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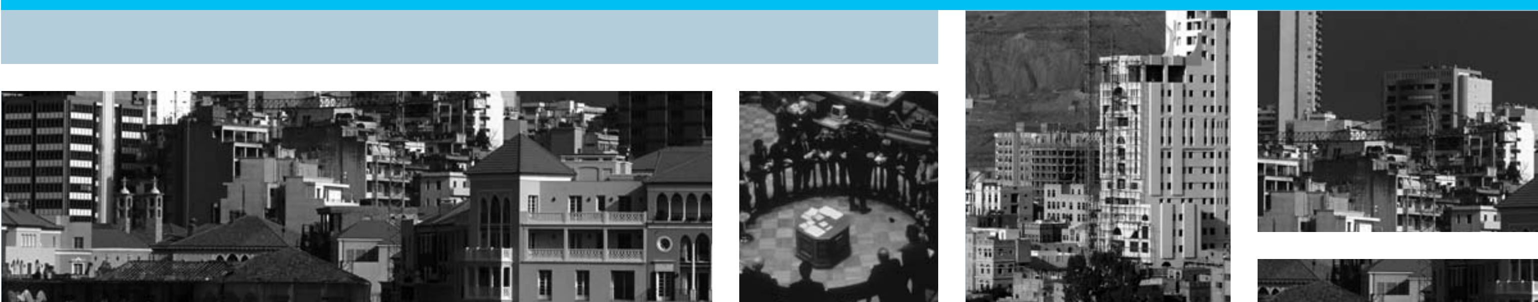
December 2007

Scaling Up Demand–Side Energy Efficiency Improvements through Programmatic CDM



Energy Sector Management Assistance Program

Carbon Finance Unit
World Bank

Energy Sector Management Assistance Program (ESMAP)

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The Energy Sector Management Assistance Program (ESMAP) is a global technical assistance partnership administered by the World Bank since 1983 and sponsored by bilateral donors. ESMAP's mission is to promote the role of energy in poverty reduction and economic growth in an environmentally responsible manner. Its work applies to low-income, emerging, and transition economies and contributes to the achievement of internationally agreed development goals through knowledge products such as free technical assistance; specific studies; advisory services; pilot projects; knowledge generation and dissemination; training, workshops, and seminars; conferences and round-tables; and publications.

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Funding

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Energy Sector Management Assistance Program and
The World Bank Carbon Finance Unit

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Acknowledgments

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[1] Christiana Figueres is a member of the CDM Executive Board. The views expressed in this paper are her own and not the position of the Executive Board.

Abbreviations

ACEEE	American Council for an Energy-Efficient Economy
AM	Approved Methodology
AMS	Approved Small-Scale Methodology
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFL	Compact Fluorescent Lamp
CO_2	Carbon dioxide
COP	Conference of the Parties (to the UNFCCC)
COP/MOP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
CPA	CDM Program Activity
CPA-DD	CPA Design Document
DOE	Designated Operational Entity
DSM	Demand-Side Management
EB	Executive Board (of the Clean Development Mechanism)
EE	Energy Efficiency
ER	Emission Reduction
ESCO	Energy Service Company
GEF	Global Environment Facility
GHG	Greenhouse Gas
GWh	Gigawatt Hour
IEA	International Energy Agency
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IPMVP	International Protocol for Measurement and Verification Procedures

LoA	Letter of Approval
Mt CO_2e	Million Tonnes of Carbon Dioxide Equivalent
MP	Methodology Panel (of the CDM Executive Board)
M&V	Monitoring and Verification
pCDM	Programmatic CDM
PoA	Program of Activities
PoA-DD	PoA Design Document
SSC	Small-Scale CDM Project
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank

Executive Summary

Improving energy efficiency (EE) is one of the most promising approaches for achieving cost-effective global greenhouse gases (GHG) reductions. However, it is severely underrepresented in the Clean Development Mechanism (CDM) portfolio. Just 10 percent of the emission reduction credits traded in the carbon market are from EE projects. In particular, small, dispersed, end-use EE measures—which entail significant GHG mitigation potential, along with other clear, local, and direct sustainable development benefits—have been largely bypassed by the carbon market.

Under the World Bank's Sustainable Development Network Integration "Challenge Fund Initiative," a joint "ESMAP - Carbon Finance Unit" team examined the synergies and possibilities of scaling up implementation of dispersed, demand-side EE efforts using the emerging programmatic CDM (pCDM) concept. This paper focuses on the key recommendations of this analysis, the potential scaling-up opportunities, and underlying operational synergies between EE programs in developing countries and pCDM.

The modalities of traditional CDM have been set for individual, stand-alone, emission reduction projects that are implemented at a single point in time (e.g., one renewable energy power plant). While CDM rules allow "bundling" of several of these projects together for registration purposes, the specific sites where they will occur must be known ex-ante and they must all occur at the same point in time. These conditions generally cannot be met by most dispersed demand-side EE programs, whose emission reductions occur over a period of time and in numerous locations (households/industries/cities). In addition, participants in energy-efficiency programs may not be known at the outset because the program may depend on gradual take-up of incentives.

The December 2005 COP/MOP decision to include "programs of activities" (PoAs) in the CDM opens the door to scaling up implementation of dispersed end-use EE activities. A PoA is a program coordinated by a private or public entity that provides the organizational, financial, and methodological framework for emission reductions to occur. The program itself does not achieve the reductions, but rather provides the enabling environment for others to do so. The specific measures through which the emission reductions are achieved are "CDM program activities" (CPAs). These must all apply the same methodology, be implemented in the same type of facility or structure, and be coordinated by the same managing entity. However, they can occur in an unlimited number of places and can be implemented over time up to 28 years.

Many observers have been concerned that the CDM Executive Board has approved few EE methodologies. While the pCDM approach opens the CDM door more widely to energy efficiency, it is likely that not all EE programs, or at least not all aspects of EE programs, will be deemed eligible for the CDM in the short term. In the CDM, project activities have to be "traceable." That is, the resulting emission reductions must be the directly attributable to the project, and measurement of emission reductions must be robust and unambiguous. Our analysis shows that EE programs that can be shown to directly replace inefficient technologies, or provide financing/financial incentives to do so, are more likely to qualify for the CDM. Policy-based EE programs (e.g., raising energy prices or reducing import taxes on energy-efficient equipment) are important for the increased uptake of EE equipment and activities, but may have more difficulty demonstrating direct causality—which is a key CDM criterion.

Our analysis also found that application of many dispersed end-use EE efforts as PoA need not wait for the development of specific CDM baseline and monitoring methodologies. There are three already approved simplified EE methodologies for small-scale CDM (SSC) projects, and these have been modified to account for leakage and are authorized to be used in the context of PoAs. Because the small-scale methodologies must be applied at the CDM Program Activity (CPA) level, the overall program savings level can exceed the small-scale threshold (maximum savings of 60GWh per year) as long as each CPA does not exceed the threshold.

In order to highlight the issues raised in this paper, a Global Environment Facility (GEF) energy-efficiency project in Uruguay[2] has been selected as an illustrative case study, and is presented in this paper.

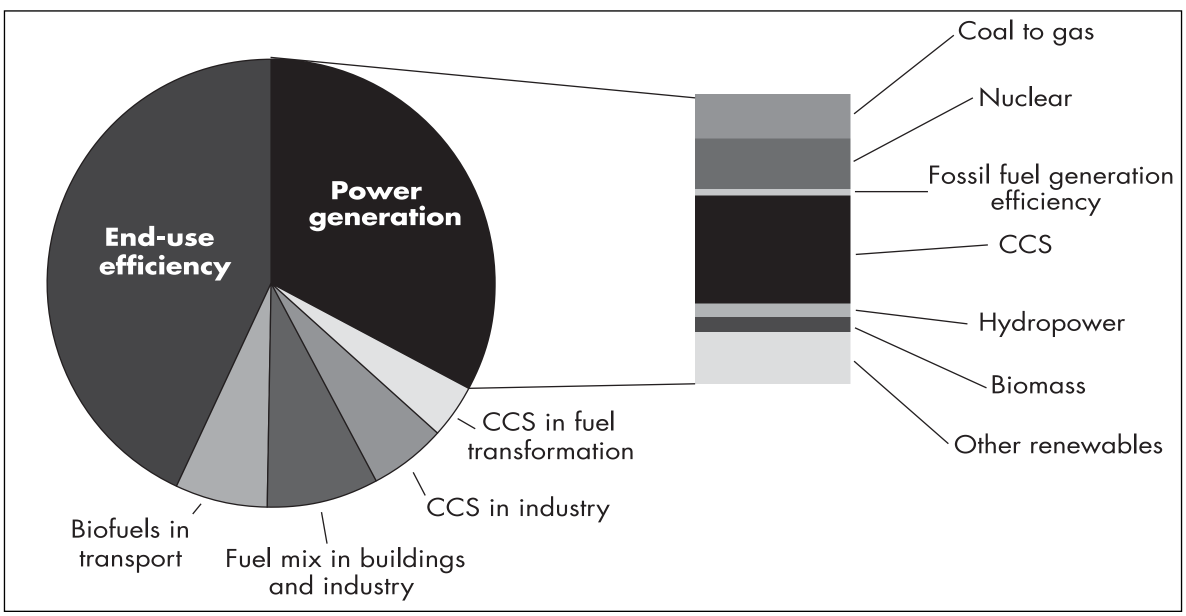
[2] Uruguay Energy Efficiency Project, Project Appraisal Document No 28525-04.

1. Introduction

Energy efficiency (EE) is widely recognized as one of the lowest-cost "sources" of energy. It is often more cost-effective to invest in energy-efficiency improvements, particularly on the end-use or demand side, than to increase energy supply to meet the growing demand for energy services. In addition to making energy more affordable, energy efficiency contributes to energy security, economic growth, and environmental sustainability through local emissions reductions and mitigation of global greenhouse gases (GHGs).

The projected potential of EE measures for mitigation of GHG over the next several decades is the highest among the other available options, as estimated by the climate change scientific community and energy sector practitioners. Energy efficiency could potentially account for more than half of the energy-related emission abatement potential achievable within the next 20–40 years, as identified by the International Energy Agency (IEA) World Energy Outlook (2006), the Fourth Assessment of the Intergovernmental Panel on Climate Change (2007), and the McKinsey Cost Curve (2007).

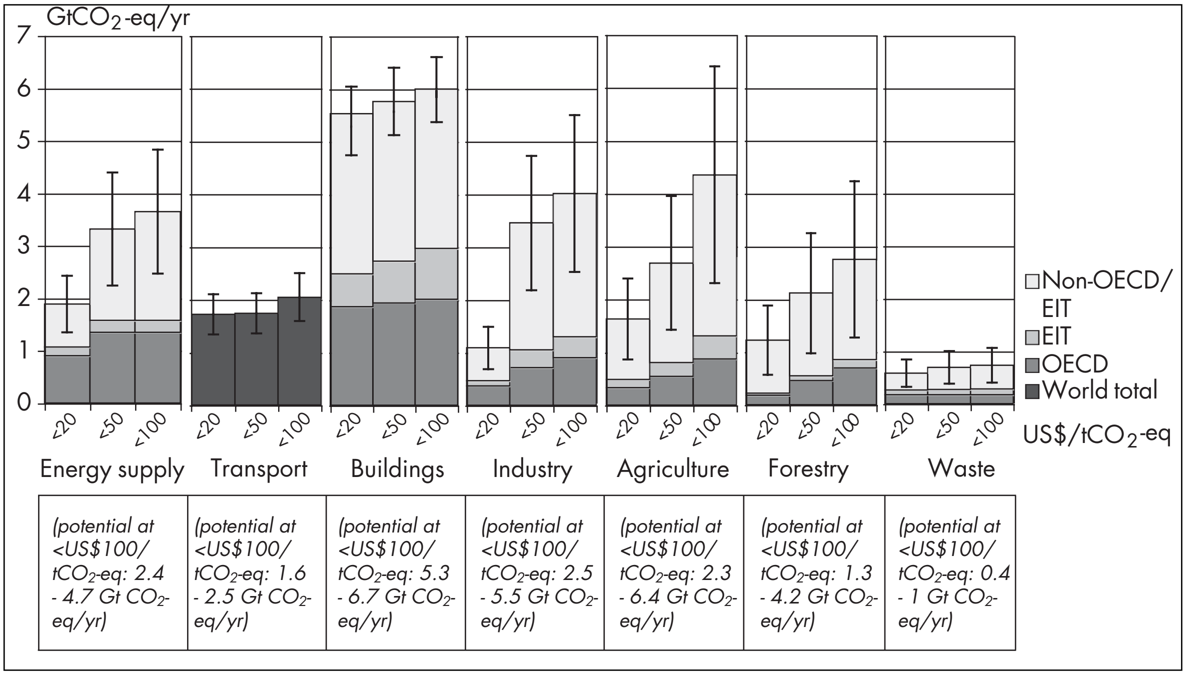
Figure 1. Potential GHG Emission Reduction by Technology Areas - Scenario through 2050



Source: IEA Energy Technology Perspectives 2006.

Improved end-use (demand side) EE is the most important contributor to potential reduced emissions

Figure 2: GHG Mitigation Measures – 2030



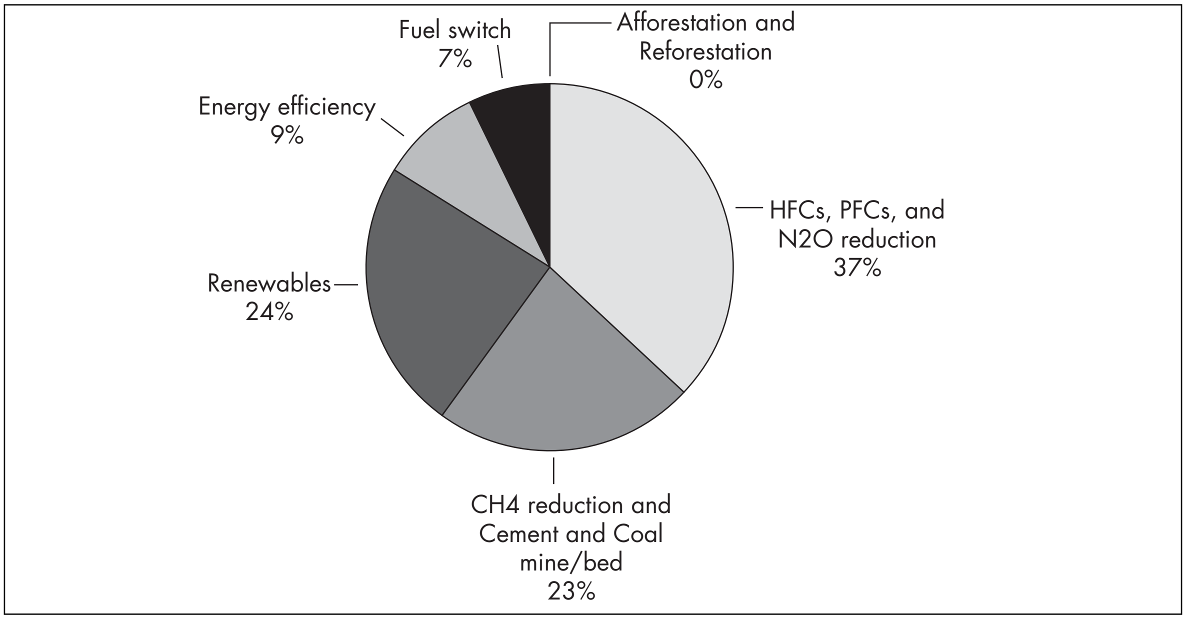
Source: IPCC 4th Assessment Report, WG.III, 2007.

Some of the highest GHG reduction potential is in EE sectors and are in the form of dispersed smaller measures (transport, buildings, industry)

The Clean Development Mechanism (CDM) under the Kyoto Protocol seeks to promote sustainable development in developing countries, to contribute to the stabilization of GHG concentrations in the atmosphere, and to assist industrialized countries (Annex I Parties under the UNFCCC) meet their quantified emission commitments. However, the CDM has bypassed the opportunity to support the delivery of energy savings across the economies of developing countries. The volume share of EE, in terms of emission reduction credits traded in the carbon market, currently stands at less than 10 percent (see Figure 3). In particular, small, dispersed, end-use EE measures—which entail significant GHG mitigation potential, along with other clear, sustainable development benefits—have been largely bypassed by the carbon market.

