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The Use of Carbon Credit Mechanisms to Finance Transportation Improvements in the Developing World.

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Abstract

The United Nation's Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases.

The Convention's Clean Development Mechanism (CDM) finances emission-reduction projects by allowing developing countries to earn saleable certified emission reduction credits that can be used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol. As a policy to promote global sustainability the program aims to stimulate sustainable development and emission reductions, while giving industrialized nations some flexibility in how they meet their emission reduction limitation targets.

After 10 years of operation the program lists 4,372 active projects and claims 11 billion tonnes of current and future carbon emission reductions (ERs), making it the world's largest generator of carbon offset credits. A wide range of projects qualify through more than 150 methodologies approved to quantify the carbon reductions. Of the 4,372 registered projects, 16 projects are identified in the transport sector, generating 49 million total current and future tonnes of carbon credits and an estimated 403 million euros of funding for the project development.

This paper provides some background on the CDM program, then reviews the 19 approved methodologies and 16 accredited transport projects that comprise the program. Registered projects include Bus Rapid Transit investments, Metros, freight initiatives and an alternative fuels project. The paper focuses on the quantified emissions impacts to demonstrate the range of outcomes that have been, and can be, financed with carbon credits. The authors then discuss factors that may be contributing to the relatively thin participation of the transport sector in CDM finance and suggest strategies to possibly enhance transport participation in the program.

Keywords

Carbon financing, public transport, urban development, alternative fuels, project finance, sustainability

1. Introduction

Under the Clean Development Mechanism (CDM) introduced by the 1997 Kyoto Protocol, industrialized countries (Annex I countries) can finance projects in developing countries (non-Annex I counties) that reduce greenhouse gas (GHG) emissions by purchasing Certified Emission Reductions (CERs) resulting from the project activities, which will assist the Annex I countries towards their Kyoto emission targets. Companies in Annex I countries can also purchase CERs for complying with their emission reduction obligations. The objective of the mechanism is to tap into low-cost emission reduction potentials (using the marginal cost of abatement) for meeting Kyoto targets in the "rich" countries while also creating a pathway for results-based funding for clean development in non-Annex I counties. The approach is justified by the fact that Annex I countries' emissions have held relatively constant since 1990, while "developing" countries' emissions have skyrocketed in the past twenty years (IEA 2011). Some of this growth is preventable with relatively small investments in clean technology.

The Kyoto protocol spawned the United Nations Framework Convention on Climate Change (UNFCCC), which governs the CDM process. The first projects were registered with the UNFCCC CDM in 2001, and the first CERs were issued in 2005. As of August 2012, over 4,000 projects have been registered with more than 11 billion current and future CERs. The projects registered are organized by the scope of their impacts. The scope with the largest number of registered projects is Energy, with over 80% of all projects, while Transport falls in at just 0.3% of projects.

Table 1 **Numbers of Registered CDM Projects by Type**	**Total Projects**	**Percent of Total**	**Total Estimated Millions of ERs by 2030** (tCO2)	**Percent of Total**
Energy	3,585	82.0%	6,494	58.9%
Waste Handling and Disposal	344	7.9%	1,110	10.1%
Industrial and Manufacturing	389	8.9%	3,326	30.2%
Forestry	39	0.9%	42	0.4%
Transportation	**16**	**0.3%**	**46**	**0.4%**
Totals	*4,372*	*100.0%*	*11,017*	*100.0%*

Source: Institute for Global Environmental Strategies CDM Project Database (Last Update 1 Aug. 2012), http://www.iges.or.jp/en/cdm/report_cdm.html

How is a Carbon Emission Reduction created and certified?

The ultimate test for a CER, which represents one ton of carbon dioxide equivalent (tCO_2e), is that it must be *additional* and *verifiable* to be trustworthy for trading and therefore for offsetting emissions elsewhere.

Additionality is the concept that a project that leads to emission reductions must face significant barriers, (usually financial hurdles) that would result in the project *never having been realized* without the influence of CDM. Therefore, the UNFCCC can declare that this project is not business-as-usual, and indeed represents an additional carbon offset created by virtue of the money that is transferred to the project proponent. Projects can also establish additionality by the demonstration of limited access to capital in the absence of the CDM, the demonstration of non-availability of human capacity to operate and maintain the technology, unavailability of the technology and high level of technology risk, being first of its kind in terms of technology, geography, sector, type of investment or investor, the presence of institutional barriers or limited information including managerial resources, organizational capacity, or capacity to absorb new technologies.

