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Nationally Appropriate Mitigation Action: Understanding the MRV framework for developing countries

September 2014

United Nations Environment Programme

FIRM Facilitating Implementation and Readiness for Mitigation

UNEP DTU PARTNERSHIP

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Nationally Appropriate Mitigation Action:

Understanding the MRV framework for developing countries

SEPTEMBER 2014

SUDHIR SHARMA

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Abbreviations

BAP	Bali Action Plan
BUR	biennial update reports
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
COP	Conference of the Parties
CPB	climate policy body
DMS	Domestic MRV System
DMEE	Domestic MRV Executive Entity
D-NAMA	Domestically supported/unsupported NAMA
DOE	designated operational entity
GCF	Green Climate Facility
GEF	Global Environmental Facility
GHG	greenhouse gas
ICA	international consultation and analysis
I-NAMA	Internationally Supported NAMA
LCDS	low-carbon development strategies
MRV	measurement, reporting and verification
NAMA	Nationally Appropriate Mitigation Action
NC	national communication
SBI	Subsidiary Body for Implementation
SD	sustainable development
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

Measurement, Reporting, and Verification (MRV) emerged as one of the key elements of the mitigation framework developed under the UNFCCC for mitigation actions by developing countries, agreed at COP16 and further defined at COP17. The key objective of MRV is to increase the "transparency of mitigation efforts made by the developing countries' as well as build mutual confidence among all countries" (UNFCCC, 2011). MRV is not a new concept, and it has been widely used in many contexts at the national and international levels to ensure transparency and help in effective implementation (UNEP Risoe, 2012).

From the perspectives of both national and international funders, a robust system of measuring, reporting and verifying is essential for effective monitoring of NAMA implementation, as well as in assessing its impact in terms of greenhouse gas emissions reductions, cost effectiveness and sustainable development benefits. Measuring, reporting and verifying enable regular evaluation of a country's progress toward achieving the objectives of the NAMA on the basis of predefined indicators and can assist countries in setting indicators to monitor transformational change in the direction of low GHG growth pathways.

Aside from being an international requirement under the UNFCCC, MRV of mitigation actions is also an important management tool enabling countries to track their progress in moving to a low-emission development path and in achieving sustainable development goals. A key imperative for transition to low-emission pathways for all countries, not just developing countries, is the significant global emissions reductions needed by 2050 in order to keep the increase in average global temperature to below 2°C (UNFCCC, 2010). This requires developing countries to limit increases of GHG emissions in the medium term and eventually reduce emissions in the long term. Such limiting requires immediate steps for integrating low-emission options into sustainable development planning so as to start building national capacities for managing GHG emissions. In this context MRV becomes an important GHG management tool, since it enables monitoring of the implementation and effectiveness of mitigation actions, facilitates access to international finance, and tracks progress in delinking economic growth from GHG emissions.

Structure of the paper: The paper is divided into four main sections. The first section discusses the context of MRV of developing-country mitigation actions and briefly summarizes the key elements of the MRV under the UNFCCC. The second section explains the domestic MRV system that developing countries are expected to develop for MRV of NAMAs. This

section focuses on the institutional, procedural and guidance elements of a domestic MRV system. The section also briefly discusses the MRV of internationally supported actions. The third section focusses on explaining what is to be measured in context of NAMAs, the role of NAMA developer in MRV of NAMA, the information to be included in a NAMA measurement plan and reporting requirements. The section also describes different types of verification system and highlights the linkage between the scope and objective of the MRV system and verification. The fourth section discusses the reporting of MRV information on NAMA implementation in BURs and discusses the format for aggregated presentation of information on NAMAs.

Target audience: The publication is aimed at increasing the understanding of MRV requirements among national and regional level policy-makers and providing guidance to NAMA developers on developing MRV systems. The paper is also aimed at increasing the understanding of MRV aspects among sectoral experts and developing-country NAMA practitioners.

In this document we have used the CDM MRV architecture as an example in order to highlight the various elements of MRV, although the two are very different instruments because the CDM MRV system can provide useful learning for developing MRV in relation to NAMAs. The CDM mechanism is a project-based market mechanism the objective of which is to generate offsets where entities (private, public, governmental) within a national boundary could voluntarily choose to implement a mitigation activity. On the other hand, NAMAs are a national obligation aimed at reducing national GHG emissions below BAU, their scope covering both national and sectoral projects.

A few definitions

Nationally Appropriate Mitigation Action (NAMA): Actions taken by developing countries to reduce GHG emissions in the context of sustainable development supported by developed countries with finance, technology and capacity-building, with the objective of achieving substantial deviation from BAU emissions.

Internationally Supported NAMA (I-NAMA): A NAMA that has some component of support from international public finance provided by international entities, such as GCF, a bilateral aid agency, a multilateral bank, etc., for implementing the activities/measures included in the NAMA. This doesn't exclude national public resources also being used in implementing the NAMA.

Domestically Supported (also referred to as unilateral) NAMA (D-NAMA)[1]: A NAMA that does not use international public money for its implementation. In this case public money supporting the NAMA comes from domestic sources (national budget, national development

[1] Developing countries have been implementing activities that have mitigation co-benefits, which can also be called domestic NAMA. The MRV, a distinct feature of NAMAs, for such mitigation action is based on existing monitoring and evaluation frameworks for national policy implementation.

entities, etc.). Such a NAMA may be financed by international loans and equity investment along with loans from national entities and investments by the national private sector.

Measurement: Collecting information on the progress of implementation and impacts of a NAMA.

Reporting: Submitting the measured information in a defined and transparent manner to the appropriate authorities.

Verifying: Assessing the information that is reported for completeness, consistency and reliability.

The Context: Why MRV

A common term used for MRV is Monitoring and Evaluation (M&E). M&E has been an integral management tool for planning and implementation, whether in governments at different levels, corporates or organizations. M&E provides an evidence-based approach for identifying and documenting successful programmes and approaches in achieving goals and objectives by tracking implementation and outputs systematically, and measuring the effectiveness of implementation. M&E is thus an important transparency tool to demonstrate that programme efforts have had a measurable impact on expected outcomes and have been implemented effectively.

M&E provides the necessary feedback for modification of interventions and assessing the quality of activities being conducted. M&E helps with identifying the most valuable and efficient use of resources. It is critical in developing objective conclusions regarding the extent to which programmes can be judged a "success". It is essential in helping managers, planners, implementers, policy-makers and donors acquire the necessary information to make informed decisions. Monitoring and evaluation together provide the necessary data to guide strategic planning, to design and implement programmes and projects, and to allocate and re-allocate resources in better ways.

In the context of the challenges of climate change and of limiting the global increase in temperature to below 2°C, the two key elements of information crucial to evaluating progress and making the necessary course corrections are: 1) national GHG emissions inventories; and, 2) projected GHG emissions. The latter information is directly related to the measures countries have planned or implemented to mitigate GHG emissions. By measuring GHG impacts, MRV of mitigation actions helps project GHG emissions, thus enabling, along with GHG inventories, assessment of the adequacy of efforts and potential for taking corrective steps, as needed, to meet the 2°C goal.

The MRV of GHG emissions is thus central to tracking progress in meeting the 2°C goal. The MRV also enables identification of the support that countries need to address their GHG emissions in so far as these result from development aimed at addressing poverty and other development needs. The information is also useful to track the effective use of international support in changing to low-carbon development pathways.

The global transformation to low-carbon development pathways is an iterative process of identifying existing opportunities, implementing measures, evaluating their impacts based on the measurement of relevant information, and adjusting future direction based on past impacts and new emerging opportunities. MRV of GHG emissions reductions is an integral part of this iterative process, as has been the MRV of plans and programs implemented to achieve sustainable development goals (Niederberger and Kimble, 2011). MRV of efforts to address GHG emissions from sustainable development plans and goals thus is an important management tool, providing feedback to policy-makers and implementing entities to assess the success of these efforts, as well as to keep continuously under review the steps needed to increase the effectiveness of GHG mitigation efforts, as well as ensure development benefits.

The following list sets out the various benefits of measuring, reporting and verifying GHG mitigation efforts (GIZ, 2013) beyond the fact that it is agreed by countries that are a Party to the Convention:

- facilitate decision-making by serving as a tool for national planning,
- support implementation of mitigation actions,
- promote coordination and communication between emitting sectors,
- generate comparable information across countries,
- generate feedback for policy-makers on the effectiveness of adopted policies and measures,
- build trust through the production of transparent information,
- signal whether a country is on track to meeting climate change-related goals,
- highlight lessons learned and good practices,
- increase the likelihood of gaining international support for mitigation actions.

Further, If MRV is done in a credible way, it helps to establish trust in the negotiations and to strengthen a country's position. Finally, MRV can strengthen mutual confidence in countries' actions and in the regime, thereby encouraging a stronger collective effort (Breidenich 2009).

International MRV obligations

As mentioned above, evaluating progress towards achieving the 2°C goal requires information, in the form of both national GHG inventories and the mitigation actions taken by countries and their impacts on GHG emissions. In terms of mitigation actions, unlike developed

countries that have taken economy-wide emissions[2] reductions, developing countries will implement NAMAs (see Sharma and Desgain (2013) for the scope of NAMAs). In line with this, the countries agreed on the MRV framework for developing countries at Cancun that covers the two elements, viz., GHG inventories and the impacts of mitigation actions. The key decisions that cover the complete MRV framework for developing countries are the Cancun agreement (UNFCCC, 2010), the Durban Outcomes (UNFCCC, 2011a) and the specific decision related to MRV taken at COP 18 and COP 19. These decisions are mentioned further in the text below alongside their various elements.

Thus the MRV framework for developing countries has the following two key elements:

- MRV of national efforts: GHG inventory and information on the efforts made to mitigate GHG emissions by the country; and,
- MRV of NAMAs: specific mitigation actions in the context of sustainable development identified and implemented by countries.

In simple terms, the MRV framework can be divided into two tiers: the MRV of the voluntary national mitigation obligations of the developing countries in accordance with the Cancun agreements under the Convention, which can be called the National MRV Tier; and the MRV of the specific individual NAMAs (implemented by the countries as part of their voluntary national mitigation obligations), which can be called the NAMA MRV Tier.

