for further success of the CDM mechanism, and they will require, among other things, continued investments in human resource capacity along the entire pipeline.

3.3 Potential ways forward and future roles for the CDM beyond 2012

The CDM has attracted growing support globally, and the number of countries that have developed their capacity to the level of hosting CDM projects has continually risen. The financial crisis has not yet significantly affected the projections of CERs to be issued by the end of 2012, as the number of projects entering the project pipeline is not rapidly dwindling, contrary to many expectations.

The UNEP Risø Centre estimate is based on the assumption that projects that have reached the stage of validation have already secured financing. In line with this estimate, 235 million CERs will be issued in 2009 – up from 140 million in 2008 – and the rate will increase to 275 million CERs in 2010, 350 million in 2011, and 420 million in 2012.[82] Depending on the outcome of the ongoing climate negotiations, and the future role of the CDM therein, the estimates of potential post-2012 demand (as well as supply) naturally vary widely. [83]

So far, the CDM's greatest strength has been its ability to bring developing and developed countries and the public and private sectors together to reduce emissions cost-effectively. In the years ahead, all countries have an interest in scaling up their efforts to reduce emissions while growing their economies in a sustainable manner. As the world considers scaling up serious action to combat climate change, the ongoing debate on the CDM focuses on how to remove the bottlenecks, and improve and scale up the mechanism as part of a future climate regime.

The ongoing debate and elements being explored – in addition to the procedural and administrative improvements, which are already rather well understood (see section 3.2) – include options for broadening the scope and reforming the structures and rules of a post-2012 CDM. While a multitude of optional CDM structures and scopes have been suggested, there seems to be an overall consensus that processes need to be streamlined and transaction costs reduced, additionality requirements need to be simplified, and new emission-reduction potentials need to be harnessed by the CDM (e.g. through programmatic activities, innovative methodologies, new project types and activities, and sectoral/national

[80] It has often happened that projects could not be submitted for registration before the deadline for old versions of methodologies, and therefore the project proponents have had to change the methodologies, or versions of the methodologies, and go through the whole validation process again.

[81] Some CDM information sources, including the Catalogue of Decisions by the CDM Executive Board, the CDM Bazaar and the UNFCCC secretariat's CDM website, have contributed to the improved transparency.

[82] Fenhann J (2009). What will happen to CER supply in 2009? *Point Carbon News. CDM and JI Monitor.* Vol. 6, issue 25. 7 January 2009.

[83] The low estimates of demand are in the range of 400–600 Mt CO_2 per year; roughly the same as the current market. The high estimates suggest an annual demand of 4,000–6,000 Mt CO_2-eq per year, which requires ambitious commitments by all Annex I Parties, no commitments of any type by any Non-Annex I Party, and CERs for a large fraction of the potential emission reductions from all existing and some new categories of sources. See: UNFCCC (2007). Investment and financial flows to address climate change.

mitigation approaches). Some of the proposed ways of scaling up are presented in this chapter,[84] as are their potential consequences with regard to regional distribution of projects and sustainability aspects, as well as the quantity of emissions reductions and the volume of CERs.[85]

Inclusion of new project activities

One central way of scaling up the CDM that is currently under discussion is the inclusion of additional project types/activities into the current CDM regime (building further on the first steps of programmes of activities, too). The current climate negotiations have included proposals that would expand the scope to include additional eligible project activities, such as other land use, land-use change and forestry (LULUCF), carbon capture and storage, and nuclear activities.[86]

While this approach would not require major changes to the current regime, modifying the scope of eligible project activities could potentially unlock a huge supply of credits at low prices.[87] According to the current rules of the CDM for the first commitment period of 2008–2012, only afforestation and reforestation project activities[88] are eligible under all potential LULUCF activities. However, in addition to afforestation and reforestation, LULUCF projects could consist of projects such as improved agriculture, reducing the unsustainable use of biomass energy, re-vegetation, and reducing emissions from deforestation and forest degradation (REDD).

Until early 2009, afforestation and reforestation activities enjoyed extremely low participation in the carbon market. The principal reasons are that they are not accepted in the EU ETS, the primary market demander of CERs, and that they generate only temporary credits. The inclusion of additional LULUCF project activities would open up considerable potential for emission reductions, but raises also several concerns, among other things, with regard to the permanence of the reductions, market balance, and the potential socio-economic challenges in the host countries.[89] The future of these LULUCF project activities in the post-2012 regime is unclear, as are the role and financing mechanisms for reducing emissions from REDD.

With regard to sustainability, some aspects of the LULUCF, but in particular carbon capture and storage,[90] as well as nuclear projects, have been widely criticized for their inability to contribute to sustainable development, and their potential to divert investments from renewable energy and energy efficiency – i.e. project areas with greater sustainable development benefits.

Concerning the regional distribution, a wider scope of LULUCF projects could encourage broader participation in the CDM, especially in Africa, as there is huge potential in non-annex 1 countries for LULUCF projects. It is the position of the African Group that REDD should be considered under the

[84] The approaches for scaling-up could also be grouped into absolute target-based crediting mechanisms, intensity-based crediting mechanisms, policy- and measure-based crediting mechanisms, and technology-based crediting mechanisms, where the difference between these approaches is the format of the baseline, i.e. absolute targets, intensity targets, policy and measures implementation, or technology implementation.

[85] The presentation here takes advantage of the framework and analysis by Deborah Murphy, Aaron Cosbey and John Drexhage of the International Institute for Sustainable Development, entitled *Market Mechanisms for Sustainable Development in a Post-2012 Climate Regime: Implications for the Development Dividend.* In: A reformed CDM – including new mechanisms for sustainable development. UNEP. 2008.

[86] UNFCCC (2008). Emissions trading and the project-based mechanisms: Draft conclusions proposed by the Chair. Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol. Sixth session, 21–27 August 2008, Accra; and 1–10 December 2008, Poznan. FCCC/KP/AWG/2008/L.12. 27 August.