For example, if Kenya wants to build a new power plant, the cost of a coal power plant might be less than a geothermal power plant, so under normal market conditions the Kenyans would always choose coal. Thus, a geothermal plant would be "additional" because the income from the sale of CERs generated by substituting geothermal for coal would make the project activity financially feasible while reducing GHG emissions. If geothermal is already cheaper than coal, or if Kenya has a law prohibiting new coal power plants, or a myriad of other conditions, then the project is not additional and therefore ineligible for CDM funding.

Once additionality has been ascertained, the Project Design Document (PDD) is drafted to establish a carbon emission baseline expected in the absence of the CDM financed project and a mechanism for verification using a thorough emission reduction calculation formula. The formulae are defined in methodologies that vary from project to project and include everything from leakage in pipes, inefficiencies, and project emissions from motor vehicles and other fossil fuel uses.

The methodologies tend to be extremely data-intensive and specific, and are used for third party validation and verification before the UNFCCC issues any CERs to the project proponents. The entire CDM process requires careful planning and detailed documentation. Planning, documentation and certification can take anywhere from six to eighteen months, and cost between $60,000 and $200,000, depending upon the project type and scale.

As noted earlier, Certified Emission Reduction credits are sold to entities in developed Annex I countries. The credits are generated over a single ten year term or for a seven year term that can be renewed twice for a total accreditation of 21 years. The total sum of financing benefits flowing to projects is greater when the term is longer, but the present value of those benefits is diminished as the finance stream extends far into the future. Thus some CDM projects elect to take a simpler but shorter ten year payout.

2. CDM Market Developments

CDM is an evolving mechanism that has changed significantly since its inception. Every year, new baseline and verification methodologies are added, allowing for new and innovative project types to be added to the registry. However, in recent years, the price of CERs on the international exchange markets has been suffering. As of August 2012, the price is at its lowest level ever, a mere €2.90 per CER, whereas in years past a CER has been worth upwards of €20.00. The current low price has been attributed to several factors, including:

- the decreasing demand for CERs from the European market as they are reducing emissions domestically
- the large increase in CER supply, mostly generated by middle-income countries such as China, India, and Brazil.

In light of these developments, the European Union will cease accepting CERs from middle-income countries in 2013, and only accept CERs from Least Developed Countries (LDCs), which provides a glimmer of hope for countries such as Ethiopia that are only beginning to have the capacity to access CDM funding.

It is worthwhile to mention two other relevant mechanisms, the voluntary carbon market and Nationally Appropriate Mitigation Actions (NAMAs), which have emerged to provide alternative mechanisms for carbon credit finance.

- The Voluntary Market uses guidelines and methods similar to UNFCCC's, but the resulting credits, coined Voluntary Emission Reductions (VERs) are verified outside of the UN system, and are purchased by countries, companies, and individuals who wish to voluntarily reduce their emissions. This is called the "non-compliance market" versus the "compliance market" developed by the Kyoto protocol. Entities that wish to market themselves as "carbon-neutral" use VERs to offset emissions from their core activities. For example, Microsoft recently announced that all of its data centers, software labs, air travel and office buildings will soon be carbon neutral. While Microsoft will certainly seek to reduce their footprint by increasing efficiency, they will also use VERs to reach carbon neutrality. The pricing for VERs is not centralized, and can vary wildly from mere cents per VER up to $20 per VER depending upon the type of project, the broker, and the purchaser. Whereas CER carbon credits trade like a commodity, the voluntary VER credits are marketed in part based on their unique non-carbon attributes. (e.g. projects that also boost community development or social equality might be able to garner a premium compared with a more straightforward fuel substitution or energy efficiency project.)