National MRV Tier: The term "nation" is used to indicate that this tier of MRV is about the MRV of country' aggregated mitigation efforts at the international level. Therefore, this is MRV of a country' BUR and NC under the UNFCCC. The National MRV Tier addresses the GHG emissions reporting and voluntary national mitigation efforts of developing countries and will be conducted at the international level under the UNFCCC. This tier covers MRV of national mitigation efforts and the national GHG inventory. It includes: 1) measuring (M) parameters to prepare the national GHG inventory; 2) reporting (R) of information on national GHG inventory and impacts of NAMAs on GHG emissions through BURs; and 3) assessment of the information included in BURs through ICA, which is the verification (V) step of MRV.

The elements of the national-level MRV system, in accordance the Cancun Agreements (UNFCCC, 2010, ibid), are as follows:

- **Measurement:** in the national context this will include measurement or estimates of national GHG emissions and of GHG impacts of mitigation actions by countries. Measurement or estimates of National GHG emissions will be based on the methodology laid down in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Countries are encouraged to use the IPCC 2006 guidelines. In undertaking the

[2] The developed countries agreed to adopt economy-wide emissions reductions targets compared to an agreed base year, some under the Kyoto Protocol second commitment period and others under the Cancun outcomes. For example, the EU agreed to reduce economy-wide emissions, i.e. emissions from all its member states, by 20% below their emissions in 1990.

measurements or in making estimates countries are expected to follow the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, and the Good Practice Guidance for Land Use, Land-Use Change and Forestry. Given the regular nature of reporting (see paragraph below on reporting), countries would benefit from creating a permanent institutional structure for developing GHG inventory. No specific methodologies are prescribed for estimating the GHG impacts of mitigation actions. Each country is expected to develop appropriate methods for estimating these impacts using good practice.

- **Reporting:** Information on the national GHG inventory and mitigation actions will be reported through Biennial Update Reports (BUR) and National Communications (NC). Information on mitigation actions will include both domestically and internationally supported NAMAs and their impacts. Developing countries will submit a BUR every two years. Least Developed Country Parties and Small Island Developing States have the flexibility to submit BURs at their discretion. Developing countries will be provided with support (financial and technical) by developed countries in preparing BURs through GEF.[3] National Communications will be submitted every four years. BURs will form a supplement to the National Communication in years when the latter is submitted.

- **Verification:** Information reported in BURs will be verified for completeness and consistency with BUR reporting guidelines, as well as transparent reporting of GHG inventories and mitigation actions and their impacts. The BURs will be submitted to International Consultation and Analysis (ICA). ICA is the verification component of the MRV of developing country mitigation efforts. The ICA process is non-intrusive, non-punitive and respectful of national sovereignty. Further, the process is not aimed at making political judgements about the appropriateness of the domestic policies or measures adopted by countries or at advising countries on the measures they should take to mitigate GHG emissions. ICA is a facilitative process for sharing information and is distinct from a system of compliance, or a review with consequences. The two steps involved in ICA are:

    · Analysis of information included in BURs will be undertaken by international experts, the objective being to assess the consistency of information and clarity in reporting assumptions and methods for estimating GHG emissions and mitigation impacts. The analysis of the report will be based on a desk review of the information made available by the country. The analysis will result in report, to be drawn up by the technical experts, taking into account the comments provided by the country concerned. The analysis may also identify capacity-building needs to strengthen the reporting further (UNFCCC 2013a).

[3] At present the financial support is channelled through GEF. GCF, once operational, may also provide financial support in preparing BURs.

- The consultation will be through a facilitative exchange of views in workshops organized under the Subsidiary Body for Implementation (SBI) and based on analysis by international experts and the BUR. The facilitative exchange of views among the Parties will consist of a one- to three-hour session for each Party or group of Parties. Parties may request to go individually or in a group of up to five Parties. SBI is presently developing modalities and procedures for undertaking the consultation. The objective of consultation is to identify challenges in implementation and ways of addressing them. The process of ICA may result in suggestions for improving the estimating and reporting of the information contained in the BUR and in identifying areas for further capacity-building.

NAMA MRV TIER: The NAMA MRV Tier addresses the MRV of individual NAMAs and will be conducted at the country level. This tier supports the National MRV Tier. This tier forms part of the National system of MRV that enables reporting to the UNFCCC. It provides the necessary information on NAMAs needed by countries to prepare their BURs. Domestically and internationally supported NAMAs will be subject to MRV under the NAMA MRV Tier. The NAMA MRV Tier will be established by the country, based on the general guidance developed by the COP (UNFCCC, 2013b). This guidance provides general principles and/or good practices to assist countries in establishing institutional arrangements and modalities and procedures for undertaking MRV of NAMAs. Modalities and procedures will include: developing measurement requirements for individual NAMAs; reporting requirements; and undertaking verification of the reported information. NAMA developers will then use the guidance provided by the domestic MRV system on measurement requirements to develop a measurement methodology for the NAMA and use the reporting requirements to report the measured information. Countries will have to report the information on the NAMA MRV Tier in the BUR.

The Cancun decision and the Durban Outcomes (UNFCCC, 2011a, ibid.) define the MRV requirements for NAMAs undertaken by developing countries in order to fulfil their voluntary mitigation obligations. These are:

- All NAMAs, D-NAMA and I-NAMA, will be measured, reported and verified domestically.
- The domestic MRV of D-NAMA will be in accordance with general guidelines developed and approved at COP19 in Warsaw. Countries can apply them voluntarily and the emphasis is on developing the domestic MRV system on the basis of national systems and undertaking the process through national expertise.
- At Cancun, Parties agreed that I-NAMA will **also**, apart from being MRVed domestically, be subject to international MRV. The Durban Agreement clarified that the international MRV will be in accordance with the guidelines developed for ICA adopted at COP17.

Unlike the MRV in the context of national-level efforts, the MRV for NAMA, and specifically for D-NAMAs, has not been defined at the international level and has been left to be

defined at the national level. The General Guidance for D-NAMAs encourages countries to develop systems voluntarily. Developing country Parties are encouraged to utilize existing domestic processes, arrangements or systems for the domestic measurement, reporting and verification of D-NAMAs. Further, the elements of such a system are indicated, which include: institutional arrangements and systems, including entities for domestic MRV; collection and management of information, including methodologies for making estimates; and verification.

The clarity on MRV of I-NAMAs is sketchier. The decision states that I-NAMAs too will be MRVed domestically, but the guidance on domestic MRV is only applicable to D-NAMAs. Further, the decision states that I-NAMAs will be subject to international MRV in accordance with the ICA guidelines (UNFCCC, 2011, ibid.).

As can be seen from the description above the two tiers are not mutually exclusive, and in fact MRV of NAMA is an important component for providing information to the reporting under the National MRV Tier. Thus synergies between MRV of NAMA and measurement systems for the National MRV Tier would help ensure consistency, as well as creating a cost-effective system for MRV.

MRV of NAMA could be developed in two ways: bottom-up, or guided top-down. In the bottom-up system each NAMA designs its own approach to MRV. In the guided top-down system, government puts in the systems that guide the process and procedures of MRV and provides guidance to all actors involved in NAMA and NAMA MRV.

There are multiple benefits of developing a top-down guided MRV system, which:

a) Enables NAMA developers to minimize their costs and efforts by providing clear guidance on developing measurement methodologies and in reporting.
b) Ensures consistency of MRV procedures between D-NAMA and I-NAMA, as existence of the system might encourage international partners to use the system and strengthen it, rather than develop separate processes and procedures for MRV of I-NAMA.
c) Enables synergies to be created between the data collection system used to prepare national GHG inventories and NAMAs.
d) Creates greater transparency and resultant trust among countries, as well as increasing the confidence of international partners in supporting NAMAs.
e) Enables building up the system that improve management of the country's climate-change policies, as well as preparing countries to assume greater mitigation responsibilities in the future.

The use of the National and NAMA MRV Tier is to explain the MRV of different levels. This does not imply that countries will develop two separate systems of MRV. The National MRV system should ideally be an integrated system that covers the system for the development

of GHG inventories, the MRV of NAMAs and other mitigation actions being implemented by the country.

Elements of a Domestic MRV System for NAMA

As mentioned earlier, MRV of NAMAs will be undertaken domestically. Countries are expected to define the domestic MRV process and report it to UNFCCC through BUR (paragraph 2(f), Annex III, decision 2/CP.17). This section is aimed at outlining the various elements, both software (guidance, process, procedures, etc.) and hardware (institutional arrangements, roles, responsibilities) of an MRV system. This section can therefore be seen as providing a basic understanding of an MRV system for the policy-makers to help them in developing the MRV system. The process and procedures for domestic MRV systems (DMS) are expected to guide the implementers of NAMA in designing measurement plans and reporting the progress and impacts of NAMAs. Along with procedures and process, countries will also define the institutional arrangements, roles and responsibilities of institutions.

General characteristics of a good domestic MRV System

An MRV system is a package of institutional arrangements (hardware), process, procedures and guidelines (software) for operationalizing the system. Key elements of a DMS system include:

- Scope of the MRV. This constitutes two aspects: aim (why MRV), and objectives (what to MRV). The scope thus defines the boundaries, objectives and requirements of the MRV. The scope lays the foundation for defining the roles of various actors and their interactions, as well what is measured, reported and verified.
- Institutional arrangements. To operate an MRV system, a clear definition of responsibilities and of the institutions that will implement these responsibilities is required. Such an arrangement would include governing body, technical bodies for establishing guidelines, systems for data collection and storage, verification entities, etc.
- Process, procedures and guidelines. Software for the MRV system that includes a clear process and procedures, as well as guidelines for the different steps in the MRV process.
- Legal/regulatory framework to support the institutional arrangements and the responsibilities of various actors involved in the MRV. This may include formal agreements among ministries or regulation requiring regular reporting by industry on relevant information.

Scope of DMS:

The scope of MRV is defined by the aim (why) and the objective (what). The aim of the MRV process in case of CDM is to ensure that the GHG emissions reductions achieved by the CDM projects are real, measurable, and additional to what would have happened in the absence of CDM. The use of certified emissions reductions (CERs) enables Annex I countries to increase their emissions. An extremely high level of accuracy is required in estimating GHG emissions

reductions in the case of CDM. In the case of the national GHG inventory submitted to UNFCCC, the aim of the MRV is to ensure completeness and transparent reporting, as well as comparability of estimates across countries. It is also aimed at providing feedback to improving the quality of data used in estimating GHG emissions.