[87] For example, with regard to LULUCF, according to one study, 94 per cent of Amazon deforestation could be avoided at a cost of less than $5 per tonne (Nepstad et al., 2007).

[88] According to the UNEP Risø Centre, September 2008, only five project activities related to afforestation and 22 to reforestation. This represented only 0.13 per cent and 0.58 per cent respectively of the projects in the pipeline, and in terms of potential 2012 CERs, only 0.07 per cent and 0.43 per cent respectively.

[89] It should be noted that forests are not just carbon stores for most of the developing world, but provide multiple uses – from meeting subsistence needs to biodiversity values.

[90] The IPCC Special Report on Carbon Dioxide Capture and Storage states that geographical formations around the world could store up to 2 trillion tons of CO_2. In early 2009, China, the EU, Japan and Norway were supportive of the inclusion of carbon capture and storage in the CDM, while many other countries, particularly in Latin America, were against the idea of letting CCS technology earn carbon credits and CERs.

project-based mechanisms to help improve regional equity; and the LDC negotiating group has called for a broadening of LULUCF activities to allow greater access for LDCs. With regard to carbon capture and storage, and nuclear activities, it is more probable that the inclusion of these activities would primarily benefit the more economically advanced developing countries.[91]

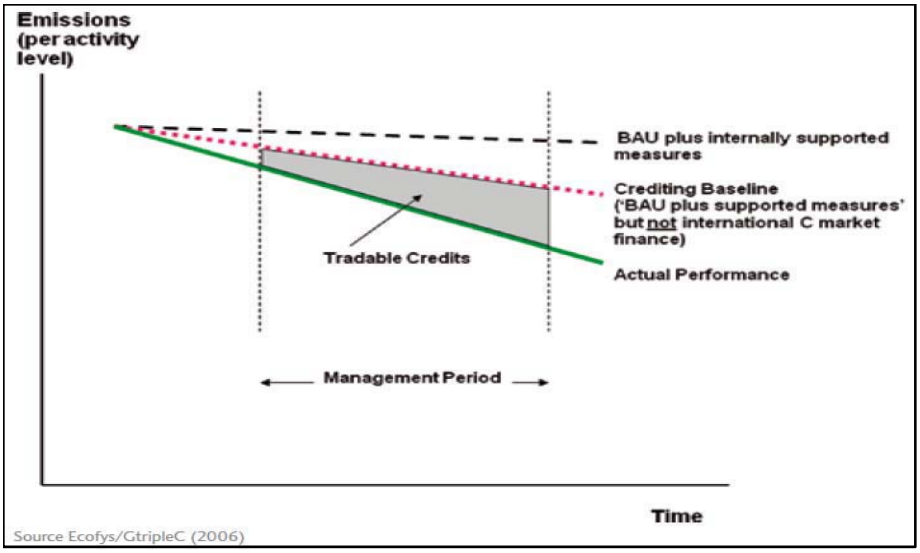
Expanding the CDM to sectoral and national policy approaches

Taking note of the magnitude of the emissions reductions required, to avoid "dangerous levels of climate change", it is evident that systematic and rapid transformations towards low-carbon pathways are necessary in all economies, on all continents. Expanding the CDM to policy and sectoral approaches could provide an opportunity to further harness the mechanism for this global challenge (fig. 11). The international discussions have narrowed the focus to include sectoral CDM for emission reductions below a baseline defined at a sectoral level (sectoral crediting of emissions reductions below a previously established no-lose target) and crediting on the basis of nationally appropriate mitigation actions (NAMAs).

Although the existing architecture of the CDM would need to be modified to accommodate these proposals, technical issues (e.g. baselines, monitoring and verification), and institutional issues such as working through the Executive Board could build to a great extent on the current CDM framework. The international negotiations have revealed interest for sectoral crediting mechanisms, and also national mitigation actions/policies (e.g. the South African proposal).

While there are a rather limited number of applicable sectors, the so-called "sector no-lose targets" (SNLT) approach might interest developing countries and developed countries for the required investments.[92] As the SNLTs would be negotiated as part of the multilateral agreement along with industrialized countries' targets, the concept of additionality would not apply. However, several challenges related to sector baseline determination at national level, understanding the international competitiveness effects, and the extensive data and monitoring requirements still remain to be solved.

Figure 11. Simple depiction of a sectoral crediting baseline. Credits are issued ex-post following verification that the crediting baseline has been beaten.



[91] Murphy D, Cosbey A and Drexhage J (2008). *Market Mechanisms for Sustainable Development in a Post-2012 Climate Regime: Implications for the Development Dividend.* International Institute for Sustainable Development.

[92] For example, electricity generation in China, India, Saudi Arabia and South Africa, cement production in Brazil, China and Mexico, iron and steel production in China, India and South Africa, gas-flaring emissions in oil and gas production in Indonesia, Nigeria and Saudi Arabia, and electricity distribution in India are some of the sectors and countries that have been suggested to be considered for SNLTs. See, for example, Ward M (2008). A new scaling-up mechanism for developing countries. In: *A Reformed CDM – Including New Mechanisms for Sustainable Development.* UNEP.

Sectoral CDM has the potential to produce huge amounts of GHG mitigation. According to some estimates, policy CDM could yield at least 3.6 GT of annual CO_2 reductions by 2030,[93] which in the case of a lack of ambitious international emission targets could swamp the carbon market.[94]

Sectoral CDM would be likely to start in the more advanced developing nations, because they are more likely to have a large industrial base, and have worked with existing sectoral initiatives. Crediting on the basis of national policies (NAMAs) would also likely favour the more advanced developing nations, thereby continuing the pattern of uneven regional distribution of projects.

