



Global
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The Status of Monitoring, Reporting and Verification of Nationally Determined Contributions to Climate Actions in Myanmar

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Acknowledgements

Monitoring, reporting and verification of greenhouse gas emissions is a critical issue that is the topic of current international negotiations. This paper presents information, in chapters I to IV, that is largely based on the works of other groups on this issue. Concepts and wording were blended from these sources to present a focused message for this paper. The author acknowledges the frequent reference to documents from the World Resource Institute (WRI 2016)¹, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (GIZ 2014)², and International Partnership on Mitigation and MRV (IPMMRV 2013)³. The author would like to thank the staff of the many departments and ministries in Myanmar who participated in meetings and endured with the questions. The interpretation and presentation of those concepts expressed in this paper are those of the author and do not necessarily represent the views of the Global Green Growth Institute or the Myanmar Ministry of Natural Resources and Environmental Conservation (MONREC).

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¹ Singh, N., J. Finnegan, and K. Levin. 2016. "MRV 101: Understanding Measurement, Reporting, and Verification of Climate Change Mitigation." Working Paper. Washington DC: World Resources Institute. Available online at <http://www.wri.org/mrv101>

² Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. 2014. "MRV Tool: How To Set up National MRV Systems" version 4.2. Available at: <https://mitigationpartnership.net/mrv-tool-how-set-national-mrv-systems>

³ International Partnership on mitigation and MRV. 2013, "Institutional Arrangements for MRV" Samah Elsayed: World Resources Institute. Available at: <https://mitigationpartnership.net/>

List of acronyms

AD	Activity Data
AFOLU	agriculture, forestry and other land use
BUR	Biennial Update Reports
BAU	Business as Usual
CBIT	Capacity building Initiative for
CSO	Central Statistics Organization
CDM	Clean Development Mechanism
CAR	Climate Action Reserve
CPEIR	Climate Public Expenditure and Institutional Review
CTF	Common tabular format
COP	Conference of the Parties
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
DAC	Development Assistance Committee
EF	Emission Factor
ECD	Environment Conservation Department
GEF	Global Environment Facility
GGGI	Global Green Growth Institute
GHG	Greenhouse gas
IPPU	industrial processes and product use
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IAR	International Assessment and Review
ICA	international consultation and analysis
LULUCF	Land Use, Land Use Change and Forestry
LDC	least developed countries
MoNREC	Ministry of Natural Resources and Environmental Conservation
MRV	Monitoring, Reporting, and Verification
MDB	multilateral development banks
NFI	national forest inventory
NFMS	National Forest Monitoring System
NSDS	National Strategy for Development of Statistics
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally Determined Contributions
OECD	Organisation for Economic Co-operation and Development
PFE	permanent forest estate
REDD+	Reducing emissions from deforestation and forest degradation
SLMS	satellite based land monitoring system
SNC	second national communication
SIDS	small island developing states
TWG	Technical Working Group
MCCA	the Myanmar Climate Change Alliance
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standards

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Executive Summary

An overview of MRV approaches:

This paper presents the basic concepts of MRV, what the expectations are under the Paris Agreement⁴, and the results of a detailed stakeholder and situation analysis conducted by the Global Green Growth Institute to study the current capabilities for Myanmar to monitor, report and verify its greenhouse gas emissions to meet its obligations under the treaty.

The practice of “MRV,” integrates three independent processes of measurement or monitoring (M), reporting (R), and verification (V). Conducting MRV helps countries understand key sources and sinks of emissions, design effective mitigation strategies as part of their Nationally Determined Contributions (NDCs) or other programs, enables countries to meet their international reporting obligations, compare their national mitigation commitments, track emissions trends, build trust in their actions and reported data, unlock new sources of finance to tackle climate change by demonstrating impact and good governance practices, and so on.

- MRV of **GHG emissions** refers to estimating, reporting, and verifying actual emissions over a defined period of time;
- MRV of **mitigation actions** involves assessing GHG emissions reductions and/or sustainable development (non-GHG) effects of policies, projects, and actions, as well as monitoring their implementation progress;
- MRV of **support** focuses on monitoring the provision and receipt of financial flows, technical knowledge, and capacity building, and evaluating the results and impact of support.

The Status of MRV in Myanmar:

Currently, the MRV related activities in Myanmar are associated with their second national communication to the UNFCCC and the monitoring of forest related emissions and sinks under the UN-REDD program. Unfortunately, these fall short of a complete MRV system needed for their obligations under the Paris agreement.

Even though all the MRV rules under the Paris Agreement have not yet been formalized, the essential building blocks of MRV systems including establishing *institutional arrangements*, *data management systems*, and *building capacities* remain the same. In preparation of GGGI’s mandate to build an MRV system for Myanmar’s NDC requirements, a detailed stakeholder and situation analysis was conducted examining its current institutional arrangements, data management systems, and capacity – the basis for an MRV system.

The stakeholder and situation analysis identified several areas where Myanmar needs additional support. There are five working groups formed in Myanmar for its second national communication but these institutional arrangements would need to be bolstered by adding an MRV expert to the groups to discuss the topics currently not being covered, that is, MRV of mitigation actions, including any offset projects such as those under the Clean Development Mechanism, along with their sustainable development co-benefits, adaptation, and MRV of support.

There also needs to be a data management system set up and managed by an expert responsible for the data with a clear mandate and timelines to follow through with the support for the duration GGGI’s mandate. Finally, all persons involved with the NDC require training. The specific needs and priorities in these areas need to be identified and tailored, and capacity building programs consisting of in-country workshops/trainings, followed up by non-internet based virtual training with practical guidance documents reinforcing the training programs need to be developed and implemented.

⁴ http://unfccc.int/paris_agreement/items/9485.php

Executive Summary (Myanmar)

အစီရင်ခံစာ အကျဉ်းချုပ်

ဤ အစီရင်ခံစာသည် ရာသီဥတုပြောင်းလဲမှုဆိုင်ရာ နိုင်ငံတကာ သဘောတူညီချက်များ အရ အကောင်အထည်ဖော် ဆောင်ရွက်ရမည့် လုပ်ငန်းစဉ်များထဲမှ မှန်လုံအိမ်ခါတ်ငွေ ထုတ်လွှတ်မှုအပေါ် စဉ်ဆက်မပြတ် စောင့်ကြည့်လေ့လာ အကဲဖြတ်ခြင်း၊ အစီရင်ခံတင်ပြခြင်းနှင့် အတည်ပြုခြင်းတို့ကို ဆောင်ရွက်နိုင်ရန် ကမ္ဘာလုံးဆိုင်ရာ အစိမ်းရောင် ဖွံ့ဖြိုးတိုးတက်မှု အဖွဲ့အစည်း (Global Green Growth Institute - GGGI) မှ မြန်မာနိုင်ငံ၏ လက်ရှိစွမ်းဆောင်ရည်ကို လေ့လာထားသည့် ပါဝင်ပတ်သက်သူများ၏ အခြေအနေ အသေးစိတ် ဆန်းစစ်ချက် ရလဒ်များနှင့် ကမ္ဘာ့ရာသီဥတုပြောင်းလဲမှုကို တုံ့ပြန်ဆောင်ရွက်မည့် ပါရီသဘောတူညီချက် တွင်ပါရှိသည့် ဆောင်ရွက်ရမည့် လုပ်ငန်းစဉ် မျှော်မှန်းချက်ဖြစ်သော စဉ်ဆက်မပြတ် စောင့်ကြည့်လေ့လာ အကဲဖြတ်ခြင်း (Monitoring)၊ အစီရင်ခံတင်ပြခြင်း (Reporting) နှင့် အတည်ပြုခြင်း (Verification) တို့၏ အခြေခံသဘောတရားများကို တင်ပြထားခြင်း ဖြစ်ပါသည်။

