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NAMAs, CDM and MRV: the case of transport sector

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Summary Points:

- This paper reinforces the need for a robust yet simplified MRV framework to make NAMAs work on a large scale providing opportunities to countries and sectors less benefited by the CDM.
- The discussion focused on the transport sector – reviewed the trend and expectations of submitted transport NAMAs then examined the performance of transport projects under the Clean Development Mechanism to find lessons that may be applicable in the design of an MRV framework for supported and credited NAMAs that is practical and appropriate to the data requirements of the transport sector.
- The author highlights the need for credible data to ensure that transport NAMAs can be implemented in an MRVable manner.

Keywords: transport; nationally appropriate mitigation action (NAMA); clean development mechanism (CDM); measurable, reportable and verifiable (MRV); CDM methodology for transport

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1. Introduction

The Bali Action Plan (UN, 2007) called for enhanced mitigation actions through the introduction of the nationally appropriate mitigation actions (NAMAs) to be taken by developing countries. BAP paragraph 1(b) (ii) states: "Nationally appropriate mitigation actions by developing country Parties in the context of sustainable development supported and enabled by technology, financing and capacity-building, in a *measurable , reportable and verifiable manner*". Depending on the support needed, NAMAs are classified into three types:

- Unilateral NAMAs: actions voluntarily taken by developing countries without any external support,
- Supported NAMAs: additional actions developing countries are willing to take with support in the form of technology, financing and capacity building and,
- Credited NAMAs: further actions developing countries are willing to take to generate emission reduction credits tradable in market-based financial mechanism, much like the current Clean Development Mechanism (CDM)

A credible measurement, reporting and verification (MRV) system is necessary to ensure transparency in tracking countries' progress unilaterally and collectively in reducing GHG emissions, and enable recognition of mitigation actions while linking developing country actions to international support. To this end, the Cancun Agreements on MRV for NAMAs as per Decision 1/CP.16 (UN, 2010) states that internationally supported NAMAs will be measured, reported, and verified domestically and will be subject to international MRV guidelines to be developed under the United Nations Framework Convention on Climate Change (UNFCCC). Domestically supported NAMAs will be MRVed domestically in accordance with general guidelines to be developed under the UNFCCC. NAMAs considered should also include information on domestic MRV and support received. In addition, a work program was agreed for the development of the modalities and guidelines for MRV of supported actions and corresponding support. A Standing Committee under COP will be established to assist on "MRV for support" provided to developing country Parties.

The UNFCCC is yet to release the MRV guidelines both for internationally supported NAMAs and domestically supported NAMAs. Expectations are high that with the intention of NAMAs to enable large scale emission reductions in developing countries, it is envisaged that the forthcoming MRV framework for internationally supported or even credited NAMAs will be less stringent than the MRV system under the CDM.

Setting up the MRV framework for NAMAs will be a highly political process. While waiting for the official MRV guidelines for NAMAs from UNFCCC, it is worthwhile to review and learn from an existing MRV system under CDM and examine how it can be simplified to possibly work for transport NAMAs.

2. Review of submitted transport NAMAs

The NAMA definition is left broad and unclear after neither COP 13 in Bali nor in the subsequent negotiations. It seems that NAMAs are likely to be defined as any kind of activity that reduces GHG emissions (Wang-Helmreich *et al*, 2011). It can be specific actions (e.g similar to a CDM project), aggregated targets such as emission targets, or policies implemented at national, regional or local level.

Currently there are already 44 NAMA submissions to the UNFCCC even though modalities and procedures for NAMAs are still evolving. More than half, 28 of the 44 (64%) NAMA submissions include activities in the transport sector as shown in Table 1 below.

Table 1. Overview of the nature of NAMA proposals for actions in the land transport sector

Non-Annex 1 Party	Full sector strategy	Sub-sector strategy	Programme of Activities	Policies	Single Projects	Unknown
Republic of Armenia				✓		
Benin		✓				
Botswana				✓		
Central African Republic				✓		
Chad				✓		
Colombia					✓	✓
Republic of the Congo					✓	✓
Costa Rica						✓
Cote d'Ivoire					✓	
Eritrea						✓
Ethiopia				✓	✓	
Gabon		✓				
Ghana		✓		✓		
Indonesia						✓
Israel						✓
Jordan				✓	✓	
Madagascar				✓		
Mauritania				✓		
Mexico		✓		✓	✓	
Mongolia				✓		
Morocco				✓	✓	
Papua New Guinea						✓
San Marino					✓	✓
Sierra Leone				✓		
Singapore				✓		
The former Yugoslav Republic of Macedonia		✓		✓	✓	
Togo				✓		
Tunisia		✓		✓		

Source: Binsted (2011). NAMA Submissions to the UNFCCC: an overview from a transport perspective.

3. CDM and NAMAs: comparing apples and oranges

It is inevitable to refer to CDM, as it is an established mechanism for climate mitigation actions, when discussing NAMAs. The CDM is a market based mechanism driven largely by private companies which prefer tapping the easy to reach "low hanging" mitigation projects concentrated in China and India comprising 67% of the total while only 2% of all registered CDM projects are in Africa (UNFCCC, 2011). As NAMAs will most likely be government initiated, it has the potential to rectify the regional as well as sectoral imbalance in the CDM distribution of which only 11 out of 3,725 registered CDM projects as of January 2012 are transport related despite the fact that transport sector emits about 13% of the total global carbon dioxide emissions.

Table 2 based on Diaz-Bone (2011) and Sekinger (2011) summarises the overview and differences between CDM and NAMAs. It is important to note the differences as they have implications in the design of potential MRV framework for NAMAs. On the one hand, the restriction of "captive fleet" which is barrier for transport projects in CDM will no

longer apply if biofuel policy or policies promoting switching to clean fuels will be national in scope (Lancaster, 2011). On the other hand, coordination of NAMAs may be a challenge if it is government led especially in less developed countries (LDCs) and small island developing states (SIDs) with fewer capable human resources to assign to implement and monitor NAMAs.