Concerning the potential for an expanded CDM to contribute to sustainable development, sectoral CDM could be employed to exploit the win–win opportunities in sectors such as deforestation, and energy, and possibly in transportation, all of which have strong development linkages. Gaining CERs on the basis of NAMA could offer developing countries a more strategic and integrated mechanism, encouraging linkages with national development policies and encouraging project activity in such sectors as energy efficiency, renewable energy and transportation – sectors that tend to generate higher development dividends.[95]

Differentiation of developing-country eligibility and other suggestions for scaling up

Any post-2012 agreement that aims to bring global emissions to a level that could help us avoid dangerous levels of climate change will require ambitious emission reduction from industrialized countries, while simultaneously indicating a clear and equitable commitment from developing countries. Regarding the carbon markets, it is these ambitions reduction targets for industrialized countries that create the demand-side basis in the international carbon market for increased investments in low-carbon technology in developing countries.

While the possible graduation of some non-annex 1 countries to the state of target- or action-based commitments has been raised and debated in international negotiations, this could considerably change the carbon market (and CDM) size and scope. The recent call by the European Commission for a global carbon market, with countries such as Brazil, China and India joining a global carbon market, would in practice mean the graduation of these countries.[96] Over the long term, this would involve a scaling down of the clean development mechanism, which generates carbon credits for emission reduction projects in developing countries.

As the major developing countries are currently also the main suppliers of CERs, their graduation would lead to a decreasing supply of CERs up to 2012. If, for example, China were removed from the market, the current CDM pipeline would be reduced by over 30 per cent, and the number of CERs by 2012 would drop by over 50 per cent. The other market participants might be able to compensate in part for this drop, with a broadening of the CDM scope and increasing programmatic activities contributing positively, but obviously, the market positions would change markedly.[97]

Regarding sustainability, the CDM mechanism might become more oriented towards development than mitigation. This would require the non-graduated developing countries to able to come up with

[93] Cosbey A, Murphy D and Drexhage J (2007). *Market Mechanisms for Sustainable Development: How Do They Fit in the Various Post-2012 Climate Efforts?* International Institute for Sustainable Development. Winnipeg.

[94] Note that if a country implements a SNLT in a given sector, this sector is no longer eligible for new CDM activities.

[95] Murphy D, Cosbey A and Drexhage J (2008). *Market Mechanisms for Sustainable Development in a Post-2012 Climate Regime: Implications for the Development Dividend.* International Institute for Sustainable Development. In: *A Reformed CDM – Including New Mechanisms for Sustainable Development.* UNEP.

[96] In its January 2009 communication, the European Commission outlined plans for a global cap-and-trade system. The suggestions included an OECD-wide carbon market by 2015, expanded to include all big emitters by 2020. The proposal includes suggestions for the future reform of the CDM, including a proposal to phase out the large developing countries in generating offsets under the CDM in highly competitive sectors. See: Towards a comprehensive climate change agreement in Copenhagen. COM(2009) 39 final. Brussels. 28 January 2009.

[97] Murphy D, Cosbey A and Drexhage J (2008). *Market Mechanisms for Sustainable Development in a Post-2012 Climate Regime: Implications for the Development Dividend.* International Institute for Sustainable Development. In: *A Reformed CDM – Including New Mechanisms for Sustainable Development.* UNEP.

compensating CDM projects, and to insist on the presence of sustainable development benefits. On the other hand, part of the carbon markets might turn towards IET and JI, with no explicit sustainable development aim.[98]

Concerning regional distribution, the graduation of more advanced developing countries could, in principle, open a greater share of the market for less advanced developing countries, and in particular LDCs, which currently account for less than 1 per cent of the projects in the CDM pipeline and of expected CERs. However, as pointed out in the previous chapters (e.g. on key barriers), unless the enabling environments and CDM capacity of the host countries are systematically improved, there is no guarantee that the funds (which formerly flowed to major developing countries with cost-efficient CDM projects) would be redirected to the LDCs.

[98] ibid.

4 Conclusions

While the signal from climate science is very clear, and indicates the need for a rapid transformation of our economies onto a low-carbon pathway, global emissions keep still rising. However, an increasing consensus is gathering around the need to systematically internalize the evident market externalities and harness the market mechanism to actually speed up a comprehensive transformation of how our societies produce, consume, move, interact and trade.

In early 2009, the CDM formed one of the central components of the rapidly evolving carbon markets and of efforts to set a price on greenhouse gas emissions. Altogether, the emerging carbon markets that were valued at $64 billion in 2007 have stimulated innovation and carbon abatement worldwide. The CDM saw transactions worth almost $13 billion in 2007 alone, and has been estimated to have leveraged $33 billion in additional investment for clean energy. The growth continued in 2008, and the value of carbon markets clearly passed the $100 billion margin.

In a very short period, the CDM has catalysed an impressive amount of project activities contributing to measurable and cost-efficient emissions reductions and fostering development in developing countries: by early 2009 the CDM pipeline contained over 4000 projects, with CERs issued from over 400 projects. The success stories so far provide a solid basis for CDM-specific lessons learned for other developing countries, while simultaneously highlighting the crucial role of an enabling environment in the host countries.

Despite the overall success of the CDM mechanism, the results have not always been fully clear, or appreciated by all stakeholders. The benefits (in terms of sustainable development, technology transfer, additionality of funding and global emission reductions) have been questioned, and so has the equitable distribution of the benefits (the CDM market has been dominated a few non-annex 1 parties). However, the key challenges and barriers for further success have been clearly identified, solutions have been proposed, and several steps have already been taken, e.g. within the Nairobi Framework, to overcome some of the hurdles and facilitate access to the CDM by the least developed countries.

In part, the proposed and ongoing solutions relate to the mechanism itself – to ways of streamlining the CDM pipeline (simplification of procedures, additionality requirements, methodologies etc.), ways of facilitating access by the least developed countries, and ways of scaling up the mechanism from project-based to programmatic and policy-based approaches that could catalyse sector-wide and economy-wide transformations towards low-carbon production and consumption. For example, energy efficiency has systematically been identified as a considerable emission reduction potential in national and international studies, but remains a crucial potential yet to be harnessed – also by the CDM.