- The Nationally Appropriate Mitigation Action (NAMA) program allows governments of developing countries to domestically create and support a voluntary intervention that directly or indirectly reduces Green House Gas (GHG) emissions. NAMAs, created under the 2007 Bali Action Plan, are more focused on orienting established patterns of international aid to more explicitly support climate change goals. The NAMA mechanism avoids the shortcomings of the market-based CER tool that is currently under-stimulating investment due to the low price of CERs. The NAMA lies outside the strictures of the market-based UNFCCC process. Certified projects are registered in a NAMA database providing a menu of candidate projects to be potentially supported with investments by developed countries as they meet their overseas development assistance goals. Annex I countries are expected to support projects where some of the funding will flow back to their own economy as domestic consultants and developers work overseas on the NAMA. Non-Annex I countries stand to benefit from "free" investment, capacity development and technology transfer. Annex I countries benefit because their industries can capitalize on the growth of economies in the developing world, and the global climate benefits because the projects result in measureable, reportable, and verifiable emission reductions – all without the use of the CER carbon transaction unit. Locally the Ethiopian Railway together with Ecofys consultants are drafting the outline of a NAMA to electrify domestic rail lines and re-establish the rail link to the port of Djibouti.

3. CDM Methodologies and Registered Transport Projects

The entire CDM process, regardless of whether it relies on UNFCCC or VERs funding, relies on the application of accepted methodologies to document and verify that investment projects do in fact reduce carbon emissions. In total, the UNFCCC recognizes 87 distinct methodologies for the evaluation of potential large scale CDM projects and 84 for smaller scale projects.[i] The transport sector features 19 different methodologies, of which only six have been employed for successfully registered projects. The methodologies encompass:

- Energy efficiency by shifting travel from automobiles and trucks to bicycles, cable cars, buses and trains
- Fuel substitution using biodiesel, ethanol, or electric to replace fossil fuels
- Efficiency gains through retrofits and routing services.

Table 2 lists all nineteen methodologies and the projects that have been registered and financed with each technique.

Table 2: CDM Methodologies for Transport Project Evaluation

	Code	Name	Projects	Registry
UNFCCC CDM Large (>60,000 tCO2e/year)	AM0016	Mass Rapid Transit Projects	BRT Lines 1-5 EDOMEX, Mexico	CDM
			Metro Delhi, India	CDM
			BRT Metrobus Insurgentes, Mexico	CDM
			Mumbai Metro One, India	CDM
			Metro Line 12, Mexico City	CDM
	AM0017	Production of waste cooking oil-based biofuel for use as fuel	-	
	AM0031	Bus rapid transit projects	BRT Bogotá, Colombia: TransMilenio Phase II to IV	CDM
			BRT Chongqing Lines 1-4, China	CDM
			BRT Zhengzhou, China	CDM
			BRT Transmetro Barranquilla, Colombia	CDM
			BRT Macrobus Guadalajara, Mexico	CDM
			BRT MIO Cali, Colombia	CDM
			BRT Metroplus Medellin, Colombia	CDM
			BRT Rea Vaya Phase 1a and 1b, South Africa	VERS
			BRT High capacity segregated corridor (COSAC I), Peru	VERS
	AM0090	Modal shift in transportation of cargo from road transportation to water or rail transportation	-	
	AM0101	High speed passenger rail systems	-	
UNFCCC CDM Small (<60,000 tCO$_2$e/year)	AMS-III.C.	Emission reductions by electric and hybrid vehicles	Installation of Low Green House Gases (GHG) emitting rolling stock cars in metro system, India	CDM
			Modal Shift from Road to Train for transportation of cars, India	CDM
	AMS-III.S.	Introduction of low-emission vehicles/technologies to commercial vehicle fleets	-	
	AMS-III.T.	Plant oil production and use for transport applications	Plant-Oil Production for Usage in Vehicles, Paraguay	CDM
	AMS-III.U.	Cable Cars for Mass Rapid Transit	Cable Cars Metro Medellín, Colombia	CDM
	AMS-III.AA.	Transportation Energy Efficiency Activities using Retrofit	-	
	AMS-III.AK.	Biodiesel production and use for transport applications	-	
	AMS-III.AP.	Transport energy efficiency activities using post - fit Idling Stop	-	

Table 2: CDM Methodologies for Transport Project Evaluation				
	Code	**Name**	**Projects**	**Registry**
	AMS-III.AQ.	Introduction of Bio-CNG in transportation applications	-	
	AMS-III.AT.	Transportation energy efficiency activities installing digital tachograph systems to commercial freight transport fleets	-	
	AMS-III.AY.	Introduction of LNG buses to existing and new bus routes	-	
	AMS-III.BC.	Emission reductions through improved efficiency of vehicle fleets	-	
Voluntary VERS	VCS under review	Methodology for Determining GHG Emission Reductions Through Bicycle Sharing Projects	-	
	VM0019	Fuel Switch from Gasoline to Ethanol in Flex-Fuel Vehicle Fleets	-	
	GS VER	Biodiesel from waste oil/fat from biogenic origin for use as fuel	-	

The most successful transport methodologies cover mass transport corridor investments and some alternative fuels as described below. Other less successful methodologies cover freight transport, high speed rail, fleet efficiency and other alternative transport fuels.