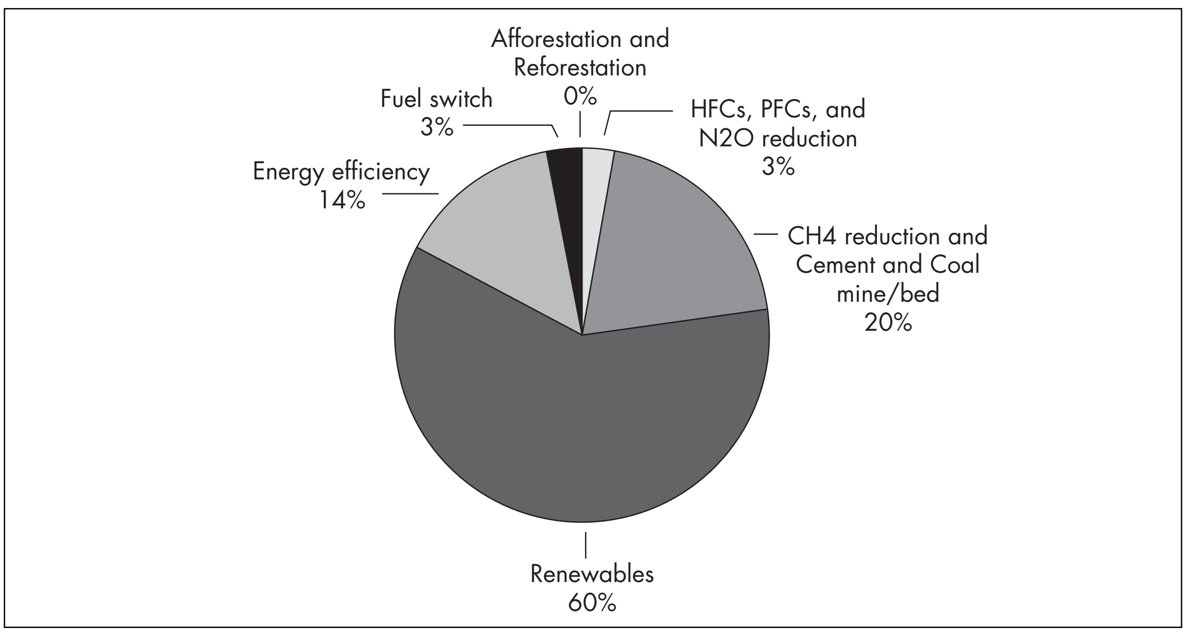
Of the 285 EE projects (as of July 2007) in the CDM pipeline, more than 90 percent are in heavy industries such as iron and steel, cement, and chemicals. The energy intensity of these industries warrants emission reduction activities that are site specific. However, small EE actions that could be performed in an unlimited number of municipalities, households, buildings, and small enterprises are barely represented in the CDM. Emission reduction activities in these areas are often dispersed, have high transaction costs, and have relatively low individual credit flows. However, the potential volume of these emission reduction opportunities is so high that their aggregation represents an important GHG mitigation strategy, with associated sustainable development benefits as well.

Figure 3: Projected Percentage of 2012 CERs by Project Type (July 2007)



Source: CD4CDM Web Site.

Figure 4: Number (%) of Projects by Sector (July 2007)



Source: CD4CDM Web Site.

Table 1: 2012 CERs by Project Type (July 2007)

Type	CDM							
	Number		CERs/yr (000)		2012 CERs (000)		CERs Issued (000)	
Biomas energy	409	20%	23,489	7%	149,893	7%	5,941	12%
Hydro	418	21%	31,420	9%	172,482	9%	2,237	4%
Wind	236	12%	18,480	6%	110,603	6%	1,444	3%
Agriculture	176	9%	5,829	2%	40,727	2%	1,929	4%
Landfill gas	146	7%	30,748	9%	187,193	9%	2,039	4%
EE OwnGeneration	148	7%	26,424	8%	149,794	7%	693	1%
Biogas	113	6%	6,489	2%	36,303	2%	228	0%
EE Industry	96	5%	2,814	1%	17,327	1%	221	0%
Fossil fuel switch	69	3%	24,464	7%	137,411	7%	240	0%
Coal bed/mine methane	40	2%	20,673	6%	118,142	6%	0	0%
N2O	37	2%	41,580	12%	246,067	12%	9,190	18%
Cement	31	2%	4,142	1%	32,443	2%	469	1%
Fugitive	20	1%	10,882	3%	77,517	4%	278	1%
EE Supply side	20	1%	1,164	0%	6,314	0%	30	0%
HFCs	18	1%	81,328	24%	504,247	25%	25,906	51%
EE Service	12	1%	48	0%	362	0%	0	0%
Geothermal	8	0%	1,774	1%	10,976	1%	102	0%
Solar	7	0%	179	0%	1,111	0%	0	0%
Afforestation and Reforestation	7	0%	831	0%	5,392	0%	0	0%
EE Households	4	0%	87	0%	510	0%	0	0%
Transport	4	0%	295	0%	2,019	0%	0	0%
Energy distribution	1	0%	55	0%	655	0%	0	0%
PFCs	1	0%	86	0%	542	0%	0	0%
Tidal	1	0%	315	0%	1,104	0%	0	0%
Total	2,022	100%	333,596	100%	2,009,132	100%	50,947	100%
HFCs, PFCs, and N2O reduction	56	3%	122,994	37%	750,856	37%	35,097	69%
CH4 reduction and Cement and Coal mine/bed	413	20%	72,273	22%	456,021	23%	4,714	9%
Renewables	1,192	59%	82,147	25%	482,471	24%	9,952	20%
Energy efficiency	285	14%	30,886	9.3%	176,981	9%	944	2%
Fuel switch	69	3%	24,464	7%	137,411	7%	240	0%
Afforestation and Reforestation	7	0%	831	0%	5,392	0%	0	0%

Source: CD4CDM Web Site.

The barriers to the implementation of end-use EE practices and technologies are well known, and range from the absence of enabling policies, to lack of information, to financing issues. (See Annex 1 for a listing of barriers to EE.) As an innovative mechanism for spurring investment, the CDM can help alleviate some of the financial barriers to EE. However, the CDM has in the past not been an effective facilitative instrument for EE due to stringent Executive Board (EB) requirements for methodology approval process and because traditional CDM projects have focused on project-specific, single-site, emission-reduction opportunities, such as the one-time building of a hydro power plant to displace fossil fuel energy on the grid. The structure of the CDM has until now not supported the greater complexity involved in designing and implementing dispersed end-use EE projects that involve a large number of units located in different sites and implementing EE measures over a period of time.

As the carbon market evolved, it became evident that the existing methodologies had to be improved and expanded to allow for dispersed EE projects. Fortunately, the December 2005 COP/MOP 1 decision to include "programs of activities" (PoA) in the CDM, and the ensuing guidance from the CDM EB, has opened the door to the implementation of more EE programs in developing countries, under the new approach of programmatic CDM (pCDM).

Under the World Bank's Sustainable Development Network 2006–2007 Integration "Challenge Fund Initiative," a joint "ESMAP - Carbon Finance Unit" team examined the synergies, and possibilities of scaling up implementation of dispersed, demand-side EE efforts (such as implementation of building EE codes, appliance EE standards and labeling systems, bulk energy efficient lighting systems, etc.) through the emerging concept of pCDM. This paper attempts a conceptual overlay of CDM requirements and existing EE best practices in order to assess the potential to integrate several types of EE practices into the CDM. The second chapter explains the new option of registering CDM projects as "programs of activities." The third chapter lists commonly implemented EE measures and examines which of these may be appropriate for implementation under the CDM. Note that not all EE efforts may be easily incorporated into the emission reduction market. The fourth chapter discusses the common elements of EE programs and CDM, and identifies methodological work that still needs to be done. Finally, the fifth chapter illustrates the above issues in the light of a case study of EE in Uruguay.

2. "Programs of Activities" under the CDM

Although end-use energy efficiency is a promising, low-cost, GHG emission-mitigation option, as a sector, it is seriously under-represented in the CDM. In addition to the range of barriers to energy efficiency that exist in developing countries, the traditional modalities and procedures of the CDM until recently have excluded the potentially most voluminous type of EE activities, particularly on the end-use or demand side, in terms of overall GHG mitigation potential.

Given the current focus on stand-alone emission reduction activities, most of the EE methodologies developed until now are for CDM projects that undertake efficiency improvements at single sites in large plants or industrial facilities. They usually involve a single owner, and are implemented at one point in time (e.g., improving steam system efficiency at a refinery). This type of EE effort can be appropriately pursued under the traditional modalities of the CDM if all activities occur within the same crediting period(s). However, the use of traditional registration options under the CDM are very cumbersome for those end-use EE efforts that involve a large number of sites/end-users and are performed over a period of time (such as the replacement of incandescent light bulbs with compact fluorescent lamps or upgrading of inefficient appliances in a large number of residential or commercial buildings.

In a recent RISOE publication (2007) on energy efficiency and programmatic CDM, Hinostroza, et al. note that end-use EE activities can be plotted on an X-Y axis according to the number of units undergoing the EE upgrade (x) and the volume of reductions achieved per unit (y). The green "big head" to the left (in the chart on the Long Tail of GHG Reductions) is made up of a few large units, each of which has a sizable reduction potential. Although only a small number of total global potential for EE in these large units has actually been developed as CDM projects, this type of emission reduction can, in principle, be tapped by traditional CDM registration options. By contrast, the "long tail"[3] depicted in Figure 5 is made up of myriad small units that are geographically dispersed and typically implemented over a period of time. These very dispersed but potentially high volume emission reduction opportunities are difficult to implement under traditional CDM.

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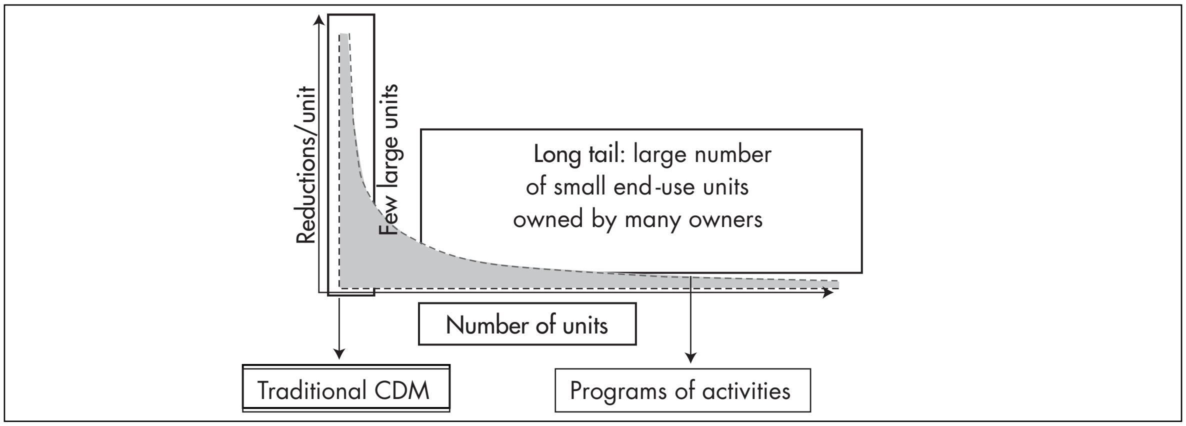
[3] The long tail is the colloquial name for a long-known feature of statistical distributions (Zipf, Power laws, Pareto distributions, and/or general Lévy distributions) in which a high-frequency or high-amplitude population is followed by a low-frequency or low-amplitude population which gradually "tails off." In many cases, the infrequent or low-amplitude events—the long tail, represented here by the grey portion of the graph—can comprise the majority of the graph.

Figure 5: The Long Tail of GHG Reductions



The concept of pCDM was taken to the international climate change negotiations at the end of 2005 with the intent of promoting widely dispersed multi-actor EE activities in the CDM. It is important to incorporate long tail EE activities into the CDM for several reasons. First, long tail aggregated volumes can be commensurate with the volumes represented by the "big head" of the graph. Second, long tail EE activities bring the benefits of the CDM to many small business and household owners, thus contributing directly to sustainable development. Third, they represent EE measures that can be implemented in all countries. In particular, they may be the type of EE efforts that are relevant to the smaller countries that do not have large industrial sites, thereby furthering regional distribution of the CDM.

At its first session, held in Montreal in November 2005, the COP/MOP decided that "a local/regional/national policy or standard cannot be considered as a clean development mechanism project activity, but that project activities under a *programme of activities* can be registered as a single clean development mechanism project activity provided that approved baseline and monitoring methodologies are used that, 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 to any that would occur in the absence of the project activity."

During the following year, the EB and the Methodology Panel (MP) of the CDM developed several draft options for defining the modalities and procedures for programs of activities. The guidance on pCDM was finalized in July 2007,[4] and the EB published the pertinent forms for the submission of PoAs in August 2007.[5]

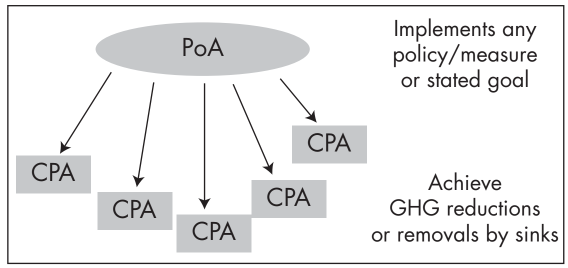
A ***program of activities* (PoA)** operates on two levels: the program level and the program activity level. A PoA is a "voluntary coordinated action by a private or public entity which implements any voluntary or mandatory policy/measure or stated goal (i.e., incentive schemes and voluntary programmes), which leads to GHG emission reductions..."[6] The program provides the organizational,

[4] Annexes 38 and 39 of EB 32.
[5] Annexes 41, 42, 43, and 44 of EB 33.
[6] Annex 38 of EB 32.

financial, and methodological framework for the emission reductions to occur, but the program does not actually achieve the reductions. The emission reductions are attained at the level of the "***CDM program activities***" (**CPAs**), the specific measures through which the emission reductions are actually achieved.

The Program Level

At the program level, the purpose of a PoA is to provide the enabling environment for others to implement a policy/ measure or stated goal. Some examples could be an incentive scheme to replace inefficient boilers, an investment program to retrofit steam traps, or activities to enforce an EE standard that would otherwise not be enforceable.



The characteristics of a PoA are:

1. **Coordinating entity.** The PoA must be submitted by one coordinating or managing entity, which can be private or public. This entity does not necessarily implement the GHG reductions but rather provides the framework and incentives for others to do so. The coordinating entity is the project participant, which communicates with the EB on all matters, including the distribution of certified emission reductions (CERs). The coordinating entity has the obligation to ensure that double counting does not occur by verifying that emission reduction activities in the program are not registered as a separate CDM project activity, nor are they part of another registered CDM program.
2. **Boundary.** The physical boundary of a PoA can extend beyond the boundary of a single host country, provided each participating country provides a letter of approval from the respective CDM Designated National Authority (DNA). Thus programs can be national within the boundary of one host country, or regional, including various countries. The boundary of the program must also be defined in terms of which gases are included or excluded, a requirement no different from that for other CDM project activities.
3. **Methodology.** The PoA can apply no more than one approved baseline and monitoring methodology[7] to all the CPAs under it. The methodology can involve one type of technology or it can involve a set of interrelated measures, as long as they are all applied in the same type of facility (e.g., all are households, all are similar industrial processing plants, etc.).
4. **Additionality.** In a program, additionality must be demonstrated at both the program and the CPA levels. At the program level, the PoA is additional if it is shown that, in the absence of the CDM, (i) the proposed voluntary measure would not be implemented, or (ii) the mandatory policy/regulation would not be enforced as envisaged but rather depends on the CDM to enforce it, or (iii) that the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

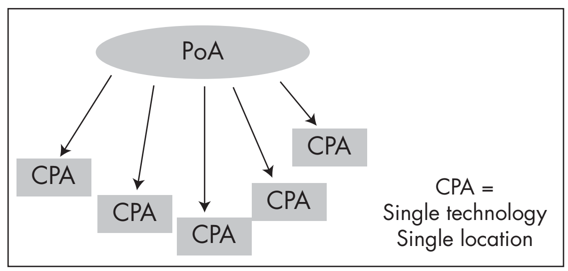
[7] A list and description of all approved CDM methodologies is available from the UNFCCC's Web site: http://cdm.unfccc.int/methodologies/index.html

5. Duration. The duration of a PoA cannot exceed 28 years, but it can be any period shorter than 28 years, depending on the type of the program. The duration must be defined by the coordinating entity at the time of registration.[8] The CPAs will have crediting periods of different durations (see below for crediting periods of CPAs), but under no circumstances can the program as a whole exceed a maximum of 28 years.