Table 2. CDM and NAMAs – overview and differences

	CDM Clean Development Mechanism	**NAMA** Nationally Appropriate Mitigation Actions
Definition	**Mechanism of the Kyoto Protocol (Art.12).** The CDM allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries	**Commitment under the Convention** All Parties (…) shall formulate, implement, publish and regularly update national (…) programmes containing measures to mitigate climate change (…). (UNFCCC Art.4.1b) Internationally supported NAMAs will be measured, reported and verified domestically and will be subject to international measurement, reporting and verification (Decision 1/CP.16)
Type of actions	**Projects** (e.g. BRT) and **programme of activities (PoA)**	**Policies, programmes and projects** (e.g. sustainable transport policy)
Initiator and coordinator of activity	**Private sector** Companies and designated operational entities (DOEs) identify and implement projects	**Government** National government, possibly in collaboration with regional or local authorities, initiate activities
Methodology	Baseline and monitoring via **CDM methodology**	Baseline and **MRV system not yet defined**
Financing	Financed through **market mechanism** Upfront financing by the **private sector** Certificates are issued ex-post based on regular verification reports	**Market mechanism only an option** (for credited NAMAs) **Domestic resources and/or international support** (e.g through bi-lateral agreements, development banks or multilateral funds, inlc. Green Climate Fund) for the preparation and implementation of NAMAs
Return on investment	**Certificates (CERs)** Certified emission reductions are issued by the CDM Executive Board based on verification reports. CERs can be traded on carbon markets.	**Financial and technical support** Developed country Parties shall provide enhanced financial, technological and capacity building support for the preparation and implementation of NAMAs of developing country Parties and for enhanced reporting by these Parties (para 52 of decision 1/CP.16)
Preconditions	Reductions in emissions must be **additional** to any that would occur in the absence of the certified project activity (KP. Art.12.5c) CDM to assist developing country Parties in achieving **sustainable development** (KP Art. 12.2)	NAMA in the context of **sustainable development**, aimed at achieving a deviation in emissions relative to 'business as usual' emissions in 2020 (para 48 of decision 1/CP.16)
Requirement	Project supports sustainable development (proven by **government letter**)	Action is nationally appropriate (proven by **government registration** under the UNFCCC)
Administrative requirements	**Strong rulebook** (Marrakech Accords)	**General guidelines** yet to be developed under the UNFCCC (paras 61 and 62 of decision 1/CP.16)
GHG reduction potential	2005 – 2011: **500 Mt CO_2eq**	2012 – 2020 (15-30% against BAU): **more than 40,000 Mt CO_2eq**

4. How to MRV NAMAs – focusing on credited NAMAs based from CDM experience

The challenges to MRV differ substantially on the type of NAMAs. The MRV requirements will most likely be different depending on the support needed. Sharing the same perspective as Wang-Helmreich *et al* (2011), the following could be the potential MRV scenarios:

- *Credited NAMAs*: MRV requirements for credited NAMAs needs to be very strict in terms of quantifying GHG emission reductions, as credits generated by NAMA would be used to offset emissions in Annex I countries.
- *Supported NAMAs*: MRV requirements may be somewhat less rigorous depending on the needs of international financiers. If the key purpose is transparency, it may suffice to focus on whether actions are actually implemented and assess intermediate indicators that have a positive correlation to GHG emissions. This may enable NAMAs with greater sustainability benefits as in the case of transport NAMAs.
- *Unilateral NAMAs*: MRV requirements for unilateral NAMAs may mainly reflect the host country's needs.

The discussions here will focus on the potential credited NAMAs based on the CDM experiences. Notwithstanding the dismal performance of the transport sector under CDM, it is the only existing mechanism to reduce carbon emissions with an internationally approved and functional MRV framework, a thorough understanding of how CDM does MRV will be valuable in framing the future MRV process for credited NAMAs and hopefully simplify the process to be more conducive for transport projects, programs and/or policies.

4.1. The CDM way of doing MRV

Basically the CDM way of measurement, reporting and verification (MRV) of carbon reductions is illustrated in figure 1 below. Emission reduction is calculated from baseline emissions less the project emissions. The process looks streamlined but in reality it is complex and takes a long time before actual certificates of emission reduction (CERs) could be issued (Mizuno, 2010).