Obviously, solving these challenges is integrally linked with the role that different stakeholders see fit for the CDM in the post-2012 climate policy framework. The role, and what will be expected from a CDM-like mechanism, depends on the level of commitment from negotiating parties and from the other key elements that will make up the cornerstones of the future international climate regime. Likewise, a common understanding of the expected role of the CDM could contribute significantly to building an ambitious international climate regime for tomorrow.

So far, one of the CDM's greatest strengths has been its ability to bring developing and developed countries and the public and private sectors together to reduce emissions cost-effectively. In the years ahead, all countries have an interest in scaling up their efforts to reduce emissions, while growing their economies in a sustainable manner. Climate science will impose much stricter emission reductions on industrialized countries, but this will not happen without developing countries taking on clearly indicated commitments based on "common but differentiated responsibilities". Within this framework, a reformed and scaled-up CDM could serve as a concrete link contributing to sustainable development in host

countries and to cost-efficient emission reductions required by tougher international commitments, and could act as a source of stable, increasing funding for a low-carbon transformation in developing countries.

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Annex 1. IPCC emission and stabilization scenarios

(Summary for Policymakers, IPCC, 2007)

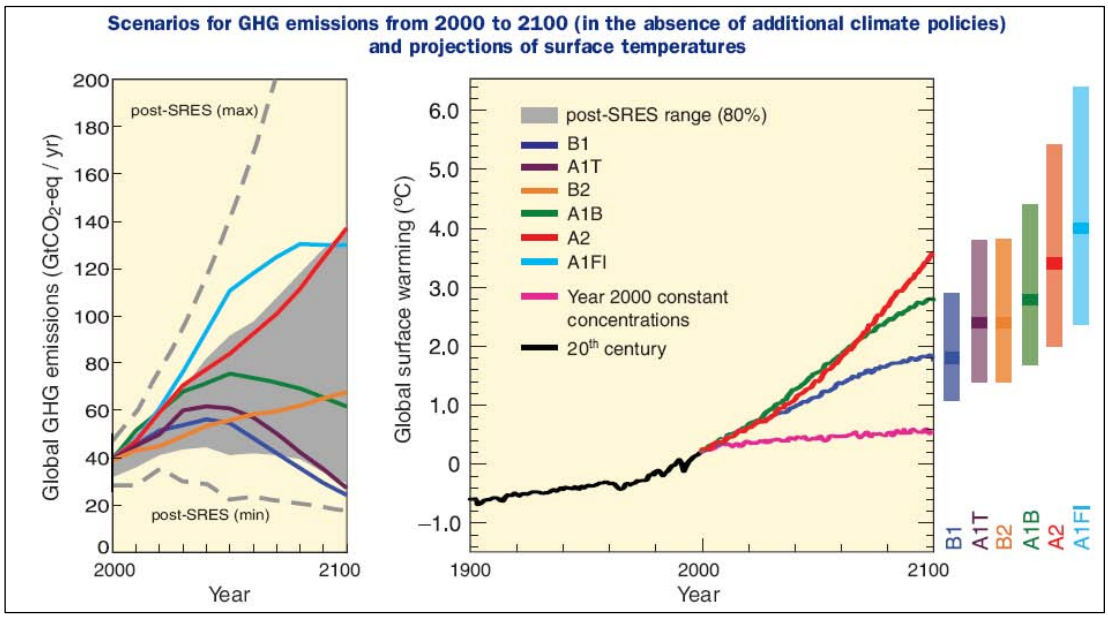


Figure 1. Left Panel: Global GHG emissions (in $GtCO_2$-eq) in the absence of climate policies: six illustrative SRES marker scenarios (coloured lines) and the 80th percentile range of recent scenarios published post-SRES (gray shaded area). Dashed lines show the full range of post-SRES scenarios. The emissions include CO_2, CH_4, N_2O and F-gases. Right Panel: Solid lines are multi-model global averages of surface warming for scenarios A2, A1B and B1, shown as continuations of the twentieth century simulations. These projections also take into account emissions of short-lived GHGs and aerosols. The pink line is not a scenario; it is for Atmosphere-Ocean General Circulation Model (AOGCM) simulations where atmospheric concentrations are held constant at year 2000 values. The bars at the right of the figure indicate the best estimate (solid line within each bar) and the likely range assessed for the six SRES marker scenarios at 2090–2099. All temperatures are relative to the period 1980–1999.

Table 1. Characteristics of post-TAR stabilization scenarios and resulting long-term equilibrium global average temperature and the sea level rise component from thermal expansion only[a]

Category	CO_2 concentration at stabilisation (2005 = 379 ppm)[b]	CO_2-equivalent concentration at stabilisation including GHGs and aerosols (2005 = 375 ppm)[b]	Peaking year for CO_2 emissions[a,c]	Change in global CO_2 emissions in 2050 (percent of 2000 emissions)[a,c]	Global average temperature increase above pre-industrial at equilibrium, using 'best estimate' climate sensitivity[d, e]	Global average sea level rise above pre-industrial at equilibrium from thermal expansion only[f]	Number of assessed scenarios
	ppm	ppm	year	percent	°C	metres	
I	350 – 400	445 – 490	2000 – 2015	-85 to -50	2.0 – 2.4	0.4 – 1.4	6
II	400 – 440	490 – 535	2000 – 2020	-60 to -30	2.4 – 2.8	0.5 – 1.7	18
III	440 – 485	535 – 590	2010 – 2030	-30 to +5	2.8 – 3.2	0.6 – 1.9	21
IV	485 – 570	590 – 710	2020 – 2060	+10 to +60	3.2 – 4.0	0.6 – 2.4	118
V	570 – 660	710 – 855	2050 – 2080	+25 to +85	4.0 – 4.9	0.8 – 2.9	9
VI	660 – 790	855 – 1130	2060 – 2090	+90 to +140	4.9 – 6.1	1.0 – 3.7	5

Notes:

(a) The emission reductions to meet a particular stabilization level reported in the mitigation studies assessed here might be underestimated, due to missing carbon cycle feedbacks.