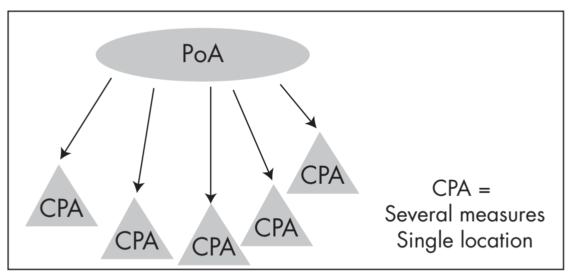
The CDM Program Activity Level

In addition to operating at the program level, a PoA operates at the CDM program activity (CPA) level, which is where the emission reductions are actually achieved by those that participate in the program. A CPA is a "single, or a set of interrelated measure(s), to reduce GHG emissions applied in either a single or many locations of the same type, within an area that is defined in the baseline methodology."[9] This definition allows for four main types of CPAs, based on whether the CPA applies a single measure or several measures, at a single location or several locations:

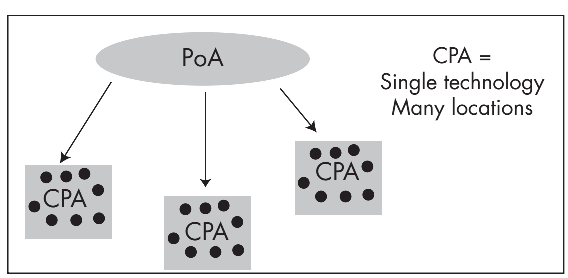
1. **Single measure, single location**. These are activities that apply a single measure to a single facility, such as improved insulation in buildings. In this example, each building is a CPA in which an EE measure is applied. In the graph, a circle represents a single measure, in this case, applied to single locations, each of which is a CPA.



2. **Several measures, single location**. These are activities that apply a set of measures to a single facility, such as a set of EE measures applied to multiple boilers in the same industrial facility. Each boiler is a CPA applying a set of efficiency measures to one industrial facility—as long as the set of EE measures is covered by one approved CDM methodology. In the graph, a triangle represents several interrelated measures. In this case, the set of measures are applied to single locations, each of which is a CPA.

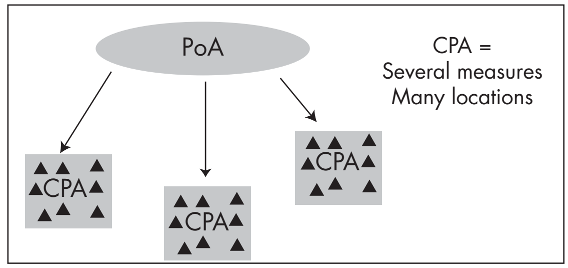


3. **Single measure, many locations**. These are activities that apply one measure, such as replacement of inefficient light bulbs, to many locations within a single CPA defined as an area. The CPA could be the replacement of all/number x of incandescent light bulbs in city/country y, area of the country, or section of the city. In the graph, the single measure is applied to many locations within the single CPA.



[8] Registration of the project by the CDM Executive Board is a key step in the CDM project Cycle. See Annex 2 for an overview of the CDM project cycle.
[9] Annex 38 of EB 32.

4. **Several measures, many locations.** These are activities that apply a set of interrelated measures, such as various EE measures in homes, to many locations within a single CPA defined as an area. The CPA could be a city, or a section of the city, in which a group of efficiency measures (such as efficient lamps, ballasts, air conditioners, fans) are applied to many homes within the area, as long as they all apply the same CDM methodology. In the graph, a set of interrelated measures is applied as a group of measures to many locations within each individual CPA.



Box 1: Determination of the CDM Program Activity (CPA)

The project proponent must define what is the CPA. **The decision of what constitutes the CPA is one of the most important decisions in the design of a PoA.** Once the CPA has been defined in the baseline and monitoring methodology, all further CPAs must apply the same baseline and monitoring methodology in the same type of facility/installation/land, and must meet the eligibility criteria established for CPAs under that program. Once this "typical CPA" has been established, every CPA in the program is simply a "repetition" of that typical CPA and do not need to be validated. Each CPA needs to be proved additional but can use the additionality argument approved for the first CPA.

The project proponent must define whether the CPA is a single location or many locations within a certain area, depending on the type of program. The decision on how to define the CPA must also weigh the advantages of maximum crediting gained by defining each emission reduction site as a separate CPA with its own crediting period versus the disadvantages of higher transaction costs, as each request for inclusion of a CPA incurs administrative costs. The trade-offs are outlined below in the case of three examples of CPAs.

Example 1: In the case of an investment program targeting the efficiency retrofit of six similar industrial plants over a period of time, the project proponent may decide that each plant is a separate CPA, as there may be a significant time lag between each retrofit which warrants defining each plant as a separate CPA and having its crediting period be independent of other plants. Furthermore, the CERs from each retrofit could be sufficient to cover the costs of individual CPAs. The option of requesting CPA inclusion for each individual site is appropriate for programs with a few large activities.

Example 2: In the case of boiler replacement, or efficiency measures applied to boilers, the project proponent may choose to define a CPA as the annual tranche of upgraded or replaced boilers. The time lag between one replacement or retrofit and the next is probably not long enough to warrant separate CPAs; on the other hand, the lifetime of the measures is long enough to not be disproportionately affected by averaging the CERs over the duration of the tranche. Since a once yearly request for inclusion of a CPA has reasonable transaction costs, this option seems appropriate for a program that lasts several years and has a manageable number of medium-size activities.

Example 3: In the case of a three-year inefficient light bulb replacement program targeting 100,000 bulbs each year, the project proponent could decide that all targeted bulbs are a single CPA (one CPA including 300,000 bulbs). This CPA could be included in the PoA when the PoA is registered. The crediting period for the CPA would then start with the date of PoA registration. In each monitoring and verification period (e.g., once a year) the number of bulbs coming up within the CPA and the associated emission reductions will be established and the corresponding CERs can be issued.

This all-encompassing definition of a CPA works best for short programs targeting equipment with a short lifetime. Even if the new bulbs last only two years, even the lifetime of the bulbs installed at the end of the three-year program lifetime will be completely covered by the CPA crediting period.

The characteristics of a CPA are:

1. **Typification.** All CPAs in a PoA must be similar to each other. The project proponent decides what the CPA is (see Box 1). The characteristics of the typical CPA and by extension the eligibility criteria of each further CPA must be clearly defined in the PoA design document (CDM PoA-DD)[10] at the time of request for program registration. (See Annex 2 for the CDM project cycle including registration.)
2. **Implementation.** The emission reductions can be implemented by many entities/owners in many locations as long as all locations/sites are of the same type.
3. **Starting date and crediting period.** A CPA can be added at any time to a registered PoA through the submission of a completed CPA design document (CDM CPA-DD).[11] The crediting period of a CPA is either 10 years non-renewable or seven years renewable two times. All CPAs end when the PoA terminates, regardless of when they have been added to the PoA. No CPA can extend beyond the maximum duration of the program as a whole. In submitting the PoA, the project proponent must be careful about establishing the duration of the PoA, so as to avoid cutting off CPAs before they are completed.
4. **Single methodology.** All CPAs under a program must apply one single approved baseline and monitoring methodology. If an approved methodology appropriate for the CPA already exists,[12] the project proponent can simply apply the methodology to each CPA, and incorporate the desired number of CPAs into a program during the duration of the program. Otherwise, the project proponent will need to develop and submit a proposed new methodology suitable for his/her project for the consideration and approval of the CDM Executive Board. In the specific case of end-use energy efficiency, only four large-scale (above 60GWh savings/year) and three small-scale methodologies (below 60Gwh savings/year) have been approved by the CDM Executive Board (while nine have been rejected and two were under consideration at the time of writing this paper). Annex 3 shows the status of end-use EE CDM methodologies.[13]

Procedures for Submitting a PoA

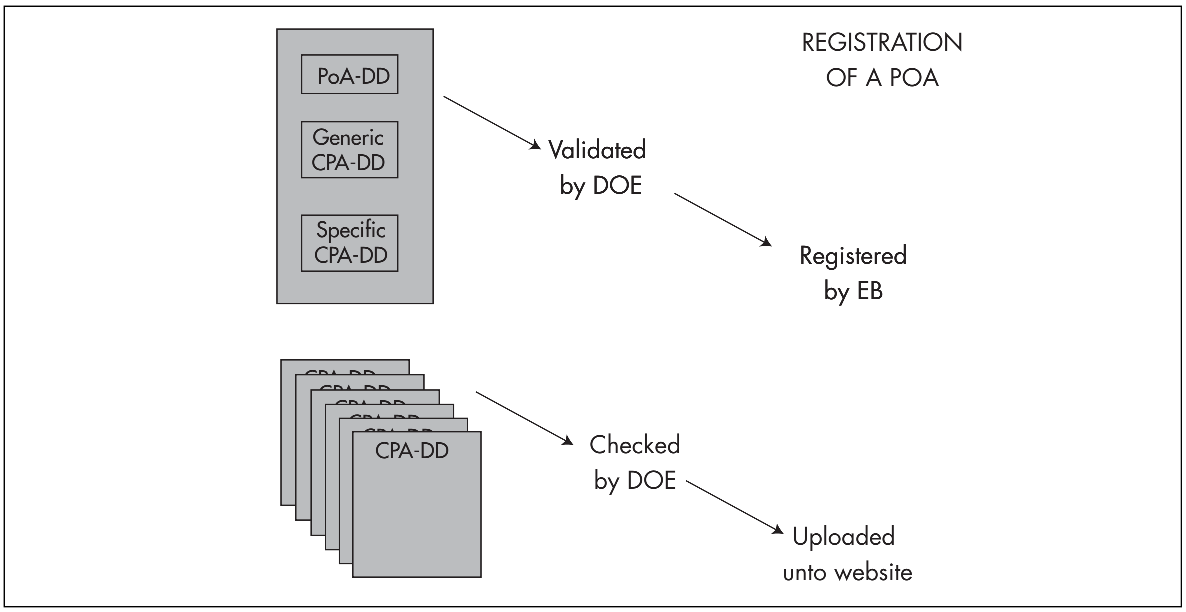
In order to request validation of a PoA, the managing entity must submit three documents to the designated operational entity (DOE):[14]

1. The PoA design document (PoA-DD) which identifies the managing entity, the boundary of the PoA, and the eligibility criteria for the CPAs, and demonstrates the additionality of the PoA at both the program and the CPA level.

[10] Annexes 41 and 43 of EB33.
[11] Annexes 42 and 44 of EB 33.
[12] There are currently 57 approved methodologies and 12 consolidated methodologies for large scale project activities in the energy sector, eight in the forestry sector, and 24 for small- scale project activities. For full listing see http://cdm.unfccc.int/methodologies/index.html.
[13] This paper does not analyze the lessons learned from the EE methodologies that have been submitted but not approved by the Executive Board. For an initial discussion of this issue see Hinostroza et al. 2007. Further experience will be gathered in the near future based on the release of the PoA guidelines, and these issues warrant specific examination.
[14] The procedures for registering a PoA are explained in detail in Annex 39 of EB 32.

2. A CPA design document (CPA-DD) which has been specified for the respective PoA, and which determines how CPA will meet the eligibility criteria defined in the PoA. This CPA-DD contains the generic information relevant to all CPAs of the PoA and is essentially the blueprint for all CPAs implemented under the PoA.
3. The completed CPA-DD of the first CPA, based on the blueprint CPA form, but containing all the information for the specific CPA which is to be implemented.

Once the DOE has validated the PoA-DD, the generic CPA-DD, and the specific CPA-DD, the three documents are sent to the EB for registration. All further CPAs do not need to be validated. Each subsequent CPA-DD will be checked by the DOE for consistency and then forwarded to the UNFCCC Secretariat for automatic uploading on the UNFCCC Web site. If a CPA is found to have been erroneously included in the PoA, that CPA will be excluded from the PoA, and the DOE must acquire and deposit the equivalent volume of CERs into a cancellation account. Once CPAs start their implementation, they are monitored according to the monitoring protocol of the respective methodology, and verified and certified like any other CDM project.



The intent of the pCDM procedures is to expedite and simplify the inclusion of CPAs in a registered PoA. However, it is too early to ascertain what the transaction costs of programs will be, and whether the DOE liability (i.e., if a CPA is found to have been erroneously included in the PoA) will present itself as a barrier. The issue is one that should be monitored carefully as programmatic CDM begins to be implemented.

Immediate Use of Existing Small-Scale Methodologies

With the one exception of approved CDM methodology for large scale projects AM0046 (distribution of efficient light bulbs to households), which may be difficult to implement due to its very rigorous and onerous monitoring requirements, the currently approved large scale EE methodologies are not intended for programs of dispersed EE efforts but rather for single-site, project-specific, EE improvements, mostly at industrial facilities. Given the history of the methodology development and approval process, it may take up to two years to develop and obtain the CDM EB's approval for new large scale methodologies for dispersed end-use EE programs. However, the three already approved small-scale methodologies offer a very interesting immediate opportunity to submit EE programs in the short term.

Simplified small–scale methodologies apply to EE projects which attain a maximum energy savings of 60GWh of energy savings per year. The three approved small-scale methodologies for EE are:

- AMS II.C. for "programs that encourage the adoption of energy-efficient equipment…at many sites";
- AMS II.D., applicable to "any energy efficiency and fuel switching measure implemented at a single industrial facility"; and
- AMS II.E. applicable to "any energy efficiency and fuel switching measure implemented at a single building…or group of similar buildings."

The EB has decided that in a program of activities, the CDM baseline and monitoring methodology shall be applied to the CPA, not to the PoA. Therefore, the 60GWh threshold for small-scale CDM projects applies to *each CPA* in a program, not to the program as a whole, independently of how many times the CPA is "repeated" in a program. In fact, this means that the PoA could go, in aggregate, well beyond the 60GWh of energy savings, as long as each individual CPA does not exceed the threshold and is identical to every other CPA in the program. Since the project proponent can define the CPA such that each CPA does not exceed 60GWh/year of savings, an important portion of the potential energy saved by dispersed end-use efficiency measures can be attained by applying one of the three above small-scale methodologies which already cover a wide array of EE possibilities.

The EB has further decided that in order to be used for PoAs, small-scale methodologies must account for leakage. Under the CDM, leakage is defined as the net change of GHG emissions outside the project boundary that is measurable and attributable to the CDM project activity. CDM project activities must estimate the associated leakage and deduct the net increase from the emission reductions achieved within the project boundary. The EB has already added a section on how to account for leakage in the small-scale methodologies and authorized them for use in the context of PoAs. It should be noted, however, that the leakage sections added to these methodologies only apply to PoAs where the limit of the entire PoA exceeds the limit for small-scale CDM project activities (e.g., 60GWh/year of savings for energy efficiency SSC projects).[15]

The inclusion of programs in the CDM, and the accompanying guidance, has opened the CDM door to implementation of dispersed end-use EE projects by allowing for the participation of many small users in one program over a period of time. However, not all "long tail" end-use EE programs may turn out to be deemed eligible or appropriate for implementation under the CDM. The following chapter explains the concept of traceability, which is critical to the CDM and identifies which types of EE measures are more likely to be eligible under the CDM.

[15] EB32 Report, paragraph 57.

3. Types of Energy Efficiency Measures and the CDM

In the previous chapter, we clarified what a "program" is in the context of the CDM. In the context of energy efficiency, a program is an integrated effort involving multiple small-scale dispersed measures to improve energy efficiency of many end-uses. However, not all EE programs are necessarily convertible into a CDM program. In order to ascertain which EE programs could be most likely implemented as a CDM program, this chapter looks at a conceptual overlay of CDM requirements and EE efforts. The overlay makes it evident that there are a wide variety of EE measures/programs being implemented around the world to some degree, but that perhaps not all of them may be deemed eligible or appropriate for the CDM. Thus, all EE programs may not qualify as "CDM programs" under the current rules and definitions. This chapter attempts to differentiate between EE programs that may have the potential to be implemented as CDM programs, and those that probably cannot be integrated into the CDM under the current CDM modalities and procedures.

A. Best Practice Programs in Energy Efficiency

While energy-efficiency improvements can be undertaken one technology at a time, such as replacing incandescent lights with compact fluorescent lights, the best practice involves the implementation of a package of measures. And while implementation can take place on a one-off, single-site, and project-specific basis, such as in a single factory or building, a far greater impact can be achieved when energy-efficiency measures are implemented on a widespread, *systemic* basis amongst many users, using a *combination of incentives*, information, and policies to achieve a "market transformation."

According to an evaluation of energy-efficiency programs by the American Council for an Energy-Efficient Economy (ACEEE), the most effective EE measures have the following characteristics:

- The programs are comprehensive and do not target just a small set of energy uses, but rather seek to improve energy efficiency of entire buildings or industrial processes;
- The programs offer customized services based on the recognition that "cookie-cutter" or "one-size-fits-all" approaches to do not meet energy user needs in many markets;

- The programs sell more than energy efficiency. While saving energy is the main objective, to be successful the programs address other objectives that meet customer needs. For commercial and industrial users, these include improved productivity, improved quality and reduced costs for operations and maintenance services, greater reliability, and comfort. In the residential sector, these include improved comfort, enhanced home value, convenience, superior product performance, and cost savings;
- The programs have strong marketing, training, and technical assistance components. Marketing is essential to obtaining high user participation rates, and training and technical assistance are needed to achieve high levels of savings;
- The programs often include financial incentives, such as rebates, but the incentives do not necessarily go to the energy users, but to other market participants such as product retailers or homebuilders; and
- The programs involve partnerships and collaborations that bring together a wide variety of market actors.[16]

This systematic approach to energy efficiency typically requires a coordinating institution such as a government agency, energy utility, or non-profit corporation. However, a government agency is almost always involved from the standpoint of setting the regulatory, financial, and legal playing field. For example, governments can mandate energy-efficiency improvements through such measures as appliance-efficiency standards, energy-efficient building codes, or utility demand-side management. Alternatively, instead of requirements, governments can provide incentives such as rebates or low-interest loans for the purchase of energy-efficient products. Finally, in addition to requirements or incentives, governments can play a less active role by providing consumer information, providing training for building or facility managers, or removing impediments to the development of private energy service companies (ESCOs), which offer services such as performance contracting for the implementation of energy-efficiency measures.