MRV ကို လက်တွေ့ အကောင်အထည်ဖော်ရာတွင် သီးခြားလုပ်ငန်းစဉ် (၃) ရပ်ဖြစ်သည့် အကဲဖြတ်ခြင်း၊ အစီရင်ခံတင်ပြခြင်းနှင့် အတည်ပြုခြင်းတို့ကို အတူတကွ ပေါင်းစပ် ဆောင်ရွက်ရခြင်းဖြစ်ပါသည်။ MRV ကို ဆောင်ရွက်ခြင်းဖြင့် နိုင်ငံများသည် မှန်လုံအိမ်ခါတ်ငွေ ထုတ်လွှတ်မှုနှင့် စုပုံယူမှု အဓိကအရင်းအမြစ်များကို သိမြင်နားလည်စေခြင်း၊ မိမိနိုင်ငံ အခြေအနေနှင့် သင့်လျော်မည့် အမျိုးသားအဆင့် ရာသီဥတုပြောင်းလဲမှု လျော့ချရေးနှင့် လိုက်လျောညီထွေရှိစေရေး လုပ်ငန်းအစီအစဉ် (Nationally Determined Contributions - NDC) နှင့် အလားတူ လုပ်ငန်းအစီအစဉ်များပါ ရာသီဥတုပြောင်းလဲမှု လျော့ချရေး ထိရောက်သည့် မဟာဗျူဟာများကို ရေးဆွဲချမှတ်နိုင်ခြင်း၊ နိုင်ငံတကာသို့ အစီရင်ခံရမည့် တာဝန်များကို ဖြည့်ဆည်းဆောင်ရွက်နိုင်ခြင်း၊ နိုင်ငံအဆင့် ရာသီဥတုပြောင်းလဲမှုလျော့ချရေး ကတိကဝတ်များကို နှိုင်းယှဉ်နိုင်ခြင်း၊ မှန်လုံအိမ်ခါတ်ငွေထုတ်လွှတ်မှု အခြေအနေကို ခြေရာခံနိုင်ခြင်း၊ လုပ်ငန်း ဆောင်ရွက်ချက်နှင့် အစီရင်ခံ တင်ပြသည့် အချက်အလက်များအပေါ် ယုံကြည်စိတ်ချမှု ရှိစေခြင်း၊ စီမံအုပ်ချုပ်မှု အလေ့အကျင့်ကောင်းများနှင့် အကျိုးသက်ရောက်မှုများကို လက်တွေ့သရုပ်ပြခြင်းဖြင့် ရာသီဥတု ပြောင်းလဲမှုဆိုင်ရာ ဘဏ္ဍာငွေ အရင်းအမြစ်များကို ရှာဖွေဖော်ထုတ်နိုင်ခြင်းစသည့် အကျိုးကျေးဇူးများ ရရှိစေပါသည်။

MRV ကို အောက်ပါအတိုင်း သုံးမျိုးခွဲ၍လေ့လာနိုင်ပါသည်-

- (က) မှန်လုံခါတ်ငွေ ထုတ်လွှတ်ခြင်းတွင် သတ်မှတ်ထားသည့် အချိန်ကာလတစ်ခုအတွင်း အမှန် ထုတ်လွှတ်ခဲ့သည့် မှန်လုံအိမ်ခါတ်ငွေ ပမာဏကို ခန့်မှန်းခြင်း၊ အစီရင်ခံခြင်းနှင့် အတည်ပြုခြင်း တို့ပါဝင်ပါသည်။
- (ခ) လျော့ချရေး လုပ်ငန်းအစီအစဉ်များတွင် မှန်လုံအိမ်ခါတ်ငွေ ထုတ်လွှတ်မှုလျော့ချခြင်းကို ဆန်းစစ်ခြင်းနှင့် စဉ်ဆက်မပြတ် ဖွံ့ဖြိုးတိုးတက်ရေးကို အထောက်အကူပြုသော မူဝါဒ

များ၊ စီမံကိန်းများနှင့် လုပ်ငန်းအစီအစဉ်များသာမက အကောင်အထည်ဖော်ဆောင်ရွက် တိုးတက်မှုတို့အပေါ် စဉ်ဆက်မပြတ် စောင့်ကြည့်လေ့လာနိုင်ခြင်း တို့ပါဝင်ပါသည်။

- (ဂ) အထောက်အပံ့ပေးခြင်းတွင် ဘဏ္ဍာငွေ စီးဝင်ခြင်း၊ နည်းပညာဆိုင်ရာ ဗဟုသုတနှင့် စွမ်းရည်တည်ဆောက်ခြင်းတို့ ကြိုတင်စီစဉ်ဆောင်ရွက်မှုနှင့် လက်ခံရရှိမှုတို့အပေါ် စဉ်ဆက်မပြတ် စောင့်ကြည့်လေ့လာခြင်းနှင့် အထောက်အပံ့ရရှိခြင်း၏ အကျိုးရလဒ် များကို ဆန်းစစ်အကဲဖြတ်ခြင်း တို့ပါဝင်ပါသည်။

