MODULE 7

Measurement, Reporting, Verification

NAMAs in the refrigeration, air conditioning and foam sectors. A technical handbook.

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Proklima

Proklima is a programme of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Since 2008 Proklima has been working successfully on behalf of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) under its International Climate Initiative (IKI) to promote ozone-and climate friendly technologies.

Proklima provides technical assistance for developing countries since 1996, commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) to implement the provisions of the Montreal Protocol on substances that deplete the Ozone Layer.

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The International Climate Initiative

Since 2008, the International Climate Initiative (IKI) of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) has been financing climate and biodiversity projects in developing and newly industrialising countries, as well as in countries in transition. Based on a decision taken by the German parliament (Bundestag), a sum of at least 120 million euros is available for use by the initiative annually. For the first few years the IKI was financed through the auctioning of emission allowances, but it is now funded from the budget of the BMUB. The IKI is a key element of Germany's climate financing and the funding commitments in the framework of the Convention on Biological Diversity. The Initiative places clear emphasis on climate change mitigation, adaption to the impacts of climate change and the protection of biological diversity. These efforts provide various co-benefits, particularly the improvement of living conditions in partner countries.

The IKI focuses on four areas: mitigating greenhouse gas emissions, adapting to the impacts of climate change, conserving natural carbon sinks with a focus on reducing emissions from deforestation and forest degradation (REDD+), as well as conserving biological diversity. New projects are primarily selected through a two-stage procedure that takes place once a year. Priority is given to activities that support creating an international climate protection architecture, to transparency, and to innovative and transferable solutions that have an impact beyond the individual project. The IKI cooperates closely with partner countries and supports consensus building for a comprehensive international climate agreement and the implementation of the Convention on Biological Diversity. Moreover, it is the goal of the IKI to create as many synergies as possible between climate protection and biodiversity conservation.

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Executive Summary

The successful establishment of systems for measurement, reporting and verification (MRV) is a crucial step when setting up nationally appropriate mitigation actions (NAMAs). A credible MRV system will demonstrate and provide recognition for national mitigation actions. A standardised reporting and verification procedure helps countries to limit their greenhouse gas (GHG) emissions in all key sectors along a national climate action plan, and therefore contributes to their share in the international effort to comply with the 2°C target.

The main approach to MRV in any new climate agreement will be to use existing reporting systems in countries under the current United Nations climate regime, and to build on these to include MRV of commitments, actions and support. To establish a successful MRV process, countries will have to provide resources and capacity. Obstacles to the development of a successful MRV system in the NAMA context include lack of government based regulations and enforcement, lack of clearly defined activity data, inappropriate default emission factors, and the lack of financial and technological support to ensure the continuous collection of data; furthermore, the lack of capable institutions, clearly defined roles and responsibilities as well as procedures, and appropriate indicators and methodologies, specifically for the quantification of mitigation impacts, sustainability and transformative change. Lack of a central data collection and processing unit may also be problematic.

The proposed outline of an MRV system in the refrigeration, air conditioning and foam (RAC&F) sectors is based on experiences made with MRV systems within project based approaches such as the Clean Development Mechanism (CDM), Voluntary Carbon Standard and Climate Action Reserve, as well as the MRV efforts undertaken under the Montreal Protocol and measures to control F-gases in the European Union (EU). This approach relies on the methodology on direct and indirect emissions reporting in the RAC&F sector established in modules 1 and 6 of this handbook.

The requisite stringency of the MRV process also depends on the type of NAMA, i.e. unilateral, credited or supported NAMA. Credited NAMAs have been discussed but not adopted under the United Nations Framework Convention on Climate Change (UNFCCC) so far. In particular supported and credited NAMAs will require reliable evidence of achieved emission reductions. The approach outlined here focuses on setting up an MRV system which can sustain the reporting requirements under a supported NAMA.

A step-by-step guideline outlines the set-up of a framework for a stringent MRV system. The approach is based on the Tier 2 methodology outlined in module 1 with data collection for direct and indirect emissions in the baseline scenario. Instead of directly establishing a Tier 2 approach, the relevant MRV regulations could also evolve stepwise, establishing first a Tier 1a or Tier 1b reporting system.

1. Introduction

The successful establishment of systems for measurement, reporting and verification is a crucial step when setting up nationally appropriate mitigation actions. The function of an MRV system is to recognise national actions that are

1. Measureable, with the aim of monitoring,
2. Reportable, with the aim of demonstrating reduction in emissions, and being able to track if mitigation impacts and related action are sufficient,
3. Verifiable, with the aim of ensuring that the measured and reported values are credible, and of learning how to improve the MRV procedures as well as the mitigation actions.

An MRV system also aims to encourage continual improvement in climate performance (UNF, 2009). In the context of NAMAs, the MRV system is used to evaluate the progress and impacts of NAMA implementation, thereby allowing for assessment and revisions to ensure that mitigation action is properly implemented. Furthermore, the system assures transparency of the activities. A credible MRV system is an essential part for any NAMA proposal to obtain financial support, either multilateral or bilateral. It is also a mandatory element for NAMAs to be registered with the UNFCCC NAMA registry.

Chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC) are controlled under the Montreal Protocol. They have been used widely as refrigerants and foam blowing agents and are still used in many developing countries. The countries have to report the consumption of these ozone depleting substances (ODS). However, hydrofluorocarbons (HFC) are being used intensively as replacement substances where ODS are being phased out. HFCs contribute to global warming but as they do not deplete the ozone layer, they are not controlled under the Montreal Protocol.

There is currently no established comprehensive MRV system for the RAC&F sectors. An MRV system for NAMAs must go beyond the reporting of consumption and instead focus on emissions. HFC emissions and indirect emissions have to be incorporated. Under the CDM the most relevant HFC related MRV methodology concerns HFC-23, which is a by-product of HCFC-22 production. HFC-23 has a very high global warming potential (GWP) of 12.000 (IPCC, 2006). Still, this methodology has low relevance for the applicability to the RAC&F sectors.

MRV systems in the RAC&F sectors will contribute to higher transparency and will therefore facilitate applications for financial and technical support, which is particularly important for a supported NAMA. It is vital to include MRV in NAMAs in order to move away from the use of HFC substances to more environmentally-friendly options and to reduce the overall energy consumption of appliances and systems in the RAC&F sectors.

The functions of MRV are complementary to those of national greenhouse gas inventories under the UNFCCC and procedures to quantify emission reductions under carbon offset schemes (UNF, 2009). While national inventories measure and report emissions and are useful for various purposes, they are not suited as a means of identifying the most promising opportunities, mobilising the required resources and tracking the effectiveness of individual mitigation actions (Niederberger and Kimble, 2011). MRV in the context of NAMAs will help to quantify, report and verify emission reductions through mitigation measures.

TABLE 1
Functions of MRV process*

Accountability functions
• Enable assessment of developed country progress towards mitigation commitments • Enable assessment of developed and developing country implementation of mitigation actions • Enable assessment of the provision of technology, finance and capacity building support • Strengthen mutual confidence in countries' actions and in the overall regime, and thereby enabling stronger collective effort
Facilitative functions
• Catalyse coordination and planning on mitigation and support within and between countries • Enable countries to identify and implement feasible emission reduction targets • Facilitate information-sharing on effective mitigation options and their cost within and between countries • Enhance the ability of the Conference of the Parties (COP) to assess the agreement's effectiveness • Facilitate national action planning • Link mitigation actions proposed by developing countries with technology, finance and capacity building support

*Adapted from Fransen, T., 2009

The MRV process has two main functions within a NAMA as illustrated in Table 1.

A sectoral MRV approach is important for tracking a sector's contribution towards national emission targets. A multi-sectoral national approach with baseline emission reporting covering national emissions on a sectoral basis and mitigation action is a prerequisite for credible mitigation action both on a national and on a global basis. This also provides a basis for stepping up ambition and mitigation action at national and international levels (UNFCCC, 2011).

To date several reports and publications have analysed and illustrated how a future MRV framework may look like and what options exist from the current reporting and reviewing requirements under the present UN climate regime (e.g. Breidenich and Bodansky, 2009; McMahon and Moncel, 2009; IGES, 2010; Sterk, 2010; Niederberger and Kimble, 2011). Based on this analysis, Table 2 provides an overview on possible MRV requirements for the different NAMA types.

Table 2 indicates an increasing level of stringency on MRV requirements from unilateral to supported and finally to credited NAMAs. A detailed description of the suggested methodologies for measurement, reporting and verification are presented in chapter 2 of this module.

TABLE 2
RAC&F MRV requirements for the different NAMA types

Type of NAMA	Measurement	Reporting	Verification
Unilateral NAMA	• GHG based indicators • (á Tier 1 for HFCs) • Supporting indicators	• Country specific reporting format/standardised reporting format	• National verification
Supported NAMA	• GHG based indicators (Direct and indirect emission reductions á Tier 2) • Supporting indicators	• Standardised reporting format	• International verification
Credited NAMA*	• GHG based indicators (Direct and indirect emission reductions á Tier 2) • Supporting indicators • Detailed accounting of emission reductions	• Standardised reporting format	• Verification by internationally accredited agency

*The framework of credited NAMAs has not yet been established. Shown MRV levels are accordingly only indicative.

2. Methodology

The focus of this module is to provide a framework for MRV for NAMAs in the RAC&F sectors. The module provides a step-by-step guideline on how a MRV system in the RAC&F sectors can be set up. The guidelines aim at supporting participating countries to demonstrate their reductions of direct and indirect emissions. The outlined methodology builds on the MRV principles and decisions from the COP meetings under the UNFCCC. It takes into account MRV principles established under the Montreal Protocol and within the European Union on the control of ODS and F-gases.

2.1 Overview of existing MRV methods in RAC&F sectors

The available HFC-related MRV methodologies under the UNFCCC were established under the Clean Development Mechanism and are, consequently, project related. To some extent they can also be applied under a sectoral NAMA approach. Other HFC-related methodologies can be found in the Voluntary Carbon Standard (VCS) and the Climate Action Reserve (cf. annex to this module). Table 3 summarises these methodologies and evaluates their applicability for roll-out of similar activities in respective sectors.