The objective (what) of MRV of NAMAs is related to the information required to undertake a review. Again taking the CDM example, the aim is "to ensure accurate estimates of GHG emissions reductions". Thus what are MRVed are the baseline emissions as well as the project emissions. Further, the MRV relates to establishing the baseline, which includes a demonstration of additionality. The objective of the MRV system in the case of CDM is thus to measure the GHG emissions reduction achieved from implementation of CDM project activity. Thus in the case of CDM the MRV starts with validation of CDM project activities to ensure additionality and that "real" reductions are confirmed through the monitoring of the relevant data for estimating GHG emissions, and more importantly verification of the data, data collection systems and records.

In the context of the National GHG inventory reporting to UNFCCC, the aim is completeness and the transparent reporting of national GHG emissions. Thus "what" to MRV relates to the data collection process, the data used and the methods used to estimate GHG emissions. This implies that the focus of the verification is to ensure conformity with the reporting guidelines, and to check the completeness of the reported information and that the appropriate data has been used in estimating GHG emissions.

The aim and objectives of MRV of the NAMAs is linked to their implementation. The international obligation for developing countries is to implement NAMAs in the context of sustainable development and report, the goal being to reduce emissions compared to BAU emissions in 2020. Further, NAMAs are to be implemented in the context of sustainable development, making achieving sustainable development goals of the host country a key objective of NAMAs, which is important from a national perspective. Therefore, from a national perspective one of the objectives of MRV could be MRV of sustainable development impacts.

From an international perspective, the objective of NAMA MRV is to increase the transparency of implementing mitigation actions, as well as to assess the impact of mitigation efforts in reducing emissions below the BAU emissions. This implies that the MRV relates to progress indicators to confirm that planned mitigation actions are implemented. Nonetheless, as the objective of actions is to reduce GHG emissions below the BAU, and as the reporting requirement for developing countries requires reporting the GHG emission reduction impacts of implementing NAMAs, the objective of MRV should be to MRV the GHG emissions reduction. As the estimates of GHG emissions reductions are used to assess whether the mitigation actions have reduced GHG below the BAU, the focus could range from robust estimates of reductions to very accurate estimates of reductions.

In this context, GHG emissions reductions (international perspective) and sustainable development (national perspective) defines the objective of MRV. From this perspective the aim would be to assess the reliability and completeness of estimates of GHG emissions reductions. At the same time, as the objective of NAMA is not to generate offsets, the level of accuracy of GHG emissions reductions should be good but does not have to be as stringent as that in CDM, unless a high level of certainty can be achieved at low costs.

Institutional arrangements for DMS

As mentioned earlier, institutional arrangements to operate the DMS is an important element in creating the required framework for MRV of NAMAs. Effective implementation of DMS, as well as the sustainability and creation of long-term capacity for DMS, will benefit from clearly defined institutional arrangements for DMS. To ensure an effective and coherent DMS, designating a single entity responsible for its overall coordination will be important.

To explain the institutional arrangements required to operate DMS and to highlight the associated roles and responsibilities, CDM institutional arrangements for MRV are described below. This does not imply that the same structure has to be replicated by all countries.

The MRV for CDM is defined in the modalities and procedures (M&P) of CDM adopted by the Meeting of Parties to the Kyoto Protocol. The M&P defines the CDM Executive Board as the body responsible for the operationalization of CDM MRV and lays down a policy framework for MRV. Thus a key institution in operationalizing a DMS is a central body whose role is to implement it. We refer to this as a Domestic MRV Executive Entity (DMEE). The roles and responsibilities of such a body would include:

- To establish the policy framework for operationalizing the aims and objectives of the DMS.
- To set out the rules, process and procedures for MRV of NAMAs.
- To establish the necessary support structures to enable it implement the DMS.

The DMEE would need supporting structures to elaborate the technical and procedural aspects, such as the process of MRV, guidelines for various aspects of MRV (guidelines for the measurement plan, reporting formats, procedures and criteria for approving support bodies [e.g., entity for verification], etc.).

In the case of CDM the following institutional structure has been put in place to support the CDM-EB in operationalizing the MRV system:

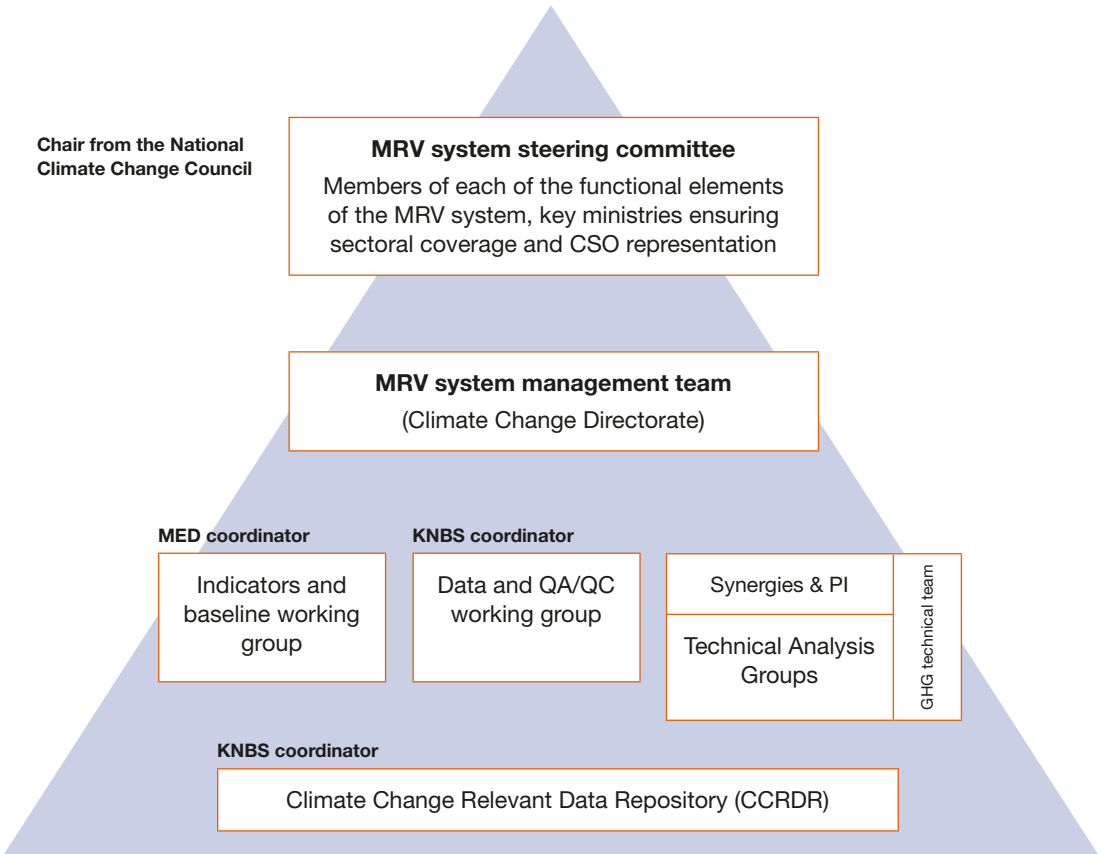
i Accreditation Panel: a technical panel responsible for framing the rules and procedures for operating the MRV system. This includes eligibility criteria for accrediting entities eligible for undertaking verification, as well as procedures for accrediting these entities as eligible and reviewing their performance.

ii Methodologies Panel. A technical panel to advise on methodological issues related to the establishment of baselines, measurement methodologies, reporting guidelines, etc. In the case of CDM, only pre-approved baseline and measurement methodologies can be used for the CDM project.

iii Designated Operating Entity (DOE). These are private-sector entities accredited by the Board to undertake verification of the emissions reductions in accordance with approved procedures. These are third-party entities that have no conflict of interest in undertaking the verification, i.e. they have no financial or other interest in the CDM projects they verify.

The above example defines the supportive institutions that would be required to support the DMEE in implementing the DMS. The DMEE may either create permanent bodies (as is done under CDM) or use expert advice to establish the rules, procedures and process, and also to provide technical advice. Countries are encouraged to use and build upon existing systems. The figure below gives the example of an MRV system established by Kenya.

Figure 1. Kenya's MRV institutional arrangements[4]



[4] Source: National Climate Change Action Plan (http://www.kccap.info/index.php?option=com_phocadownload&view=category&id=40)

Process and Procedures for DMS

As mentioned above, the DMEE would have to clearly establish the rules of DMRV or the software to operate the system. This will ensure the reliability and consistency of the measured information, as well as its timely reporting and verification.

Again we take the example of CDM to outline the elements of software, which includes both the policy framework for operating the MRV system and guidelines for NAMA developers. In the context of the CDM, the software aspect of MRV includes: a policy document to guide the MRV process and procedures; guidelines for developing baseline and monitoring methodologies; procedures for the approval of such methodologies; guidelines for ensuring the accuracy and quality of data collection; the process and procedures for the submission and approval of CDM projects; the procedure and templates for reporting measured data; and, the process and procedure for verification of the emissions reductions reported. All these guidance documents and the process and procedures are available on the CDM website. Based on this, at the minimum DMS guidance should include:

1. A policy framework for operating the DMRV that describes the guiding principles for MRV, the roles of the various institutions involved in the MRV process and the overall framework.

2. Guidelines for developing measurement plans and approaches to data measurement and storage.

    - What actions should be measured, how they should be measured, how often and what type of information should be collected related to their implementation. This may take into account domestic reporting requirements.
    - Methods for measuring emissions/removals or other performance metrics of nationally appropriate mitigation actions; procedures for documentation of the methodologies for estimating impacts; data collection ; quality assurance / quality control requirements; and, storage of collection data to ensure that emissions/ removals data is transparent, reproducible and facilitates domestic review and verification.

3. Guidelines for reporting information to ensure transparent, consistent, comparable and complete reporting, including reporting frequency, reporting requirements and formats.