လက်ရှိတွင် မြန်မာနိုင်ငံရှိ MRV နှင့် ဆက်စပ်သောလုပ်ငန်းများမှာ ကုလသမဂ္ဂ ရာသီဥတု ပြောင်းလဲမှုဆိုင်ရာ မူဘောင်ကွန်ဗင်းရှင်း (UNFCCC) သို့ တင်သွင်းရမည့် ရာသီ ဥတုပြောင်းလဲမှုဆိုင်ရာ ဒုတိယအကြိမ် အမျိုးသားအဆင့် အစီရင်ခံစာနှင့် သစ်တောပြုန်းတီး ခြင်းနှင့်သစ်တောအတန်းစားကျဆင်းခြင်းမှ ကာဗွန်ထုတ်လွှတ်မှု လျှော့ချရေး ကုလသမဂ္ဂ လုပ်ငန်းအစီအစဉ် (UN REDD Program) တွင် ပါရှိသည့် သစ်တောနှင့်ဆက်စပ်သော မှန်လုံ အိမ်ခါတ်ငွေ ထုတ်လွှတ်ခြင်းနှင့် သိုလှောင်ခြင်းများကို စဉ်ဆက်မပြတ် စောင့်ကြည့်လေ့လာ အကဲဖြတ်ခြင်းများ စသည်တို့ဖြင့် ဆက်စပ်နေပါသည်။ သို့သော် အဆိုပါ လုပ်ငန်းများတွင် ပါရှိ သောတူညီချက်ပါ ဆောင်ရွက်ရမည့် တာဝန်များကို ဖြည့်ဆည်းနိုင်ရန်အတွက် လိုအပ်သည့် ပြည့်စုံသော MRV စနစ်တစ်ရပ် အပြည့်အဝ ပါဝင်ခြင်းမရှိသည်ကို တွေ့ရှိရပါသည်။ ပါရှိသော တူညီချက်တွင်ပါရှိသည့် MRV စည်းမျဉ်းစည်းကမ်းများမှာ တရားဝင် ပုံစံတကျ ဖော်ပြ ထားခြင်းမရှိ၊ မရှိသေးသော်လည်း MRV စနစ်များတွင် မရှိမဖြစ်အခြေခံလိုအပ်ချက်များ ဖြစ်သော အဖွဲ့အစည်းတည်ထောင်မှု အစီအစဉ်များ၊ အချက်အလက်များစီမံထားသည့် သိမ်းဆည်း မှုစနစ်များနှင့် စွမ်းဆောင်ရည် မြှင့်တင်မှုလုပ်ငန်းများ စသည်တို့ကိုလည်း စနစ်တကျ ဆောင်ရွက်ရန် လိုအပ်ပါသည်။

မြန်မာနိုင်ငံ၏ NDC ကို အကောင်အထည်ဖော်ရာတွင် လိုအပ်မည့် MRV စနစ် တည်ဆောက်ရန် GGI ၏ တာဝန်အရ ပြင်ဆင်ဆောင်ရွက်လျက်ရှိရာ MRV စနစ်တစ်ရပ်၏ အခြေခံဖြစ်သည့် လက်ရှိ အဖွဲ့အစည်းဆိုင်ရာ စီစဉ်မှုများ၊ အချက်အလက် စီမံခန့်ခွဲမှု စနစ်များနှင့် စွမ်းဆောင်ရည်တို့ကို ဆန်းစစ်သည့် ပါဝင်ပတ်သက်သူများ၏ အခြေအနေ အသေးစိတ် ဆန်းစစ်ချက် တစ်ရပ် ပြုလုပ်ခဲ့ပါသည်။

အဆိုပါ ပါဝင်ပတ်သက်သူများ၏ အခြေအနေ အသေးစိတ် ဆန်းစစ်ချက်အရ မြန်မာ နိုင်ငံမှ အထောက်အပံ့လိုအပ်လျက်ရှိသည့် နယ်ပယ်များစွာကို သတ်မှတ် ဖော်ထုတ်နိုင်ခဲ့ ပါသည်။ ရာသီဥတုပြောင်းလဲမှုဆိုင်ရာ ဒုတိယအကြိမ် အမျိုးသားအဆင့် အစီရင်ခံစာ ပြုစုရေး စီမံကိန်းအတွက် နည်းပညာ လုပ်ငန်းအဖွဲ့ ၅ ဖွဲ့ကို ဖွဲ့စည်းထားပါသည်။ သို့သော်လည်း စဉ်ဆက်မပြတ် ဖွံ့ဖြိုးတိုးတက်မှု အကျိုးအမြတ်များကိုပါ ပူးတွဲရရှိစေမည့် ကာဗွန်ထုတ်လွှတ်မှု လျှော့ချသည့် လုပ်ငန်းစဉ်ယန္တရား (Clean Development Mechanism – CDM) အရ အကောင် အထည်ဖော်မည့် မှန်လုံအိမ်ခါတ်ငွေ ထုတ်လွှတ်မှုလျှော့ချမည့် စီမံကိန်းများအပါအဝင် ရာသီဥတု ပြောင်းလဲမှုလျော့ချရေးနှင့် လိုက်လျောညီထွေဖြစ်စေရေး လုပ်ငန်းအစီအစဉ်များနှင့် အထောက်အပံ့ ရရှိခြင်းတို့အပေါ် စဉ်ဆက်မပြတ် စောင့်ကြည့်လေ့လာ အကဲဖြတ်ခြင်း၊ အစီရင်ခံ

တင်ပြခြင်းနှင့် အတည်ပြုခြင်းစသည့် ထည့်သွင်းမဖော်ပြထားသည့် အကြောင်းအရာများအတွက် ဆွေးနွေးနိုင်ရန် MRV ကျွမ်းကျင်သူအုပ်စုများကို အဖွဲ့အစည်းများတွင် ထည့်သွင်းစီစဉ်ရန် လိုအပ်ပါသည်။

GGGI ၏ အထောက်အပံ့ဖြင့် ကျွမ်းကျင်သူတစ်ဦးမှ တိကျရှင်းလင်းသည့် တာဝန်နှင့် အချိန်ဇယားတို့အရ စီမံ တည်ဆောက်မည့် အချက်အလက် စီမံခန့်ခွဲမှုဆိုင်ရာ စနစ်တစ်ရပ် လိုအပ်ပါသည်။ အချုပ်အားဖြင့်ဆိုသော် NDC နှင့် ဆက်စပ် လုပ်ကိုင်နေသည့် လူတိုင်း အတွက် သင်တန်းများ ပို့ချရန်လိုအပ်ပါသည်။ အဆိုပါနယ်ပယ်များအတွက် အဓိကလိုအပ်ချက်များနှင့် ဦးစားပေးအစီအစဉ်များကို ရှာဖွေဖော်ထုတ်ရန် လိုအပ်ပါသည်။ နိုင်ငံအတွင်း အလုပ်ရုံဆွေး နွေးပွဲများကျင်းပခြင်း၊ လက်တွေ့ အသုံးချနိုင်သည့် လမ်းညွှန်ချက်များအပါအဝင် သင်တန်း အစီအစဉ်များကို ပြန်လည် သုံးသပ်ဆောင်ရွက်ခြင်းဖြင့် လက်တွေ့ အကျိုးထိရောက်မှုရှိသော သင်တန်းပေးခြင်းများကို အကောင်အထည်ဖော်၍ ဖွံ့ဖြိုးတိုးတက်စေရန် လိုအပ်ပါသည်။

Introduction

Based in Seoul, The Global Green Growth Institute (GGGI) is an intergovernmental organization founded to support and promote a model of economic growth known as "green growth", which targets key aspects of economic performance such as poverty reduction, job creation, social inclusion, and environmental sustainability. GGGI works with countries around the world, building their capacity and working collaboratively on green growth policies that can impact the lives of millions. The organization partners with countries, multilateral institutions, government bodies, and the private sector to help build economies that grow strongly and are more efficient and sustainable in the use of natural resources, less carbon intensive, and more resilient to climate change.