Although the EE *systems* approach is the most effective from a pure EE perspective, it is relatively difficult to incorporate it into the CDM at the present time due to the difficulty in directly attributing the achieved energy savings (or emission reductions) to the systemic EE interventions. The concept of "traceability," or direct vs. indirect impact, is key to the CDM. Understanding the concept can help identify which EE best practice programs have the potential to be implemented under the CDM, and which do not.

B. Types of EE Programs

Energy-efficiency programs encompass a wide range of interventions to influence the timing, type, and amount of energy consumed by various sectors in the economy. A supportive government policy and

[16] America's Best: Profiles of America's Leading Energy Efficiency Programs, American Council for an Energy Efficient Economy, Washington, D.C. 2003.

a regulatory framework are key to the success of energy-efficiency programs, even while the program delivery can be managed by a variety of entities, such as municipal governments, energy utilities, ESCOs, or specialized non-profit corporations. Regardless of the implementing entity, there are three broad categories of programs: policy and regulatory; institutional; and financing.

i) Policy & Regulatory

Most countries have adopted national energy policies, legislation and regulations that lay out the governments' general goals and objectives regarding energy efficiency and the means for achieving those goals and objectives. But such policies and plans can end up representing only intentions. Their implementation and enforcement have often been problematic and have lacked political will, institutional support, and/or financing incentives, as is well documented in the EE literature. However, when effectively implemented, energy policies that require certain actions can be the most cost-effective measures to achieve implementation of EE goals. These policy and regulatory measures include the following:

- Energy price rationalization — Energy prices in developing countries are frequently below the cost of supply, and government subsidies of energy prices and of energy supply institutions such as utilities or district heating companies are common. While some of the targeted subsidies are useful to alleviate the problems faced by low-income energy users, there are often subsidies and cross-subsidies that end up being applied to large end-use sectors as a whole (most commonly, residential and agricultural sectors as seen in most countries), thereby discouraging large sectors from implementing energy-efficiency measures and instead encouraging excessive and wasteful use of energy. It is well known that raising energy prices to rational levels is a necessary though often difficult step for improving energy efficiency.
- Reducing import duties — In many countries, particularly in Africa, energy-efficient products are simply not available because the products are not domestically manufactured and have to be imported. Frequently, the product vendors simply do not perceive markets for such products. There also may be high import duties, frequently imposed to protect domestic manufacturers from foreign competition, with the result that imported energy-efficient products are too expensive. The high duties not only retard the entry into the market of imported high-efficiency products, but of domestically manufactured energy-efficient products as well. Without competition from imported energy-efficient products, there is no incentive for protected domestic manufacturers to improve the efficiency of their products. A simple energy-efficiency policy step is to reduce import tariffs on energy-efficient products and their component parts.
- Performance risks — Developing countries often suffer from problems in their energy supply infrastructures that limit the use of energy-efficient products routinely used in industrialized countries. For example, electric utilities frequently have problems with voltage fluctuations and voltage imbalances, which decrease appliance efficiencies and lead to premature motor burnout. These conditions serve as disincentives to users to purchase more expensive high-efficiency products. In addition, most developing countries lack well-developed, low-pressure, natural gas distribution networks, so the use of efficient gas-consuming equipment is often impossible. Although energy-using products can be "hardened" to accommodate power quality problems, the hardening can add considerably to the

cost of the products. Reducing power quality problems is a key policy precondition to implementing a robust end-use, energy-efficiency program.

- Appliance-efficiency standards and labelling — While many energy-efficiency programs involve voluntary steps by energy users and other stakeholders, appliance-efficiency standards involve mandatory actions on the part of appliance manufacturers, assemblers, importers, and retailers, and an obligatory labelling of appliances. To be effective, they also require effective enforcement, something lacking in many countries. Many countries have taken the easier step of establishing appliance-labelling programs without imposing standards. Labelling programs require that labels be affixed to appliances that provide energy-efficiency information or ratings to consumers. They are easier to adopt than standards from both a political and regulatory standpoint but have to be carefully designed as well as accompanied by aggressive information campaigns to disseminate the information amongst consumers who would make the investment decisions on efficient (or inefficient) appliances based on the information on the labels.
- Energy-efficient building codes — Many developing countries have introduced EE building codes. These generally cover new buildings but sometimes also existing buildings, and both building envelope and building energy systems. However, even though incorporating energy efficiency into the codes is the first step, it is difficult to enforce these codes due to lack of institutional set ups, training, availability of materials and equipment, etc. For such policies to produce meaningful results, it is essential to promote a market development and capacity-building process, involving (i) architects, building developers, and engineers, who need to understand and comply with the codes; (ii) local code officials, who need to know how to enforce the codes; and suppliers of construction materials, who need to know the kinds of materials and products to make available to builders.

ii) Institutional

Energy-efficiency programs typically involve the existence or establishment of an institution to carry out much of the analytic work or oversight of the implementation of program elements emanating from energy-efficiency policies, regulations, and/or legislation. The institution can be a public entity, a parastatal entity, an energy utility, or a public-private entity. It may or may not have regulatory or enforcement authority, but advises the government on policies and regulations, and then helps to carry out the policies. Institutional programs can include:

- Public information programs — One of the most common institutional interventions is the provision of energy-efficiency information to households, businesses, and other energy users. The information includes explanations of the benefits and costs of various energy-efficiency measures, how to get energy-efficiency products, and how to get help deciding what measures to pursue. The program can take the form of a public information campaign to save energy or can involve technical information for engineers, factory managers, and building owners. Information programs are essential components of overall energy-efficiency programs; but they have been found to be relatively ineffective if they are not carried out in conjunction with more substantive elements such as financing programs, financial incentives, or government regulatory requirements.

- Bulk procurement — The purchase of efficient equipment is typically more costly than its inefficient equivalent. One way to overcome these higher costs is to procure energy-efficient products in bulk, under which municipalities, schools, hospitals, and other large energy users form what is essentially a buyers' cooperative that can negotiate lower prices with product suppliers. Electric utilities (generally through what is called Demand Side Management programs) can also facilitate bulk procurement of efficient appliances and equipment and have them distributed directly or through intermediaries (including ESCOs) to consumers at a cost or at subsidized prices (for instance, distribution of efficient light bulbs in several programs in Africa).
- Training programs — Facility managers, responsible for maintaining the physical plant at municipalities, schools, public buildings, hospitals, and other energy-consuming facilities, often lack knowledge of energy-efficient operations and maintenance practices. They may not know how to accurately track energy consumption, how to tune-up equipment, when to replace certain parts, or how to procure higher efficiency equipment, all of which are essential activities to deliver the energy savings and associate GHG reductions. Training programs, particularly those that provide monitoring equipment and that have a certification component, can have a significant impact on reducing energy waste in buildings and other facilities.

iii) Financing

Financing and financial incentives available to energy users are the keys to gaining widespread market penetration of energy-efficiency measures. However, the availability of affordable financing is often a barrier to EE implementation. Many countries do not have mature commercial banking sectors and may not even have term lending programs, which are conducive to the EE sector. Other countries that have active banking sectors and high liquidity also perceive both performance and technical risks associated with energy-saving projects. Furthermore, energy bill savings that stem from a retrofit project are considered less bankable than a cash flow from a new investment. Therefore, these savings are more difficult to finance.

- Affordable financing — Even if energy users are willing to invest in energy-using products on the basis of their life-cycle costs, they may not have the investment capital to pay the higher initial costs of the more efficient products. If they do have the capital, they may face competing investment opportunities. Particularly in the industrial sector, firms with limited capital tend to concentrate their investment on expanding production or developing new products rather than on cost-cutting projects and services. One way to overcome this barrier is through the provision of affordable financing—for example, through the establishment of a low-interest loan or loan guarantee program for energy-efficiency investments. The IFC-GEF's Commercializing Energy Efficiency Financing (CEEF) in Hungary, and now expanded to other Eastern European countries, is an example of this approach.
- Financial incentives — Energy users, be they individuals, businesses, or governments, should ideally select products that have the lowest life-cycle cost. In practice, they tend to select products with the lowest first cost. If a more energy-efficient model is available, the users tend to spend the additional capital for it only if they think the financial return on the investment will be very high in the

near term. That is, consumers apply high discount rates to energy-efficient investments. This behaviour is characteristic of energy users everywhere, but in developing countries where incomes are low, discount rates tend to be even higher than in industrialized countries.

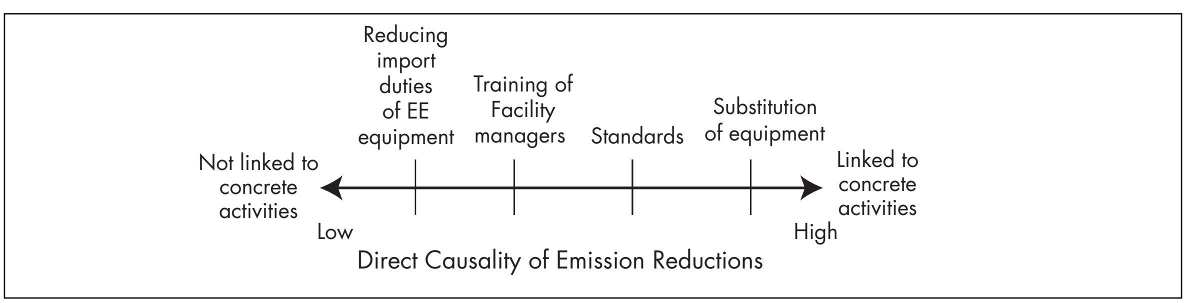
These discount rates are far in excess of the market rates that are used, for example, by electric utilities to evaluate the long-term financial benefits of power plants. If a utility applied its discount rate to a range of energy-efficiency investments, many of the efficiency investments would have a much higher rate of return than that of a new power plant. But unless the utility is participating in a program to purchase energy savings—for example through a demand-side management (DSM) program—the efficiency investments are left to individual consumers, whose high discount rates make the investments prohibitive.

One way to overcome the high discount rate barrier is for an energy-efficiency program to provide a financial incentive, for example, by providing a rebate for the purchase of a high-efficiency refrigerator, air-conditioner, industrial motor, etc. A government energy program, a utility operating a DSM program, or a non-profit corporation tasked by a government or utility to operate energy-efficiency programs could provide the incentive payments. The payments could go to the energy users, the product retailers, or the manufacturers. Many programs focus on the users, but it is often more cost-efficient to provide the incentives upstream in the supply chain, for example, to the manufacturers, as was successfully done in the IFC-GEF's Poland Energy-efficient Lighting Program.

C. Traceability of Energy Efficiency

The ideal energy-efficiency program involves a set of sub-programs that use a combination of techniques to reach a variety of end-users across different sectors of the economy. An overall EE program could involve, for example, a combination of rationalizing energy prices; promoting high-efficiency products to consumers and retailers; providing financial incentives for industrial energy-efficiency improvements; and adopting and enforcing energy-efficient residential building codes. However, in approving the concept of CDM, the Parties to the Kyoto Protocol explicitly decided that a policy or standard cannot be considered a CDM project activity. However, programs that are implemented by project activities that directly lead to emission reductions can be eligible.

Figure 6: Degree of Traceability of Emission Reductions



There are several reasons for this decision, but perhaps the most evident is the fact that CDM project activities, and CDM programs, must be real and directly measurable. Most traditional CDM project activities achieve emission reductions through a one-time change of technology (e.g., fossil fuel power plant replaced by a wind farm). In this case the cause-effect link is very clear: the emission reductions are attained due a specific and concrete change in technology. Given a continuum of "traceability" of emissions, the majority of current CDM projects can be situated at one end of the gamut where projects are typically one time "brick and mortar" type projects, with a concrete physical activity that is directly measurable. But not all GHG mitigation activities are of this nature, especially not EE efforts which are implemented in a broadly systemic manner.

From a CDM perspective, the key question to address in EE efforts is therefore whether an energy-efficiency program is expected to result in direct or indirect savings. Producing energy savings *directly* means that the link between the program activity and the savings can be directly demonstrated. An example would be an incentive program such as an energy-efficient appliance rebate program in which consumers are offered incentives to install energy-efficient refrigerators, air-conditioners, etc. For each participant receiving the incentive, there is the expectation that there will be direct energy savings. Conversely, in the case of information and education types of EE programs, it is relatively difficult to establish the direct linkage of the program to an actual energy savings, and therefore more difficult to be included under the CDM. In these programs, the link between the activities and any eventual savings is *indirect* and relatively difficult to establish. That is, an EE program that provides information to consumers about how to save energy may—or may not—result in any direct, easily measurable savings. The savings obtained depend upon the program inducing some form of behavioural change, and their measurement and verification is comparatively difficult.

As discussed above, ideal EE programs involve a set of sub-programs that combine different techniques to reach a variety of end-users. As not all EE activities are expected to be eligible for the CDM in the short term, it is entirely possible that an EE effort will involve both CDM-eligible and non-CDM-eligible activities. Until CDM guidance for EE changes, it will be important for project proponents to distinguish between those activities that are eligible for the CDM and those that are not. Those activities that are eligible could be "factored out" of the integrated EE program and submitted to the CDM, although they are components of a larger effort that as a whole is not eligible.

The following section identifies some common EE programs, listed along a continuum of traceability, based on how direct or indirect the savings (and hence the consequent emission reductions) are. The more "traceable" the emission reductions of an EE measure are, the more likely that they could be implemented as CDM programs under the current set of rules. The different types of EE measures are listed below according to their degree of "traceability" (lowest to highest).

- **Policies in general —** Although the adoption of policy measures in and of themselves is not eligible for CDM credit—because no clear, actual, energy-efficiency gains may result and their impact on energy efficiency is not directly traceable—many observers recognize that all successful energy-efficiency programs in developing or industrialized countries have sound policy backing. It is clear that the adoption and implementation of such policy needs to be well designed, marketed, financed, enforced, monitored, and evaluated in order to be successful. But policy support is the key. While a policy in and of itself is not eligible for the CDM, a clearly traceable measure to implement an EE policy (voluntary or mandatory) could be eligible for the CDM as long as the GHG reductions can be shown to be the direct result of an intentional project activity.

- **Rationalizing electricity prices —** Rationalizing energy prices to reflect the true cost of supplying electricity is a sound energy policy and is critical to stimulating EE activities. However, price rationalization is probably best described as a policy measure and is thus not eligible as a project activity under the CDM. It is difficult to unambiguously measure, attribute, and verify energy savings resulting from price increases with the degree of certainty sought under the CDM. This is because very little data on true price elasticities and consumer behaviour exists, particularly in developing countries. In addition, some energy users respond to the higher prices by switching to different fuels or engaging in power theft, or, if they are poor, curtailing some of their energy use even though they need the heat, light, etc. to retain a minimum level of comfort. This behaviour, although fully understandable, would make it impossible to directly and unambiguously attribute energy savings to the price increases. Even where there is no fuel switching or energy use curtailment, there are substantial methodological difficulties involved in accurately tracking the energy savings resulting from pricing policies and attributing the savings to the policies. Hence, an energy price increase may not be appropriate for the CDM, although, where energy price rationalization accompanies the implementation of an energy-efficiency program such as a loan or rebate program, it contributes to the measurable and verifiable energy savings that gets attributed to the loan/rebate program.
- **Reducing import duties** — Reducing the import duties on energy-efficient appliances and equipment is a policy approach whose impact on energy savings is difficult to measure unambiguously and directly. Like rationalization of energy prices, it is a necessary but insufficient measure for achieving energy savings in the economy. Because of its highly indirect impact on energy savings and the difficulty of attributing energy savings to a reduction of import duties, a duty-reduction policy may not be eligible as a CDM project.
- **Performance risks due to supply-side distortions** — Reducing supply-side distortions such as voltage fluctuations involves implementing and maintaining a set of maintenance procedures, which in turn depends on government policy and enforcement. Policies that result in reduced voltage fluctuations do not lend themselves to the CDM. As with tariff increases, most government policies that indirectly improve energy efficiency present major methodological issues with regard to determining baselines, additionality, and monitoring and verification (M&V) methods. It is difficult to attribute energy savings directly to these improved policies.
- **Training programs** — Certain types of training and certification programs, such as the training and certification of building operators, can have a major impact on energy consumption in commercial and institutional buildings. Although it may not be possible to assign specific savings to each of a range of improved operation and maintenance (O&M) procedures, a trained facilities manager can have a measurable impact on the overall energy consumption of a specific facility. However, within the current restrictions of the CDM, it is not likely that energy savings could be directly attributed to a training program. The Executive Board has clearly decided that training and capacity building, as such, cannot be considered CDM projects. "The eligibility of project activities that are

a result of the transfer of know-how and training shall be based only on measurable emission reductions which are directly attributable to these project activities." (EB 23 paragraph 80.)