TABLE 3
Summary of existing MRV methodologies in RAC&F sectors

Methodologies from	Applicability	Measured variables	Approach to quantify project impact	Number of projects applying the methodology	Sector scope	Source (cf. annex)
Clean Development Mechanism *Small scale*	Energy efficiency appliances	• Power • Operating hours or Energy use	Baseline-project difference	11* but none related to cooling activities	Energy demand	AMS II.C
	Energy efficiency in buildings	• Energy use of buildings	Baseline-project difference	2 – one of them with activities improving the air conditioning system (insulation and chiller efficiency increase)	Energy demand	AMS II.E
	Polyurethane (PU) manufacture	• Produced amount of PU foam, which is directly linked with the blowing agent amount	Baseline-project difference	3	• Energy demand • Fugitive emissions from production/consumption of halocarbons and sulphur hexafluoride	AMS III.X
	Energy efficiency and refrigerant change in domestic refrigerators	• Electricity consumed • Refrigerant (kg) • No. of refrigerators in operation	Sample of project refrigerators against sample of baseline refrigerators	None	Energy demand	AMS III.AE
	Electricity use in residential buildings	• Energy use • Heating degree days • Cooling degree days	Sample of project buildings against sample of baseline buildings (computer model or regression analysis)	None	Energy demand	AM 0060

* Programmes of Activities(PoAs)

TABLE 3
Summary of existing MRV methodologies in RAC&F sectors

Methodologies from	Applicability	Measured variables	Approach to quantify project impact	Number of projects applying the methodology	Sector scope	Source (cf. annex)
Clean Development Mechanism *Large scale*	Chiller replacement	• Leaked refrigerant • Chiller performance parameters (flow rate, chill water temperatures)	Baseline-Project difference via power consumption function	None	Energy demand	AM 0060
	Refrigerator energy efficiency improvement for manufacturers	• Energy consumption during use based on sample or rated electricity consumption reduced by a generic correction factor of 0.95	Setting market benchmark to at least the top 20% performance (in case of labelling schemes, half of the market share of labelled units are considered)	None	Manufacturing industry	AM 0070
	Low-GWP refrigerant; same or better energy efficiency	• Unit numbers produced for domestic market • Emission factors (default of factory specific)	Baseline - project difference; unit numbers capped by historical market share	None	Fugitive emissions from production/consumption of halocarbons and sulphur hexafluoride	AM 0071
Voluntary Carbon Standard	Recovering and destroying ODS, ODS refrigerants and/or ODS blowing agents	• Amount of destroyed gas	Baseline - project difference	None; methodology approved in September 2011	ODS recovery and destruction	Refer to annex to this module
Climate Action Reserve	ODS collected in developing countries and destroyed in the US	• Amount of destroyed gas	Baseline - project difference	6	Destruction of ODS (CFCs only)	Refer to annex to this module

The project based MRV methodology (i.e. with the CDM) quantifies the project impact as the difference between the baseline and the realised emission reductions. In most cases, countries find that the methods are complicated and resource-intensive (Bakker and Würtenberger, 2010). Some of the methodologies are criticised for not being clearly additional, i.e. creating real GHG mitigations as compared to the situation without the CDM project. Investigations on HFC-23 based CDM projects indicate that in some cases the amount of HFC-23 waste gas produced was increased intentionally in order to maximise the available CDM benefits (Baietti et al., 2012). Such incentives could have a negative impact on climate mitigation. Of the 2000 projects registered under the CDM, 19 HFC-23 projects account for more than half of all carbon emission credits (UNEP Risoe Centre, 2011).

The Programme of Activity (PoA) approach, which combines several individual emission reduction projects in a programme, aims at closing some of the loopholes of CDM projects and the MRV of CDM projects. Still the PoA approach rarely reaches the scope of a full sectoral approach or multi-sectoral approach in a country. This has the consequence that neither national nor sectoral emissions are covered comprehensively. The NAMA approach in the RAC&F sectors seeks for a comprehensive coverage of the entire RAC&F sector.

Discussions on NAMAs in developing countries have underlined the importance for developing multisectoral emission baseline scenarios[1], in order to identify and prioritise actions. The UNFCCC working group report states, that "transparency on the assumptions and methodologies used in developing these scenarios is beneficial in terms of attracting support and enhancing the ability of a country to manage the process of the preparation and implementation of NAMAs" (UNFCCC, 2012). The establishment of sector specific assumptions and methodologies in this context also serves for a transparent MRV basis.

2.2 MRV of NAMAs

NAMAs and the MRV of NAMAs seek a wide scope and policy induced level of enforcement. Ideally, sector-wide MRV provisions will be put in place[2]. NAMAs in the RAC&F sectors have the advantage of being able to follow the approach of HCFC phase-out management plans (HPMP) under the Montreal Protocol. HFCs could be phased out or phased down in a similar way to HCFCs. The chosen policy instruments – regulations and legislation, mandatory registration or licensing controls on production, import and export controls – could be similar to the instruments applied for the phase-out of HCFCs, combined with measures on energy efficiency as outlined in the modules 6 and 8.1.

As part of a country's legislation companies can be obliged to report on their use or reduction of use of HFC substances and refrigerant containing substances and appliances. Especially for HFCs origination controls are more cost effective than emissions controls at end user sites. In some cases leakage or fugitive emission controls are not practical either.