(b) Atmospheric CO_2 concentrations were 379ppm in 2005. The best estimate of the total CO_2-eq concentration in 2005 for all long-lived GHGs is about 455ppm, while the corresponding value including the net effect of all anthropogenic forcing agents is 375ppm CO_2-eq.

(c) Ranges correspond to the 15th to 85th percentile of the post-TAR scenario distribution. CO_2 emissions are shown so that multi-gas scenarios can be compared with CO_2-only scenarios.

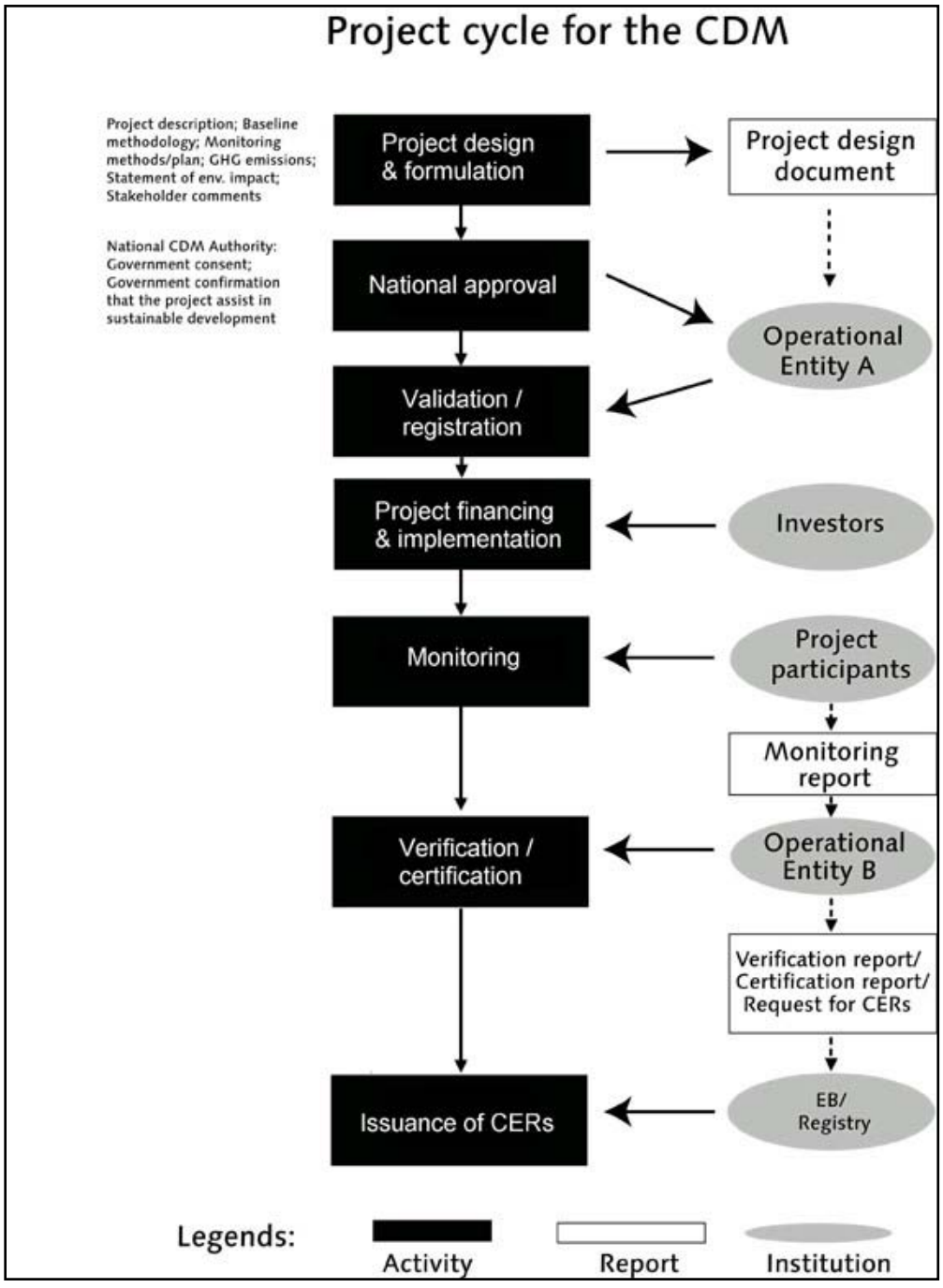
(d) The best estimate of climate sensitivity is 3°C.

(e) Note that the global average temperature at equilibrium is different from the expected global average temperature at the time of stabilization of GHG concentrations, due to the inertia of the climate system. For the majority of scenarios assessed, stabilization of GHG concentrations occurs between 2100 and 2150.

(f) Equilibrium sea level rise is for the contribution from ocean thermal expansion only and does not reach equilibrium for at least many centuries. These values have been estimated using relatively simple climate models (one low-resolution Atmosphere-Ocean General Circulation Model and several Earth System Models of Intermediate Complexity based on the best estimate of 3°C climate sensitivity) and do not include contributions from melting ice sheets, glaciers and ice caps. Long-term thermal expansion is projected to result in 0.2 to 0.6m per degree Celsius of global average warming above pre-industrial levels.