Bus Rapid Transit	**AM0031**	Nine CDM & VCS projects	€1,029 million total value	28 million tonnes in reductions	€232 million in finance

Bus rapid transit is a fixed guideway transit service that uses buses on exclusive lanes for operation of urban trunk routes. The methodology estimates and documents emission reductions resulting from the construction and operation of a BRT system for urban transport. AM0031 compares emissions per passenger trip in the project area with a baseline condition that would exist in the absence of the project. (Grütter 2007).

Mass Rapid Transit	**AM0016**	Five CDM projects	€3,430 million total value	20 million tonnes in reductions	€162 million in finance

Mass Rapid Transit Systems (MRTS) include urban and suburban passenger services that can be based on elevated, surface level or underground roads or rail systems. They may be rail-based systems such as subways/metros, Light Rail Transit (LRTs) systems, including trams, or suburban heavy duty rail systems or road-based bus systems. For BRTs with feeder plus trunk routes, the above methodology AM0031 is more suitable. However, BRTs without feeder lines, where passengers realize their trip partially on the project system and partially on conventional buses, use this methodology instead.

Cable Car Mass Transit	**AMS-III.U**	One project	€8 million total value	0.4 million tonnes in reductions	$3 million in finance

The highly specific cable car methodology was used for an urban cable car project in Medellin

Colombia. The electric cable cars substitute for traditional road based transport trips. The calculation of baseline and project emissions is based on total emissions from trip origin to trip destination using this distinctive mode of transport.

Electric & Hybrid Vehicles	**AMS-III.C**	Two projects	€55 million total value	0.6 million tonnes in reductions	$5 million in finance

The emission reduction methodology has been used in two projects in India (Installation of Low Green House Gases emitting rolling stock cars in metro system, and Modal Shift from Road to Train for transportation of finished automobiles). The methodology has reached its 13th version in 2010 after being first accepted in 2002. This methodology estimates emission reductions resulting from the introduction of new electric and/or hybrid vehicles to displace fossil fuel vehicles for passenger and freight transportation.

A similar methodology focusing on the introduction of low-emission vehicles/technologies to commercial vehicle fleets (AMS-III.S.) has had no projects registered. With AMS-III.S., all low-GHG vehicles are permitted, not only electric, and the retrofit of existing vehicles is also an option. A third methodology, Transportation Energy Efficiency Activities using Retrofit Technologies (AMS-III.AA.), has also had no projects registered since the methodology's acceptance in 2009. Here an engine retrofit for existing/used vehicles in commercial passenger transport results in increased fuel efficiency of the vehicle with consequent reduction in GHG emissions.

Plant oil production and Transport use	**AMS-III.T**	One project	$2 million total value	0.1 million tonnes in reductions	$.8 million in finance

This methodology covers the cultivation of oilseeds, the production of plant oil and the use of plant oil for transport fuel and lubricants. A similar methodology covering biodiesel production and use (AMS-III.AK.), has had no projects registered. This methodology includes waste oil and fat for biodiesel production.

Other methodologies have not yet been employed to certify emission reductions and finance project investments. Some of these methodologies are described below.

Modal shift in transportation of cargo from road transportation to water or rail transport	**AM0090**

This methodology is applicable to projects that shift the transportation of a specific cargo from trucks to rail or maritime (barge or ship) transport. The method covers

- direct investment in new infrastructure for water or rail transport; and
- refurbishment/replacement of existing water and rail transportation infrastructure or equipment, with transport capacity expansion.

This methodology was prepared by ArcelorMittal Tubarão and accepted by the CDM executive board in 2010 for a project under development in Brazil, but as of yet no projects have been registered. Two projects in India were rejected.

High speed passenger rail systems	**AM0101**

High Speed Rail (HSR) is a system of rail infrastructure, rolling stock and operations that provides passenger service speeds equal to or greater than 250 km/h and up-graded high-speed rail lines equipped for speeds of at least 200 km/h. The high speed rail methodology was accepted in 2012, prepared by Grütter Consulting AG (who also prepared ACM0016 and AM0031 and several other methodologies), but as of yet no projects have been registered.