The following section introduces the relevant definitions and outlines concepts on a sectoral MRV NAMA approach. Chapter 3 gives a step-by-step guide for setting up a RAC&F specific MRV system for a country.

2.2.1 Relevant concepts

The concepts of activity and results being measurable, reportable and verifiable are closely linked. It is presumed that actions or commitments that are measurable can be monitored on a regular basis, and they are therefore reportable and verifiable. However, each concept has its distinct justification and it is important that each be considered in its own right before establishing a continuous MRV process.

Measurement and monitoring

Typically used in connection with quantifiable attributes, the function of measurement is to describe a phenomenon in reasonably precise and objective terms of an established standard or unit of measurement. Measurements are undertaken to keep track of the greenhouse gases that are emitted or consumed – as in the RAC&F sectors where consumed HFCs lead to emissions. Consequently, emissions that are avoided through mitigation actions will also be subject to measurement.

1 Baseline scenarios are understood here in the context of the UNFCCC as business-as-usual emissions pathways. Whereas in the context of the Montreal Protocol the baseline years are understood as reference years or starting years i.e. for the phase-out for the production and consumption of HCFCs.
2 See also GIZ NAMA tool 8.6 (2012b) Step 5, and GIZ NAMA source book (2012a) chapter 5.

Besides those mitigation actions leading directly to emission reductions there are also actions that support the so-called enabling environments under which emission reductions can take place. These secondary actions include support provided in the form of financing, capacity building and technology transfer. Both primary and secondary actions can be measured with appropriate data and indicators. Indicators for supporting actions can be achieved energy savings, improved energy efficiency of appliances and reduced air pollution.

Monitoring is the recording of measurements on a regular basis and of different indicators, for example the imported amounts of certain types of HFCs or amounts of HFCs consumed at industry levels.

BOX 1
Principles of an appropriate MRV system in the RAC&F sectors

An appropriate MRV system in the RAC&F sectors should follow the following principles

- **Practicality:** The parameters chosen are reasonable and it is possible to monitor them.
- **Continuity:** The monitoring is a guaranteed continuous process at regular interval, wherever applicable.
- **Transparency:** Monitored data is referenced wherever possible, and thus traceable to ensure accountability.
- **Accessibility of data:** Interested parties and members of the public, evaluators, etc. have access to monitored data for verification purposes, research and reporting to national or international bodies. Aggregated data should be stored centrally with providing relevant governing departments and policy-making bodies access.
- **Accessibility of sites and information:** Evaluators have access to sites and relevant information to ensure greater reliability of monitored data. They also have access to relevant documentation regarding financial support, its use and corresponding benefits.
- **Responsibility:** Defined entities are responsible for carrying out the monitoring. Typically, the monitoring is carried out by independent third parties, such as the German Technical Inspection Association (TÜV) or Norwegian Det Norske Veritas (DNV). A specific industrial track record on monitoring of RAC&F equipment will be required, i.e. from previous experience on sector specific CDM verification and validation. The monitoring efforts need to be supervised through government bodies, ideally related to the issuing and enforcement of policies and regulations.
- **MRV indicators should follow the SMART-concept,** i.e. being Specific, Measurable, Accepted, Realistic, Timely.

Reporting

The purpose of reporting under the UNFCCC is to allow others to assess national activities. Reporting by the countries is done mainly through national communications (NC). Successful reporting is a function of two factors (Breidenich and Bodansky, 2009):

1. The precision and reliability of the reported information, which is directly related to the issue of measurement
2. The degree to which information is presented in a transparent and standardised way that allows comparisons between reports and verification by others

Under the UNFCCC countries are advised to report their emissions and emission reduction efforts according to the guidelines developed by the Intergovernmental Panel on Climate Change (IPCC, 2007). The methodologies for reporting of emissions specific to the RAC&F sectors are outlined in module 1.

The Cancun Agreement states that developing country parties should submit NCs every four years, as well as biennial update reports (BURs) containing key mitigation information, including information on national circumstances and institutional arrangements, the national inventory, information on mitigation actions and their effects, constraints and gaps and related financial, technical and capacity needs, information on the level of support received, and information on domestic MRV. This is also the framework any developing country should follow as a good practice on its emissions in the RAC&F sectors.

BOX 2
Good practice reporting on NAMAs in the RAC&F sectors

Good practice reporting on NAMAs in the RAC&F sectors includes recording of direct mitigation actions, results and the activities undertaken to establish the appropriate enabling environments for mitigation actions (Breidenich and Bodansky, 2009).

Specific examples are
- Government specific policies and measures for the sector i.e. regulation on containment and leakage rates or minimum energy efficiency standards for specific RAC appliances,
- Sector or subsector specific investment data in phasing out old equipment or investments in alternative technologies,
- Support provided either domestically or internationally.

Verification

Verification is the process of independently checking the accuracy and reliability of reported information or the procedures used to generate submitted information. The purpose is to ensure that the information is correct and that confirmed methodologies for monitoring mitigation progress have been applied. Verification can play a key role in building confidence among parties that could lead to improvements in the quality of reported information. The set-up of a high quality reporting system can be on focus areas for financial or technical assistance as part of a supported NAMA.