Annex 2. The CDM project cycle

The Clean Development Mechanism (CDM) is a mechanism whereby an annex 1 party may purchase emission reductions that arise from projects located in non-annex 1 countries. The carbon credits that are generated by a CDM project are termed Certified Emission Reductions (CERs), expressed in tonnes of CO_2 equivalent (tCO_2-e). In order for a project to generate CERs, it must undergo a rigorous process of documentation and approval by a variety of local and international stakeholders, as specified under the CDM Modalities and Procedures. The key stages, activities and stakeholders in the CDM project cycle are shown below.[99]



[99]Jørgen Fenhann, UNEP Risø Centre.

Annex 3. The CDM pipeline by project type, February 2009 [100]

CDM projects in the pipeline	All CDM projects in the pipeline				CDM project with CERs issued		
Type	Projects	1000 CERs	2012 kCERs	2020 kCERs	Projects	Issued kCERs	Issuance success
Afforestation	5	344	1864	7058			
Agriculture	230	8592	51724	101131	39	3670	45 %
Biogas	282	13563	62213	154260	7	1111	63 %
Biomass energy	676	42396	212135	522724	103	11391	86 %
Cement	38	6749	39723	80299	7	1103	66 %
CO_2 capture	2	24	149	336	1	43	191 %
Coal bed/mine methane	66	28685	132298	344119	2	638	41 %
Energy distribution	7	2040	8390	21002			
EE households	14	945	3936	9733			
EE industry	180	6825	33906	73948	21	921	85 %
EE own generation	408	61114	280099	676408	29	10523	89 %
EE service	11	170	730	1892	1	4	61 %
EE supply side	52	16193	34704	175501	4	328	76 %
Fossil fuel switch	140	44263	204323	499663	16	1817	88 %
Fugitive	29	10786	56906	140805	3	5153	112 %
Geothermal	15	3433	17179	43574	2	318	29 %
Hydrofluorocarbons	23	83066	493877	1118942	16	136124	107 %
Hydro	1174	120544	477901	1422793	85	8668	95 %
Landfill gas	331	50734	267031	610000	32	5771	34 %
N_2O	66	48387	256901	638144	10	53204	124 %
Perfluorocarbons	8	1121	4704	11806			
Reforestation	32	1716	9012	26989			
Solar	28	719	3115	8000	1	1	18 %
Tidal	1	315	1104	3631			
Transport	9	981	4885	12554	1	129	47 %
Wind	647	56370	252114	667150	85	9630	76 %
Total	4474	610073	2910925	7372462	465	250546	97,9%

[100] UNEP Risø Centre. CDM Pipeline. February 2009. http://www.cdmpipeline.org. Pipeline was produced by Jørgen Fenhann.

Annex 4. CDM projects by country and region, August 2009 [101]