Figure 1. The CDM way of doing MRV

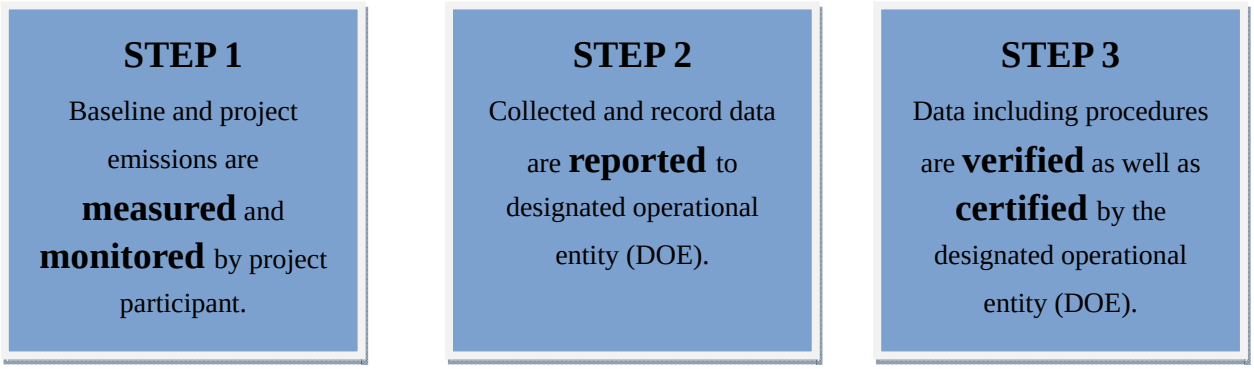


Table 3. CDM project cycle

Activity	Description
1. Planning a CDM project activity	CDM project participants (PPs) plan a CDM project activity following the several conditions in order to be registered as a CDM project activity.
2. Making the project design document (PDD)	PPs make the project design document (CDM-PDD) for a CDM project activity. The CDM-PDD contains information on the project activity, the approved baseline methodology applied to the project activity, and the approved monitoring methodology applied to the project.
3. Getting approval from each Party involved	PPs shall get written approvals of voluntary participation from the designated national authority (DNA) of each Party involved, including the host Party.
4. Validation	Validation is the process of independent evaluation of a project activity against the requirements of the CDM on the basis of the PDD. It is carried out by a designated operational entity (DOE) following a formal procedure for validation.
5. Registration	Registration is the formal acceptance of the validated project as a CDM activity done by the CDM executive board (EB). PPs pay registration fee at registration stage. If there are changes from the project activity as described in the registered PDD, PPs can notify and request approval of such changes.
6. Monitoring a CDM project activity	PPs collect and archive all relevant data necessary for calculating GHG emission reductions by a CDM project activity, in accordance with the monitoring plan written in the PDD.
7. Verification and certification	Verification is the periodic independent review and ex post determination of the monitored GHG emission reductions carried out by the designated operational entity (DOE). Certification is the written assurance by a DOE that a project activity achieved the reductions in the GHG emissions as verified.
8. Issuance of CERs	The EB will issue certified emission reductions (CERs) equal to the verified amount of GHG emission reductions. Among issued CERs, 2% of those will be deducted for the share of the proceeds to assist developing Parties that are particularly vulnerable to adverse effects of climate change to meet the costs of adaptation (SOS-Adaptation).
9. Distribution of CERs	CERs will be distributed among PPs. The decision on the distribution of CERs from a CDM project activity shall exclusively be taken by PPs.

Source: Adopted from "CDM in Charts v.14", IGES 2011.

4.2. MRV experience of transport CDM projects

In a nutshell, the CDM project cycle is described in table 3. Not including the time allotted in planning and preparing the project design document (PDD), the average time transport projects are in the CDM pipeline prior to registration, if successful, is 4 years and 5 months. A detailed list is presented in table 4 showing the performance of registered transport projects. It could be observed that the first of a kind project for a certain methodology took longer time than the succeeding ones. Experience accumulated by the different actors involved in the CDM project cycle reduced the processing time, e.g. the first CDM BRT project – the TransMilenio in Bogota – took about 4 years and 9 months to be registered; it was reduced by 1 year and 8 months in the case of BRT Chongqing and 2 years and 5 months for BRT Zhengzhou.

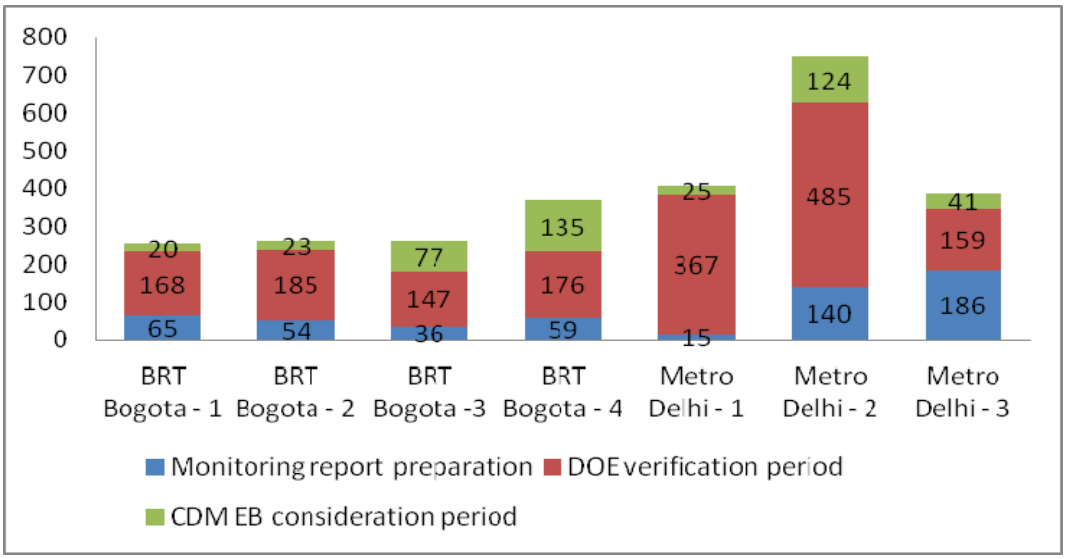
Table 4. Duration of CDM projects in the pipeline prior to registration

Projects	Methodology used	Number of days prior to registration
Mumbai Metro One, India	ACM0016 v.2	1,294
BRT Metrobus Insurgentes, Mexico	ACM0016 v.2	2,444
Metro Delhi, India	ACM0016	2,058
BRT Zhengzhou, China	AM0031	856
BRT Lines 1-5 EDOMEX, Mexico	ACM0016	1187
Modal shift from road to train	AMS-III.C	772
Biodiesel for transport	AMS-III.T	1,282
BRT Chongqing Lines 1-4, China	AM0031	1,119
Cable cars	AMS-III.U	2,572
Regenerative braking system	AMS-III.C	2,432
BRT Bogota: TransMilenio Phase II to IV	AM0031	1,742

Source: CDM Database, IGES Feb 2012.

Monitoring and collection of relevant data necessary to calculate GHG emission reductions by a CDM project activity start after the project is registered. It is often done on a yearly basis. Currently only BRT Bogota: TransMilenio Phase II to IV (from 2007) and Regenerative braking system of Metro Delhi (from 2008) have been issued CERs. The number of days after monitoring to report, verify and certify emission reductions prior to issuance of CERs are shown in figure 2. It took almost 5 years and 6 months for the BRT Bogota and 7 years and 10 months for the Metro Delhi to be issued CERs after entering the CDM pipeline. The yearly process does not necessarily improve as time goes by as shown in the graph.

Figure 2. Number of days from the end of monitoring to issuance of CERs



Source: IGES CDM Monitoring and Issuance Database, August 2011. Data on yearly basis per issuance of CERs.