In contrast to review, which may contain political elements, verification has a more technical, non-judgemental function. As with measurement, verification can be performed through direct observations, with the aim to ensure that reductions are achieved over time, or through indirect indicators. Verification can take place through on-site inspections, on-site monitoring or remote monitoring through qualified – and in the case of CDM accredited – independent institutions.

2.2.2 MRV types

The GIZ approach to NAMAs (GIZ NAMA Tool 8.6, 2012) outlines three types of MRV:
- MRV of emissions,
- MRV of mitigation actions,
- MRV of support received/provided.

The proposed approach to MRV in the RAC&F sectors follows this approach. The three MRV types in the context of RAC&F are outlined in the following.

MRV of emissions

The proposed MRV for the RAC&F sector is based on the unit stock model. Direct and indirect emissions and emission reductions are captured for each unit of stock in the RAC&F sectors, such as for example a household refrigerator.

The practical application guide provided in chapter 3 suggests the optional development of a unit stock based MRV system from a bulk based MRV system first. The bulk based MRV system only records imported, produced and exported bulk HFC. This can serve as a first step to indicate direct emissions or emission reductions. However, it will not be sufficient for the recording of indirect emission reductions. This approach is not stringent enough to serve as a basis for supported or credited NAMAs.

According to the stock based MRV approach mitigated emissions are calculated as the difference between the baseline emissions (BAU scenario) and the mitigation scenario (see module 5). The first scenario assumes a business-as-usual development, i.e. conventionally used equipment entering the market, while in the latter scenario environmental friendly technical options are introduced, causing emission reductions. This achieved emission mitigation is subject to MRV.

Module 5 of this handbook outlines the baseline emission scenarios for the RAC&F sectors. The baseline is established based on specific direct and indirect emissions per standardised appliance. The emissions of the reference system are in turn given by a set of key default parameters for calculating direct and indirect emissions, such as the type of refrigerant, initial charge, emission factors, average energy consumption etc. The RAC&F baseline emission approach is detailed in the annex 1 to module 1. This approach can in principle be adopted as the actual MRV baseline and business-as-usual (BAU) scenario for the NAMA[3].

The principle baseline approach requires the adoption of country specific data where available. Default values have to be changed or amended with country specific data. For example, indirect emissions differ from country to country, depending on the climatic conditions, the typical end-user behaviour, and direct emissions differ depending on the maintenance practices or the skill levels of technicians in a country.

To measure and calculate the emission mitigation, the increasing stock unit amounts of alternative technology options with lower emissions have to be recorded, such as for example the substitution of HFC based refrigerators with hydrocarbon refrigerators.

The above described MRV approach is applicable for most of the RAC&F sectors and subsectors where ready-to-use-stock units from the production line, such as refrigerators or room air conditioners, are concerned. For tailor-made applications in the commercial and industrial refrigeration subsectors emissions are calculated based on end-user usage metrics including the type of system, refrigerant used, initial charge, refilling intervals and amounts, runtime hours, cooling capacity, working temperature etc. Optionally such data can be traced through remote monitoring systems or a short message service tool where the service technicians report the amount of refilled refrigerant by sending a standardised short message service to a central collection point that automatically updates a database.

A good practice approach to establish the baseline requires further validation and quality checks on the main assumptions. Possible quality checks are:

- **Statistical samples,** for example to verify the ownership of households air conditioning appliance systems,
- **Regional comparison** with other countries that are socioeconomically comparable and with similar climatic conditions,
- **Direct monitoring** of direct emissions (e.g. from leakage) and indirect emissions (energy consumption) on focal appliances.

It is recommended that verification on the baseline is repeated every three to four years. This allows capturing changes of emission patterns in the baseline sample. The latter is particularly relevant when a dynamic baseline methodology is chosen that relies on varying input data for a defined set of baseline systems[4].

MRV of mitigation actions

Direct MRV of emissions is not always possible, in particular, where capacity building or preparatory action will potentially lead to future emission reductions. To capture mitigation actions that lead to future emission reductions the MRV systems include the appropriate indirect monitoring of trends and supporting indicators. Appropriate supporting indicators can be, for example, a target number of service technicians that have been trained, which can be monitored through checking certificates.

MRV of support received

Developing countries have agreed to enhance their reporting, including on the support received (COP 16). In accordance with paragraph 46 of Durban decision 2/CP.17, developing countries are invited to report for their NAMAs the amount and type of support received and disbursed for preparation, full costs or incremental costs for implementation. Where NAMAs target a change in production or end-user applications, it is suggested to record the incremental financial support of the beneficiaries. This would be in line with the reporting established as part of the sectoral conversions under the Montreal Protocol[5].