    - Define the process for reporting information to relevant audiences.
    - Define the periodicity of reporting, such that the necessary policy adjustments or enhancements can be made in line with the outcomes of implementation.

4. Guidelines and process of undertaking verification.

5. Process of accreditation of verification entities if third party verification approach is adopted.

6. Process and procedures to consider verification outcomes and its use, such as feedback for improving MRV or the development of enhanced nationally appropriate mitigation actions and assessing the need for support.

As the objective of CDM is very different from NAMAs, the DMS system does not need to include steps related to the pre-approval of NAMA measurement plans.[5] Further, as a number of sources exist for developing GHG emissions estimation methodologies and identifying SD indicators, the guidance can only focus on providing good practices for developing measurement plans as well as reporting.

Countries do not need to re-invent the wheel and, adapting in accordance with country needs, could base these guidelines for DMS on:
- Procedural standards and guidelines elaborated in other countries;
- The experiences of other GHG reduction programmes.

The process of building up the guidelines for operating the DMS could be gradual and build upon experience gained from the process of developing and implementing NAMAs.

Building DMS System

Establishing an MRV system does not imply that countries have to wait for the system to be in place before starting to develop and implement NAMAs: the systems can be developed in parallel with the development of NAMAs. Experience of MRV in early NAMAs can provide the necessary inputs in developing the guidelines, process and procedures for DMS.

The DMS could start with a simple system and be based on experience. Over time, and gaining from experience, it could provide standard approaches for estimating the impacts, as well developing standard methods for measuring data to ensure reliability of the data. This improves the consistency of reported information, while open and transparent access to information improves the efficiency of the system. Countries do not need to start from scratch, as a number of systems already exist that could be used to identify and to develop DMS. Countries will most likely base DMS on the existing institutional arrangements for policy-related data collection, taking into account domestic laws and regulations that stipulate the authorities and responsibilities of institutions and domestic governance structures and principles.

The data collected to estimate the GHG impacts could also be relevant in preparing national GHG inventories. This is especially the case, as over time countries move from using the Tier I approach of IPCC in preparing GHG inventory to a higher tier with improvements in

[5] In the case of CDM, the measurement methodology is pre-approved as part of the Registration of the CDM Project/Programme of Activity. In certain cases the measurement plan of a Project/Programme of Activity does not need to be pre-approved.

accuracy. Thus in the long run – as shown in Figure 1 depicting the MRV system established by Kenya – the DMS system should create a system of data collection that is independent of the NAMAs, based on key mitigation measures. Such a system would serve both verification of the impacts of NAMAs and information for preparing national GHG inventories.

Thus over time the DMS system should be able to move to a system that goes beyond specific NAMA-related MRV to integrate the different levels (NAMA, regional and national) of systems to monitoring the climate change related actions in the country. Such a system should clearly define:

- Entities responsible for the collection and management of sources/relevant data.
- Formal agreements, where necessary, among ministries and other stakeholders concerning data collection and sharing processes. This is essential to ensure that the relevant government institutions are dedicated and have clear responsibilities for overseeing the compilation and management of emission information.
- Developing partnerships with entities other than government agencies or ministries, such as data providers, expert contributors, industry associations, consultants, universities, etc. to support the system.
- Linking national greenhouse gas inventories to ensure a coordinated approach to mitigation actions.
- Linkages with climate change policy-making and oversight institutions to enable effective monitoring of the effectiveness of nationally appropriate mitigation action.
- Arrangements to improve the quality of data and the process over time.

MRV of Internationally Supported NAMAs

One question often raised is whether I-NAMA will also be measured and verified according to the same processes and procedures as national DMRV systems. This arises from the fact that the COP decision regarding MRV of I-NAMA is not very clear on this aspect. The Cancun decision stated that I-MRV will be domestically measured, reported and verified and will be subject to international MRV. The Durban decision further stated that international MRV of I-NAMA will be conducted in accordance with the guidelines for ICA. There could be two interpretations of these decisions.

- The phrase “I-NAMA will domestically measured, reported and verified” could be interpreted to imply that I-NAMA will be measured, reported and verified according to the DMS established by the country. Further, the information for each individual I-NAMA will be reported in BUR, which in turn would be subject to ICA. The guidelines for BUR leave it flexible for countries either to report information by each mitigation action or a group of mitigation actions. It must be noted that D-NAMAs too will be subject to ICA if country reports its D-NAMAs through BUR. However, countries have every incentive to report the D-NAMAs in BURs in order to showcase their own efforts.

- MRV of I-NAMA will be undertaken by domestic entities, but the guidelines for MRV will be in accordance with the requirements of the international partners involved in I-NAMA. Information on the progress and outcomes of INAMAs, individually or collectively, will be reported through BUR, which will be subject to ICA.

It should be stressed that, as defined in the definition of I-NAMA, funding for I-NAMAs is likely to be a mixture of international support and national funds. One could also see a situation arising in which some components of a NAMA are supported by national funds and some purely by international support. Thus the host country would have an interest in conducting MRV of I-NAMA to assess the latter's effectiveness in delivering both national sustainable development and GHG reductions.

The MRV of I-NAMA is likely to depend on the expectations of the international support providers and the robustness of the national DMS. It should be noted that the principles of MRV will be the same for D-NAMA and I-NAMA, so if DMRV is developed in line with best practice, it is more likely to meet the requirements of international support providers. Ideally it would be more effective if the MRV of I-NAMA were also to be in accordance with the DMS, as this will provide consistency in evaluating all NAMAs. Further, it will avoid duplication of effort and reduce the costs of MRV for I-NAMAs at the same time that it helps strengthen the DMS. It may happen that international support providers may request additional requirements regarding measurement or verification in conjunction with the DMS requirements.[6]

As already mentioned, as the principles of MRV are no different for D-NAMA and for I-NAMA, the discussions in the following sections apply equally to both.

MRV of NAMAs

One of the questions often posed is whether each NAMA has to develop its own MRV approach. As discussed in the section above, if a country has established a DMRV, the NAMAs would follow the process, procedures and guidelines established by the MRV. This section focuses on the application of the MRV system to a specific NAMA. NAMAs could have different scopes – national, sectoral, cross-sectoral, programme and project. The NAMAs being developed in various countries are at the level of programme or sub-sectoral NAMAs. The description here focusses on the MRV of a NAMA that is programme or sub-sectoral in scope, as well as project-level NAMAs.

It is the role of the NAMA developer to develop the MRV framework for NAMA in accordance with the DMRV system, if one exists. Though the responsibility for meeting the international obligation is that of the national government, a NAMA could be developed and implemented by any of the stakeholders in the country. Because policy-making and implementation are

[6] See Hinostroza, Sharma and Karavai (2014) for details.

the responsibilities of governments, a policy NAMA would be developed and implemented by the government. On the other hand, NAMAs that stress the use of best technology and practice could be developed by the private sector. For example, the cement industry could develop and implement a NAMA for energy efficiency in the cement sector.

The role of the NAMA developer in the context of a NAMA can be set out as follows:

a) Define the indicators and information needed to monitor implementation
b) Describe the measurement plan
c) Describe the reporting plan
d) Describe the verification process

This section discusses what information on MRV a NAMA document should include, what does reporting entail, and what the different approaches to verification are.

Measurement

The MRV of a NAMA is based on the measurement of information. The function of measurement is the "systematic process of collecting information to describe a phenomenon in reasonably precise, objective terms, in terms of an established standard or 'unit of measurement'" (Breidenich and Bodansky, 2009). Measurement could be qualitative or quantitative.

To assess the progress and impacts of a NAMA, measurement should include the following information:

- **What** information and data to collect?
- **How** to collect information and data?
- **Who** is responsible for collecting information and data?
- **How long** to store information and data, and how to do so (electronically, paper trail, etc.)?
- **QA & QC** procedures.

For reasons of transparency, the NAMA document should also report the methodology used for estimating the SD and GHG impacts. The estimation methodology is the starting point for defining what to measure.

Measurement is conducted after a programme has begun and continues throughout the programme implementation period. Thus in a NAMA the measurement methodology covers only aspects to be measured during the implementation phase. This raises the question of measuring data in order to capture the impacts beyond NAMA implementation. This issue could be addressed by developing indicators at the sectoral level to track the impacts post NAMA implementation.

Reporting

As mentioned earlier, the reporting of measured information and the estimates of impacts will be in accordance with the reporting requirements of DMS, assuming one has been established in the country. Otherwise, the NAMA should clearly include information on the following aspects: what will be reported, to whom, and the frequency of reporting.

A report from the NAMA implementer to the appropriate authorities should include the following information: information on indicators for assessing progress, as well as the impacts of NAMA implementation; estimation methodology; and assumptions where indicators are estimated from measured data. It should also include a description of the measurement approach and the QA/QC procedures used. In designing reporting, the following principles should be considered:

- Consistency: reporting of information should be consistent between different types of projects or programmes and different periods of time for the same project or programme.
- Comparability: the information or estimates, especially of GHG emissions reductions, should be comparable across NAMAs. To enable comparability, the NAMA implementer should use standardised formats for reporting.
- Transparency: all the data and methodologies used should be clearly explained and appropriately documented in the report, so that anyone can verify their accuracy. Reporting should include all relevant information to enable readers to come to the same conclusions as the report and to replicate the impact results arrived at in the report.

In developing reporting formats, it is important to consult with the national authority responsible for coordinating NAMA activities in the country, as well as the entity responsible for preparing BURs. As the primary aim of NAMAs is sustainable development, they should take into account the requirement for national policy-makers to assess the sustainable development impacts. In the case of I-NAMAs, it should also take into account requirements of the entity providing support, especially on greenhouse gas emissions reduction impacts.

Verification

Verification of the reported information is the key element in increasing transparency and trust. The International Standards Organization (ISO) defines verification as a process that uses objective evidence to confirm that specified requirements have been met. Verification is the assessment of the data collection and estimating of impacts being undertaken and reported against a defined procedure or standard that establishes the requirements of relevance, completeness, consistency, transparency and accuracy. Thus verification is a process of independently checking the accuracy and reliability of reported information (Breidenich and Bodansky, 2009) but it could extend to objective assessment of the procedures used to generate information.

Verification could be based on either documentary evidence or physical evidence. Furthermore, verification could be undertaken by the first party, second party or third party.