4.3. Challenges of MRVing transport projects under CDM

Currently there are 10 transport and 5 biofuel methodologies applicable to transportation projects as listed in table 5 below. If we categorize the purpose of these methodologies following the Avoid-Shift-Improve approach to reducing emissions from the transport sector, there is no methodology for Avoid strategies, i.e. to avoid the need to travel.

Table 5. Approved CDM methodologies applicable to transport projects

Category	Methodology	Purpose
Bus systems	AM0031, ACM0016	Shifting travel to more sustainable modes
Mass rapid transit systems	ACM0016, AMS-III.U	Shifting travel to more sustainable modes
Energy efficiency	AMS-III.AA, AMS-III.AP, AMS-III.C, AMS-III.AT	Improve the efficiency of modes
Fuel switch (bio-CNG)	AMS-III.AP	Improve the efficiency of modes
Fuel switch through retrofit	AMS-III.S	Improve the efficiency of modes
Transportation of cargo	AM0090	Shifting travel to more sustainable modes
Biofuel for transport	AM0047, ACM0017, AM0089, AMS-III.AK, AMS-III.T	Improve the efficiency of modes

Source: IGES CDM in Charts v.15, Nov 2011

The common methodologies used by transport projects in the CDM pipeline are AM0031 for Bus Rapid Transit (BRT) projects, ACM0016 for mass rapid transit systems, AMS-III.C for energy efficiency, and ACM0017 for biodiesel as fuel for transport. While it is understandable that a rigorous MRV process in the CDM is necessary to ensure the environmental integrity of the carbon emission reduction, the current process is just too long, costly and impractical. A number of issues were raised identifying the causes of backlogs such as

- Numerous parameters[2] to be monitored which take a long time taken for the DOE/UNFCCC secretariat to verify and check their accuracy
- Monitoring method specified by the CDM methodology is not practical in some cases
- Lack of clear guidelines for MRV approaches such as sampling size
- Lack of DOEs capable to do verification

Looking at the MRV parameters in the CDM for transport methodologies, the degree of complexity is varied. It is not much of a problem for methodologies intended to improve energy efficiency. For example, AMS-III.AA, which deals with vehicle efficiency improvement, the parameters to be monitored are (i) fuel efficiency of the baseline and project vehicle, (ii) annual average distance travelled by project vehicles and (iii) number of operating project vehicles then the effect of efficiency improvements could be relatively easy to determine – efficiency gains multiplied by the number of vehicles. Data availability may be a challenge in determining emission factors or age structure of vehicles especially in developing countries but IPCC

2 To illustrate, the data requirements for AM3001 for Bus Rapid Transit are shown in the Appendix

or national default values may be used.

However, methodologies to shift travel demand to more sustainable modes like BRT or other mass transport systems (AM0031, ACM0016) require more parameters that are difficult to quantify and monitor. For BRT projects baseline emissions constitute those emissions caused by alternative transport mode a person would have used in the absence of the project activity. Baseline emissions are based upon emissions per transported passenger requiring data on the following indicators:

- Transport modes in the absence of BRT project
- Fuel consumption of such modes
- Fuel types used by the different transport modes and their carbon emission factor
- Occupancy rate of different modes
- Trip distance taken by different modes
- Total number of new passengers on the new system

In table 6, default values for specific fuel consumption of different transport modes and fuel types as well as fuel emission factors are already being used. The *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 2)*[3] allows project developers to use IPCC default values for emissions adjusted for uncertainty, use national or regional default values for liquid fuels if based on well-documented, reliable sources or to apply project-specific values.

Table 6. Key parameters for AM0031 baseline establishment and data sources

Indicator	AM0031
The transport modes used in the absence of BRT project	Passenger survey
Fuel types of different modes	Local statistics
Average speeds	Project data of local statistics
Specific fuel consumption by mode and fuel type	Local statistics, national or international literature, or IPCC values multiplied by an annual technology improvement factor of 0.99 for buses, taxis and passenger cars, 0.997 for motorcycles
Fuel emission factor	IPCC values
Average occupancy rate of the vehicles by mode	Project statistics or official statistics
Average trip distance for each mode	Project statistics or official statistics
Total number of passengers on the new system	Recorded per entry station

Source: Eichhorst et al (2010) based on AM0031 Methodology

[3] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

Comprehensive surveys are needed to gather data as well as in monitoring the number of passengers transported in the project. Overall, the effect of shifts between transport modes is more difficult to quantify even on a project basis which leads to more demanding monitoring requirements. Not many DOEs are also familiar with the complex demands of the transport sector so the verification process usually takes longer time as reflected in figure 2.

5. Summary and way forward

There is no question that NAMAs are the way forward in mitigating large scale emissions in developing countries. MRV will play a critical role to ensure the actions pledged are taking place, to assess the mitigation impact of such actions and/or to guarantee transparency for emission reduction credits generated by NAMAs.

The CDM experience shares a fundamental lesson that regardless of what or how the future MRV framework for NAMAs will look like, its effectiveness is hinged on availability of reliable data which is very critical especially in the case of the transport projects requiring numerous parameters to measure and monitor emission reductions. While waiting for the official MRV guidelines for NAMAs from UNFCCC, it is prudent to build a strong foundation on transport data collection and management which could make or break the effective implementation of transport NAMAs in an MRVable manner.

Unlike in CDM where private companies can profit from CERs, this incentive may not be in place with government led NAMAs. However, the potential to support sustainable development policies and measures in developing countries while contributing to the global goal of mitigating climate change is a strong motivation to pursue NAMAs. The MRV system should aim at supporting this to be both attractive to developed and developing countries. The trade-off between accuracy and practicality has to be considered earnestly as complex MRV procedures may pose as an inertia losing the interests of governments and/or project participants to engage in ambitious NAMAs. To ensure that the future MRV framework for credited transport NAMAs will be less complex than the CDM, the following lessons based on the experience from CDM should be considered.

a. Simplified and practical measurement and monitoring methods

The MRV system should be established in such a way which avoids imposing too much burden on project proponents and at the same time assures the quality of emission reduction. Limited data availability is a serious challenge especially in the transport sector which requires many data yet data management is fragmented or scattered among different agencies if not collected at all. This problem is more pronounced in developing and less developed countries. Possible options are to consider use of initial default values fitting to the region or country in lieu of conducting expensive surveys. Monitoring surveys can also be simplified by requiring only sample surveys. Currently in CDM, regardless of project size, projects are required to apply the same MRV procedures with the small scale projects also making the same report as large scale ones.