3 see also GIZ NAMA tool 8.6 (2012b) step 4, and GIZ NAMA source book (2012a)
4 In a static baseline approach both the defined set of baseline equipment and baseline equipment input parameter are unchanged.
5 See http://www.multilateralfund.org/65/English/1/6508.pdf

Recent discussions have stressed the transformative effect of NAMAs, i.e. that NAMAs should trigger a process towards a Low Carbon Development (LCD) which has a much broader scope than reducing emissions in specific sectors (see also co-benefits in module 10). In the long run, environmental and low carbon aspects will be integral issues when it comes to new investments. Therefore, the MRV process should include these development issues. However, transformation cannot be adequately represented by a single indicator or parameter. The transformation effects society, economy and environment, thus, a range of indicators should be used and integrated in the MRV system. Suitable indicators include (PWC, 2011):

- Carbon productivity of GDP (higher weighting)
- Emissions intensity of poverty reduction (higher weighting)
- Quality of the enabling and investment environment
- Scale of technology deployment
- Private sector investment levels
- Growth and job creation
- Private sector engagement and development

3. Practical application

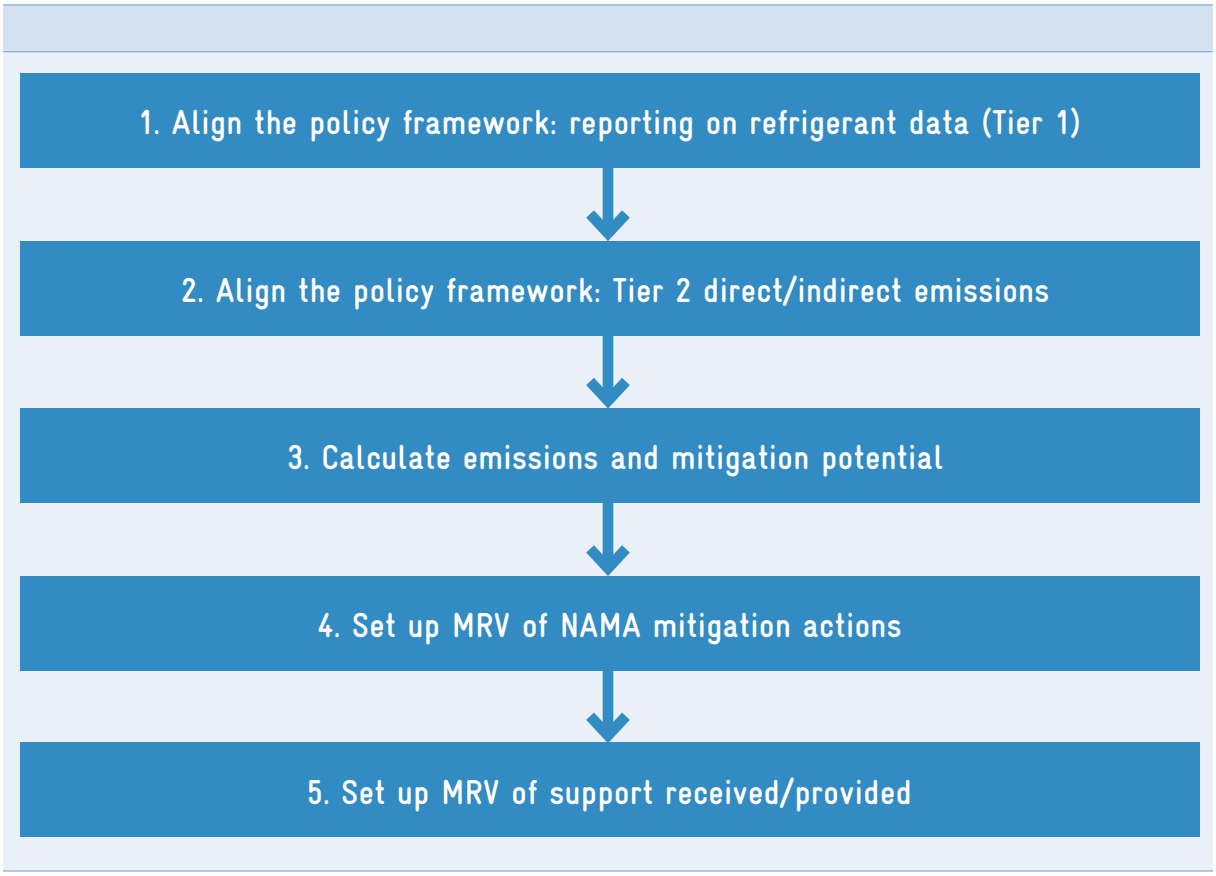
M = Measurement / monitoring
R = Reporting – both at the national and international level
V = Verification – includes both national quality assurance/quality control (QA/QC) and international oversight

Align the design of MRV systems in the early stages of the NAMA development.

Most developing countries currently neither record direct and indirect emissions nor their reductions. The MRV of emission reductions will be the central part of an MRV system in the RAC&F sectors. In order to conduct MRV of emission reductions, it is suggested that a national MRV system is set up step by step[6]. This includes first of all the evolution of an appropriate reporting system, which is ideally realised by governmental regulations (policy framework), and secondly the calculation of emissions and their abatement. The key parameters which build the basis for the MRV system are explained in this section.

The first three steps describe the MRV of emissions, while step 4 and step 5 focus on the MRV of mitigation actions and support received.