The HSR project must establish a new rail-based infrastructure supporting an average design speed between the origin and the destination of at least 200 km/h. The project can extend an existing HSR or upgrade an existing line to HSR standards. All systems must electrically powered.

Emission reductions through improved efficiency of vehicle fleets	**AMS-III.BC**

The methodology considers improved operational efficiency of vehicle fleets (e.g. fleets of trucks, buses, cars, taxis or motorized tricycles), resulting in reduced fuel usage and greenhouse gas emissions. Supported improvements include idling stop devices, eco-drive systems, tire-rolling resistance improvements, air-conditioning improvements, low viscosity oils, aerodynamic measures, and transmission improvements.

No projects have been registered under the similar transport energy efficiency activities using post - fit Idling Stop device methodology (AMS-III.AP). It is only applicable for idle stop device retrofits on vehicles using conventional petroleum based fuels.

Another similar methodology applies to commercial freight transport fleets where digital tachograph systems are used to enhance fuel efficiency (AMS-III.AT). The system uses GPS tools to assist urban delivery vehicle operators to determine the most direct and efficient routes for pickups and deliveries. The system provides feedback to the driver to inhibit inefficient driving using voice reminders and other cues.

Emission reductions through improved efficiency of vehicle fleets	**AMS-III.AQ**

This methodology covers the production and use of Biogenic Compressed Natural Gas (Bio-CNG) from renewable biomass including waste organic matters to be used in transportation applications. The crops from renewable biomass origin used for production of the Bio-CNG should be sourced from dedicated plantations.

Introduction of LNG buses to existing and new bus routes	**AMS-III.AY**

The methodology covers the introduction of LNG buses to existing and new routes for passenger transportation.

Table 3: Investment and CER Details for Registered Transport Projects

Project	**Estimated Initial Investment** (Millions of Euros)	**Crediting duration** (years)	**Total estimated ERs** (Millions of tCO2)	**Estimated ER income** (Millions of Euros)	**CDM Finance as % of Project Cost**
BRT Chongqing Lines 1-4, China	41	21	4.94	39	97%
Cable Car Metro Medellín, Colombia	8	21	0.40	3	41%
Plant-Oil Fuel Production, Paraguay	2	21	0.12	1	37%
BRT Barranquilla, Colombia	54	21	1.26	11	21%
BRT Macrobus Guadalajara, Mexico	57	21	1.16	10	18%
BRT Metrobus Insurgentes, Mexico	43	21	0.89	7	17%
BRT Lines 1-5 EDOMEX, Mexico	173	21	3.18	26	15%
BRT TransMilenio Bogotá, Colombia	425	21	6.31	50	12%
Rail Transport of New Automobiles, India	17	10	0.23	2	10%
Low GHG metro rolling stock, India	39	10	0.41	3	8%
Metro Delhi, India	1,444	21	11.18	92	6%
Metro One Mumbai India	338	10	1.96	14	4%

Table 3: Investment and CER Details for Registered Transport Projects					
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BRT (COSAC I), Peru	151	10	0.69	5	3%
Metro Line 12, Mexico City	1,433	21	2.70	23	2%
BRT Rea Vaya, South Africa	302	10	0.40	3	1%
BRT Zhengzhou, China	NA	21	4.98	42	NA
BRT MIO Cali, Colombia	NA	21	4.43	38	NA
BRT Metroplus Medellin, Colombia	NA	21	3.86	35	NA
Totals	*4,525*		*49.10*	*403*	

Source: Institute for Global Environmental Strategies CDM Project Database (Last Update 1 Aug. 2012), http://www.iges.or.jp/en/cdm/report_cdm.html and authors' analysis of sponsors' project design documents.

4. Financial Benefits of CDM Finance for Transport Development

In total CDM has netted €403 million in current and future finance for more than €4.5 billion in transport project investment in the developing world. This comprises somewhat less than 10% of initial project costs for all 18 projects. These figures, while impressive, are a tiny fraction of the overall billions of finance generated for all projects funded with CDM monies.