- Introduction of regional or national default values in setting the baseline

Availability of reliable transport data necessary for *ex-ante* estimation is scarce in many developing countries if non-existent at all in LDCs and SIDs. Often there is no system in place on which agency is responsible for collection and management of which transport data. The intention of providing appropriate default values for certain parameters like average occupancy and average trip distance is primarily to lessen the burden of data gathering thereby reducing cost at the outset of the project preparation. The implications on actual emission reduction, either under or over estimation, could be corrected by necessary surveys to monitor and validate actual emission reduction.

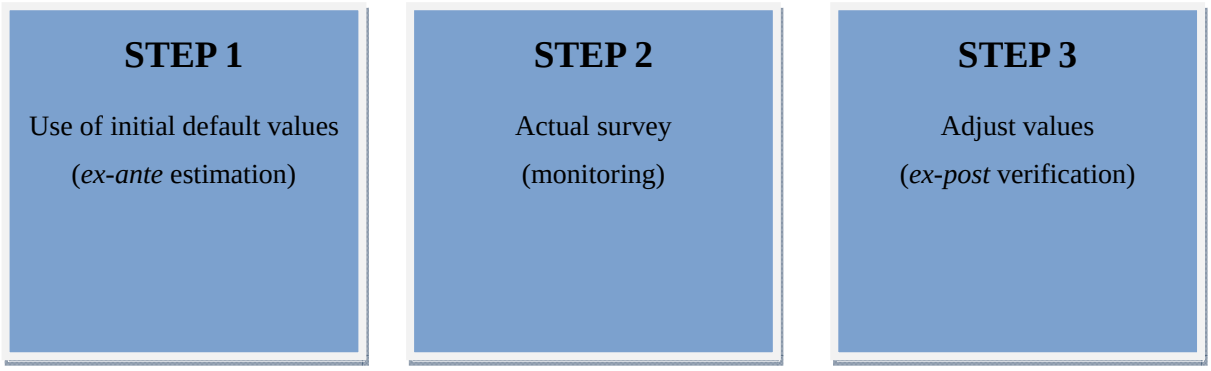
For example, conservative values for average

occupancy rate and average trip distance could be based on previous empirical research, expert opinion, and other sources such as the Global Environment Facility's (GEF) *Manual for Calculating Greenhouse Gas Benefits of GEF Transportation Projects* or based on PDDs of similar projects in the same region with near-like circumstances.

- Adjustment of baseline values after verification to enhance the accuracy of emission reductions

To ensure the environmental integrity of the carbon emission reductions, recognizing the potential under or over estimation based on using initial default values, the baseline values will be updated based on actual local values generated by conducting the necessary surveys to monitor and validate the project once it is implemented. This process of enhancing and updating the values is continuous.

Figure 3. Adjustment of baseline values after verification



b. Prioritize capacity building for MRV in transport

Capacity building is needed for relevant government agencies, project participants, and verification organizations to demystify the requirements and processes of MRVing future transport NAMAs. This is even more important as the experiences gained by the private sector in implementing CDM projects may not be transferable to government agencies that will be in-charge of implementing NAMAs. Capacity building activities could be coupled with pilot projects as most likely, NAMAs will follow a learning-by-doing mode.

c. Strengthen transport data collection and management

An inventory should be done on existing transport data available and collected by government agencies vis-à-vis transport data needed to conduct MRV as exemplified by the parameters required in CDM. Capacity of local and/or national agencies in collecting and compiling of relevant transport data should be strengthened as their functions could be coordinated. Also, exploring the use of information and communications technology (ICT) and global system for mobile (GSM) to collect and monitor traffic could improve and streamline data collection.

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Appendix

Table 7: Details of transport NAMAs submitted

Non-Annex 1 Party	Action
Republic of Armenia	• Improve energy efficiency in all sectors of the economy • Expand the use of electrical transport and increase the share of natural gas in fuel used for motorized transport
Benin	• Development of an urban transport system in Cotonou and greater Cotonou to reduce GHG emissions
Botswana	• Reduce emissions from the use of petrol in the transport sector • Policies in the transport sector (national projects and programmes will target mass transport systems)
Central African Republic	• Programme design of new urban areas, integration of principle of optimization of energy consumption and limiting urban sprawl • Control emissions from vehicles in large urban areas
Chad	• Develop less polluting modes of transport • Promoting the use of biofuels in the transport sector
Colombia	• Undertaking studies on the mitigation potential and on abatement cost curves for the transport, agriculture, energy, waste management and industrial sectors as part of its national strategy of low-carbon emissions development • Implementation of CDM in the transport sector
Republic of Congo	• Control emissions from vehicles in large agglomerations • Rehabilitation of transport infrastructure
Costa Rica	• Implement a “long-term economy-wide transformational effort to enable carbon-neutrality” that will help the country to significantly deviate from ‘business as usual’ emission scenarios from now until 2021 and beyond. • The country is in the process of identifying concrete policies, sectors and measures that will be specific NAMAs. On a preliminary basis efforts will focus on sectors that specifically include the transport sector
Cote d’Ivoire	• Conduct awareness campaigns in the transport sector to support sustianble production and consumption
Eritrea	• Research, develop, demonstrate, apply, diffuse and transfer of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in sectors including transport
Ethiopia	• Biofuel development for road transport • 8 railway projects with trains to run from electricity generated by renewable sources • 1 light rail project with trains to run with electricity generated from renewable sources
Gabon	• Develop a quality public transport with buses running on more energy efficient fuel import and sell used vehicles that are less than 5 years old (promote scrapping, green label cars, and import new vehicles operating with LNG)
Ghana	• Improve road conditions by increasing the percentage of paved road • Expand road and develop infrastructure and promote rail, maritime, air and inland water transportation systems • Expand infrastructure for non-motorised transport • Incentivise the use of public transport and promote carpooling • Enforce road worthiness certification requirements • Retrofit existing refinery infrastructure and ensure that new refinery produce non-metallic based gasoline • Substitute the use of gasoline with CNG, LPG and electricity for public transport • Promote the production and use of biofuels as transport fuel • Promote the use of Euro III and above as well as use flexi vehicles