Host region/country	At validation			Registered			Total						Issued	
	Number	kCERs	2012 kCERs	Number	kCERs	2012 kCERs	Number		kCERs	2012 kCERs		2020 kCERs	Number	kCERs
Latin America	**357**	**27204**	**99920**	**429**	**46230**	**281389**	**805**	**18%**	**77066**	**393565**	**14.2%**	**947401**	**172**	**47492**
Argentina	12	1014	3390	15	4126	26211	27	0.6%	5140	29601	1.1%	56769	8	911
Bolivia (Plurinational State of)	3	396	1465	3	229	2063	6	0.1%	625	3528	0.1%	8602	1	726
Brazil	180	9651	38687	160	20023	131994	347	7.6%	30712	174332	6.3%	399761	91	33468
Chile	33	2742	11026	34	4623	28448	69	1.5%	7438	39740	1.4%	99978	15	3311
Colombia	26	1310	5511	15	2158	10287	44	1.0%	4354	18963	0.7%	52222	5	487
Costa Rica	3	195	741	6	294	2247	9	0.2%	489	2989	0.1%	5304	1	21
Cuba	0	0	0	2	465	2441	2	0.0%	465	2441	0.1%	5941	1	167
Dominican Republic	4	1001	3693	1	124	299	5	0.1%	1125	3992	0.14%	11899	0	0
Ecuador	10	2526	7219	13	667	3675	23	0.5%	3193	10895	0.4%	35094	9	517
El Salvador	1	7	35	5	475	3307	8	0.2%	630	3506	0.1%	8543	1	216
Guatemala	7	466	1984	10	825	4439	17	0.4%	1291	6423	0.2%	16427	4	830
Guyana	0	0	0	1	45	208	1	0.0%	45	208	0.01%	567	0	0
Honduras	12	380	1639	15	288	2062	27	0.6%	668	3701	0.1%	8557	8	201
Jamaica	1	232	1061	1	53	456	2	0.0%	284	1517	0.1%	2840	1	172
Mexico	36	3559	13292	117	8816	49201	156	3.4%	13344	65723	2.4%	151819	20	5843
Nicaragua	4	62	255	4	577	3947	8	0.2%	640	4202	0.2%	8836	2	417
Panama	10	1484	3704	6	292	1422	16	0.3%	1776	5126	0.2%	19280	0	0
Paraguay	3	42	188	0	0	0	3	0.1%	42	188	0.0%	522	0	0
Peru	9	1933	5527	18	1899	7408	29	0.6%	4350	14714	0.5%	49102	4	166
Uruguay	3	203	503	3	251	1274	6	0.1%	455	1777	0.1%	5338	1	41
Asia and the Pacific	**2158**	**245895**	**875003**	**1248**	**246500**	**1290779**	**3582**	**78.1%**	**516949**	**2254705**	**81.1%**	**6037494**	**353**	**264525**
Bangladesh*	2	65	348	2	170	1116	4	0.1%	235	1464	0.1%	3119	0	0
Bhutan*	2	3781	16078	1	1	4	3	0.1%	3782	16082	0.6%	37321	1	0.5
Cambodia*	1	370	432	4	124	595	5	0.1%	495	1028	0.0%	4962	0	0
China	1081	154054	575138	599	182206	891641	1804	39.3%	356984	1541284	55.4%	4286051	125	144815
Fiji	0	0	0	1	25	164	1	0.0%	25	164	0.0%	389	1	18
India	699	61610	187198	448	36346	232705	1168	25.5%	99804	427393	15.4%	1040384	198	68938
Indonesia	58	5983	22116	27	3501	18529	92	2.0%	9694	41368	1.5%	109236	6	326
Lao People's Democratic Republic*	1	193	579	1	3	19	2	0.0%	196	598	0.0%	2158	0	0
Malaysia	61	3508	13874	58	3629	18808	128	2.8%	8266	36619	1.3%	95931	5	649
Mongolia	1	181	724	3	70	385	4	0.1%	251	1109	0.0%	3062	0	0
Nepal*	1	36	162	2	94	697	3	0.1%	130	859	0.0%	1900	0	0
Pakistan	13	2107	9361	3	1280	5451	17	0.4%	3474	15121	0.5%	43631	1	962
Papua New Guinea	0	0	0	1	279	1836	1	0.0%	279	1836	0.1%	2789	1	215
Philippines	37	1179	4808	39	1431	6389	77	1.7%	2614	11215	0.4%	29918	2	95
Republic of Korea	36	3225	10020	28	14817	94943	67	1.5%	18072	105052	3.8%	240415	7	43021
Singapore	7	664	1955	1	15	63	8	0.2%	679	2018	0.1%	6861	0	0
Sri Lanka	16	350	1463	5	159	1086	21	0.5%	509	2550	0.1%	5490	3	182
Thailand	80	4347	17092	18	1441	8720	102	2.2%	6014	26577	1.0%	64797	2	815
Viet Nam	62	4241	13654	7	908	7628	75	1.6%	5448	22367	0.8%	59083	1	4487
Europe and Central Asia	**23**	**2574**	**10104**	**20**	**1628**	**6764**	**46**	**1.0%**	**4605**	**18482**	**0.7%**	**50000**	**0**	**0**
Albania	3	50	210	0	0	0	3	0.1%	50	210	0.0%	611	0	0
Armenia	2	39	179	4	195	1139	7	0.2%	243	1357	0.0%	3154	0	0
Azerbaijan	3	785	3671	0	0	0	3	0.1%	785	3671	0.1%	7831	0	0
Cyprus	3	269	855	5	113	506	8	0.2%	382	1361	0.0%	4104	0	0
Georgia	4	273	1333	1	73	286	6	0.1%	685	3003	0.1%	7150	0	0
Kyrgyzstan	0	0	0	0	0	0	0	0.0%	0	0	0.0%	0	0	0
Malta	1	20	100	0	0	0	1	0.0%	20	100	0.0%	201	0	0
Republic of Moldova	2	91	373	4	227	1055	6	0.1%	318	1427	0.1%	3598	0	0
Tajikistan	0	0	0	0	0	0	0	0.0%	0	0	0.0%	0	0	0
The former Yugoslav Rep. of Macedonia	1	33	82	0	0	0	2	0.0%	87	273	0.0%	973	0	0
Uzbekistan	4	1014	3301	6	1020	3779	10	0.2%	2034	7080	0.3%	22380	0	0
Africa	**70**	**7483**	**25658**	**32**	**10234**	**52729**	**105**	**2.3%**	**18205**	**80569**	**2.9%**	**214313**	**6**	**4588**
Cameroon	1	131	460	0	0	0	1	0.0%	131	460	0.0%	1512	0	0
Cape Verde*	1	95	340	0	0	0	1	0.0%	95	340	0.0%	1101	0	0
Côte d'Ivoire	0	0	0	1	72	253	1	0.0%	72	253	0.0%	827	0	0
Democratic Republic of the Congo*	3	248	551	0	0	0	3	0.1%	248	551	0.0%	14673	0	0
Egypt	7	884	3462	4	1795	10749	12	0.3%	3134	16272	0.6%	38711	1	3861
Equatorial Guinea*	0	0	0	0	0	0	0	0.0%	0	0	0.0%	0	0	0
Ethiopia*	1	29	181	0	0	0	1	0.0%	29	181	0.0%	414	0	0
Kenya	13	604	2364	1	130	551	14	0.3%	733	2914	0.1%	8271	0	0
Liberia*	1	72	215	0	0	0	1	0.0%	72	215	0.0%	715	0	0
Madagascar*	1	49	210	0	0	0	1	0.0%	49	210	0.0%	486	0	0
Mali*	2	168	281	0	0	0	2	0.0%	168	281	0.0%	1623	0	0
Mauritius	0	0	0	0	0	0	0	0.0%	0	0	0.0%	0	0	0
Morocco	5	245	908	5	287	1692	10	0.2%	533	2599	0.1%	6016	1	26
Mozambique*	1	46	228	0	0	0	1	0.0%	46	228	0.0%	593	0	0
Nigeria	5	3046	9268	2	4124	18401	7	0.2%	7169	27669	1.0%	71692	0	0
Rwanda*	1	19	74	0	0	0	1	0.0%	19	74	0.0%	186	0	0
Senegal*	1	89	319	0	0	0	1	0.0%	89	319	0.0%	1032	0	0
South Africa	13	1077	4097	15	2901	15556	29	0.6%	4005	19745	0.7%	49098	4	701
Swaziland*	1	64	252	0	0	0	1	0.0%	64	252	0.0%	767	0	0
Tunisia	0	0	0	2	688	4125	2	0.0%	688	4125	0.1%	6876	0	0
Uganda*	8	212	911	1	36	290	10	0.2%	254	1230	0.0%	3158	0	0
United Republic of Tanzania*	4	256	949	1	202	1112	5	0.1%	458	2062	0.1%	5062	0	0
Zambia*	1	150	588	0	0	0	1	0.0%	150	588	0.0%	1500	0	0
Middle East	**25**	**1878**	**7192**	**21**	**4868**	**24623**	**50**	**1.1%**	**7486**	**34014**	**1.2%**	**88190**	**4**	**192**
Iran (Islamic Republic of)	2	206	614	0	0	0	3	0.1%	670	2234	0.1%	7395	0	0
Israel	12	905	3586	16	1849	8585	28	0.6%	2753	12171	0.4%	30685	4	192
Jordan	1	163	488	1	397	1855	3	0.1%	597	2472	0.1%	6295	0	0
Qatar	0	0	0	1	2500	13748	1	0.0%	2500	13748	0.5%	34002	0	0
Syrian Arab Republic	0	0	0	1	68	243	2	0.0%	133	460	0.0%	1524	0	0
United Arab Emirates	10	604	2504	2	55	192	13	0.3%	833	2928	0.1%	8288	0	0
Total (76 countries)	**2633**	**285034**	**1017877**	**1750**	**309460**	**1656283**	**4588**	**100%**	**624311**	**2781335**	**100%**	**7337398**	**535**	**316796**
Total for small-scale CDM projects	1267	35508	141347	761	21162	119148	2086	**45%**	58384	266837	9.6%	757492	198	14067
* = Least Developed Countries	33	5942	22699	12	631	3833	46	1.0%	6578	26562	1.0%	80769	1	0.5