Table 3 was compiled from review of the project design documents filed for the 16 registered transport projects with CDM and 2 registered transportation projects with VER. These data show that not all projects derive the same benefits from the CDM. The author's estimates of ER revenues are based on the historical CER price and a projection of future prices for CER of approximately €8 per tonne after 2014.

Review of Table 3 allows us to make observations concerning CDM in the transport sector.

- First, the overwhelming majority of transport CDM projects are developed in the middle-income countries.

- Second, CER finance as a fraction of initial investment project costs varies widely from a high of 97% to a low of 1%. Overall carbon credits finance somewhat less

- Third, projects that rely on mode shift for their CDM credits tend to be most efficient when the project development costs are relatively low. Capital intensive metro rail investments tend to be inefficient producers of carbon credits relative to total project cost.

- Fourth, the low ER revenue to project cost ratios for Metro projects suggests that considerable tact and delicacy can (and must) be applied in establishing "additionality" for very large scale urban developments. (It's hard to conceive how a one or two percent contribution to overall project cost can be framed as absolutely critical to project success.)

5. Transport Challenges for CDM Finance

Reviewing the project design documents for the 16 successful CDM projects and scanning the literature on CDM for transport project development at least two "challenges" are apparent.

First, the methodologies for evaluation of transport CDM projects, particularly those that focus on shifting urban transport mode share away from automobiles (and trucks) are *complex and data* *intensive*. The planning horizon and data necessary to establish a credible baseline and plausible mode shift are substantial, requiring time and funding.

- According to a review of transport sector methodologies by the Clean Air Institute (2011), "CDM is considerably data-intensive due to the requirement for verification of progress during the lifetime of the project and the need to undertake ex-ante and ex-post analyses. These data may also not be readily available in developing countries. Costly data collection which frequently exceeds what CDM credits pay."

- According to ITDP (2011), CDM methodologies require $300,000-500,000 up-front costs for data collection, along with $60,000-100,000 per year for on-going monitoring, which can be more than the actual income from ERs. Furthermore, the use of default data must be sharply discounted, as conservative numbers may miss the benefits all together. To approach this problem, ITDP developed a number of Transport Emissions Evaluation Models (TEEMP) for structured GHG emission reduction estimation for a variety of different project types, including pedestrian, bike share, bikeways, roads improvement, BRT, and MRT.

- A team from the Wuppertal Institute for Climate, Environment and Energy (Eichorst 2010) supports the other research noting that complex methodologies for evaluation of transport projects poses a problem for project development.

This challenge can be addressed by starting the CDM process early in the project lifecycle and enlisting the support of experts that have a successful track record with UNFCCC.

Second, the *risk/reward* equation for CDM finance of many potential projects is not favorable. Transport projects tend to be very capital intensive and the fraction of overall cost that can be covered with CDM finance can be quite low, especially when overall project costs are high.

This challenge can be addressed by early evaluation to determine whether the project is a good candidate for CDM finance and the likely fraction of overall project cost that can financed with CDM. As the catalog of successful (and unsuccessful) applications for CDM finance grows, the predictability of the CDM process should improve, reducing the risks of CDM compared with potential rewards.

6. Strategies for Success

A review of the 18 registered projects suggests some strategies to be considered for successful carbon finance of transport development projects.

- **Start Early** – The CDM process is complex and time consuming. To avoid delays and uncertainty, project developers are encouraged to begin exploring the potential for CDM finance as early as possible in the project development cycle.

- **Leverage the Work of Others** – Study the publicly available project documents for comparable projects before you commit to CDM finance. Enlist support from successful CDM transport developers. Some organizations have a strong track record in successfully securing CDM registration. Over half the registered transport CDMs were developed with the assistance of a single Swiss entity.

- **Focus on CDM Efficiency** – If your principal goal is to generate transport development investment via the sale of carbon credits, then focus on projects where the ratio of carbon finance to overall project cost is most favorable. The most favorable terms seem to be for fuel substitution projects and relatively low capital bus rapid transit projects.

  Capital intensive metro rail projects have laudable impacts on urban mobility, community integration and economic development but generally score relatively low in generating air quality and energy benefits. This finding is consistent with long experience among Annex I countries investing in public transport since the 1970's to achieve air quality and energy goals. It has been increasing recognized (and grudging acknowledged) that while high capital rail projects are very attractive on many dimensions they are relatively inefficient in generating air quality and energy benefits via mode shift. In the developing world, the mode shift benefits are even more modest as fewer trips are shifted from single occupant automobiles and a larger fraction of forecast metro trips represent travel that wouldn't have been made in the absence of the project investment.