Non-Annex 1 Party	Action
Indonesia	• Shifting to low-emission transportation modes
Israel	• A National Action Plan will be prepared to reduce emissions with a focus on energy efficiency, renewable energy, green buildings and transportation
Jordan	• Railway project (start design and feasibility study) • Amman to Zarqa light rail project to improve urban transport standards in greater Amman to Zarqa metropolitan area, reduce pollution and cut back vehicle emissions by introducing an environmentally friendly transport system • Modernise the Freight Transport Fleet operating in Jordan, stop importing old trucks and transform gradually into a modern efficient fleet • Build and develop the Amman dry port south of the city on an 80 m new ring road to create a new corridor which aims to reduce congestion of trucks and pollution. • Aqaba Port Project. By moving the port south to the Saudi border, thus cutting back significantly the distance for the ships to travel in Jordan water and congestion in the city of Aqaba
Madagscar	• Promote the exploitation of biofuels in the transport sector • Introduce and develop the least polluting mode of transport (means of transport intermediaries, urban rail, reduce transport vectors).
Mauritania	• Promote public transport (as a component of their strategy to enhance energy efficiency and reduce energy consumption in urban and rural areas)
Mexico	• Mexico adopted its Special Climate Change Program in 2009 including a set of nationally appropriate mitigation and adaptation actions to be undertaken in all relevant sectors
Mongolia	• To promote the import of fuel efficient vehicles, it can use economic measures such as implementation of used vehicle import standards and vehicle registration tax
Morocco	• Enhance the role of technical inspection centres in controlling the vehicles in circulation to reduce emissions • Renewal of vehicle fleets for road freight, taxis, and ‘premium renewal vehicles’ • Promote and develop railway transport by enhancing the Tanger to Casablanca route and by electrifying the Fès to Oujda route • Develop a regional suburban express train service in Casablanca • Commission a tram service in Rabat • Implement urban travel plans as well as long-distance/inter-urban plans to ensure consistency and to support land-use planning
Papua New Guinea	• No NAMAs specified but an intention outlined to conduct NAMAs in the transport sector
San Marino	• Reduction of energy consumption in the transport sector through energy saving and rational use and ‘information campaigns to favour implementation thereof’
Sierra Leone	• Development and enforcement of regulations on regular maintenance of vehicles • Improvement of the use of mass transport for passengers and freight
Singapore	• Contains no specific NAMAs but refers instead to ‘mitigation and energy efficiency measures announced under the Sustainable Singapore Blueprint in 2009’
The former Yugoslav Republic of Macedonia	• Improvement of the overall efficiency in the transport sector and energy efficiency of vehicles (revitalization, extension and better maintenance of road and railway infrastructure; extension of the electrification of the railway network; modernization of the vehicle fleet; motivation for wider use of alternative fuels and other power systems (i.e. LPG, CNG, biodiesel, hybrid vehicles) • Improvement of the public urban and inter-city transport (improvement in the planning, organization and control of traffic; measures for regulation of the traffic in central urban areas; modernization of the transport equipment for the public traffic; synchronization of the road signalization in towns; introduction of electronic pay toll charging; introduction of electrically driven types of transport (i.e. tramways); electrification of the railway network • Harmonization of the national transport legislation with EU Directives (energy and climate package – biofuels; regulation on fuels in accordance with EU norms)

Non-Annex 1 Party	Action
Togo	• Reduce energy consumption of public transport
Tunisia	• Develop public transport in cities (metro, bus and train) • Use land-use planning and logistics to ensure that economic hubs are well served by transport • Develop multimodal transport • Land-use planning to reduce the demand for transport • Develop an energy efficiency program for the transport sector

Table 8. Data requirements for AM0031 v3.1: Methodology for Bus Rapid Transit (BRT)

ID number	Data variable / Quality control (QC) and quality assurance (QA) procedures	Source of data	Data unit	Measured (M), calculated (C) or estimated (E)	Recording frequency	Proportion of data monitored / Uncertainty level of data	Comment
1. $TC_{PJ,x,i}$	Total fuel consumption -- Data can be cross-checked against specific fuel consumption data. Variations are possible due to different bus models used, variations resulting from routes and frequency, load factor variances and driver variances	Proprietary	litre kWh kg m^3	M	Annual	100% -- Low	Required if alternative A is chosen for as described in baseline methodology (for total project or only for truck lines); based in general on company records. In case of biofuel blends being used, the biofuel share must be transparently recorded and emissions are only calculated on the fossil share; it must shown that conventional comparable urban buses use the same biofuel blend as project buses. In case of usage of electricity based on kWh
2. $SEC_{j,x,y}$	Fuel efficiency -- Operators record fuel consumption data. Distance driven based on GPS thus precise results for project data. Variations in the specific fuel consumption in a specific enterprise and between enterprises need to be controlled. Variations are possible due to different bus models used, variations resulting from routes and frequency, load factor variances and driver variances. Controls are based on checking data with operators including checks of bills issued by fuel companies. If project fuel emissions are based on specific fuel consumption values of not the total fleet but only a representative sample then all data with specific fuel consumptions more than 20% lower than the average fuel consumption of comparable units is omitted to ensure conservative approach	Proprietary	litres/km kWh/km kg m^3/km	M	Annual	100% or sample -- Low	Required if alternative B is chosen as described in the baseline methodology for total or part of the project; required for trunk or feeder buses separately. In case of biofuel blends being used, biofuel share must be transparently recorded and emissions are only calculated on the fossil share; it must be shown that conventional comparable urban buses use the same biofuel blend as project buses. In case of usage of electricity based on kWh