- **Appliance-efficiency standards --** There is already one unsuccessful experience with efficiency standards in the CDM. In February 2007, the Executive Board of the CDM rejected NM159-rev, a proposed new methodology that had the intent of implementing an "efficiency testing, consumer labelling and quality-assurance program for air conditioners in Ghana." In addition to some technical details that could have been fixed, the methodology was rejected because "the calculated emission reductions can *hardly be clearly attributed to the proposed 'soft' measures, since efficiency of appliances is also affected by many other factors.*"[17] The measures that the EB perceived as "soft" included efficiency information labels; building of a testing lab; training of customs officials, manufacturers, importers, and/or distributors; and incentive schemes. At its 33rd meeting, the EB reiterated that "the eligibility of project activities that are a result of the creation of infrastructure (e.g., testing labs, creation of an enforcement agency) or capacity to enforce the policy or standard shall be based only on measurable emission reductions which are directly attributable to these project activities." (EB 33, paragraph 30.)

Having learned from this experience, it is evident that in order for the activities involved in establishing minimum EE performance standards to be accepted by the CDM in the near future, they will have to be based on more concrete emission reduction activities. The actual adoption and enforcement of appliance-efficiency standards is more concrete than the ancillary (though necessary) activities like establishing appliance testing labs and training appliance manufacturers. In addition, it is possible that energy savings and emission reductions resulting from appliance-efficiency standards could be perceived by the EB as more traceable if the appliance standards program focuses on three key evaluation parameters: the number of energy-efficient appliances sold, the energy performance of the efficient appliances, and the disposal of the replaced models.

The first of these—the number of efficient appliances sold—is difficult to determine on a macro level in those developing countries that have inadequate or unreliable retail data and large informal retail sectors. However, if the program includes a rebate for which the purchaser qualifies through proof of purchase, the rebate applications can allow for a centralized tracking of the type, model, and location of new appliances sold. This is more efficient than trying to collect the data from widely dispersed appliance retailers. The more accurate sales list facilitates improved estimates of energy savings and emission reductions.

The second parameter—the performance of the efficient appliances—can be determined with a survey of the measured performance of the appliances installed on the customers' premises. These on-site inspections determine not only energy performance but also whether the appliance was properly installed, whether it is being properly operated, and whether the appliance manufacturer or importer is providing goods that are in compliance with the standards.

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[17] Meth Panel Summary Recommendation to the Executive Board, http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_JA1VACKZLM20SI92BPXFDDSVG58IJ2.

The third parameter—the disposal of the replaced appliances—must be addressed in any appliance-efficiency program and is key to the success of all appliance-efficiency programs under the CDM, whether based on mandatory standards or voluntary purchases. When energy-efficient appliances are purchased as replacements for inefficient models, if the replaced, inefficient appliances remain in use or are sold on the secondary market, they will continue to consume (and waste) energy. This is considered leakage under the CDM. In order to minimize leakage, the rebate program can be designed such that purchasers qualify for it not only by showing proof of purchase but also by handing in his/her old (working) appliance, whose parts are then recycled for non-energy consuming applications.

- **Appliance labelling** — The mere establishment of a labelling program does not guarantee that energy will be saved, and hence such programs, important as they may be, may not be generally eligible for the CDM. The effect of a labelling program must be made traceable in order to be considered for CDM eligibility. As with appliance standards, the impact of appliance labelling programs could perhaps be more easily measured if they linked to financial incentive programs that facilitate the tracking of energy-efficient appliance penetration in the marketplace. Otherwise, the impact of the labelling program must be traced through retailer surveys and consumer surveys. These are legitimate evaluation practices in industrialized countries and may be applicable in some of the more advanced developing countries. But in most developing countries, survey results will have a high degree of uncertainty because of the difficulty of tracking retail purchases and sales.
- Likewise, appliance testing, though an essential component of a labelling program, will not by itself catalyze market penetration of energy-efficient appliances. The best way to track the market impact, and thus the energy savings, of a labelling program is to provide incentive payments to consumers for the appliance purchases. However, while such an approach may be best for tracking implementation, it may not be the best approach from a program design perspective. Consumer subsidies do foster market penetration, but studies have shown that providing financial incentives earlier in the supply chain—for example, to appliance manufacturers—will result in a lower retail price than providing the payments to the consumers. This is a problem for the CDM because the superior program design approach—providing the incentives to the manufacturers—is one that allows for less traceability of the purchase and implementation of the energy-efficient equipment.
- **Energy-efficient building codes —** EE improvements resulting from mandatory energy-efficient building codes are traceable back to the codes, although significant savings are unlikely if the codes are not enforced. One can evaluate the energy saved from building codes by applying energy simulation software to what is determined to be an "average" residential or commercial structure. Then a baseline is established, and sampling of these buildings is done for the evaluation.[18] Where there are standardized building types, the baselines and sampling exercises are more straightforward and accurate.

The State of California has adopted a protocol for measuring and verifying energy savings resulting from EE building codes and appliance-efficiency standards.[19] The protocol describes how energy sav-

[18] "Residential Energy Code Evaluations," Brian Yang, 2005 National Workshop on State Building Energy Codes, June 29, 2005.
[19] "California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals," Sacramento: California Public Utilities Commission, April 2006.

ings should be estimated for programs that result in, or contribute to, changes in building codes or appliance standards. As part of the protocol, actions designed to increase compliance with code requirements can be evaluated for their impact on energy savings. In other words, the codes themselves generate some level of improved EE, but programs to increase compliance with the codes generate additional improvements in EE.

As with the estimates of energy savings under other kinds of EE programs, the approach to determining energy savings under California's Codes and Standards Program is to establish a baseline representing the existing and likely market penetration of buildings and appliances that would be in compliance with the codes and standards if the codes and standards did not exist; assess decision changes caused by the codes and standards; and assess the energy impacts of those decision changes.

- **Bulk procurement of energy-efficient products** — Because of the relative ease of establishing a baseline and implementing accepted M&V methods, the energy-efficient procurement approach lends itself easily to the CDM. In fact, the M&V procedures for this approach will yield a more accurate penetration rate for the energy-efficient products because the installation of each unit can be more readily tracked and directly attributed to the procurement program than if the products were provided by retailers.
- **Financial programs —** A program to provide dedicated financing or financial incentives to EE projects could be perceived as an appropriate type of pCDM project. Baseline energy usage, as well as penetration rates of energy-efficient products within a defined geographic region, can be readily determined, and, through application of an accepted EE measurement and verification methodology, the amount of energy savings and GHG emission reductions resulting from specific products purchased with incentive payments can be accurately calculated and directly attributed to the incentive program. An underlying assumption is that the financing program will be dedicated only to energy efficiency. In the event that there is a broader financing program of which EE is only one component, then it is assumed that the amount of funds going to EE can be broken out and quantified. Another underlying assumption is that most consumers who implement EE measures for which incentives are eligible will take advantage of the incentives. However, for various reasons, there are always some users who implement the measures and do *not* apply for the incentives, causing a positive spill-over effect. Thus, calculating energy savings based on the incentive payments is undercounting the actual savings. The resulting conservative estimate for program-induced energy savings and emission reductions offsets some or all of the savings that would be assigned to free ridership. (See Section 4B below for a discussion of spillover and free riders.)

As discussed at the beginning of this chapter, experience shows that the EE efforts with the greatest impact are those that combine an array of measures, including policy and regulation, incentives, information, and standards to achieve the desired market transformation. However, it is apparent that not all these measures are eligible for the CDM, at least not under the current guidelines. This does not mean that EE efforts should eliminate important elements that won't qualify for the CDM. What it does mean is that, in submitting CDM programs, project proponents should not highlight the elements that are likely to be ineligible. Rather, they should base their CDM program on those elements that do contribute to the unambiguous traceability of the emission reductions. For the time being, it would seem that technology replacement, (e.g., through a bulk procurement program) and financially based measures (e.g., rebates, loans, etc.) are the most traceable from a CDM perspective. Well-designed appliance-efficiency standards accompanied by strong monitoring and verification protocols may also present a good argument for traceability. EE programs that are structured around those types of measures would have a better probability of being eligible and approved under the CDM.

4. Integrating EE Practices and CDM Procedures

CDM procedures and modalities are meant to encompass a wide range of emission reductions activities. At the outset, programmatic CDM was deliberately designed to facilitate the implementation of EE measures under the CDM. The conceptual overlay of EE practices and pCDM methodological requirements shows that there are many common elements that can be used to successfully integrate EE initiatives, particularly on the demand-side, into the CDM.

A. Baseline

The objective of EE projects is to achieve energy savings above and beyond what would have normally occurred. They therefore typically start off by defining a baseline of energy consumption prior to the implementation of the EE measures. In the CDM, this baseline is expressed as the level of emissions associated with the energy consumption baseline. The calculation of the respective baseline emissions is based on a baseline "methodology"—either an existing (already approved by the CDM EB) or a new methodology developed specifically for the project (also requiring the approval of the CDM EB).

In considering whether to develop a new baseline methodology, it is useful to look at experience to date in the development of baseline methodologies for EE projects. A lesson learned from several of the EE baseline methodologies that have not been approved in the past is that, in determining the baseline, they failed to distinguish among the three different efficiency markets (for a full discussion see Arquit Niederberger and Spalding-Fecher, 2006):

- Discretionary retrofit, or premature replacement of existing technology before the end of its useful life for the primary purpose of improving energy efficiency;
- Planned replacement, or the replacement of existing technology at the end of its lifetime with higher efficiency equipment than would normally have been installed; and
- Installing energy-efficient equipment and design features at the time of new construction.

While there is no explicit requirement to differentiate, it makes sense in terms of determining the appropriate baseline for a given EE project. In fact, this differentiation is likely to be critical for the future development of EE methodologies. For discretionary retrofits, the baseline scenario of efficiency activities is usually the existing actual or historical emissions in the absence of the implementation of the program. The baseline emissions are the emissions associated with the energy use that would have occurred in the absence of the EE project. The energy use baseline is derived as is typically done for EE projects through an energy audit of existing conditions; it is then multiplied by an emission factor determined with base year electricity use data and characteristics of the power plants supplying the electricity. All currently approved end-use EE methodologies apply to the retrofit market.

The development of a baseline for planned replacement projects and new construction projects is more difficult than for a discretionary retrofit project because determinations must be made about what sort of replacement equipment or building practices would have normally been used in the future. It is challenging from a CDM perspective due to the difficulties of identifying a comparable and measurable situation where the CPA has not been performed. In particular the difficulty lies in taking into account factors unrelated to energy efficiency (such as electricity prices, local population growth/decline, and local economic changes) that could affect future emission levels. A baseline is a hypothetical value. Various reasonable assumptions can lead to different baselines, and thus there is some level of uncertainty in any baseline, and some uncertainty regarding the impact of EE measures on that baseline. While this level of uncertainty is acceptable in EE practice, the conservative nature of measurement in the CDM requires discounting for uncertainty. Unlike energy generation projects whose power output can be accurately measured, it is difficult to measure an EE program's impact on the baseline with great precision because individual EE measures may not perform as anticipated: some users may install or operate the energy-efficient product incorrectly; and some energy users may decide to increase their energy usage in response to the lower cost of the energy service whose efficiency was improved. This is particularly true in cases where new, energy-efficient construction is involved—for example, as a result of energy-efficient building codes—and assumptions have to be made about what sort of buildings would otherwise have been built and what their energy consumption would have been. There is an additional level of uncertainty in how the EE baseline changes over time. In most markets, EE improves over time to some degree with or without EE programs, so baselines should reflect some *autonomous EE improvement* rate. EE program impacts must thus be greater than the EE improvement rate assumed in the baseline.

B. Estimation of Emission Reductions

Energy savings in EE projects are typically estimated via computer-based tools combined with direct measurements. Variations are averaged and a system-wide average value of avoided generation is used to quantify savings. Similarly in the CDM, emissions reductions are estimated, and the difference between the baseline emissions and the estimated emission reductions constitutes the estimated gross emission reductions. In EE projects, as in CDM projects, the estimated gross emission reduction figure generally needs to be adjusted for certain factors that affect the net level of emission reductions achieved.

These factors can positively or negatively affect the level of reductions. Negative effects can be caused by leakage, free riders, or rebound. Leakage is the net change of GHG emissions outside the CDM project boundary that is measurable and attributable to the CDM project activity. From a CDM perspective, free riders are those GHG-reducing activities that would have occurred even without the CDM but that would want to claim CDM credits. The rebound effect refers to the increase in the demand for energy services (heating, refrigeration, lighting, etc.) which can occur when the cost of the service declines as a result of technical improvements in energy efficiency.

Conversely, the level of reductions can be positively affected due to spillovers, wherein additional EE savings result from a project, but are viewed as indirect rather than direct savings. Positive spillover occurs, for example, when an individual hears about the benefits of the efficient equipment and decides to purchase it on his/her own ("free driver"); or program participants that, based on positive experience with the equipment, exchange additional equipment beyond the maximum allotted per user by the program. Spillover is an unintended but welcome consequence of EE programs. Analysis has shown that in many cases the positive spillover effect is larger than the negative effect from leakage or free-ridership (Vine and Sathaye 1999, Quality Tonnes 2005). In fact, the most effective EE programs have a market-transforming effect under which EE measures and practices become business-as-usual. Malcolm Gladwell (2000) calls this the "Tipping Point," the moment when something unusual becomes common.

Most EE programs are affected to some degree by one or all of these factors. While it is conceivable that each proposed new CDM methodology for EE address these necessary adjustments in an individual fashion, it would be perhaps more effective to have top-down guidance on default values for gross-to-net adjustments for different types of EE programs, in order to avoid the cost and inconsistency of case-by-case estimations. In fact, this has been recommended by several experts (Arquit-Niederberger 2007 and Painuly 2007).

C. Monitoring

Energy savings are typically measured and monitored in EE projects. A widely accepted set of procedures for measuring energy savings is the International Protocol for Measurement and Verification Procedures (IPMVP), originally developed by the U.S. Department of Energy and now managed by the non-governmental organization, Efficiency Valuation Organization (www.evo-world.org). The IPMVP has been used widely in the U.S. and is increasingly being used in developing countries, most significantly in Thailand, Mexico, Brazil, and China. The IPMVP is not so much a standard or set of specific directions as it is a set of M&V guidelines. In the U.S., it has also been used to verify energy savings and secure financial benefits pursuant to emissions trading programs involving local pollutants.[20]

Under the IPMVP, there are four options for measuring energy savings:

[20] International Performance Measurement & Verification Protocol, Vol. 1, 2002, p. 40.

A) Engineering calculations based on spot measurements
B) Engineering calculations based on short-term monitoring
C) Billing analysis at the whole-building level using statistical techniques
D) Calibrated engineering simulation models.

It should be noted that M&V guidelines apply to individual sites, buildings, or facilities. When improvements to a number of sites are undertaken pursuant to a more far-reaching EE effort, a representative sampling of the sites is used to produce an overall evaluation of savings in the total population of sites. Generally accepted statistical methods are used to move from the sample estimations to the program- or population-based estimates. Estimating the program's overall energy savings impact is known as an "impact evaluation."

Similarly, in pCDM, monitoring of emission reductions is performed by the project proponent at the CPA level, not at the program level. As discussed above, if an appropriate baseline/monitoring methodology already exists as an approved CDM methodology, each CPA merely applies the monitoring protocol that has been approved for that methodology. In most cases, monitoring methodologies are for individual sites; however, there are 13 approved methodologies that allow for sampling, four of which are heavily based on sampling procedures. (See Annex 4 for a full list of approved CDM methodologies that use sampling procedures.) In the event that an approved appropriate baseline/monitoring methodology does not exist, the project proponent must submit a proposed new methodology for the consideration of the CDM Methodology Panel[21] and the Executive Board. The development and approval of new methodologies that apply EE measures to a single site should be rather straightforward (in most cases). What is perhaps more challenging is the development and approval of monitoring methodologies for CPAs that apply EE measures in many locations within a CPA, as those will require robust sampling techniques. In the EE field, a variety of internationally accepted sampling procedures, such as sequential sampling, cluster sampling, multi-stage sampling, and stratified sampling with regression estimation, have been used for some time now and could be incorporated into the CDM monitoring protocols. However, these techniques have not yet been widely used in the CDM. It should be noted that despite the availability of accepted sampling procedures, the more robust and mature EE programs can create difficulty for evaluators trying to isolate the impacts of individual energy-efficiency programs and measures.