Verification based on documentary evidence. Documentary evidence is essentially the reports. In some systems the reports are submitted physically as documents, while in others it could be done through electronic submission of information. The reported information gives the details of the collected data, process of collection, frequency of collection, systems for QA/QC of data, estimation methodology, etc. Verifiers may review such documents to evaluate the accuracy of the information. As a key part of verification is about ensuring the quality of data, prescribing minimum QA/QC procedures as part of the measurement plan could enable better verification.

The review of the Annex I country national GHG inventory is an example of a document review based verification. The National GHG inventory is submitted in accordance with agreed guidelines. International experts identified by UNFCCC review the GHG inventory to assess its compliance with the reporting requirements, completeness, transparency and consistency. The experts can ask questions of clarification from the country and if need be also conduct an in-country review involving interview-based clarification on how the data was collected and used.

Verification based on physical evidence. The second approach to verification could be through physical evidence, that is, information gathered by direct observation through a visit by the verifier to a location where data is measured and stored. Examples of physical evidence include the inspection of measurement meters, calibration equipment, etc. Verifiers may identify that such meters are present, operational and correctly calibrated. They may also observe how personnel use this equipment to collect the relevant data to determine whether this task is being performed correctly.

The CDM system is based on both documentary and physical verification. The DOE undertakes a site visit to confirm the information provided on measurement methods, instruments, recording of data etc. The objective is to ensure through on-site records that due process was followed in recording and storing information, as well as ensuring the accuracy of meters. The verification of objectives are to confirm that project activity is implemented in accordance with the registered project; that the measurement system is in compliance with the approved methodology; the completeness and accuracy of data provided in the reports; and to evaluate the GHG emissions reductions data recorded and stored in accordance with the monitoring methodology and issue a conclusion confirming that the CERs requested for issuance are free of material misstatements.

Verification could be undertaken by a first party, second party or third party.

First-party verification is through self-certification by the implementing entity. This should ideally be undertaken by a quality control mechanism within the entity that is generally independent of the team or department implementing the activity. This is akin to internal financial audits. This could be used where the DMS provides detailed guidelines for quality control and quality assurance of the measurement, that is, standards for data collection and estimation. This would require that the DMEE establishes clear standards for different types of NAMAs up front, which in the initial stages of implementation of DMS might be challenging.

Second-party verification is assessment by an organization that sets the standard against which the assessment is done. Where a DMS is established, second party verification could be done by the DMEE. This could be based on the documentary verification approach. Thus the reports submitted are verified to ensure completeness, consistency and accuracy, and that the best practices of data measurement have been applied. The verification is conducted to check that the reports are in accordance with the reporting guidelines and general guidelines for measurement. The aim of such an approach is to ensure that good practices in data measurement and reporting have been followed.

The review of Annex I GHG inventories corresponds to second-party verification of reported information, where the experts rostered by UNFCCC undertake document-based verification on behalf of the UNFCCC. The review is a technical assessment and includes assessing whether the report complies with the reporting requirements and that all the data and estimates have been transparently reported and can be used by a third person to draw the same conclusions as the report. The review is desk-based. Thus verification in this case is a technical and non-judgemental task. One may also consider it as Quality Assurance and Quality Control (QA/QC) to improve measurement and reporting.

Third-party verification is when an implementer is assessed against a standard by an independent (third-party) organization that is different from both the implementer and the entity setting the standard (e.g., the DMEE). CDM is a third-party form of verification based on physical evidence. As the objective of CDM is to ensure the environmental integrity of the offset certificates, the level of stringency required is much higher.

The countries are responsible for implementing NAMAs with the objective of reducing the national GHG emissions below the BAU. The aim of MRV of NAMAs is to demonstrate effective implementation and assess the transparency and reliability of estimated GHG emission impacts. The objective is to MRV the progress of implementation and the robustness of impacts on GHG emissions. In the context of NAMAs, the verification could be defined as a process that uses objective evidence to confirm that the goals or targets of a NAMA are being achieved. Thus verification could include independent checking of the implementation of the activities in a NAMA, the impacts of the NAMAs, and the process and procedures for collecting and reporting information. Thus the aim of verification is to

increase the completeness and transparency of the reported information. In the context of the impact on GHG emissions, verification may also involve a technical review of the appropriateness of the estimation methodology, the use of emissions factors (in the case of GHG estimates), information gathering systems as well verification of the reported information against information collected independently. It may also include provisions for public and/or relevant stakeholder input and review.

In the case of NAMAs that do not result in the generation of offsets, the verification process would be a technical review of the reported information, with a mechanism for feedback to implementers for improvements in MRV procedures. A key consideration in defining the verification process of NAMAs is that verification is not for enforcing compliance but for improving the quality of information and estimates on the impacts of NAMAs. The DMEE would thus have to clearly lay out the scope of verification and the approach to verification, as well as how verification will be undertaken.

In the case of verification of NAMAs, countries may use a third party-based documentary verification, where the third party, accredited by the DMEE, undertakes verification. This verification could be either ex-post or ex-ante. Ex-ante verification is of the measurement and reporting plan, thus ensuring the plan has been designed taking into account international good practice and that it meets all the requirements laid down by the DMEE. This is akin to the validation process of the CDM. Ex-post verification is the standard verification based on documented reports.

In the case of I-NAMA, international support providers may expect third-party verification. As the costs of verification could be significant for a programme or larger scale NAMAs, this could also be a factor for I-NAMAs in defining the verification.

Measuring progress and estimating GHG impacts

The previous section discussed the MRV of a NAMA. This section discusses the development of a measurement methodology for specific NAMAs, taking into account the scope of the NAMA (policy NAMAs, NAMAs to promote a specific technology, etc.). Finally, this section focusses on measuring GHG impacts, as this is relevant in the context of international requirements. This is not to say that sustainable development benefits, which are the primary reason for countries to implement NAMAs, are not relevant. The section first discusses the development of indicators for measuring progress and impacts. This is followed by discussion on how to measure and estimation of GHG emissions.

Identification of indicators

The guidance on what to measure in NAMA at the international level is anchored in the guidelines for developing BUR. The BUR guidelines adopted at Durban COP (Annex

III, decision 1/CP.17) state that developing country Parties shall provide the following information to the extent possible:

1. Name and description of the mitigation action, including information on the nature of the action, coverage (i.e. sectors and gases), quantitative goals and *progress indicators*
2. Information on *methodologies and assumptions*
3. Objectives of the action and steps taken or envisaged to achieve that action
4. Information on the *progress of implementation* of the mitigation actions and the *underlying steps* taken or envisaged, and the results achieved, such as *estimated outcomes* (metrics depending on type of action) and *estimated emissions reductions*, to the extent possible;
5. Information on international market mechanisms.

Further, paragraph 46 of decision 1/CP.17 requests countries submitting NAMAs and seeking support to provide, among other things, the following information:

- "the estimated emissions reductions"
- "other indicators of implementation".

To summarize the above, countries are expected to measure the following information on NAMAs (planned and implemented) for reporting to the UNFCCC:

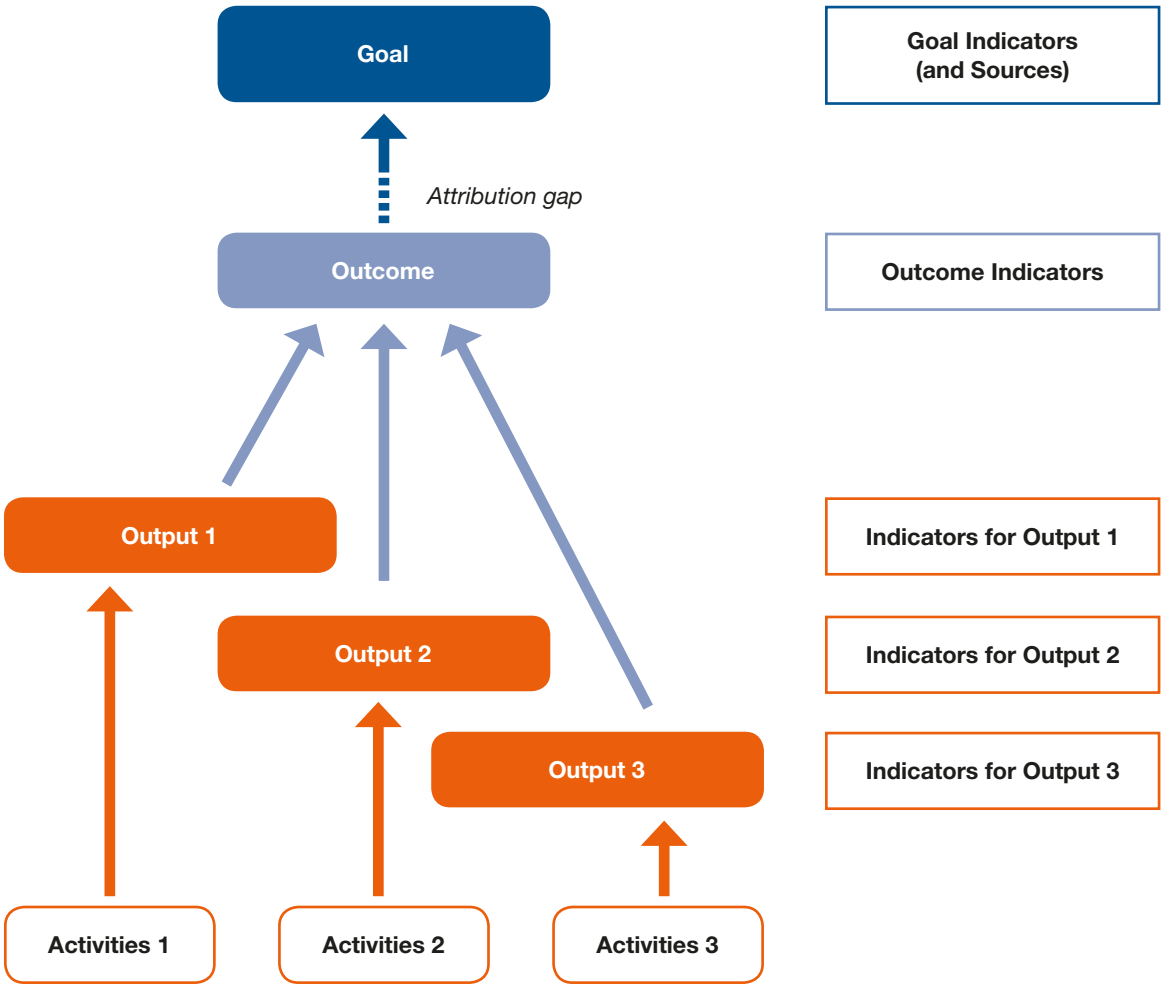
a) Information on planned NAMAs:
   i) *Progress indicators* to track the implementation of NAMAs
   ii) *Methodologies and assumptions* related to estimating greenhouse gas emissions reductions

b) Information on NAMAs under implementation, or already implemented:
   ii) *Progress* of NAMAs under implementation, including the underlying steps taken and further steps envisaged
   ii) Results achieved, *outputs* (metrics depending on type of action)
   iii) *Impacts* in terms of greenhouse gas emissions reduction

Though the BUR guidelines do not require submission of information on SD impacts, this information is of great relevance to policy-makers in the country, as NAMAs are nationally appropriate actions designed to address sustainable development needs using low carbon pathways.