GGGI is working with the Republic of the Union of Myanmar, hereafter referred to as Myanmar, to design its 2017-18 program. The planned outcome of this program is strengthening the government's institutional framework for the implementation of its Intended Nationally Determined Contribution (INDC) and assessing Myanmar's green growth potential and future green growth priorities.

Based on Myanmar's request for GGGI to support NDC implementation and financing, the Institute will support government in establishing a monitoring, verification and reporting (MRV) system to facilitate data collection and report generation requisite for national and international review. To introduce MRV in Myanmar, GGGI conducted a detailed stakeholder and situation analysis to assess the current institutional capacity and data availability for such a system, to eventually build on the existing mechanisms and institutional roles and responsibilities, strengthen capacity to collect and manage data, and support the aggregation of this information into reports and inventories. The MRV system will incorporate poverty reduction, gender and social inclusion metrics in its design in order to strengthen buy-in for mitigation action among policy makers and their constituencies, showcasing the social impact of mitigation. This exercise will also include the costing the INDC and an analysis of investment requirements.

This paper presents the basic concepts of MRV, what the expectations are under the Paris Agreement, and the results of a detailed stakeholder and situation analysis conducted by the GGGI to study the current capabilities for Myanmar to monitor, report and verify its greenhouse gas emissions to meet its obligations under the treaty.

Monitoring, Reporting, and Verification

Effective mitigation of climate change requires a clear understanding of greenhouse gas (GHG) emissions and their sources, and regular monitoring of mitigation strategies and their impacts. The practice of “MRV,” which integrates three independent, but related, processes of measurement or monitoring (M), reporting (R), and verification (V), is fundamental in this regard. MRV includes the following steps and procedures:

Step 1: Measure or monitor (M) data and information on emissions, mitigation actions, and support. This may entail direct physical measurement of GHG emissions, estimating emissions or emissions reductions utilizing activity data and emission factors, calculating changes relevant to sustainable development, and collecting information about support for climate change mitigation⁵. For example, a typical estimation for GHG emissions is:

- **Emission = Activity Data (AD) x Emission Factor (EF)**
 - Activity data used in emission estimates, e.g. fuel use by fuel, use of mineral products (e.g. limestone, dolomite), plant production
 - Emission factors (IPCC Default values are available)

An Example of *Measurement: What, Who, How and When?*⁶

What is measured?	Who measures?	How to measure?	When to measure?
<p>Emissions and removals of GHGs (CO₂, CH₄, N₂O and F-gases)</p> <p>Underlying activity data (AD) such as energy statistics and country-specific emission factors (EFs)</p> <p>At sub-national level: community-scale GHG inventories.</p>	<p>This may involve a range of organizations such as companies, industrial operators, trade associations, Government department and/or research institutes.</p>	<p>Generally derived from estimation rather than measurement, e.g multiplying activity data with emissions factors. Emissions may also be measured from some point sources, including from industrial installations, but recognized standards and protocols need to be used.</p> <p>At sub-national level: e.g. GPC (Global Protocol for Community-Scale GHG Emissions, a standard for measuring GHGs from cities.⁷).</p>	<p>This is usually driven by reporting requirements at national and/or international level (e.g. National Communications or Biennial Update Report for the UNFCCC).</p>

Step 2: Report (R) by compiling this information in inventories and other standardized formats to make it accessible to a range of users and facilitate public disclosure of information.

⁵ For the purposes of this paper, greenhouse gases (GHGs) refer to the seven gases covered under the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulfur hexafluoride (SF₆), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF₃). However, many of the concepts in this paper are also applicable to the MRV of other gases, such as those covered under the Montreal Protocol.

⁶ See (GIZ 2014)

⁷ <http://www.iclei.org/activities/agendas/low-carbon-city/gpc.html>

An Example of *Reporting*: What, Who, How and When?⁸

What information is reported?	Who reports?	How to report?	When to report?
GHG estimates by sector, activity and type of gas Institutional arrangement Description of methodologies used in compiling the inventory Data sources, underlying assumptions, QA/QC procedures Level and sources of uncertainty and description of methodology used to determine the uncertainty	This depends on the scope: the national entity responsible for the delivery of national GHG inventory, or individual company or operator	Use of Reporting Guidelines Through National Communications and Biennial Update Reports (BURs) CDM registry At sub-national level carbon Cities Climate Registry	This is driven by reporting time scales at national or international level e.g first BURs (which includes national GHG inventory) need to be submitted by Dec 2014 and subsequent BURs every two years for Non-Annex 1 Parties ⁹

Step 3: Verify (V) by periodically subjecting the reported information to some form of review or analysis or independent assessment to establish completeness and reliability. Verification helps to ensure accuracy and conformance with any established procedures, and can provide meaningful feedback for future improvement.

An Example of *Verification*: What, Who, How and When?¹⁰

What information is verified?	Who verifies?	How to verify?	When to verify?
Annex I GHG inventories are reviewed annually by UNFCCC Biennial Update Report (BUR) subjected to international consultation and analysis (ICA)	UNFCCC reviewers (and for EU Member States, EU Review team) A team of technical experts under the UNFCCC who conducts ICA Independent auditor (for CDM project)	See Review Process for Annex I Parties Comparison against guidelines The Types of verification determines the way verification is carried out	Annex I GHG inventories are reviewed annually by UNFCCC First round of ICA of BURs within 6 months of submission of first BURs. Frequency after that will depend on frequency of further submissions.

⁸ Op Cit (UNFCCC)

⁹ http://unfccc.int/national_reports/non-annex_i_parties/biennial_update_reports/items/9186.php

¹⁰ Op Cit (UNFCCC)

The Five principles of MRV¹¹

1. **Transparency** means that the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information.
2. **Consistency** means that an inventory should be internally consistent in all its elements with inventories of other years. An inventory is consistent if the same methodologies are used for the initial and all subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks.
3. **Comparability** means that estimates of emissions and removals reported should be comparable among all reporting Parties.
4. **Completeness** means that an inventory covers all relevant sources and sinks, as well as all gases. Completeness also means full geographic coverage of sources and sinks
5. **Accuracy** is a relative measure of the exactness of an emission or removal estimate. Estimates should be accurate in the sense that they are systematically neither over nor under true emissions or removals, as far as can be judged, and that uncertainties are reduced as far as practicable. Appropriate methodologies should be used, in accordance with the relevant MRV system guidance, to promote accuracy.