D. Verification

In CDM EE practice, the installation and proper operation of EE measures can be verified through site inspections and reviews of commissioning reports. The energy savings can be determined by comparing baseline energy use to actual post-project energy use. Thus,

Energy savings = Baseline kWh equivalent/year – Post-project kWh equivalent/year

[21] The Methodology Panel is the body of experts that assist the Executive Board in the assessment of proposed methodologies.

All energy performance projections are based upon certain assumptions about operating conditions, e.g., occupancy, seasonal uses, weather, etc. These affect the baseline and energy efficient design estimates. Deviations from the operating assumptions are tracked by an appropriate mechanism such as a site survey or short and/or long term metering. The baseline and EE projections are then modified accordingly to determine actual savings. For instance, the IPMVP framework described above incorporates such variations arising due to change or uncertainties in different variables and parameters.

In the EE practice, particularly in the case of projects done on the basis of performance guarantees through ESCOs, an independent, third-party monitoring and verification agency is involved. Likewise, with the CDM, the verification of emission reductions is done by a Designated Operational Entity (DOE)[22] at the CPA level. Best practice in EE program evaluation involves periodic reevaluation to determine the persistence of the savings. Likewise, with the CDM, the DOE engages in regular re-evaluation to verify that the project proponent is applying the approved CDM monitoring methodology correctly and to determine the persistence of the energy-savings and emissions reductions. The time interval for this verification is established in the respective monitoring methodology, but is in any event performed prior to each request of issuance of certified emission reductions by the CDM Executive Board. Thus, issuance occurs only based upon verified emission reductions.

As a CDM program will often involve a number of CPAs—all of which are similar to each other—the EB33 guidelines provide for the possibility of sampling at the verification stage. It should be made clear that if sampling is used for verification, it will sometimes be applied over a set of CPAs where each CPA has one location/site (e.g., each industrial burner is a CPA). However, sampling will also sometimes be applied over a set of CPAs where there are many GHG-reducing locations within each CPA (e.g., bulb replacement at a city level), and where monitoring itself has been performed by sampling. In these cases, the DOE must ensure that verification that is done by "sampling of sampling" does not adversely affect the credibility and measurability of the program activities.

E. Additionality

While the best EE programs seek to support those EE measures that would not have been implemented without the program, the CDM places a great emphasis on proving the "additionality" of emission reductions. "A CDM project is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity" (UNFCCC decision 17/CP.7). In a CDM program, additionality must be proven both at the program level as well as at the CPA level.

At the program level, the PoA is additional if it is shown that in the absence of the CDM (i) the proposed voluntary measure would not be implemented, or (ii) the mandatory policy/regulation would not

[22] DOEs are independent auditors of GHG reductions whose role is to support the Executive Board in the validation and verification of CDM project activities.

be enforced as envisaged but rather depends on the CDM to enforce it, or (iii) that the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

Additionality at the CPA level must be proven in one of two ways: either by an investment analysis (showing that the project is not the least cost option/most attractive option), or by the barrier analysis (showing that without the CDM the CPA could not be realized due to lack of finance or non-availability of technologies). The CPA must then also show that it is not common practice in the host country. This is no different from the additionality test for all CDM project activities.[23] In a program, the additionality of all CPAs must be proven, but provided that additionality is well proven in the first CPA, subsequent CPAs can use the same reasoning.

In the case of most EE efforts, the traditional investment analysis is usually not appropriate to demonstrate additionality due to the fact that most EE efforts are in principle cost-effective and have relatively short pay-back periods. However, EE often does not occur—particularly in developing countries—because of the lack of an enabling policy framework, the high initial capital cost, and the usual observed reluctance to base investment decisions on life-cycle cost analysis. The CDM investment analysis has traditionally interpreted profitability as implying a lack of additionality for projects. In EE this is clearly not the case, as the well-documented barriers to EE are persistent and actually do impede the dissemination of efficient technologies. Since the investment analysis creates the impression of lack of additionality, the barrier analysis is a more appropriate analysis for additionality.

Annex 1 lists the typical barriers to EE implementation. Any one or group of these can be credible barriers in the CDM additionality analysis, as long as the project then proves that the CDM overcomes the chosen barrier(s).

It is evident that EE practices lend themselves to CDM procedures, as they both define an *ex-ante* baseline, estimate energy savings or emissions reductions, and do constant monitoring. However, the conceptual overlay of CDM requirements on EE practices also shows that CDM requisites are more stringent particularly with respect to such issues as additionality, as well as with monitoring and verification. While EE best practices can be integrated into the CDM, it will require re-casting those efforts from the perspective of the CDM.

[23] The tool to assess the additionality of any CDM project activity can be found under http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf.

Box 2: The Split Incentive Barrier

One of the most challenging barriers to EE implementation, particularly in the buildings sector, is the "split incentive". The direct beneficiaries of energy-efficiency programs are typically the consumers who pay for the energy services, as the energy savings will be reflected in a lower electricity bill. Yet the consumers are often not the same as those who incur the costs of installing the energy saving technologies. This situation is known as the "split incentive" due to the fact that those who invest in the technologies, and who want/need to keep upfront costs low, are frequently not those who will use the system in the long term and would benefit from efficient systems that have low life-cycle costs. The most common example of this is the landlord-tenant problem, in which the tenants/renters who pay the energy bills would benefit from improved EE, but it is up to the building owner/landlord to decide to make EE improvements, which he/she will not directly benefit from. Viewed from a CDM program perspective, the coordinating entity that incurs the cost of designing and running the program does not accrue the benefits of the energy savings at the CPA level, and often does not have the capital to set up the program.

The barrier analysis of the CDM must not only identify a pervasive barrier, but also show how the CDM helps to surmount that barrier. The split incentive is a financial barrier which the CDM can help overcome. In addition to the energy savings, the CDM provides EE projects with a new asset (emission reductions) which has market value that can be converted into an additional and flexible income flow. Although CERs are the emission reduction equivalent of the energy savings, the income from the sale of CERs need not flow to those who benefit from the energy savings (CPA level), but rather can be intentionally directed to the cost centers of the project (program level), thus providing the missing financial link. Under the CDM, projects consisting of programs of activities could enable the revenue flows of the CERs to go to the entity that implements the efficiency program in order to defray the costs of the program, while the consumer/end-user is, as usual, benefited by the energy savings. For example, projected income from the CERs could be used by the producers of high efficiency bulbs and lighting systems to lower the net cost of production, thus diminishing the cost to distributors, retailers, and consumers. Alternatively, the cost incurred by landlords and developers to improve energy using equipment could be offset by CERs.

In terms of additionality in the CDM, the split incentive is one of the most challenging barriers to EE implementation. It is not the only barrier, as demonstrated by the list in Annex 1. It would facilitate the dissemination of EE if the CDM system could reach an agreement on recognizing the generic barriers to EE, so that each methodology does not have to argue the specifics of its additionality. But given the case-law approach to methodology development in the CDM, this is unlikely in the short term. For the time being, each new methodology proposed will have to prove its own case in terms of the additionality of CPAs.

5. Illustrative Case: Uruguay Energy Efficiency Project

In order to examine the issues raised in this paper, the proposed GEF energy efficiency project in Uruguay[24] has been selected for illustrative purposes only. It is clear that no GEF funding can be devoted to individual investments that will result in carbon crediting through the CDM, nor pay for methodology development or verification/certification of CERs. However, GEF resources can be used for barrier-removal costs in a project that is filing for CDM, and to the extent that roles can be clearly defined, GEF resources can be used to complement carbon finance. The relationship between GEF resources and potential carbon finance in this particular project is not discussed here, and it merits separate consideration. For purposes of this paper, the focus of analysis is limited to the possible eligibility of the various components of the projects as CDM programs of activities.

The EE project in Uruguay has three core components, different both in nature as well as in targeted end-users:

1. Replacement of incandescent bulbs in poor neighbourhoods;
2. Financial facility for industry and commercial sectors; and
3. Performance standards for equipment and appliances.

Were this project to be considered for submission under programmatic CDM, each component would have to be structured separately. Since each CDM program can apply only one single CDM methodology, and all CPAs under the program must be similar to each other, each of the components would have to be a separate CDM program. The three components can be conceptually placed along the continuum of traceablitiy, thereby comparing the ease with which they could be submitted as CDM programs. The three components are discussed below, starting with the most likely to be eligible for the CDM.

[24] Uruguay Energy Efficiency Project, Project Appraisal Document No. 28525-04. This project was approved by the GEF Council in May 2003, endorsed by the CEO in April 2004, and subsequently approved by the World Bank (as GEF Implementing Agency) in May 2004.

1- Replacement of incandescent bulbs.

This project would be executed by UTE (the National Power Utility), the national entity expected to implement demand-side management programs to moderate energy demand in critical areas and thus postpone investments in power supply facilities. UTE has several projects under preparation in public buildings, hotels, and residential and street lighting systems, and is preparing a business plan to expand activities. A DSM pilot project is to be carried out in "Ciudad de la Costa," close to Montevideo, targeted at the poor neighbourhoods that do not pay their electricity bills. In a first stage, households will receive two coupons to purchase compact fluorescent lamps (CFL), which would be repaid in instalments through the electricity bill. The coupons will be collected from the sellers by the lamp manufacturers or distributors and sent to UTE for payment. Only lamps meeting the performance specifications of the Efficient Lighting Initiative will be financed under the DSM pilot project.

Submission as a CDM program

Given the direct link between bulb replacement and energy savings/emission reductions, this pilot project is a very likely CDM program. If the project were to be submitted as a CDM program, the project proponents may wish to consider the following design features. If the expected energy savings in Ciudad de la Costa are below 60GWh/year, and if bulb replacements will only occur in households (only one type of site) in a relatively short period of time, bulb replacements in the entire city could be considered the "typical CPA" with which the program would be launched. This would allow the project proponents to later simply add the desired number of CPAs to the program, without having to go through the entire program submission process again. In that case the PoA-DD would be accompanied by a CPA-DD that has been specified for this program, and a CPA-DD that has been completed with the information pertinent to Ciudad de la Costa. The project proponents need to assess how "repeatable" the Ciudad de la Costa activity is, as all future CPAs need to be sufficiently similar to the first. The physical boundary of the program could be the country of Uruguay, and the physical boundary of the first CPA (the pilot project) could be Ciudad de la Costa, the perimeter of which would have to be clearly defined. The coordinating entity of the overall program could be UTE, which would incur the obligation to ensure that double counting does not occur by verifying that bulb replacements covered by the program are not registered as a separate CDM project activity, nor are they part of another registered CDM program. The program could apply approved small-scale methodology AMS II.C. for "programs that encourage the adoption of energy-efficient equipment…at many sites." At the program level, additionality could be demonstrated by the fact that the replacements would not occur in the absence of the CDM program. At the CPA level, additionality would have to be proven though the barrier analysis, identifying which is the most challenging barrier to the bulb replacement in the absence of the CDM program, and showing how the CDM helps to overcome that barrier. The baseline would be the further use of incandescent light bulbs, and energy savings and corresponding emission reductions would be estimated on the basis of the number of coupons collected, which would include information on the type of CFL sold. Savings would be estimated on the basis of the energy consumption of each type of CFL, compared with the consumption of the replaced incandescent lamp, which would have to be destroyed in order to avoid leakage.[25] The project proponents would have to use robust sampling procedures for the monitoring of emission reductions within each CPA, and would have to avoid leakage by scrapping the old bulbs.

2- Financial Facility

The second component of the Uruguay EE project is the financial facility being created by the National Development Corporation (CND), a development agency dependent on the Central Bank. The facility would provide grants for EE project preparation, and would guarantee commercial loans for project implementation. The grants would be repaid if the projects are implemented and the guarantee would only be triggered in case of a repayment default.

Submission as a CDM program

The creation of the facility itself cannot be considered a CDM project, but the grants and loan guarantees that specifically target EE could provide the traceability needed for a CDM project, as long as each grant and loan guarantee is clearly associated with a specific EE activity. The facility intends to support the implementation of EE projects in both industrial plants and commercial buildings. Because these are two different types of sites, it is likely that for purposes of the CDM the financial facility may have to be divided into two CDM programs, one for industrial plants (replacement of motors, pumps, compressors, boilers) and one for buildings (lighting, and heating and cooling equipment).

The industrial plant program could apply the approved small-scale methodology AMS II.D., applicable to "any energy efficiency and fuel switching measure implemented at a single industrial facility." In this case every industrial site has to be a CPA. The building program could apply the approved small-scale methodology AMS II.E., applicable to "any energy efficiency and fuel switching measure implemented at a single building...or group of similar buildings." In this case, a group of similar buildings applying the same EE measures could be considered a CPA. It must be remembered, however, that in both cases, all CPAs must be similar to all other CPAs in the respective program.

The physical boundary of each program could be the country of Uruguay, and the physical boundary of the CPA would in one case be the single industrial facility and in the other case the group of buildings, which would have to be clearly defined.

[25] For example, the CDM methodologies for small-scale EE projects specify that "if the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered." As a result, this requirement can be eliminated through the destruction of the replaced, less-efficient equipment to ensure that it does not continue to be used and emit GHG emissions elsewhere.

The coordinating entity of both programs could be CND, which would incur the obligation to ensure that double counting does not occur by verifying that equipment replaced under either program is not registered as a separate CDM project activity, nor is part of another registered CDM program.

At the program level, additionality could be demonstrated by the simple fact that the replacements would not occur in the absence of the CDM program. At the CPA level, additionality would have to be proven though the barrier analysis, identifying which is the most challenging barrier to the equipment replacement in the absence of the CDM program (financing, knowledge of the existence of CFLs, distrust of new technology, etc.), and showing how the CDM helps to overcome that barrier. The baseline would be the further use of the existing equipment. The baseline emissions would have to be determined by energy service companies based on energy audits before project implementation.

Energy savings and emissions reductions achieved by the CPAs would have to be measured through another energy audit after equipment replacement. In the case of the industrial sites, since each site is a CPA, each site would need to be monitored according to the monitoring methodology of AMS II.D. In the case of the buildings, the group of buildings would have to be monitored according to the monitoring methodology of AMS.II.E. In both cases, the coordinating entity would have to account for CDM free riders (i.e., provide an estimate of free riders and not count them in the project's impact on emission reductions). Verification on the part of the DOE can be done by a sampling of the universe of CPAs. Again, destruction of the replaced equipment would have to occur in order to avoid leakage (otherwise, leakage emissions would need to be assessed and subtracted from the project's emission reductions).

3- Performance standards

The government of Uruguay is setting standards for EE equipment including lighting equipment, water heaters, refrigerators, heating and cooling equipment, and electric motors. The effort is being led by the Ministry of Industry, Energy and Mines. As discussed in Chapter 3, the existence of a performance standard cannot be considered a CDM project. Furthermore, soft measures such as efficiency information labels, testing labs, and training of customs officials, manufacturers, importers, and/or distributors, do not provide the degree of traceability that is necessary in the CDM and are thus unlikely to become eligible CDM projects under the current modalities.[26]

Submission as a CDM program

Of the three components of the Uruguay EE project, this is the most challenging to incorporate into the CDM due to both the traceability challenge and to the simple fact that no appropriate CDM method-

[26] Paragraph 30 of EB 33: "30. The Board agreed that creating infrastructure (e.g. testing labs, creation of an enforcement agency) or capacity to enforce the policy or standard, as such, cannot be considered as CDM project activities. The eligibility of project activities that are a result of the creation of infrastructure (e.g. testing labs, creation of an enforcement agency) or capacity to enforce the policy or standard shall be based only on measurable emission reductions which are directly attributable to these project activities."

ology exists for this case, necessitating the development of a new CDM methodology. The methodology would likely have to focus on the three key evaluation parameters: the number of energy-efficient equipment/appliances sold, the energy performance of the efficient appliances/equipment, and disposition of the replaced models. It would also probably have to incorporate a rebate program in order to strengthen the traceability of the achieved emission reductions.

In considering the Uruguay energy efficient project for the CDM, project proponents could consider starting with the bulb replacement program and the financial facility, both of which could be submitted with (expected) relative ease using existing CDM methodologies. In the case of the performance standards, project proponents can consider their interest in developing a methodology with high traceability. This could be an important contribution to the CDM, and if it were approved by the CDM Executive Board, it would have wide applicability.

6. Conclusions and Recommendations

There is no doubt that energy-efficiency projects qualify as CDM projects. In fact, 86 EE projects had been approved and registered by the CDM Executive Board by July 18, 2007. Seventeen large-scale and three small-scale CDM methodologies have been approved for a range of project types, but mainly for supply-side and single-site industrial projects, which account for all but five of the registered EE projects.

While large-sized industrial EE projects are important, an equally significant potential for cost-effective EE improvements is available through large numbers of smaller, dispersed, end-use energy-efficient technologies and services installed in many buildings, homes, and facilities. These can be implemented through an EE program administered by a government EE agency, a municipality, an energy utility, or a non-profit corporation. Such a "programmatic" approach was not allowed under the CDM until recently. The 2005 COP/MOP decision to allow PoAs, which implement many small projects over time, has opened new opportunities for this type of EE program under the CDM.