ID number	Data variable / Quality control (QC) and quality assurance (QA) procedures	Source of data	Data unit	Measured (M), calculated (C) or estimated (E)	Recording frequency	Proportion of data monitored / Uncertainty level of data	Comment
3. $DD_{TB,v}$ $DD_{FB,y}$	Distance -- Based in general on GPS; kilometres driven is the base for paying bus operators. This data is thus well checked and verified by transit operator	Proprietary	km million	M	Annual	100% -- Low	Required for alternative B baseline; required for trunk and for feeder buses separately; based in general on GPS (at minimum for trunk buses) and/or reports checked by the operator of the BRT system as payments are based *inter alia* on distance given
4. $N_{i,x}$	Number of vehicles -- Various official data are available (vehicle registration data, transportation statistics). Important to have the same data source for distance driven and passengers for public transport to ensure consistency. Data can either be with or without the informal sector as long as abovementioned parameters are from the same data source. In general including only the formal sector is of better data quality and thus should be taken. To ensure quality the data source and calculation method need to be stated. With the annual survey data on the fuel type of passenger cars used by passengers now using the BRT system is recorded. Changes to the baseline emission factor for passenger cars are only made if the monitored data results in lower emission factors, not so however if the data results higher emission factors	Official statistics or proprietary	vehicles	M	Before project start and annually (in the case of modal shift for passenger cars)	100% and annually based on a survey of passengers using the new system -- Low	Per vehicle category the amount of vehicles per relevant furl type (gasoline, diesel, LNG, CNG or electric vehicles) needs to be identified. Only categories are included where modal shift is expected (next to public transport). Annual recording of fuel type used from passengers using the new system which in absence of the project would have used a passenger car (only required is a modal shift of passenger cars is included in the project)
5. $SEC_{x,i}$	Fuel efficiency per vehicle category required -- Result is checked for consistency against manufacturer data and default IPCC values	Proprietary, IPCC or international literature	litres/km kWh/km kg/km m^3/km	M	Before project start	Sample -- Medium	Based either on local measurements or international data from comparable regions or IPCC values adapted to local circumstances. In the case of biofuel blends being used, the biofuel share must be transparently recorded and emissions are only calculated on the fossil share; in case of usage of electricity based on kWh

ID number	Data variable / Quality control (QC) and quality assurance (QA) procedures	Source of data	Data unit	Measured (M), calculated (C) or estimated (E)	Recording frequency	Proportion of data monitored / Uncertainty level of data	Comment
6. $DD_{Z,S}$ $DD_{Z,M}$ $DD_{Z,L}$ DD_{T}	Total distance driven by all vehicles in category -- In general, various official sources are available (vehicle registration data, transport statistics). For quality assurance, it is important to have the same data source for items 4,5 and 7 if calculations are related	Official statistics	km	M	Before project start and partially annually	Sample -- Medium	Statistics are based in general on samples. Required for all sub-categories of buses baseline and for taxis and potentially other categories. Important to have the same data source for distance driven and passengers for public transport to ensure consistency. Data can be either with or without the informal sector as long as the above mentioned parameters are from the same data source. In general, data including only the formal sector is of better data quality and should thus be taken.
7. P_i	Passengers transported baseline by vehicle category *i* -- In general, various official sources are available (vehicle registration data, transport statistics). The same data source should be taken as for item 6 to ensure data consistency	Official statistics	passengers	M	Before project start	100% -- Low	This is for calculation of emission factor for the baseline and is not for calculating the total baseline emissions. Latter are calculated based on the passengers transported by the project. It is important to have the same data source for distance driven (ID 6) and passengers (ID 7) to ensure consistency. Data can be either with or without the informal sector as long as the abovementioned parameters are from the same data source. In general, data including only the formal sector is of better data quality and should thus be taken.
8. OC_i $OC_{i,y}$	Average occupancy rate baseline of vehicle category *i* -- The same data sources should be taken as for item 9 to ensure data consistency	Official statistics or proprietary	passengers	M	Before project start and for buses and taxis minimum year 3,6 and 10	Sample -- Medium	Required for all categories of vehicles baseline if passenger-km is calculated based on occupancy rate and trip distance and for leakage taxis and buses. For buses, monitoring required at a minimum in years 3,6 and 10 as part of leakage. For taxis also if this vehicle category is included in the project. Need to have explanation of how survey is done.

ID number	Data variable / Quality control (QC) and quality assurance (QA) procedures	Source of data	Data unit	Measured (M), calculated (C) or estimated (E)	Recording frequency	Proportion of data monitored / Uncertainty level of data	Comment
9. TD_i $TD_{i,y}$	Average trip distance baseline for vehicle category *i* -- Data is based on origin-trip survey used to design the project including the QA procedures involved in such studies. The same data source should be taken as for item 8 to ensure data consistency. The annual survey is based on a questionnaire, which is representative. Data from the annual survey is however only used if this results in lower baseline emissions (i.e. lower trip distances are monitored than the original baseline data)	Official statistics or proprietary	km	M	Before project start and annually (in the case of modal shift for passenger cars)	Sample and sample survey -- Low	Required for all categories of vehicles baseline if passenger-km is calculated based on occupancy rate and trip distance. Average trip distances of passengers using the new system are recorded through surveys based on the mode of transport they would have used in absence of the project (for users which would have used passenger cars, taxis, or motorcycles; only required if modal shift effects are demanded by the project
10. $TC_{x,i}$	Total fuel consumption per vehicle category -- Data is based on sector surveys of fuel consumption per category and can be checked against statistics of total fuel consumption. The study should have a 95% confidence interval with a 5% error margin	Official statistics or proprietary	litre	M	Before project start	Sample -- Low	Required if Calculations are based on sectoral fuel consumption data
11. P_y	Passengers transported by project -- Statistics are based on electronic or mechanic measurements and are cross-checked against financial receipts from the sale of tickets	Proprietary	passengers	M	Annually	100% -- Low	Statistics of transit management unit show the number of passengers transported by the project in total. This is based on electronic or mechanical measurement of all passengers using the system. Used to calculate ex-post the baseline emissions and to fulfil the applicability conditions
11b. S_i	Share of passengers that would have taken transport mode *i*	Proprietary	%	M			The project monitors what transport mode passengers would have used in absence of the project. A survey is also required if no modal shift is included in the project. In this case the modes of transport are only public transport, NMT, rail based urban transit and induced traffic