[101] UNEP Risø Centre. CDM pipeline. February 2009. http://www.cdmpipeline.org. Pipeline was produced by J. Fenhann.

Annex 5. Programmatic CDM [102]. Programmatic CDM allows the development of many smaller projects as part of a larger CDM programme, coordinated by a coordinating entity. The programmatic approach can be of special interest for LDCs since these countries often have potential for smaller scattered projects such as biogas for households, rural electrification etc. The table below shows the programmatic CDM projects, as of August 2009.

Title	Host country	PoA Boundary and Province / State/Region	Status	Type	Sub-type
Installation of Solar Home Systems in Bangladesh	Bangladesh	Bangladesh	At validation	Solar	Solar PV
Installation of Solar Home Systems in Bangladesh (IDCOL)	Bangladesh	Many	At validation	Solar	Solar PV
Methane capture and combustion from Animal Waste Management System (AWMS) of the 3S Program farms of the Sadia Institute	Brazil	Rio Grande do Sul & Santa Catarina & Paraná & Minas Gerais & Mato Grosso	At validation	Methane avoidance	Manure
BRA/SC – 678228 S02 / 3SP – AWMS/SI	Brazil	Santa Catarina	At validation	Methane avoidance	Manure
New Energies Commercial Solar Water Heating Programme in South Africa	South Africa	South Africa	At validation	Solar	Solar water heating
New Energies Commercial Solar Water Heating Programme in South Africa. CPA Nr 1	South Africa	Gauteng	At validation	Solar	Solar water heating
CUIDEMOS Mexico (Campana De Uso Intelegente De Energia Mexico) – Smart Use of Energy Mexico	Mexico	Mexico	Correction request	EE households	Efficient light bulbs
CUIDEMOS Mexico (Campana De Uso Intelegente De Energia Mexico) – Puebla	Mexico	State of Puebla	Correction request	EE households	Efficient light bulbs
UGANDA MUNICIPAL WASTE COMPOST PROGRAMME	Uganda	Uganda	At validation	Landfill gas	Landfill composting
Municipal waste composting Project for Jinja Municipality	Uganda	Jinja	At validation	Landfill gas	Landfill composting
Promotion of Energy-Efficient lighting using Compact Fluorescent Light Bulbs in rural areas in Senegal	Senegal	Rural Senegal	At validation	EE households	Efficient light bulbs
Promotion of Energy-Efficient lighting using Compact Fluorescent Light Bulbs in the concession of Saint-Louis-Dagana-Podor as part of the Senegalese rural electrification plan.	Senegal	Saint-Louis	At validation	EE households	Efficient light bulbs
Masca Small Hydro Programme	Honduras	Honduras	At validation	Hydro	Run of river
Matarras I	Honduras	Atlántida	At validation	Hydro	Run of river
Solar Water Heater Programme in Tunisia	Tunisia	Tunisia	At validation	Solar	Solar water heating
Solar Water Heater Programme in Tunisia – CPA 1	Tunisia	Tunisia	At validation	Solar	Solar water heating
Energy Saving Renovation Programme at Instant Coffee Production Factories of Dongsuh Foods Corporation in Korea	South Korea	South Korea	At validation	EE industry	Food
Energy Saving Renovation Activity 1 at Bupyung Instant Coffee Production Factory Freeze Dry Line of Dongsuh Foods Corporation in Korea (CPA-1)	South Korea	Incheon	At validation	EE industry	Food
Installing Solar Water Heating Systems in the South of Viet Nam	Viet Nam	Southern Viet Nam	At validation	Solar	Solar water heating
Installing Solar Water Heating Systems in the South of Viet Nam - 01	Viet Nam	Southern Viet Nam	At validation	Solar	Solar water heating
Hydraulic rams for irrigation and domestic water supply in Zhejiang, China	China	Chun'an, Kaihua, Quzhou, Suichang, Songyang, Lishui, Rui'an and Cangnan counties in Zhejiang	At validation	Agriculture	Irrigation
Hydraulic rams dissemination in Songyang and Kaihua, Zhejiang province, China in 2008	China	Songyang and Kaihua	At validation	Agriculture	Irrigation
CFL lighting scheme – "Bachat Lamp Yojana"	India	India	At validation	EE households	Efficient light bulbs
CFL lighting scheme -- "Bachat Lamp Yojana" --Habsiguda District, Electrical Division of Ranga Reddy North of Central Power Distribution Company of Andhra Pradesh Limited, Andhra Pradesh	India	Andhra Pradesh	At validation	EE households	Efficient light bulbs

[102] UNEP Risø Centre. CDM pipeline. February 2009. http://www.cdmpipeline.org.