One of the conclusions of the analysis conducted in this study is that many practices followed in implementing EE initiatives naturally lend themselves to CDM procedures. First, all EE efforts start by defining a baseline of energy consumption prior to the implementation of the EE measures. In the CDM, this baseline is expressed as the level of emissions associated with an energy consumption baseline. Second, EE programs prepare estimates of anticipated energy savings compared to baseline energy use. CDM projects prepare estimates of emission reductions compared to baseline emissions. Third, both EE and CDM efforts have to include robust monitoring and verification activities to determine the actual level of energy savings and emissions reductions, respectively. Protocols such as the IPMVP and techniques such as sampling that are used for EE practices are relevant and applicable for EE programs under the CDM, and it appears that there is no need to reinvent—at least not fully—the wheel for the CDM.

However, in order to qualify for CDM crediting, EE practices must be structured according to specific CDM requirements. Three key features of the CDM must be kept in mind while developing the synergies with EE programs:

1. **Traceability**. The most effective EE efforts combine several elements such as policy and/or regulation, institutional strengthening, training, awareness raising, etc. There is no reason to exclude these elements from an EE effort. But it should be clear that such activities are considered "soft" from the perspective of the CDM because of a perception that measurable energy savings cannot be directly and unambiguously attributed to them. Thus, while EE efforts should ideally have many components, only those whose energy-saving impact can be directly traced back to the program component with a large degree of certainty should be submitted as CDM activities.
2. **Additionality**. The definition of additionality in the CDM, and particularly how it is to be proven, is unique and specific. Of the two options for determining additionality—investment analysis and barrier analysis—the one that makes sense for most EE efforts will be barrier analysis. Such an analysis can be used to show the additionality of EE efforts, but the analysis and supporting evidence must be credible and convincing.
3. **Monitoring and Verification**. EE programs typically monitor energy savings to determine the impact of the EE measures. The International Protocol for Measurement and Verification Procedures (IPMVP), originally developed for EE activities in the U.S., is being increasingly adapted and applied around the world. While it is evident that the IPMVP model can serve as the foundation for emission reduction verification under the CDM, it is meant to be used for monitoring and verification of single sites/buildings. Thus, it remains to be seen whether the IPMVP can be useful as the basis for a programmatic CDM monitoring methodology. California's Energy Efficiency Evaluation Protocol addresses monitoring and verification of multiple sites/buildings and may be applicable to programmatic CDM projects. In any event, an effort will have to be made to develop EE monitoring methodologies that can be approved by the CDM Executive Board.

Admittedly, the CDM is not a panacea for the dearth of EE activities in developing countries, and much additional work is required to fully tap into the end-use EE market for generation of emission reductions. However, the introduction of the programmatic approach can help scale up the development opportunities for EE, particularly end-use EE, under the CDM. More important, the carbon finance available through the CDM may be a critical incentive to leveraging large scale EE efforts, with the following specific recommendations.

Recommendation #1: Implement EE programs through the CDM using existing small-scale methodologies.

The three approved small-scale EE methodologies allow for a programmatic approach. There are limits on the allowed amount of energy savings under these methodologies, but the limits are applied at the CPA level, not the PoA level. That is, the overall EE program (PoA) can generate unlimited energy savings, but each activity under the program (CPA) is limited to achieving 60GWh/year. However, there is no limit to the *number* of CPAs under the program. Bearing in mind that not all elements of EE programs may be eligible, we recommend project developers begin to advance promising EE programs for carbon finance operations through the CDM process pursuant to these small-scale methodologies:

- AMS II.C., for "programs that encourage the adoption of energy-efficient equipment…at many sites";
- AMS II.D., applicable to "any energy efficiency and fuel switching measure implemented at a single industrial facility"; and
- AMS II.E., applicable to "any energy efficiency and fuel switching measure implemented at a single building…or group of similar buildings."

To qualify for CDM credit, the PoA design document must define: the coordinating entity, such as an energy office or energy utility; the program boundary (e.g., city-wide, country-wide, etc.); the single approved methodology, such as one of the above methodologies, to be used by all CPAs; a demonstration of additionality at both the PoA and CPA levels; the program duration, which can be up to 28 years; and a description of the typical CPA, along with its parameters, characteristics, and crediting period (ten years or seven years twice renewable).

Recommendation #2: Choose EE activities whose emissions reduction impacts are traceable with a relatively high degree of certainty.

The EE activities proposed must have "traceability"; that is, the emission reductions must result directly from the CDM program activity. The December 2005 COP/MOP 1 decision clearly states that EE policies, such as energy price rationalization, are not eligible under pCDM. Likewise, most institutional measures, such as information dissemination efforts and training workshops, are not expected to qualify as CDM programs. The program activities that can be most directly linked to energy savings and emission reductions are either technology replacement programs, such as bulk procurement, or financing/incentive programs, where the loans, grants, rebates, etc. are given to specific energy users whose purchase and installation of specific EE products can be tracked. Regulatory programs, such as energy-efficient building codes and appliance-efficiency standards, are also potentially traceable if they are well-enforced and well monitored, although there is a perception that making the link between these programs and observed emission reductions involves a great deal of uncertainty. CDM programs must describe how that tracking will be done. This requirement of the CDM de facto limits eligible EE efforts to those based on financing schemes, which reduces the potential of EE efforts to reduce emissions. However, until CDM modalities are revised, it does seem that equipment replacements and financing schemes—particularly financial incentives—are the "windows of opportunity" to begin to integrate EE into the CDM.

Recommendation #3: Submit EE programs that go beyond the established small-scale threshold

Energy-efficiency programs generally start out small and expand as experience is gained, successes are achieved, and a larger administrative budget becomes available. Although small at first, they should have a long-term strategy that involves the adoption of supportive policies and regulations, and the facilitation of widespread implementation of EE measures. Two features of the CDM make pursuit of a longer-term, large-scale approach worthwhile even if the program will start out small. First, the program is eligible for crediting for 28 years. Second, the program is made up of a series of CPAs that can be added at any time to a registered PoA, and each CPA may save up to 60GWh/year. So a program could consist of lighting measures where each CPA saves up to 60GWh/year, or it could be a boiler replacement program where each boiler (if it is defined as the CPA) saves up to 60GWh/year. There is no limitation on the number of CPAs allowed in a program, nor on the emission reductions allowed in the overall program. Thus, even if an EE program is going to start out small, project developers should submit the program as a whole for registration by the CDM Executive Board, without prejudice to how many CPAs may eventually be added.

Recommendation #4: Carefully design the CPA

A CDM program operates at two levels: the program (PoA) level and the program activity (CPA) level. The program provides the organizational and financial framework for the emission reductions to occur, but the program does not actually achieve the reductions. The emission reductions are attained at the level of the CPAs. Since all CPAs must be similar to each other, it is important that great care be taken when defining the parameters and eligibility criteria of the typical CPA. The CPA should be defined in such a manner that it is specific enough to differentiate between an activity that is eligible and one that is not, but general enough to allow for some normal variation among activities. For example, an electric motor replacement program will naturally have to have some flexibility in terms of the size and technical specifications of the motors to be installed/replaced in each facility. So the CPA should explain the types of motors and their applications, but should not be too specific on the size of the motors or their technical specifications. The definition of the CPA should further balance transaction costs and volume of CERS. Frequent requests for inclusion of a CPA could maximize CERs, but would also increase transaction costs. Less frequent requests for inclusion of a CPA will somewhat limit CERs but will minimize transaction costs. Ultimately, it is important to match the design of the typical CPA to the scope of the project, while trying to achieve the maximum benefit possible.

Annexes

Annex 1
Barriers to EE

The multitude of barriers to energy efficiency is well documented. The following is a list of the main barriers, broken out by the individual or institution that faces the barrier(s). In each country, there is usually a combination of barriers from each of the categories below. There are always informational and financial roadblocks, and insufficient capacity/political will is very common.

Barriers at the Consumer Level

- *High consumer discount rate* – Even if they understand that they will save money from energy-efficiency investments, many households, businesses, and institutional energy users will only invest in EE measures if the financial returns occur in the very short term. These users often do not apply such a high discount rate to other investments.
- *Tight cash situation plus limited ability to borrow* – Energy consumers often have a general understanding of the benefits of EE investments. But they are often cash-constrained and either do not want to go into debt for energy efficiency or are unable to take on more debt.
- *Higher investment priorities* – With limited cash reserves or indebtedness capability, energy consumers often prefer to apply their limited resources and debt capacity to other, higher priorities.
- *Unavailability of affordable financing* – Usually, energy-efficient products are more expensive than the products they are meant to replace, partly because they have higher quality components and partly because of the higher transaction costs of these products' less developed, less competitive markets. Even where energy users would like to purchase higher efficiency products and would like to borrow to do so, affordable financing is unavailable. Some countries have little or no term lending. Others have term lending, but it has high interest rates and short maturities. (See Financial Institution Barriers below.)
- *Lack of information* – There are many parties in the EE equation who often have insufficient information about the costs and benefits of energy efficiency, but energy users are often at the top of that list. Even in industrialized countries, only a minority of users know the relative efficiency and cost-effectiveness of energy-efficient products and services.
- *Doubts that promised savings will accrue* – Many energy users do not trust that energy savings will accrue from their EE measures, or at least doubt that the savings will be as large as they feel they were led to believe.

- *Incentives not high enough* – Many energy users do not have a financial incentive to implement EE measures. This can be due to low energy prices. But even where there are higher prices, users often need an extra financial incentive such as a rebate before they will take action.
- *Split incentives* – When the builder or owner of a home or building does not pay the energy bills, he/she usually have little financial incentive to make EE improvements, while the tenants, who pay the bills, do not want to make major EE investments in property they do not own.

Barriers at the Market Level

- *Unavailability of energy-efficient products* – Manufacturers often do not make or market more energy-efficient products as they do not expect to have a market for these (usually invisible) enhancements to their products. In addition, product distributors and retailers often do not have any incentive to stock or aggressively display energy-efficient products, making it difficult for customers to find the more efficient products they may seek.
- *Insufficient capability to manufacture energy-efficient products* – Manufacturers often do not have the know-how or access to higher-quality components to make energy-efficient products.
- *High import tariffs on energy-efficient products* – Some countries have import tariffs that result in elevated prices for energy-efficient products. Some countries have high import tariffs on what are considered "luxury goods," and these sometime include products like air conditioners.

Barriers at the Financial Institution Level

- *Potentially high credit risks* – Banks and other lending institutions are often sceptical of the anticipated cash flows generated by energy-efficient products and thus consider lending for such products to be risky. Thus, if they offer term loans at all, the interest rates are often high and the maturities short.
- *Small investment size* – Although investments in energy-efficient products can seem high for consumers, many financial institutions consider them too small. The institutions' fixed costs mean that loans below a certain level are not worthwhile.
- *Lack of financing history and expertise* – Lending institutions often are unfamiliar with EE technologies and are unwilling to learn about them, particularly if they don't see a large market developing for them.

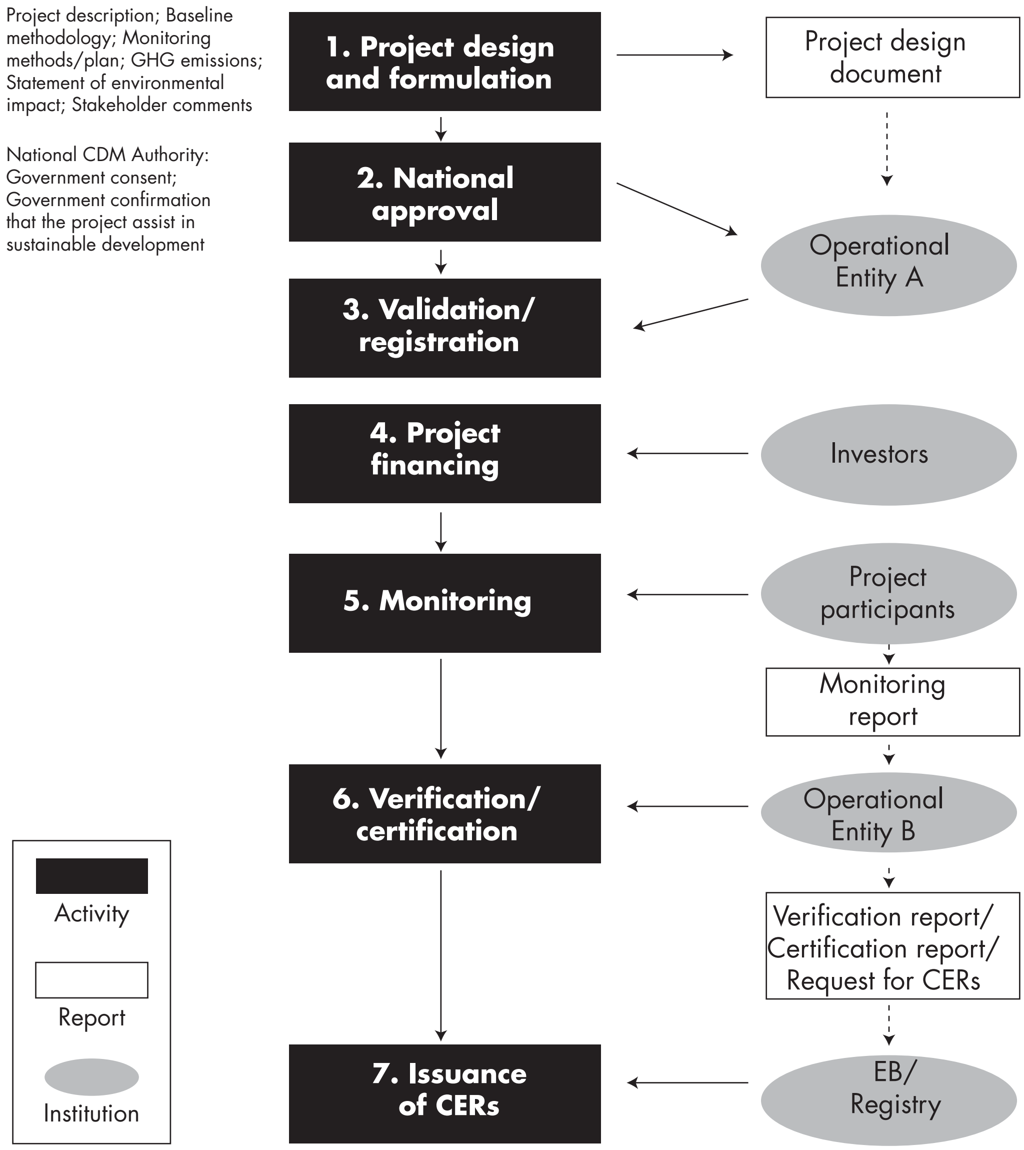
Barriers at the Government Level

- *Subsidized energy prices* – Although governments usually understand that rationalized energy prices make economic sense and that price rationalization usually involves removing subsidies, the resulting higher prices are obviously unpopular with consumers. Raising energy prices is thus politically difficult for politicians and government agencies to do.
- *Lack of capability and budgetary resources* – Governments typically have at least a general understanding of the benefits of energy efficiency. But they neither have the capability to design and administer EE programs nor the budgetary resources to support them.

- *Inability to enforce codes and standards* – Even where governments are willing to adopt appliance-efficiency standards or energy-efficient building codes, they lack the ability and/or will to enforce them. Because energy-efficient appliances are more expensive, a black market can develop to provide lower-cost, inefficient appliances. Likewise, the more expensive EE elements in building codes can be circumvented by builders if a culture of compliance with codes, and a capacity/willingness among building inspectors to enforce them, does not exist.
  - *Low priority:* Demand side management and EE are often regarded as a low priority, particularly for users whose energy costs are low relative to other costs.

Annex 2

CDM Project Cycle



Source: Introduction to the CDM, UNEP RISOE Centre, 2002.

Annex 3
Demand-Side EE Methodologies

	Approved	Rejected	Under Consideration
Consolidated	none	n/a	n/a
Large-Scale	• AM0017 (steam system efficiency at refineries) • AM0018 (steam system optimization) • AM0038 (energy efficiency of electric arc furnaces) • AM0044 (energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors) • AM0046 (distribution of efficient light bulbs to households)	• NM0086 (petrochemical industry) • NM0092-rev (smelter upgrade) • NM0099 / NM0101 / NM0137 / NM0154 (cement) • NM0100 (unitary equipment replacement) • NM0118-rev (brewery optimization) • NM0119 (process energy integration) • NM0169 (efficient utilization of energy in the form of fuel, power and steam) • NM0182 (advanced SCADA control systems & energy management) • NM159 (Activities to increase market penetration of energy efficient appliances)	• NM0197 (replacement of electrical equipment with variable load) • NM0195 (steam turbine replacement)
Small-Scale	• AMSII-C (specific technologies) • AMSII-D (industrial facilities) • AMSII-E (buildings)	n/a	n/a

Original source: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html and http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html
Updated table from Arquit Niederberger, 2007.