Three Types of MRV¹²

Even before the term MRV emerged under the United Nations Framework Convention on Climate Change (UNFCCC), some form of monitoring and evaluation had routinely been used by governments and other entities to accurately and transparently assess their actions and goals.

Domestically, conducting MRV helps countries understand key sources and sinks of emissions, design effective mitigation strategies as part of their Nationally Determined Contributions (NDCs) or other programs, assess impacts of mitigation projects and policies, track progress toward climate goals, meet stakeholder demands for public disclosure of GHG information, and enhance credibility and promote good governance, among other objectives.

Internationally, MRV enables countries to meet their international reporting obligations, compare their national mitigation commitments, track emissions trends, build trust in their actions and reported data, unlock new sources of finance to tackle climate change by demonstrating impact and good governance practices, and so on. Entities should employ principles of relevance, completeness, consistency, transparency, and accuracy to establish MRV systems to track and report information for both domestic and international audiences.

There are three distinct types of MRV systems (see figure 1):

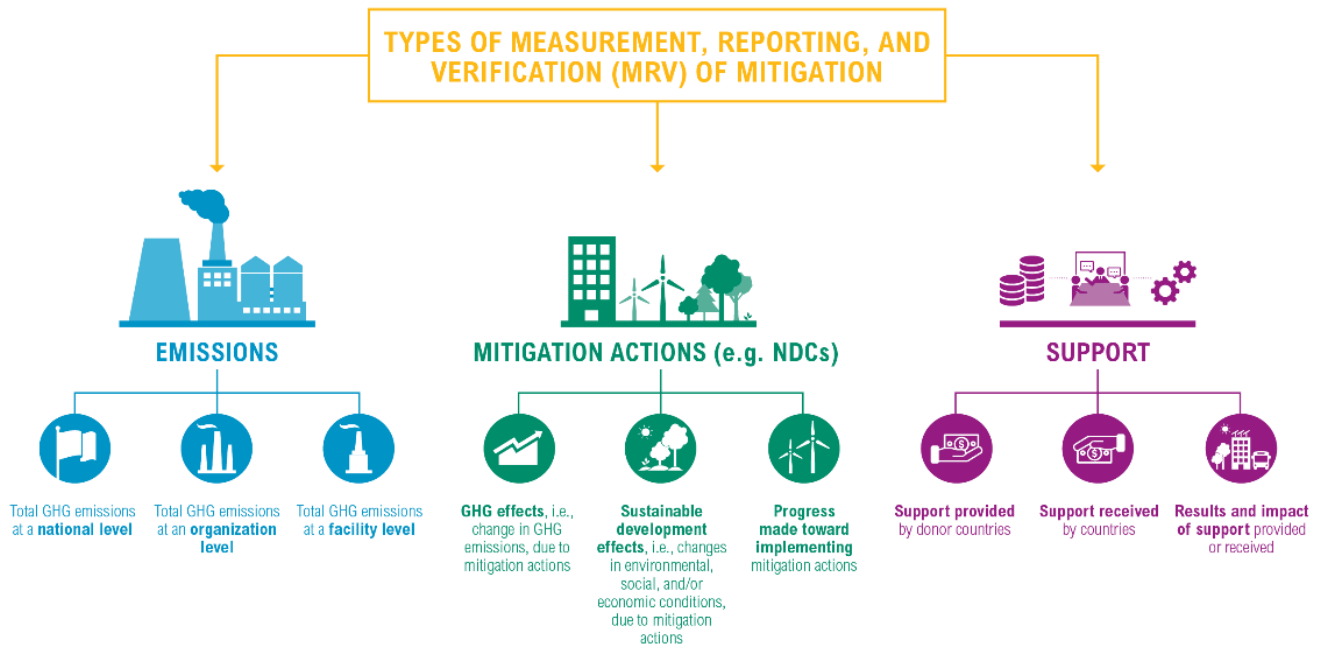
1. MRV of **GHG emissions** refers to estimating, reporting, and verifying actual emissions over a defined period of time. This type of MRV can be performed at national level, or by organizations and facilities. For example, national GHG inventories, which are mandatory national MRV systems established by the Conference of the Parties, include an account of emissions from a country for a particular period, are reported to UNFCCC, and undergo some form of review.
2. MRV of **mitigation actions** involves assessing (ex-ante or ex-post) GHG emissions reductions and/or sustainable development (non-GHG) effects of policies, projects, and actions, as well as monitoring their implementation progress. For example, the policies and mitigation actions identified in a country's NDC fall into this category. It also involves assessing progress toward mitigation goals. While MRV of GHG emissions measures actual emissions, MRV of mitigation actions estimates the *change* in emissions and other non-GHG variables that results from those actions.

¹¹ Based on 2006 IPCC Guidelines for National Greenhouse Gas Inventories

¹² The concepts for this section is largely based on WRI 2016.

3. MRV of **support** focuses on monitoring the provision and receipt of financial flows, technical knowledge, and capacity building, and evaluating the results and impact of support. An example of this kind of MRV would be developing countries tracking climate-specific finance received through bilateral or multi-lateral channels.

Figure 1: MRV Types



*For simplicity, this graphic uses the term "emissions" as shorthand for "emissions and removals."

wri.org/mrv101

 WORLD RESOURCES INSTITUTE

Source: WRI, 2016

MRV of GHG Emissions

MRV of GHG emissions entails measuring and monitoring the GHG emissions and removals associated with activities of entities such as countries, organizations, or facilities, reporting the collected data in a GHG inventory or other forms, and undertaking review and verification. The MRV of emissions can be undertaken at the following levels:

National, which involves measuring, reporting, and verifying the total amount of GHG emissions and removals resulting from human activities in a country. These are often reported in a national GHG inventory categorized across four major economic sectors: energy; industrial processes and product use (IPPU); agriculture, forestry and other land use (AFOLU); and waste, with the option of defining an additional sector, labelled as "other".

Organization, which involves building an organization-wide inventory of total emissions and removals from all sources (including stationary and mobile sources, and process and fugitive emissions) within the organization's boundary.

Facility, which involves assessing total GHG emissions and removals from all sources within a single facility (e.g., power plant, factory, or waste disposal site), as opposed to an entire organization, to produce a facility-level inventory.

By calculating the national GHG inventory, often using national level data as opposed to individual sources, a country is essentially establishing MRV of emissions at a national level. These types of calculations are referred to as *Top-Down* calculations which rely on aggregated data and generally involve the least amount of effort.

Some countries have established organizational or facility level MRV of emissions where individual GHG sources are used to measure GHG emissions at the facility level. The measurements from these facilities is then summed-up to the national level to produce a national inventory. These types of MRV of emissions are referred to as *Bottom-up* systems which rely on disaggregated data and can be more precise than a Top-down, but involve a higher degree of effort.