Thus the two broad categories of information to be measured or estimated in the context of NAMAs are: (i) progress of implementation; and (ii) impacts, including GHG and sustainable development impacts.

Figure 2. Diagrammatic representation of links between NAMA implementation and what to be measured.



Logical framework analysis provides a good basis for understanding the above. Figure 2 links the measurement needs to the NAMA implementation stages.

Table 1 defines the logical framework in its simplest form, just to highlight the link between activities, outputs, outcomes/impacts, and hence their measurement.

Progress indicators track the implementation status of NAMA activities and outputs. The expected activities and outputs for each of the activities described in the NAMA are a good basis for identifying progress indicators. Progress indicators may also relate directly to impact indicators if the impact is assessed on the basis of certain milestones being reached. For example, the number of efficient lighting products distributed in the market could be a progress indicator where the activity is a target for EE lamp distribution. This indicator

Table 1. Inputs to Impacts: the chain of causality.

Inputs	Activities	Outputs	Outcomes/impacts
what resources go into a NAMA	what activities the NAMA undertakes	what is produced through those activities	the incremental changes or benefits that result from implementation of the NAMA
e.g. money, staff, equipment	e.g. development of training materials, training programs	e.g. number of booklets produced, workshops held, people trained, investment made, etc.	e.g. increased skills/ knowledge/ confidence, leading in the longer term to the promotion of appropriate technology, new jobs, behaviour change, etc.

Figure 3. Example of progress indicator (UNEP, 2013).

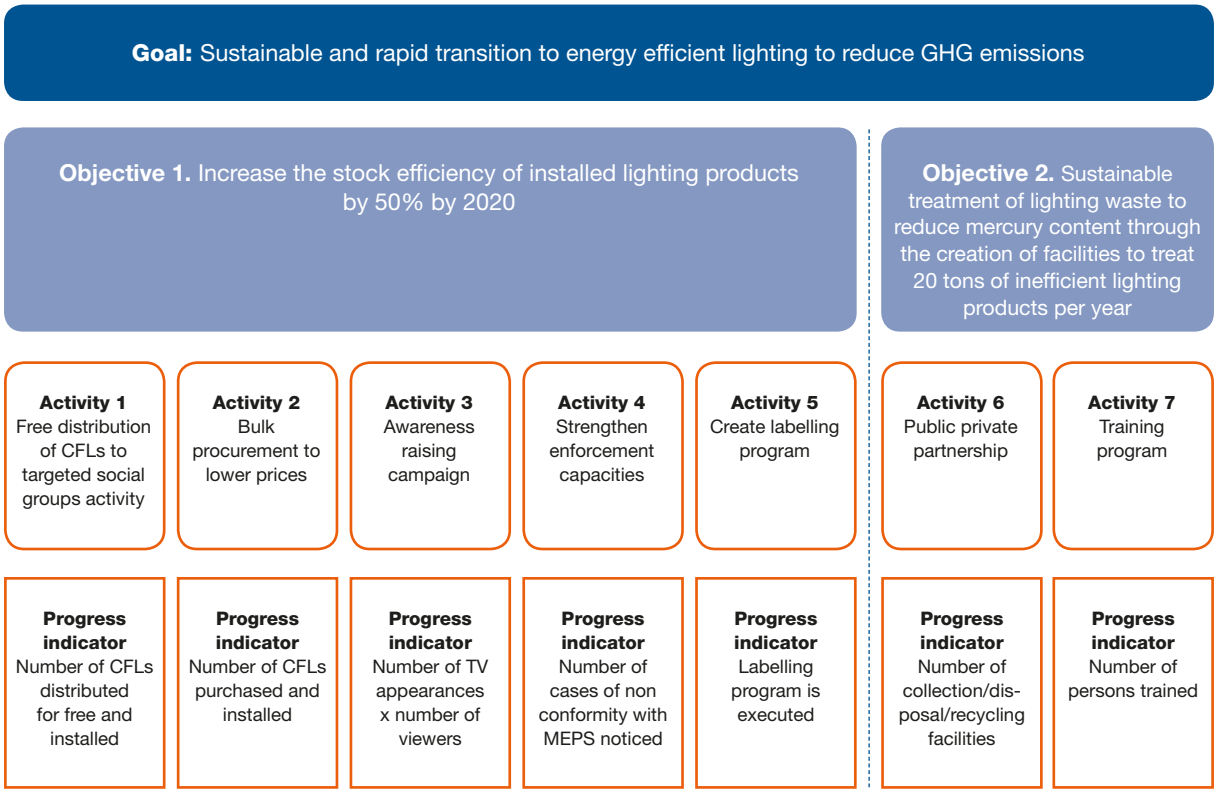


Figure 4. Examples of impact indicators (UNEP, 2013).

Activities						
Provide rebates or distribute products to targeted groups	Buy products in bulk to obtain lower prices	Provide information via communications campaign	Strengthen capacity to enforce standards	Create labelling program	Create a public-private partnership to plan and execute the scheme and its financing	Offer a training program
Outcomes						
Increased installation of EE lamps					Old lamps managed in an environmentally sound manner	
Impacts						
Climate: Lower greenhouse gas emissions (compared to business as usual)		Economic: Energy cost savings	Institutional: Increased mitigative capacity		Environmental: Less mercury and other hazardous materials in waste streams and environment	Social: Green jobs created

is also an input to estimate the GHG impacts. Progress indicators help to demonstrate the effectiveness of implementation and the efficiency of support for specific NAMA activities. Figure 3 gives an example of progress indicators for NAMA to promote EE lighting.

Impact indicators track the outputs and impacts of NAMAs, which are referred to as outcomes in the logical framework analysis. Outcomes could be short-term changes (learning: awareness, knowledge, skills, motivations), medium-term changes (behaviour, practice, decisions, policies) or long-term changes (consequences: social, economic, environmental etc.). Normally the long-term outcomes are referred to as impacts. In the context of NAMAs, the two relevant impacts are the achievement of sustainable development goals and reductions in greenhouse gas emissions. For GHG reductions the indicator is the amount of GHG emissions. In the case of SD, the goals and potential benefits of implementing the NAMA are a good starting point for identifying appropriate indicators. Indicators could be either quantitative (MW of RE capacity created) or qualitative (such as the successful enforcement of EE appliance standards). Figure 4 gives some examples of impact indicators.

Measuring/estimating indicators

Indicators should aim to be specific, measurable, accurate, realistic and time-bound ("SMART"), while bearing in mind the trade-off between price and precision. Indicators

could either be measured directly (e.g., number of CFLs purchased or installed) or have to be estimated (e.g., GHG emissions reductions). In developing a measurement methodology, the following principles should be adhered to:

- Accuracy: measurement should be as accurate as the NAMA budget will allow and aligned with the use of measurement results in evaluating outcomes and impacts. Accuracy trade-offs should be accompanied by increased conservativeness in making estimates and judgements. Further, accuracy should be determined taking into account the significance of the outcomes and impacts.
- Completeness: measurement methodologies should cover information related to all the effects of activities included in a NAMA. Some of the outcomes and impacts, such as reductions in GHG emissions, will be estimated based on measured data. In such cases, the documented methodology should clearly outline the process and procedures for estimating outcomes and impacts (emissions factors of electricity production, for example), as well as other measured data used for estimates.
- Conservativeness: estimates and measurements should be made so as to err on the side of the conservative reporting of outcomes and impacts. The principle of conservativeness should be applied to situations in which either measurement or estimating have a high level of uncertainty or in which a high level of accuracy of measurement or estimating is not cost-effective. The measurement methodology should expressly identify the uncertainty in measurements and include procedures for choosing conservative values.

The estimation methodology for an indicator defines the data to be measured (see section on estimating GHG emissions reductions). Good references for SD indicators and its measurement or estimation are Olsen (2013) and the new tool recommended by the CDM Executive Board for measuring the SD benefits of CDM projects.[7]

How to measure? The measurement could be undertaken either directly or indirectly. The data to be measured could either be directly measured (e.g. in estimating GHG emissions reductions from implementing a NAMA to promote wind energy, the amount of electricity produced through wind-power plants can be directly measured at the wind-power plants established as a result of a NAMA), collected through survey methods based on sampling techniques (e.g., for estimating GHG emissions reductions from the use of EE lights, data on the number of hours the lamps are used could be obtained through a survey of appropriate samples of installed CFLs), or collected from secondary sources (e.g., the emissions factor for a grid could be sourced either from registered CDM projects or estimated using information available in public documents).

Who should undertake the measurement? Responsibility for measuring does not lie solely with the NAMA implementer, but the NAMA implementer is responsible for ensuring that data are measured, stored and reported in accordance with procedures by those

[7] http://cdm.unfccc.int/Reference/tools/index.html

responsible for undertaking measurement. Responsibility for measuring would depend on the type of activity. For example, if a NAMA is to implement EE measures in the cement industry, measurements of fuel consumption, the emissions factor for fuel and output could be undertaken by the cement plants participating in the NAMA in accordance with the procedures designed in the NAMA. On the other hand, if the NAMA is to promote the use of biogas plants in rural households, the burden of measurement of each biogas plan on the household will be excessive. In this case the measurement could be undertaken by the NAMA implementing authority using periodic surveys by a designated entity to undertake the survey. Government entities responsible for collecting statistics could also be involved in collecting data by integrating data collection formats in its regular data collection activities.