ID number	Data variable / Quality control (QC) and quality assurance (QA) procedures	Source of data	Data unit	Measured (M), calculated (C) or estimated (E)	Recording frequency	Proportion of data monitored / Uncertainty level of data	Comment
12 $P_{i,y}$	Passengers transported by project who would have used transport mode *i* -- Important to have the same methodology used to estimate transport modes over the whole crediting period. For QA a precise transport data collection protocol is established detailing methodology and operational issues (including frequency, location, time, duration of measurement). The sample size is determined to ensure 90% confidence interval using statistical techniques for random surveys. A survey format as well as survey methodology should be shared. A sensitivity analysis of this parameter must be realized.	Proprietary	passengers	C	Bi-monthly	Sample survey -- Low	
13. Policies	Policies that affect the baseline -- Policies are assessed on their potential impacts on the modal split and on the other relevant parameters affecting the baseline emissions based on information or studies realized by the policy promoter. If the impact in modal switch is significant, it is assumed that the full modal switch of the implementation year is attributable to the policy and not the project. If a measurable impact exists on any baseline parameter, the respective baseline emission factors are changed.	Proprietary		E	Before project start and annually	100% -- Medium	Transport policies, which affect the baseline emissions, are identified and their impact on any of the baseline factors is estimated. This is done ex-ante before project starts. Annually the project assesses if a new policy has been implemented which changes in a measurable manner a baseline parameter. Project participants need to assess if policies might have effects on various parameters.

ID number	Data variable / Quality control (QC) and quality assurance (QA) procedures	Source of data	Data unit	Measured (M), calculated (C) or estimated (E)	Recording frequency	Proportion of data monitored / Uncertainty level of data	Comment
14 $ROC_{i,v}$ $OC_{i,y}$	Occupancy rate of vehicle category *i* relative to capacity; occupancy of vehicle category *i* -- Average occupancy rates of remaining taxis and conventional buses (relative to capacity in buses). Important is that the same methodology is used to measure the occupancy rate thus ensuring data consistency. For QA a precise and transparent data protocol is thus established detailing methodology and operational issues (including frequency, location, time, duration of measurement). The data is only required at a medium level as only changes >10% points will be registered. The same data source should be taken as for item 12 to ensure consistency.	Proprietary	%	C,M	Before project start plus regular interviews thereafter	Sample -- Medium	The occupancy rate of taxis and the remaining bus fleet is monitored through representative samples. If results show negative changes >10% in the load factor, this change is attributed and included in the leahage calculation for all years since the last monitoring of the load factor. Recommended interval: year 3, 6 and 10 for 10 year crediting period; year 3 and 7 for 7 year crediting period
15 $N_{Z,y}$ $N_{T,y}$	Number of conventional buses and taxis still operating -- In general various official sources are available (vehicle registration data; transportation statistics). Important is to ensure that over time the same data source or the same calculation method (e.g. average of sources) is applied. The same data source should be taken as for item 14 to ensure data consistency.	Official statistics or proprietary	units	M	Before project start plus regular intervals thereafter	100% -- Low	Registration statistics; same years to be monitored as item 14

ID number	Data variable / Quality control (QC) and quality assurance (QA) procedures	Source of data	Data unit	Measured (M), calculated (C) or estimated (E)	Recording frequency	Proportion of data monitored / Uncertainty level of data	Comment
16 SRS	Share of road space used by public transport baseline -- Based on calculations made for urban infrastructure and transport or on the calculation method provided using data on the distance driven of various vehicle categories.	Official statistics or proprietary	%	E,C	Before project	Medium	Used for urban transport and infrastructure models; see baseline equations for calculation of SRS if the data is not available from reports. The share of road space used by public transport is a figure often calculated in transport studies. If no reliable data is available as proxy, the relative distance driven per different vehicles can also be taken. SRS would then be the distance driven by the public transport (baseline) divided by the total distance of all vehicles driven (baseline). This would be conservative factor as buses are larger than private cars and thus occupy a larger share of road space per kilometre driven
17 RSP RSB	Road space baseline and project -- Based on the calculation (RSP) and infrastructure statistics	Official statistics or proprietary	index km	E	Before project start	100% -- Low	Road space baseline based on official information. Reduced road space based on construction plans (reduced road space is lanes which were eliminated due to dedicated bus lanes). Road space project = road space baseline – eliminated lanes
18 TR_C	Number of daily trips undertaken by passenger cars -- Based on calculations made for urban infrastructure and transport scenarios; based on sample counting in general	Official statistics or proprietary	unit	M	Before project start	Sample -- Low	Based on surveys. Used for urban transport and infrastructure models

ID number	Data variable / Quality control (QC) and quality assurance (QA) procedures	Source of data	Data unit	Measured (M), calculated (C) or estimated (E)	Recording frequency	Proportion of data monitored / Uncertainty level of data	Comment
19 V_{PJ} V_{BL}	Average speed of passenger car in baseline and project -- Traffic models use such data and have verified them. The data accuracy is not very important as data is only used to estimate roughly leakage based on change of vehicle speed and induced traffic. Both elements in it have moderate accuracy.	Official statistics or proprietary	Km/h	M/E	Before project start	100% -- Medium	Based on transport models. The average speed of passenger cars before project start and the expected speed after decongestion is calculated
20. NCVNG,y	Net calorific value of the natural gas used by the project during the year *y*	Local, regional, national data or IPCC default values	GJ/m^3	M	Annually	100%	If IPCC default values at the upper limit of the uncertainty at a 95% confidence interval
21 $EF_{CO2, upstream, CH4}$	Emission factor for upstream fugitive methane emissions from production, transportation and distribution of natural gas	National data or IPCC	tCH4/GJ	M	Before project start	100%	
21 $EF_{CO2, upstream, LNG}$	Emission factor for upstream CO2 emissions due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system	National or IPCC	tCO2/TJ	M	Before project start	100%	

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