Historically, MRV for GHG emissions for the UNFCCC has been based on top-down approaches and is expected to remain the same in the future. For this reason, this paper does not cover organizational or facility level MRV of emissions¹³.

MRV of Mitigation Actions

“Mitigation actions” refer to interventions and commitments, including goals, policies, and projects, undertaken by a government or another entity to reduce GHG emissions. Examples include national climate plans, NDCs, policies identified in Myanmar’s **National Climate Change Strategy and Action Plans**. MRV of mitigation actions includes estimating, reporting, and verifying their GHG and sustainable development effects, as well as monitoring their implementation.

MRV of mitigation actions involves an assessment of the effects and implementation progress associated with mitigation actions:

- **GHG effects** refer to actual or projected *changes* in GHG emissions and removals—as opposed to absolute levels of emissions and removals—due to the implementation of mitigation actions. MRV of GHG effects involves estimating changes in emissions resulting from all significant GHG effects of a mitigation action, such as enhanced GHG removals due to tree-planting as part of degraded forestland policy, or a decrease in GHG emissions due to reduced fossil fuel consumption or electricity use resulting from a home-insulation subsidy policy.
- **Sustainable development effects** refer to changes in environmental, social, and/or economic conditions that occur as a result of mitigation actions. Examples include: measuring and reporting changes in average household income resulting from the sale of non-timber forest products (e.g., mushrooms, honey, edible nuts) due to a policy to improve degraded forestland; assessing the changes in household disposable income resulting from a home-insulation subsidy policy; or assessing changes in the incidence of health problems due to air pollution among the population affected by a new bus rapid transit system.
- Implementation progress refers to monitoring, reporting, and verifying conformity with agreed modalities and approaches, and assessing progress made toward the implementation of a mitigation action. In the case of a degraded forestland policy, this could entail regularly monitoring the number of forest managers trained, percentage change in annual reforested area, and number of saplings transplanted for reforestation, and verifying whether training-related guidelines, if any, are being followed.

¹³ See <http://www.ghgprotocol.org/> for more information.

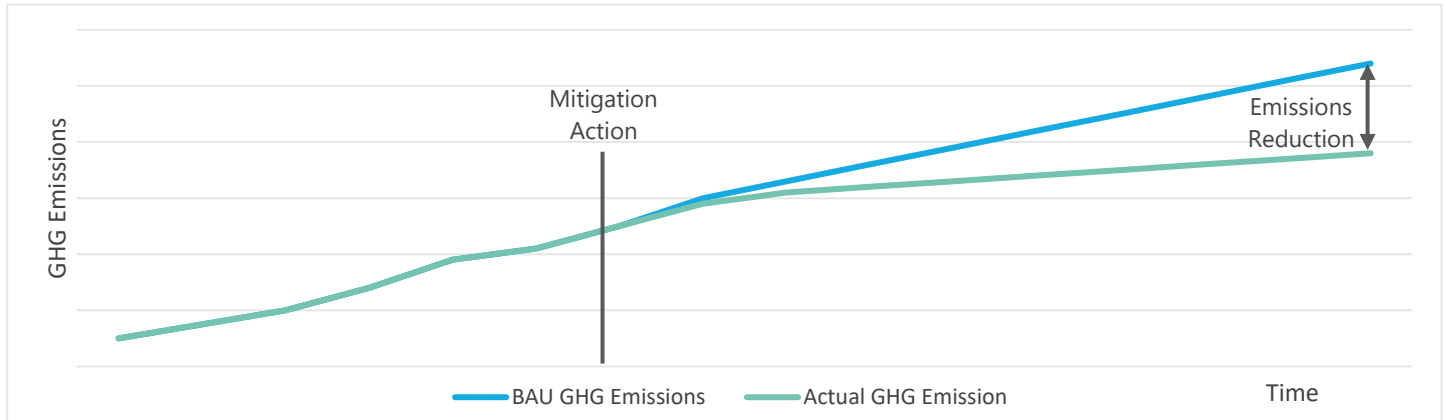
Relationship between National Inventories and MRV of Mitigation Action

National inventories are a critical element in designing national mitigation goals, tracking goal progress, and assessing goal achievement. When designing a mitigation goal, national inventories are needed to identify high-emitting sectors, understand mitigation opportunities, and target significant emissions sources. To track progress toward the goal, an inventory is needed to calculate base year emissions or as the starting point for estimating baseline scenario emissions, depending on the goal type. National inventories are also needed throughout the goal period to assess progress toward the goal. At the end of the goal period, governments need to review the national inventory to determine whether their goal has been achieved.

However, at the same time, tracking progress toward goals differs from inventory accounting in a number of important ways. While a GHG inventory covers the full range of a jurisdiction's emissions and removals across all sectors and gases, accounting for mitigation goals focuses only on those sectors and gases included in the goal boundary, which may be a subset of total emissions. Furthermore, goals accounting can include purchases and sales of transferable emissions units (such as offset credits and tradable allowances) and emissions and removals from the land sector, which may be accounted for under a different inventory system. Therefore, tracking progress toward mitigation goals should be carried out as a complement to developing and updating a GHG inventory.

It may be useful at this point to conceptually distinguish MRV for emissions and MRV of mitigation actions. The MRV for emissions is a straightforward exercise of calculating emissions using available activity data. From section I, this is achieved by collecting and compiling activity data as precisely as possible then applying an emission factor to obtain a GHG estimate. This calculation can be carried out over time and is illustrated by the Actual GHG Emissions line on figure 2.

Figure 2: GHG emissions path



The calculation of emissions mitigation, however, is somewhat less straightforward. Suppose that a mitigation action is implemented which effectively lowers GHG emissions from that point onward. Actual emissions can still easily be observed but the Business as Usual (BAU) scenario can no longer be observed. This BAU scenario is often termed the baseline and has to be projected. Essentially, the BAU scenario is the emission path that would have occurred in the absence of the mitigation action. As such, calculation of the BAU and hence emission reductions have to be estimated following rigorous assumptions. Currently, there are no international agreed upon assumptions, or protocols, for the MRV of mitigation actions. These are under negotiation now and are slated for completion by CoP24 in 2018. However, there are over 100 methodologies to calculate baselines, which are essentially MRV protocols for mitigation actions, developed by the UNFCCC process for the Clean Development Mechanism (CDM).

These protocols have been vetted and tested, and it would make sense that any future protocols for the MRV of mitigation actions would largely be based on those¹⁴.

MRV of Support

Support refers to climate finance, technology transfer, and/or capacity building. It includes monetary support— such as climate finance for developing a national emissions trading system, investments in low-emissions technologies, and funds toward organizing training workshops for energy auditors. The definition of support also includes non-monetary support—such as technical advice to design national energy efficiency standards or labeling schemes.