QA/QC procedures: An important element of the measurement plan is to define quality control and quality assurance systems. This is specifically relevant where the verification process is a documentation-based review. The two key elements of QA/QC are 1) specification of the measurement to ensure accuracy, and 2) procedures for measurement to ensure there are no errors in recording information. In a way the QA/QC process is a means of verification at the level of the NAMA implementer. This also includes ensuring that data transfer from measurement to storage does not result in the inaccurate recording of information.

Key institutions and entities to consult on the measurement plan: To develop a measurement plan, two relevant entities for defining who and how to collect data are 1) the national socio-economic and environment data collection entity; and 2) the entity responsible for preparing national GHG inventories. These entities could provide information on the data collected by them, thus providing a good starting point for understanding which of the data to be measured could be sourced from these entities and what data would have to be collected during implementation. In most countries specific government departments are vested with the responsibility for collecting data for national planning. For GHG-related measurements, the entity responsible for national GHG inventory preparation should be consulted in order to identify data that are available and regularly collected in preparing the GHG inventory. This includes both activity-level data and emissions factors. In most countries the Ministry of Environment is the nodal ministry for preparing the GHG inventory. Normally this is also the entity responsible for national reporting to the UNFCCC.

Estimating GHG Impacts

The starting point for identifying data to be collected for estimating the GHG impact indicator (GHG emissions reduction) is the estimation methodology. In the case of GHG emissions reductions, NAMA developers do not need to reinvent the wheel and could use a number of existing methodologies, such as IPCC methodologies or CDM methodologies. CDM methodologies have three elements: establishing the baseline, demonstrating additionality, and the estimation method for emissions reductions. The relevant element to be taken from the CDM methodologies is the emissions reductions estimation method.

In the context of NAMAs, additionality is not a relevant concept as it is for CDM projects. The additionality aspect is linked to the business-as-usual (BAU) GHG emissions one expects to observe if the NAMA were not to be implemented, as the objective of the NAMA is to implement actions that enable GHG emissions to be reduced below the BAU. Thus a robust BAU estimate is an integral part of the methodology for estimating GHG reductions. Establishing BAU also defines the geographical scope and sources of GHG emissions that will be impacted by implementing a NAMA, thus being a key element in defining the data to be collected in estimating GHG emissions reductions.

Estimating BAU is a challenging task, as it is about projecting into the future the course of development that would happen in a sector or sub-sector. A key challenge in projecting BAU is considering existing policies and programmes that have positive impact on reducing GHG emissions relevant to NAMA. Taking into account the impact of these policies depends on a number of factors, including the level of implementation, the available resources, etc. Thus estimating BAU involves a lot of assumptions, and also a very accurate estimate may result in heavy data requirements and hence also costs. BAU should therefore be robust and transparently explained. The objective of the estimate is to assess the order of magnitude of GHG emissions reductions, not arrive at accurate GHG emissions reductions. The key for NAMAs is to ensure effective implementation and design that turns the long-term choice to low carbon options.

An example is presented below (based on UNEP 2013) for NAMA to increase use of EE lighting in a country. The estimation method is based on CDM methodologies AM0046 and AMS-II.

$$ER = ES * EF$$

$$ES = \frac{Q * (P_{BL} - P_{EE}) * O * (1 - RE)}{(1 - TDL)}$$

ER Emissions reductions achieved annually (tCO_2)
ES Electricity saved by use of energy-efficient lighting products (MWh)
EF Emissions factor for electricity (tCO_2/MWh)
Q Energy-efficient lighting devices replacing baseline lighting devices
PBL Power rating of the baseline lighting product
PEE Power rating of the energy-efficient lighting products
O Average annual operating hours
TDL Transmission and distribution losses (fraction)
RE Rebound effect (fraction)

The key information and data needed to estimate the greenhouse gas emissions reductions of efficient lighting programmes include:

- Types of different efficient lighting products to be covered in the NAMA
- Estimates of the penetration of each energy-efficient lighting product type used in the accounting period
- Average annual operating hours for each energy-efficient lighting product type
- Power consumption of each type of energy-efficient lighting product
- Power consumption of baseline lighting product replaced by each type of energy-efficient lighting product
- Transport and distribution losses and emissions factors (may need to be calculated by region)

Emissions reductions are estimated against a business as usual scenario. This describes the total lighting stock, including the installation rate of efficient lighting products in the absence of the NAMA. Establishing the business as usual case requires information on:

- Existing stock of lighting products for a given base year and expected rate of growth of lighting product use
- Current level of energy-efficient lighting products on the market
- Rate of growth of energy-efficient lighting products in the market over the past few years
- Expected change in policies and regulations regarding energy-efficient lighting products (in the absence of the NAMA), and assessment of their impact on the use of energy-efficient lighting products
- Impact of projects and programmes to promote the use of energy-efficient lighting products, either under implementation or planned for implementation
- External factors, such as imports of energy-efficient lighting products, prices of energy-efficient lighting products, electricity prices, or other factors that may affect purchasing or use behaviour

Business as usual can be established either by expert judgement, based on the available data, or by using models. The use of projection methods depends on the availability of data and the level of accuracy desired. Modelling does not guarantee greater accuracy, but it does enable the implications of various factors in the use of lighting products and the penetration of energy-efficient lighting products to be understood. The trade-off is between the resource intensity of the estimate and its accuracy.

Reporting NAMA information in BUR

BURs are the main channel for reporting information on mitigation efforts taken by developing countries through NAMAs. As mentioned earlier, countries are required to report on actions taken to mitigate climate change, including information on outcomes and estimated emissions reductions (para 11-12, BUR guidelines, Annex III Decision 2/CP.17). The BUR guidelines state that countries will report information in tabular format for

mitigation action or group of mitigation actions, including, as appropriate, those listed in document FCCC/AWGLCA/2011/INF.1.

The document mentioned above lists what one may refer to as national voluntary mitigation actions pledged by countries to meet their obligations under the UNFCCC in accordance with the Cancun Agreement. These pledges have been classed by Sharma and Desgain (2013) into five categories: 1) national-level goals (expressed in terms of absolute or intensity targets for national GHG emissions with respect to a base year or GHG emissions reductions targets compared to BAU emissions in 2020); 2) sectoral goals (generally expressed in non-GHG matrix -energy intensity, percentage of share of low-carbon options, etc.); 3) focus areas (generic sub-sectoral, sectoral or cross-sectoral mitigation options with no specific goals or measures to implement them, e.g., improving share of RE in electricity generation, energy efficiency in industry, increasing afforestation rates, etc.); 4) measures (specific policies, regulations or technology initiatives); and 5) specific actions (project or technological action in a specified location). In this context, it should be noted that the term 'NAMA' is used for both nationally determined voluntary mitigation actions to address GHG emissions and specific mitigation actions identified at the sectoral, sub-sectoral or local levels.

The challenge of reporting for countries that have adopted national-level goals is different from those that have not done so. Reporting national-level goals is similar to reporting on absolute reduction targets adopted by developed countries, and information to be reported to demonstrate progress in meeting these goals will depend on the nature of the goal. Table 2 describes information that may help reporting on national-level goals.

The key monitoring framework for the group of countries with national-level goals is the GHG inventory preparation system. Thus IPCC guidelines for QA/QC of inventory preparation are an important element of the MRV of the GHG inventory in the case of these countries.

To achieve the national-level goals, countries would have to identify policies, programmes and specific mitigation actions, which could be categorised as individual specific NAMAs being developed by many countries. For example, Mexico in its "Programa Especial de Cambio Climático 2008-2012" (PECC, or Special Programme on Climate Change)" outlines the policies and measures it would undertake to meet its declared goals. A few examples of these are: to develop a strategy to promote CHP (leading to a 10% additional share of electricity production in 10 years); an Infrastructure Investment Plan including measures to reduce transmission losses by 2025 (leading to 4% distribution losses in 2030); improving the efficiency of fossil-fuel power plants (leading to average efficiency of 45% (coal) and 60% (natural gas) by 2030; and increasing the share of renewable energy by at least 10% in 10 years of the share of production of electricity.

To strengthen mutual trust, it will be important for countries to report these policies, programmes and actions in BUR as well. The information could also include estimates

Table 2. Information to report progress on developing country national level goal NAMAs

Scope		Example to illustrate the scope	Possible options for reporting on progress
Economy-wide Goals	Absolute reduction target	Antigua and Barbuda: reduce GHG emissions by 25 per cent below 1990 levels by 2020.	Tracking progress is straightforward through comparison of annual GHG inventory. It would require clearly defining sources and gases covered, as well as building an inventory system to develop consistent data over time for comparison. The reporting should also include projections of GHG emissions, taking into account policies and measures adopted to address GHG emissions.
	BAU Deviation Target	South Korea: reduce national GHG emissions by 30 per cent from the 'business as usual' emissions in 2020.	Demonstrating progress is more challenging. The country has to establish BAU emissions up to 2020. This will require a reporting methodology for establishing BAU, including assumptions. The country should clearly define the sectors and sources covered as part of its pledge. This should be consistently covered in both establishing the BAU and in preparing national GHG inventory. BUR should also include projections of GHG emissions, taking into account the policies and measures adopted to address GHG emissions.
	Intensity target	India: reduce the emissions intensity of GDP by 20–25 per cent by 2020 compared with the 2005 level.	The primary basis for demonstrating progress is again annual GHG inventory. Additionally the country needs to define the source of information on GDP it would use in calculating GHG intensity. Further, the basis of intensity calculation should be real GDP, and the country should define a common base year for measuring its value . The country also needs to define clearly the sectors and gases included in defining the goal, and the GHG inventory should be consistent with it. Similar to the first case, the level of accuracy and consistency of data should be ensured for effective comparison between the base period and the end period. BUR should also include projections of GHG emissions, taking into account the policies and measures adopted to address GHG emissions. Also, BUR should report on the projections of GDP growth.