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[i] UNFCCC also has separate catalog of methodologies for forestry projects.

Appendix A: CDM Financed Transport Projects World Wide (as of August 2012)

Transport Projects	Host Party	Project Consultant	Project type	Scale	Registry	Methodology	Crediting duration (years)	Total estimated ERs (tCO2)	Estimated ER income (EUR)	Estimated initial investment (EUR)	ER income percentage of project cost
BRT Chongqing Lines 1-4, China	China	Grütter Consulting AG	BRT	LARGE	CDM	AM0031	21	4,941,339	39,383,462	40,600,000	97%
Cable Cars Metro Medellin, Colombia	Colombia	Grütter Consulting AG	Urban Transport	SMALL	CDM	AMS-III.U.	21	401,560	3,203,265	7,800,000	41%
Plant-Oil Production for Usage in Vehicles, Paraguay	Paraguay	Ecotawa AG	Bio Fuel	SMALL	CDM	AMS-III.T.	21	120,319	786,855	2,100,000	37%
BRT Transmetro Barranquilla, Colombia	Colombia	Corporación Andina de Fomento	BRT	LARGE	CDM	AM0031	21	1,260,822	10,999,221	53,500,000	21%
BRT Macrobus Guadalajara, Mexico	Mexico	Corporación Andina de Fomento	BRT	LARGE	CDM	AM0031	21	1,161,624	10,097,147	57,000,000	18%
BRT Metrobus Insurgentes, Mexico	Mexico	International Bank for Reconstruction and Development Finance	BRT	LARGE	CDM	ACM0016	21	894,066	7,339,242	42,600,000	17%
BRT Lines 1-5 EDOMEX, Mexico	Mexico	Grütter Consulting AG	BRT	LARGE	CDM	ACM0016	21	3,181,980	25,677,010	172,800,000	15%
BRT Bogotá, Colombia: TransMilenio Phase II to IV	Colombia	Ministry of Housing, Spatial Planning and Environment (VROM)	BRT	LARGE	CDM	AM0031	21	6,307,805	49,673,801	425,000,000	12%
Modal Shift from Road to Train for transportation of cars	India	-	Freight	SMALL	CDM	AMS-III.C.	10	230,000	1,610,000	16,827,759	10%
Installation of Low Green House Gases (GHG) emitting rolling stock cars in metro system, India	India	Japan Carbon Finance Ltd.	Other	SMALL	CDM	AMS-III.C.	10	411,600	3,237,542	38,600,000	8%
Metro Delhi, India	India	Grütter Consulting AG	Metro	LARGE	CDM	ACM0016	21	11,181,927	91,529,462	1,444,000,000	6%
Mumbai Metro One, India	India	Grütter Consulting AG	Metro	LARGE	CDM	ACM0016	10	1,955,468	14,137,423	338,000,000	4%
High capacity segregated corridor (COSAC I), Peru	Peru	Carbon Solutions Group Latin America S.A.C.	BRT	LARGE	VCS	AM0031	10	688,308	4,840,959	151,000,000	3%
Metro Line 12, Mexico City	Mexico	Grütter Consulting AG	Metro	LARGE	CDM	ACM0016	21	2,696,601	22,893,888	1,433,000,000	2%
BRT Rea Vaya Phase 1a and 1b, South Africa	South Africa	Grütter Consulting AG	BRT	LARGE	VCS	AM0031	10	398,292	2,501,256	302,000,000	1%
BRT Zhengzhou, China	China	Grütter Consulting AG	BRT	LARGE	CDM	AM0031	21	4,979,296	41,631,162	No investment analysis	Not available
MIO Cali, Colombia	Colombia	Corporación Andina de Fomento	BRT	LARGE	CDM	AM0031	21	4,429,480	38,462,144	No investment analysis	Not available
BRT Metroplus Medellin, Columbia	Colombia	Gütter Consulting AG	BRT	LARGE	CDM	AM0031	21	3,861,810	34,648,765	No investment analysis	Not available
							Totals	49,102,297	402,652,604	4,524,827,759	

Source: Institute for Global Environmental Strategies CDM Project Database (Last Update 1 Aug. 2012), http://www.iges.or.jp/en/cdm/report_cdm.html