Steps for setting up a MRV framework in the RAC&F sectors:



6 see also GIZ NAMA Tool 8.6 (2012b), steps 4; 5 and 9

Step 1: Align the policy framework: reporting on refrigerant data (Tier 1)

First of all, make sure the defined NAMA focal point is in charge of organising all collected data. The reporting of all parameters mentioned in steps 1a to 1c should be done on a regular, i.e. annual basis, similar to the reporting systems established under the Montreal Protocol. Make sure the quantified amounts are reported to the coordinating NAMA focal point.

a) Mandatory reporting on bulk HFC production, imports and exports

Set up a RAC&F sector-wide reporting system, or even a quota/licensing system for production, import and export of HFCs. The metric to be measured is tonne of refrigerant in bulk.

Use these data to calculate potential emissions using the Tier 1a approach (see module 1). This gives a quick overview about the use of HFCs and allows considering a phase-in of alternative refrigerants, such as natural refrigerants, as NAMA measures. Module 1 lists potential data sources.

Reporting of import, export and production of HFCs is currently not obligatory in developing countries. In addition, specific codes such as the harmonised system codes at the customs departments hinder the interpretation of data. These are barriers that make it difficult to get a complete picture of the situation in the country.

Thus, to guarantee completeness of data, the government may mandate the implementation of an MRV system.

b) Extended reporting to cover pre-charged appliances for imports and exports

More detailed information about the HFC consumption of a country is provided though the Tier 1b approach (cf. module 1). Use the Tier 1b approach to calculate emissions, as it specifically accounts for refrigerants that are imported or exported within appliances.

Thus, collect data of imported and exported equipment and differentiate whether these are pre-charged or not. You wish to record further metrics, such as the type of refrigerant or the blend and the amount per appliance system. Module 1 lists potential data sources. The major data sources will be the customs department or manufacturers. Also, contact air conditioning and refrigeration industry associations as they might have a good overview about import and export dynamics.

To improve the completeness of the collected data a country may establish mandatory reporting as part of the MRV, obliging all manufacturing enterprises to report imported and exported systems, types of systems, initial charges, refrigerants etc.

c) Reporting by distributors of amounts and types of HFC substances delivered to various subsectors and recipients

After step a) and b), you should investigate to which subsectors the refrigerants and blowing agents are delivered. To allow for a proper reporting of the distribution of the substances to the subsectors, include traders and distributors in the MRV system. Ask them to define the recipients of refrigerants and blowing agents and the subsector to which these recipients belong (e.g. unitary air conditioning or mobile air conditioning). Distributors and traders may be reluctant to share this data. Therefore, provide them with proper background information about MRV and the purpose of NAMAs.

Governmental involvement will be indispensable in order to engage all stakeholders. When a government-driven MRV system is established, the distributors and traders can be committed by law to report.

Step 2: Align the policy framework: Tier 2 direct/indirect emissions

An MRV approach based on steps 1a to 1c will provide information on direct emissions. An appliance- and system-based MRV system follows the Tier 2 approach based on the inventory and stock model described in annex 1 to module 1. Therefore, to set-up a stringent MRV system you also need to gather data on the appliance level and on the amounts of foam produced. This level of detail will be required for a supported NAMA where donors demand a high level of accuracy and integrity regarding the achieved emission reductions. Calculations focus on GHG emissions, energy-related metrics or other physical metrics, such as leakage, of specific appliances and systems. Where emissions cannot be measured directly, a proxy-based approach based on the physical metrics of appliance systems can be required (Teng et al., 2009). For example, you may calculate indirect emissions via energy consumption and emission factors.

As the basis for your MRV system, collect the following metrics:

Market and production data

- Production data
- Units produced for export and imported units
- Domestic sales figures of units
- Refrigerant distribution of sold units (i.e. percentage of different refrigerant-type units and blowing agents, respectively)

Technical data

- Dominant refrigerant/blowing agent for each unit
- Average initial charge of units (emission factors (manufacture, in-use and disposal emission factors); for foam the relevant factors are: first year loss (percentage), annual loss (percentage) and max. potential end-of-life loss (percentage))
- Average product lifetime
- Average cooling capacity
- Average coefficient of performance
- Average run time hours
- Country-specific emission factors for electricity and expected changes (due to the increasing importance of renewable energy)

Collect these metrics regularly. A single inventory is only a snap-shot, but if the procedure is repeated, it is the core of the emission-based MRV system. Explain the rationale for this procedure to the stakeholders, such as the manufacturers, to make sure that they contribute production data regularly. If manufacturers do not respond regularly, you can introduce an obligatory reporting system. This allows you to continuously monitor change of refrigerant use and reduced refrigerant amounts needed for service due to lower leakage rates.

In addition, to improve the emission calculations, derive country specific emission factors using refrigerant demand from servicing companies. Companies will generally know the amount of refrigerants they use per time period. However, they do not record the amount and types of systems that are subject to service. Within the framework of an MRV system, you can establish such a mandatory reporting easily: Technicians would need to record the amount and type of system that they service, in addition to documenting the amount of refrigerant that is used.

Step 3: Calculate emissions and mitigation potential

After having collected data according to step 2, create the baseline emissions (see module 1). Emission reductions are generally calculated as the difference between the baseline emissions (BAU scenario) and the mitigation scenario (see module 5). The first scenario assumes a business-as-usual development, i.e. conventionally used equipment continues to enter the market. The latter scenario assumes that more environmentally friendly technical options are introduced, which leads to emission reductions.