Table 3. E.g. of indicators to track the progress of sectoral or focus area NAMAs

	Policy objectives	Indicators
Solar Programme	Increase share of solar in grid-connected electricity Increase R&D and innovation Increase solar manufacturing Increased use of solar energy in all areas	Solar capacity installed and electricity supplied to the grid
		Imports/exports/production of solar panels
		Cost of solar electricity generation
		Credit provided by banking and financial institutions for financing the manufacturing of solar systems and solar grid-connected projects.
		Subsidy provided by governments
		Sale of solar home systems (in MWp)
		Sale of solar thermal products (MWth)
Energy efficiency Programme	EE in energy-intensive industry EE appliances in identified sector (e.g., ceiling fans, agricultural pumps)	Specific energy consumption (energy consumed per unit production) by industry Share of EE appliances in total appliances produced and sold Average EE of appliances
EE improvement of Buildings	Law to implement minimum energy standards for buildings	Level of enforcement of building codes measured in terms of % of new building built according to building codes Average energy efficiency of buildings by different building types. Typical energy type and energy consumption of different buildings types, etc.

of the impacts of policies, programmes and actions on GHG emissions reductions. This information supplements information on the indicators used to report on national-level goals and provides an assessment of countries' progress towards achieving their goals. Countries would have to develop systems for tracking progress and the impacts of these measures to assess their progress in meeting national-level mitigation goals. Hence, countries would benefit from developing sectoral-level indicators that could also be used in estimating GHG impacts.

In the middle are countries that have pledged NAMAs in terms of either sectoral goals or focus areas. The process of drawing up a measurement plan is the same for these NAMAs as would be for specific mitigation actions. The scale and mode of collecting information are likely to be different. For sectoral NAMAs or focus areas, the matrix would be in terms of non-GHG indicators that capture best progress towards low-carbon development. Such a matrix for the energy sector could include reporting on increased energy efficiency in

electricity generation, energy efficiency improvements in the industry sector, increasing the share of renewable energy in electricity generation, etc. The non-GHG matrix is also an input into estimating GHG emissions and can be developed based on the methodology for estimating GHG impacts. The non-GHG matrix is relevant from a country perspective in terms of tracking national goals and development benefits. Table 3 gives examples of a few NAMAs that are sectoral or that identify a focus area.

At the other extreme are countries that have submitted a list of specific mitigation actions as their NAMAs, based on countries' sustainable development priorities and opportunities for reducing GHG emissions. For example, Ethiopia reported a list of more than twenty actions to address GHG emissions, such as creating specific railway lines to move traffic from road to rail. Reporting on NAMAs could be based on either detailed reporting of each and every specific NAMA, or it could be based on presenting aggregated information for each sector and linking the GHG impacts to changes in GHG emissions for those sectors. The BUR guidelines state that information on NAMAs should be provided in tabular format. Thus the expectation is not to present detailed information on each NAMA. Nonetheless, it is important to assess the level of detail to be presented in the tabular formats that will convey critical information and ensure transparency.

The costs of presenting detailed information on the progress and impacts of NAMA may not be large, as each NAMA is expected to develop a measurement plan as a basis for reporting progress and impacts. Thus information on the progress and impacts of each NAMA would be available for reporting in a NAMA. Nonetheless detailed information on each of the NAMAs in a BUR may make it a difficult document to read and comprehend. It may therefore be useful to aggregate the information by sectors, which also makes it easier to link with the sectoral national GHG emissions inventory. Decision criteria for aggregation should also take into account the relevant level of information needed for countries' policy-makers to evaluate climate change policy implementation and the tracking of national goals. Information could focus on major recent changes, or provide a complete picture of the country's mitigation strategy, actions, projected impacts and supporting analysis.

Thus, irrespective of the nature of a country's pledge, the level of reporting on specific mitigation actions could be presented in a common format by all countries. It is important to establish a standardized format that all countries can use in presenting information in an aggregated format. Such a standard format allows easy comparability of information across NAMAs within and across countries, and also comparability over time. Apart from developing aggregate reporting on mitigation actions, this information could also be useful in ensuring the comparability of national-level estimates of GHG emissions. The standard format should be sufficiently detailed and presented in such a way as to provide a clear picture of the types of mitigation actions that are being planned and those that have already been implemented, their expected or observed impacts, and the estimation method for estimating the impacts in quantitative terms.

Table 4. Example of tabulated reporting format for NAMAs in BURs

Sector (in accordance with GHG inventory tables)	Mitigation measures	Objective and/or activity affected and key GHG emission sources impacted	Implementation information: start, end date, implementing entity, source of finance (unilateral or supported) and status.	Progress of implementation reporting on key progress indicators, including non-GHG matrix					Expected baseline emissions in the absence of NAMA (define year)	Estimated GHG emissions reductions below baseline (for reporting year)
Sector 1										
Sector 2										

Another question is whether, while aggregating information on NAMAs, countries should present information separately for domestically supported and international supported NAMAs. Countries may use this as a layer of information in developing a standard format. In some cases where the differentiation between D-NAMA and I-NAMA is not easy, one may highlight the I-NAMA component but present an aggregated impact. Table 4 gives an example template based on the format suggested by Ellis, et al. (2011).

Compilation of NAMAs by sector is proposed, as this would help link the impacts of NAMAs to the GHG inventory. Further, the sectoral aggregation also provides alignment with national policy and regulation, creating responsibilities which are normally organized along sectoral lines. It is expected that the sectoral line ministries will have the authority to oversee progress in the development and implementation of NAMAs in countries or policies and measures for low carbon development. Thus sectoral aggregration is also useful in terms of national evaluation of the implementation of the climate change strategy.

Further, aligning the reporting with the preparation of the national GHG inventory would have benefits in terms of creating synergies between the MRV of NAMAs, as well as improving the quality of the national GHG inventory. The information required for preparing Tier II,[8] and especially Tier III, inventory requires country- and entity-specific information. In preparing their national GHG inventories, a number of developing countries have identified areas in which to strengthen accuracy and reliability. Some of these include emissions factors for various activities, as IPCC defaults are not applicable, information on emissions factors related to industrial processes, fugitive emissions from oil and gas production, agriculture

[8] IPCC GHG inventory guidelines define three approaches to estimating national GHG emissions; these are called Tier I, Tier II, and Tier III.

soils, etc. Similarly, countries have admitted a lack of systems and processes with which to collect information on household-level energy consumption, industry-specific energy efficiencies etc. Some of this information could come from the measurement plans of NAMAs implemented in these sectors. Thus the sectoral approach of tracking the implementation of NAMAs helps the collection of data to strengthen information for preparing national GHG inventories. This also could result in costs savings by sharing the institutional arrangements for data collection.

Countries can complement the reporting of information on NAMAs in BURs with detailed reporting on individual NAMAs by establishing a National NAMA Registry. The National NAMA Registry could serve multiple purposes. It could be used to inform in-country stakeholders about prioritized NAMAs that have been identified for implementation in line with national sustainable-development and climate-change strategies, as a platform for reporting to national stakeholders on progress in implementing NAMAs. As part of the latter, the final approved and verified reports on progress in the implementation of individual NAMAs could be made available on the National NAMA Registry, along with information on impacts. This would supplement the information that countries provide in the BURs.

Conclusions

MRV is a key element of NAMAs, an instrument that can assess the efforts made by countries in addressing GHG emissions in such a way as to facilitate reviews of the collective efforts of all countries. It is also an important instrument for building confidence among countries. From a developing country perspective it is also a useful instrument with which to manage GHG emissions and assess the sustainable development benefits of implementing NAMAs.

In facilitating the MRV of NAMAs, countries could benefit from institutionalizing the MRV process through a DMRV system. Such a system will bring coherence to MRV at the national level and enable the collation and comparison of NAMA impacts. This will also reduce the efforts of individual NAMA developers in developing an MRV approach. Countries have national systems to monitor and evaluate policy and programme implementation, and this could be the basis on which countries could build DMRV.

Information generated from the MRV of NAMAs is useful for national policy-makers in assessing the implementation of national climate policy and strategy, as well as in reporting countries' mitigation efforts to the UNFCCC through BURs. In terms of reporting on NAMAs through BUR, the reporting might vary depending on the nature of the voluntary national obligation (national goal, sectoral goals, specific policy goals, etc.) submitted by countries. Nonetheless, for reasons of transparency, even countries with national or sectoral goals could present information on the individual NAMAs that they develop and implement to achieve the national/sectoral goals. Further, countries may also integrate sectoral level indicators into the DMRV systems in order to track progress on implementing mitigation

actions at the sectoral level. In pursuing this endeavour, countries may also benefit from establishing a National Registry of NAMAs.

As part of regular BURs, countries are in the process of developing institutionalized arrangements for preparing GHG inventories. Countries would benefit by integrating GHG preparation with the DMRV system. This would help save costs and create synergies and consistency in reporting.

The process of developing institutional GHG inventory systems and DMRV would be gradual and would benefit from the use of existing institutional frameworks as an alternative to building new parallel institutions.

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Measuring, reporting, and verifying NAMAs – developing in-country institutional arrangements and process

Measurement, Reporting, and Verification (MRV) emerged as one of the key elements of the mitigation framework developed under the UNFCCC for mitigation actions by developing countries to increase the "transparency of mitigation efforts made by the developing countries' as well as build mutual confidence among all countries.

The objective of the publication is to enhance the knowledge of the policy makers and decision makers in developing countries on MRV systems, including requirement of operationalizing such a system. The paper is also aimed at increasing the understanding of MRV aspects among sectoral experts and developing-country NAMA practitioners.

The publications will describe:

(i) The MRV framework of developing country mitigation actions as agreed by the Parties to the UNFCCC.

(ii) Common elements of a MRV system, including institutional arrangements as well as processes and procedures.

(iii) What is to be measured in context of NAMAs, the role of NAMA developer in MRV of NAMA, the information to be included in a NAMA measurement plan, reporting requirements, and different types of verification system.

(iv) Reporting of NAMA implementation in BURs and format for aggregated presentation of information on NAMAs.

Catalogue entry:

Measuring, reporting, and verifying NAMAs – developing in-country institutional arrangements and process is designed to enhance the knowledge of the policy makers and decision makers in developing countries on MRV systems and methodologies for GHG assessment.

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