MRV of monetary support encompasses measuring, reporting, and verifying the provision of funds by donor countries, the receipt of funds by recipient countries, and the results and impact achieved that can be attributed to these funds:

- **Provision of support** includes identifying and reporting relevant data on overall support provided by donor countries through various channels, such as multilateral and bilateral institutions, and ensuring that they are reliable. The EU tracks and reports information on mitigation-related financial and technical support provided to developing countries; this is an example of MRV of provision of support. Relevant information to be collected includes the financial instrument used, recipient country or institution, and information related to the mitigation project.
- **Receipt of support** involves recipient countries tracking and reporting mitigation-related support received from donor countries in the form of various financial instruments such as loans, grants, etc. For instance, Indonesia reports information on finance needs and finance received in its national communications to the UNFCCC.
- **Results/impact of support** involves monitoring the results achieved and evaluating how effectively climate support is utilized toward achieving mitigation-related objectives. Indicators to measure output and impact of support for various mitigation efforts can include, for example, the number of emissions-reduction projects implemented with the support, GHG emissions avoided, energy savings achieved, and private investment mobilized.

Different types and levels of MRV can use common methodologies and data, and the same institutions can perform different MRV-related functions. For example, the methodology used to estimate GHG emissions from natural gas use may also be used to build a national GHG inventory and to assess the effects of energy policy. A single lead institution might coordinate all national MRV processes. Entities should identify areas of overlap between their different MRV processes and explore ways of increasing synergies to improve the efficiency of the overall MRV system. This can help in developing a comprehensive MRV system while utilizing fewer overall resources, and provides an opportunity to customize the MRV system to serve domestic objectives

MRV under the Paris Agreement

The historic Paris Agreement brokered in December 2015 established universal and harmonized measurement, reporting, and verification (MRV) provisions for climate change mitigation. A common system of transparency now applies to all countries. MRV is central to effectively implementing the Nationally Determined Contributions (NDCs) submitted under the Paris Agreement, which describe countries' mitigation goals and policies.

Under the Paris Agreement, an enhanced *transparency framework* has been established for both action—for post-2020 climate change commitments, or NDCs—and support, with flexibility for countries to take account of their different capacities. Each country will regularly provide a national inventory report of emissions and removals (*MRV of*

¹⁴ See: <https://cdm.unfccc.int/methodologies/index.html>

GHG Emissions), as well as information necessary to track progress made in implementing and achieving its NDC¹⁵ (MRV of Mitigation Actions). Countries are also expected to provide information on climate impacts and adaptation, as well as information on financial, technology transfer, and capacity-building support provided, needed, and received (MRV of Support). Accompanying details regarding the kind of information that should be tracked and reported, and the methods to be used, are to be developed by 2018 and adopted by 2020.

Although the MRV guidelines have yet to be developed, NDC monitoring could include elements related to tracking of GHG effects, sustainable development impacts, and implementation progress. Countries are also expected to provide information on climate impacts and adaptation, as well as information on financial, technology transfer, and capacity-building support provided, needed, and received. Common modalities, procedures, and guidelines will be developed in the future for the transparency of mitigation action and support and will guide the provision of such information, which will then undergo a technical expert review.

Identifying the type of MRV Needed

One of the important issues to address in operationalizing MRV is the provision of methodological and technical guidelines. Methods to measure, report, and verify information differ based on what is assessed and at what level. In some cases, such as MRV of GHG effects from mitigation projects, a variety of methods may be available for use; in other instances, such as building national inventories, there is only one internationally accepted method, that is, the IPCC Guidelines. Methods and tools exist for undertaking MRV (e.g., of emissions or emissions reductions) at different levels (Table 1). Available methods may need to be customized or new methods may have to be developed to suit particular needs and circumstances.

Table 1: Methodologies for different types of MRV¹⁶

Methods for MRV of GHG Emissions				
	MEASUREMENT		REPORTING	VERIFICATION
	Method	Data Requirements		
National GHG inventory	IPCC Guidelines for National Greenhouse Gas Inventories	<ul style="list-style-type: none"> Activity data and emission factor Data requirements associated with calculating emissions from some sources, particularly non-energy sources (i.e., AFOLU), can be significantly more complicated Data from continuous emissions monitoring system (CEMS) where feasible 	To the UNFCCC as part of: <ul style="list-style-type: none"> National Inventory Reports for developed countries National Communications for developed and developing countries Biennial Reports (BR) for developed countries, and Biennial Update Reports (BURs) for developing countries Countries may also develop inventories solely for domestic objectives	<ul style="list-style-type: none"> Prescribed by UNFCCC—International Consultation and Analysis (ICA) for developing countries, and International Assessment and Review (IAR) for developed countries The Paris Agreement sets up a technical expert review process for the information provided by countries
	Methods for MRV of Mitigation Actions			
	MEASUREMENT		REPORTING	VERIFICATION
	Method	Data Requirements		

¹⁵ UNFCCC. 2015. Adoption of the Paris Agreement. FCCC/CP/2015/L.9/Rev/1. Available online at: <http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>