Annex 4

Approved CDM Methodologies that Use Sampling Procedures

AM002	Percentage of landfill gas that is methane (wCH4,y) - using a continuous analyzer or, alternatively, with periodical measurements, at a 95% confidence level, using calibrated portable gas meters and taking a statistically valid number of samples.
AM003	Percentage of landfill gas that is methane (wCH4,y) - using a continuous analyzer or, alternatively, with periodical measurements, at a 95% confidence level, using calibrated portable gas meters and taking a statistically valid number of samples.
AM007	**Sample biomass to determine whether it is used for other commercial or non-commercial purposes.**
AM010	Percentage of landfill gas that is methane (wCH4,y) - using a continuous analyzer or, alternatively, with periodical measurements, at a 95% confidence level, using calibrated portable gas meters and taking a statistically valid number of samples.
AM011	Percentage of landfill gas that is methane (wCH4,y) - using a continuous analyzer or, alternatively, with periodical measurements, at a 95% confidence level, using calibrated portable gas meters and taking a statistically valid number of samples.
AM017	25% sampling of operating conditions: pressure, efficiency, temperature, etc.
AM022	Indicator of baseline wastewater methane emissions. Organic material concentration can be sampled on site, but off-site analysis by an accredited lab is recommended.
AM025	**Fraction of fossil carbon in waste to be determined through sampling where the samples shall be chosen in a manner that ensures estimation with 20% uncertainty at 95% confidence level.**
AM028	In case non-dispersion infrared absorption analyzer is used, N2O concentration shall be checked by sampling by gas chromatography.
AM031	**May sample fuel efficiency and passengers transported.**
AM039	Samples with Oxygen content less than 10%. Measurement itself to be done by using a standardized mobile gas detection instrument.
AM040	MgO content of the raw meal due to non-carbonate sources via calcium silicates or raw materials.
AM046	**Sampling of households.**

Note: Methodologies in bold highlight rely heavily on sampling.

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List of Technical Reports

Region/Country	Activity/Report Title	Date	Number
	SUB-SAHARAN AFRICA (AFR)		
Regional	Power Trade in Nile Basin Initiative Phase II (CD Only): Part I: Minutes of the High-level Power Experts Meeting; and Part II: Minutes of the First Meeting of the Nile Basin Ministers Responsible for Electricity	04/05	067/05
	Introducing Low-cost Methods in Electricity Distribution Networks	10/06	104/06
	Second Steering Committee: The Road Ahead. Clean Air Initiative In Sub-Saharan African Cities. Paris, March 13-14, 2003	12/03	045/03
	Lead Elimination from Gasoline in Sub-Saharan Africa. Sub-regional Conference of the West-Africa group. Dakar, Senegal March 26-27, 2002 (Deuxième comité directeur : La route à suivre - L'initiative sur l'assainissement de l'air. Paris, le 13-14 mars 2003)	12/03	046/03
	1998-2002 Progress Report. The World Bank Clean Air Initiative in Sub-Saharan African Cities. Working Paper #10 (Clean Air Initiative/ESMAP)	02/02	048/04
	Landfill Gas Capture Opportunity in Sub Saharan Africa	06/05	074/05
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Cameroon	Decentralized Rural Electrification Project in Cameroon	01/05	087/05
Chad	Revenue Management Seminar. Oslo, June 25-26, 2003. (CD Only)	06/05	075/05
Côte d'Ivoire	Workshop on Rural Energy and Sustainable Development, January 30-31, 2002. *(Atelier sur l'Energie en régions rurales et le Développement durable 30-31, janvier 2002)*	04/05	068/05
Ethiopia	Phase-Out of Leaded Gasoline in Oil Importing Countries of Sub-Saharan Africa: The Case of Ethiopia - Action Plan	12/03	038/03
	Sub-Saharan Petroleum Products Transportation Corridor: Analysis and Case Studies	03/03	033/03
	Phase-Out of Leaded Gasoline in Sub-Saharan Africa	04/02	028/02
	Energy and Poverty: How can Modern Energy Services Contribute to Poverty Reduction	03/03	032/03
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	The Kenya Portable Battery Pack Experience: Test Marketing an Alternative for Low-Income Rural Household Electrification	12/01	05/01
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Mauritania	Phase-Out of Leaded Gasoline in Oil Importing Countries of Sub-Saharan Africa: The Case of Mauritania - Action Plan *(Elimination progressive de l'essence au plomb dans les pays importateurs de pétrole en Afrique subsaharienne Le cas de la Mauritanie – Plan d'action.*)	12/03	040/03
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	Nigerian LP Gas Sector Improvement Study	03/04	056/04
	Taxation and State Participation in Nigeria's Oil and Gas Sector	08/04	057/04
Senegal	Regional Conference on the Phase-Out of Leaded Gasoline in Sub-Saharan Africa *(Elimination du plomb dans l'essence en Afrique subsaharienne Conference sous regionales du Groupe Afrique de l'Ouest*	03/02	022/02
	Dakar, Sénégal. March 26-27, 2002.)	12/03	046/03
	Alleviating Fuel Adulteration Practices in the Downstream Oil Sector in Senegal	09/05	079/05
South Africa	South Africa Workshop: People's Power Workshop.	12/04	064/04
Swaziland	Solar Electrification Program 2001 2010: Phase 1: 2001 2002 (Solar Energy in the Pilot Area)	12/01	019/01
Tanzania	Mini Hydropower Development Case Studies on the Malagarasi, Muhuwesi, and Kikuletwa Rivers Volumes I, II, and III	04/02	024/02
	Phase-Out of Leaded Gasoline in Oil Importing Countries of Sub-Saharan Africa: The Case of Tanzania - Action Plan	12/03	039/03
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	Technology Assessment of Clean Coal Technologies for China Volume II-Environmental and Energy Efficiency Improvements for Non-power Uses of Coal	05/01	011/01
	Technology Assessment of Clean Coal Technologies for China Volume III-Environmental Compliance in the Energy Sector: Methodological Approach and Least-Cost Strategies	12/01	011/01
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Philippines	Rural Electrification Regulation Framework. (CD Only)	10/05	080/05
Thailand	DSM in Thailand: A Case Study	10/00	008/00
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	Greater Mekong Sub-region Options for the Structure of the GMS Power Trade Market A First Overview of Issues and Possible Options	12/06	108/06
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	Renewable Energy Action Plan	03/02	021/02
	Vietnam's Petroleum Sector: Technical Assistance for the Revision of the Existing Legal and Regulatory Framework	03/04	053/04
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	SOUTH ASIA (SAS)		
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Bhutan	Hydropower Sector Study: Opportunities and Strategic Options	10/07	119/07
	EUROPE AND CENTRAL ASIA (ECA)		
Azerbaijan	Natural Gas Sector Re-structuring and Regulatory Reform	03/06	099/06
Macedonia	Elements of Energy and Environment Strategy in Macedonia	03/06	100/06
Poland	Poland (URE): Assistance for the Implementation of the New Tariff Regulatory System: Volume I, Economic Report, Volume II, Legal Report	03/06	101/06
Russia	Russia Pipeline Oil Spill Study	03/03	034/03
Uzbekistan	Energy Efficiency in Urban Water Utilities in Central Asia	10/05	082/05
	MIDDLE EASTERN AND NORTH AFRICA REGION (MENA)		
Morocco	Amélioration de d´Efficacité Energie: Environnement de la Zone Industrielle de Sidi Bernoussi, Casablanca	12/05	085/05
Regional	Roundtable on Opportunities and Challenges in the Water, Sanitation And Power Sectors in the Middle East and North Africa Region. Summary Proceedings, May 26-28, 2003. Beit Mary, Lebanon. (CD)	02/04	049/04
Turkey	Gas Sector Strategy	05/07	114/07
	LATIN AMERICA AND THE CARIBBEAN REGION (LCR)		
Regional	Regional Electricity Markets Interconnections - Phase I Identification of Issues for the Development of Regional Power Markets in South America	12/01	016/01
	Regional Electricity Markets Interconnections - Phase II	04/02	016/01
	Proposals to Facilitate Increased Energy Exchanges in South America Population, Energy and Environment Program (PEA) Comparative Analysis on the Distribution of Oil Rents (English and Spanish)	02/02	020/02
	Estudio Comparativo sobre la Distribución de la Renta Petrolera Estudio de Casos: Bolivia, Colombia, Ecuador y Perú	03/02	023/02

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	Latin American and Caribbean Refinery Sector Development Report - Volumes I and II	08/02	026/02
	The Population, Energy and Environmental Program (EAP) (English and Spanish)	08/02	027/02
	Bank Experience in Non-energy Projects with Rural Electrification	02/04	052/04
	Components: A Review of Integration Issues in LCR	12/04	061/04
	Supporting Gender and Sustainable Energy Initiatives in Central America		
	Energy from Landfill Gas for the LCR Region: Best Practice and Social Issues (CD Only)	01/05	065/05
	Study on Investment and Private Sector Participation in Power Distribution in Latin America and the Caribbean Region	12/05	089/05
	Strengthening Energy Security in Uruguay	05/07	116/07
Bolivia	Country Program Phase II: Rural Energy and Energy Efficiency Report on Operational Activities	05/05	072/05
	Bolivia: National Biomass Program. Report on Operational Activities	05/07	115/07
Brazil	Background Study for a National Rural Electrification Strategy: Aiming for Universal Access	03/05	066/05
	How do Peri-Urban Poor Meet their Energy Needs: A Case Study of Caju Shantytown, Rio de Janeiro	02/06	094/06
	Integration Strategy for the Southern Cone Gas Networks	05/07	113/07
Chile	Desafíos de la Electrificación Rural	10/05	082/05
Colombia	Desarrollo Económico Reciente en Infraestructura: Balanceando las necesidades sociales y productivas de la infraestructura	03/07	325/05
Ecuador	Programa de Entrenamiento a Representantes de Nacionalidades Amazónicas en Temas Hidrocarburíferos	08/02	025/02
	Stimulating the Picohydropower Market for Low-Income Households in Ecuador	12/05	090/05
Guatemala	Evaluation of Improved Stove Programs: Final Report of Project Case Studies	12/04	060/04
Haiti	Strategy to Alleviate the Pressure of Fuel Demand on National Woodfuel Resources (English) *(Stratégie pour l'allègement de la Pression sur les Ressources Ligneuses Nationales par la Demande en Combustibles)*	04/07	112/07
Honduras	Remote Energy Systems and Rural Connectivity: Technical Assistance to the Aldeas Solares Program of Honduras	12/05	092/05
Mexico	Energy Policies and the Mexican Economy	01/04	047/04
	Technical Assistance for Long-Term Program for Renewable Energy Development	02/06	093/06
Nicaragua	Aid-Memoir from the Rural Electrification Workshop (Spanish only)	03/03	030/04
	Sustainable Charcoal Production in the Chinandega Region	04/05	071/05
Perû	Extending the Use of Natural Gas to Inland Perú (Spanish/English)	04/06	103/06
	Solar-diesel Hybrid Options for the Peruvian Amazon Lessons Learned from Padre Cocha	04/07	111/07
	GLOBAL		
	Impact of Power Sector Reform on the Poor: A Review of Issues and the Literature	07/00	002/00
	Best Practices for Sustainable Development of Micro Hydro Power in Developing Countries	08/00	006/00
	Mini-Grid Design Manual	09/00	007/00
	Photovoltaic Applications in Rural Areas of the Developing World	11/00	009/00

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	Subsidies and Sustainable Rural Energy Services: Can we Create Incentives Without Distorting Markets?	12/00	010/00
	Sustainable Woodfuel Supplies from the Dry Tropical Woodlands	06/01	013/01
	Key Factors for Private Sector Investment in Power Distribution	08/01	014/01
	Cross-Border Oil and Gas Pipelines: Problems and Prospects	06/03	035/03
	Monitoring and Evaluation in Rural Electrification Projects: A Demand-Oriented Approach	07/03	037/03
	Household Energy Use in Developing Countries: A Multicountry Study	10/03	042/03
	Knowledge Exchange: Online Consultation and Project Profile from South Asia Practitioners Workshop. Colombo, Sri Lanka, June 2-4, 2003	12/03	043/03
	Energy & Environmental Health: A Literature Review and Recommendations	03/04	050/04
	Petroleum Revenue Management Workshop	03/04	051/04
	Operating Utility DSM Programs in a Restructuring Electricity Sector	12/05	058/04
	Evaluation of ESMAP Regional Power Trade Portfolio (TAG Report)	12/04	059/04
	Gender in Sustainable Energy Regional Workshop Series: Mesoamerican Network on Gender in Sustainable Energy (GENES) Winrock and ESMAP	12/04	062/04
	Women in Mining Voices for a Change Conference (CD Only)	12/04	063/04
	Renewable Energy Potential in Selected Countries: Volume I: North Africa, Central Europe, and the Former Soviet Union, Volume II: Latin America	04/05	070/05
	Renewable Energy Toolkit Needs Assessment	08/05	077/05
	Portable Solar Photovoltaic Lanterns: Performance and Certification Specification and Type Approval	08/05	078/05
	Crude Oil Prices Differentials and Differences in Oil Qualities: A Statistical Analysis	10/05	081/05
	Operating Utility DSM Programs in a Restructuring Electricity Sector	12/05	086/05
	Sector Reform and the Poor: Energy Use and Supply in Four Countries: Botswana, Ghana, Honduras and Senegal	03/06	095/06
	Meeting the Energy Needs of the Urban Poor: Lessons from Electrification Practitioners	06/07	118/07
	Scaling Up Demand –Side Energy Efficiency Improvements Through Programmatic CDM	12/07	120/07

About World Bank Carbon Finance Unit (CFU)

The World Bank Carbon Finance Unit (CFU) uses money contributed by governments and companies in OECD countries to purchase project-based greenhouse gas emission reductions in developing countries and countries with economies in transition. The emission reductions are purchased through one of the CFU's carbon funds on behalf of the contributor, and within the framework of the Kyoto Protocol's Clean Development Mechanism (CDM) or Joint Implementation (JI).

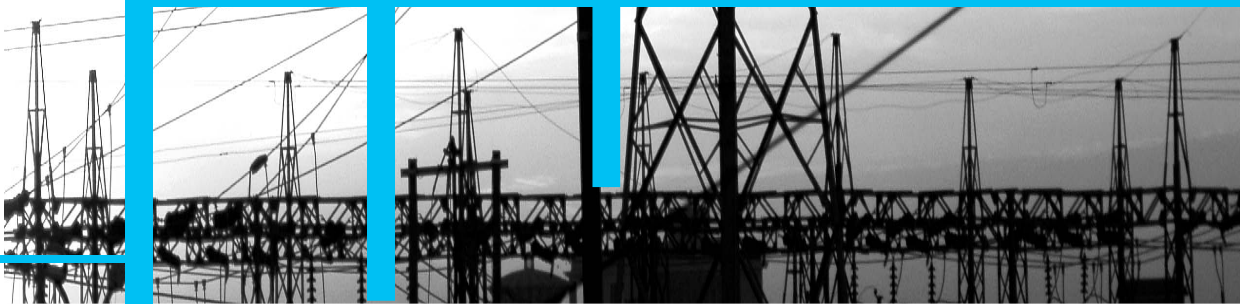
Unlike other World Bank development products, the CFU does not lend or grant resources to projects, but rather contracts to purchase emission reductions similar to a commercial transaction, paying for them annually or periodically once they have been verified by a third party auditor. The selling of emission reductions - or carbon finance - has been shown to increase the bankability of projects, by adding an additional revenue stream in hard currency, which reduces the risks of commercial lending or grant finance. Thus, carbon finance provides a means of leveraging new private and public investment into projects that reduce greenhouse gas emissions, thereby mitigating climate change while contributing to sustainable development.

The Bank's carbon finance operations have demonstrated numerous opportunities for collaborating across sectors, and have served as a catalyst in bringing climate issues to bear in projects relating to rural electrification, renewable energy, energy efficiency, urban infrastructure, waste management, pollution abatement, forestry, and water resource management.

The World Bank's carbon finance initiatives are an integral part of the Bank's mission to reduce poverty through its environment and energy strategies. The threat climate change poses to long-term development and the ability of the poor to escape from poverty is of particular concern to the World Bank. The impacts of climate change threaten to unravel many of the development gains of the last several decades. The Bank is therefore making every effort to ensure that developing countries can benefit from international efforts to address climate change.

A vital element of this is ensuring that developing countries and economies in transition are key players in the emerging carbon market for greenhouse gas emission reductions. The role of the Bank's Carbon Finance Unit is to catalyze a global carbon market that reduces transaction costs, supports sustainable development and reaches and benefits the poorer communities of the developing world.

For more information, please visit our website: **www.carbonfinance.org.**



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