In contrast to module 5, the mitigation scenario for the MRV system is not based on assumptions, but on the recorded phase-in of environmentally friendly equipment. Consequently, the mitigation scenario reflects the real situation and the dynamics within the country after NAMA measures have been introduced. The difference between the baseline emissions and the real emissions from the considered subsectors is the achieved mitigation which is subject to MRV.

Step 4: Set up MRV of NAMA mitigation actions

The phase-in of environmentally friendly technology will be a result of various NAMA measures. In terms of policy measures, module 8 introduces numerous options, such as the introduction of labelling and standards, the ban of the use of HFCs in equipment, licensing systems, incentives and taxes etc. These policy measures will be accompanied by education and capacity building activities, such as workshops and training for technicians. Record all these mitigation actions and detect barriers as well as factors of success.

Step 5: Set up MRV of support received/provided

Record the incremental financial support received by the beneficiaries. Use the experience of the mechanism established as part of the sector conversions under the Montreal Protocol, as they can serve as a guideline to establish the MRV of support received/provided under NAMAs.

4. References

Baietti, A., Shlyakhtenko, A., La Roca, R., Patel, U. (2012). Chapter 5, Regulations and Monitoring Programs [p62–71]. In: Green Infrastructure Finance: Leading Initiatives and Research. World Bank Study. The World Bank, Washington, DC.

Bakker, S., Würtenberger, L. (2010). Nationally Appropriate Mitigation Actions (NAMAs) and Measurement, Reporting and Verification (MRV). Policy Brief. Energy Research Centre of the Netherlands (ECN), Unit Policy Brief. Available online at: http://www.ecn.nl/docs/library/report/2011/o11018.pdf

Breidenich, C. and Bodansky, D. (2009). Measurement, reporting and verification in a post-2012 climate agreement. Pew Centre on Global Climate Change, Arlington Virginia.

Fransen, T. (2009). Enhancing today's MRV framework to meet tomorrow's needs: the role of national communications and inventories. WRI Working Paper. Washington, DC: World Resources Institute. Available online at: http://www.wri.org

GIZ (2012a). National Appropriate Mitigation Actions – A Technical Assistance Source Book for Practitioners (GIZ NAMA source book); Version 1.0. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

GIZ (2012b). Nationally Appropriate Mitigation Actions (NAMAs) – Steps for Moving a NAMA from Idea towards Implementation (GIZ NAMA tool). Version 8.6. Deutsche Gesellschaft für Internationale Zusammen-arbeit (GIZ) GmbH.

IGES (2010). Measurable, Reportable and Verifiable (MRV): Trends and developments in climate change negotiations. Institute for Global Environmental Strategies, Kanagawa Japan.

IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 3. Japan: IGES. Available online at: http://www.ipcc-nggip.iges.or.jp/

McMahon, H.,Moncel, R. (2009). Keeping Track: National Positions and Design Elements of an MRV Framework. WRI Working Paper. World Resources Institute, Washington DC. Available online at: http://www.wri.org/climate

Mucci, M. (2012). Measurement, reporting and verification: a note on the concept with an annotated bibliography. The International Institute for Sustainable Development (IISD), Winnipeg Canada. Available online at: http://www.iisd.org/

Niederberger, A. A., Kimble, M. (2011). MRV under the UN climate regime: paper tiger or catalyst for continual improvement? Journal of Greenhouse Gas Measurement & Management, 1:47–54

PwC (2011). Monitoring Results from Low Carbon Development, Final Report. This report has been prepared for HMG and was authored by PwC. It is the major output of DFID project number: 40047473.

Sterk, W. (2010). Nationally Appropriate Mitigation Actions: Definitions, issues and options. JIKO Policy Paper 2/2010. Wuppertal Institute for Climate, Environment and Energy.

Teng, F., Wang, Y., Gu, A., Xu, R., McMohan, H., Seligsohn, D. (2009). Mitigation actions in China: Measurement, Reporting and Verification. WRI Working Paper. World Resources Institute, Washington DC. Available online at: http://www.iisd.org/

UNEP Risoe Centre (2011). CDM/JI Pipeline Analysis and Database, The United Nations Environment Programme, Risoe Centre on Energy, CDM Pipeline overview 2011. Available online at: http://cdmpipeline.org/publications/CDMpipeline.xlsx

UNF (2009). Ensuring "MRVable" National actions: An MRV Model with a Focus on Continual Improvement in Climate Performance. The United Nations Foundation, Washington DC. Available online at: http://www.policy-solutions.com/Publications%20pdf/UNF%20White%20Paper%20MRV%20150709.pdf

UNFCCC (2011). Working programmes on monitoring, reporting and verification (MRV) for developing countries. Norway submission to the Ad-Hoc Working Group on Long Term Cooperative Action (AWG-LCA),

UNFCCC, 28 March, 2011. Available online at: http://unfccc.int/files/meetings/ad_hoc_working_groups/lca/application/pdf/norway_-_submission_work_programme_on_mrv_-_developing_countries_-_final.pdf

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