¹⁶ Source: WRI 2016

GHG effects	<p>For mitigation goals and policies:</p> <ul style="list-style-type: none"> Guidance to be developed for tracking of nationally determined contributions by countries as per the Paris Agreement GHG Protocol Mitigation Goal Standard for mitigation goals set by governments GHG Protocol Policy and Action Standard for mitigation policies 	<p>For mitigation goals:</p> <ul style="list-style-type: none"> National GHG inventory Other data requirements may include data on emissions and removals from the land sector, transferable emissions units (e.g., carbon credits and tradable allowances), depending on the kind of goal 	<ul style="list-style-type: none"> Any reporting requirements developed in future as per Paris Agreement for post-2020 contributions To domestic stakeholders To the UNFCCC as part of National Communications, Biennial Reports, and/or Biennial Update Reports To donors supporting the implementation of goals, policies, and projects 	<ul style="list-style-type: none"> The Paris Agreement sets up a technical expert review process for the information provided by countries May be prescribed by domestic laws Under the UNFCCC, review is carried out as part of International Consultation and Analysis (ICA) and International Assessment and Review (IAR) processes For credited mitigation projects, verification prescribed by crediting scheme (e.g. CDM, VCS, Climate Action Reserve (CAR))
	<p>For mitigation projects:</p> <ul style="list-style-type: none"> Methodological guidance developed under the Clean Development Mechanism (CDM) GHG Protocol Project Standard Gold Standard Verified Carbon Standards (VCS) 	<p>For mitigation policies and projects:</p> <ul style="list-style-type: none"> Defined by GHG emissions quantification method and the policy/project type Typically include activity data, emission factors, and socio-economic data 	<p>For mitigation projects:</p> <p>To the relevant program (e.g., CDM or emissions trading program) under which the project has been undertaken</p>	
Sustainable development impacts	<ul style="list-style-type: none"> Nationally Appropriate Mitigation Action (NAMA) Sustainable Development Evaluation Tool CDM Sustainable Development co-Benefits Tool Methods specific to the sustainable development effect concerned May use guidance from relevant standards such as the GHG Protocol Policy and Action Standard 	<ul style="list-style-type: none"> Defined by the type of sustainable development effect under consideration Typically include socio-economic data related to employment, health, air quality, etc. 	<ul style="list-style-type: none"> To domestic stakeholders To donors supporting the implementation of policies or projects 	<ul style="list-style-type: none"> May be prescribed by domestic laws
	<ul style="list-style-type: none"> Climate Policy Implementation Tracking Framework Monitoring Implementation and Effects of GHG Mitigation Policies: Steps to Develop Performance Indicators Guidance from donor entities 	<ul style="list-style-type: none"> Data related to performance indicators (such as permitting; licensing; procurement; financing; behavioral, technology, and process changes; changes in GHG emissions) 	<ul style="list-style-type: none"> To domestic stakeholders To the UNFCCC as part of National Communications, Biennial Reports, and/or Biennial Update Reports, and future reporting requirements yet to be determined for post-2020 contributions To donors supporting the implementation of mitigation actions 	<ul style="list-style-type: none"> May be prescribed by domestic laws or as per donor or project under requirements Under the UNFCCC, review is carried out as part of ICA and IAR processes Technical expert review for post-2020 actions, per the Paris Agreement
Methods for MRV of Support				
	MEASUREMENT		REPORTING	VERIFICATION
	Method	Data Requirements		
Provision of Support	<ul style="list-style-type: none"> Future guidance to be developed for post-2020 period per the Paris Agreement Common tabular format (CTF) in Biennial Reports under the UNFCCC 	<ul style="list-style-type: none"> Intended funding to be provided in future as per the Paris Agreement Overall amount in US dollars or local currency Source of finance and detailed information on financial 	<ul style="list-style-type: none"> Future reporting requirements for post-2020 contributions To the UNFCCC as part of National Communications, Biennial Reports, and/or Biennial Update Reports 	<ul style="list-style-type: none"> May be prescribed by domestic laws Under the UNFCCC, review is carried out as part of International Consultation and Analysis (ICA) and International

	<ul style="list-style-type: none"> • May use Organization for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC) climate markers or the joint method developed by the multilateral development banks (MDBs) 	<ul style="list-style-type: none"> • contributions to climate specific funds, international financial institutions, and multilateral institutions • Detailed information on public bilateral support • Indication of new and additional financial resources • Information on provision of support for technology development and capacity building • Information on status, funding, source, financial instrument (e.g., grant, concessional finance, equity, loan guarantee, insurance), and sector • Sector and/or subsector targeted by finance • Category (e.g., asset finance, venture capital support, research, demonstrations, capacity building, training, planning, analysis) • Recipient ministry or domestic organization in recipient countries (National Implementing Entity) 		<ul style="list-style-type: none"> • Assessment and Review (IAR) processes • Technical expert review for post-2020 period, per the Paris Agreement
Receipt of support	<ul style="list-style-type: none"> • Climate Public Expenditure and Institutional Review for domestic budgeting (CPEIR) • Different methods in use by different countries and funding agencies to track and report development and climate finance 	<ul style="list-style-type: none"> • Climate finance needs and climate finance received as per the Paris Agreement • Overall amount in US dollars or local currency • Information on status, funding, source, financial instrument (e.g., grant, concessional finance, equity, loan guarantee, insurance), and sector • Sector and/or subsector targeted by finance • Category (e.g., asset finance, venture capital support, research, demonstrations, capacity building, training, planning, analysis) • Recipient ministry or domestic organization in recipient countries (National Implementing Entity) 	<ul style="list-style-type: none"> • To the UNFCCC as part of National Communications and Biennial Update Reports • To domestic stakeholders and donors 	<ul style="list-style-type: none"> • May be prescribed by domestic laws • Under the UNFCCC, review is carried out as part of International Consultation and Analysis (ICA) and International Assessment and Review (IAR) • Technical expert review for post-2020 period, per the Paris Agreement
Results/impact of support	<ul style="list-style-type: none"> • May use guidance provided by various mitigation funds (e.g., Clean Technology Fund, Global Environment Facility) and donor organizations 	<ul style="list-style-type: none"> • Data related to indicators such as emissions reduced, volume of private finance leveraged, annual energy savings, etc. 	<ul style="list-style-type: none"> • To domestic stakeholders as well as existing or potential donors 	<ul style="list-style-type: none"> • May be prescribed by domestic laws • Under the UNFCCC, review is carried out as part of ICA and IAR processes • Technical expert review for post-2020 period, per the Paris Agreement

Current MRV activities in Myanmar

National Communications

National Communications from developing countries provide information on greenhouse gas (GHG) inventories, measures to mitigate and to facilitate adequate adaptation to climate change, and any other information that the Party considers relevant. Myanmar has submitted its first national communication in 2012 and is currently in the process of preparing its second national communication (SNC) based on more up to date data. The SNC is being fully supported by the Global Environment Facility (GEF).

REDD+

The UN-REDD programme estimated that deforestation and forest degradation account for 17 percent of carbon emissions, more than the entire global transportation sector and second only to the energy sector¹⁷. Reducing emissions from deforestation and forest degradation (REDD+) is a mechanism developed by Parties to the UNFCCC, with the “plus” signifying conservation, sustainable management of forests, and enhancement of forest carbon stocks. It creates a financial value for the carbon stored in forests by offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development.

MRV for REDD+ specifically refers to the measurement, reporting and verification of a country’s forest, and associated GHG emissions and removals, including their changes over time. Quantifying GHG emissions for REDD+ relies on the IPCC’s good practice guidance for Land Use, Land Use Change and Forestry (LULUCF). In its basic form, emissions estimates are equal to changes in the area of land use, times the average amount of emissions per unit-area of each type of activity.

Myanmar became a partner country of the UN-REDD Program in December 2011 and has quickly taken steps to start implementing REDD+ readiness activities. Myanmar has established the institutional structure to manage the REDD+ Readiness process.

Myanmar will develop a “National Forest Monitoring System” (NFMS), comprising a monitoring function and a Measurement, Reporting and Verification (MRV) function (referred to by the Forest Department as “Monitoring and Measurement, Reporting and Verification (M&MRV). The monitoring function will serve to assess whether REDD+ activities are results-based, while the MRV function will be the tool used to assess and report on the mitigation performance of REDD+ activities to the UNFCCC. The NFMS will consist of a satellite based land monitoring system (SLMS) and a national forest inventory (NFI) and be the prime information system to produce relevant data for UNFCCC reporting, the definition and eventual adaptation of reference levels for REDD+ and the information necessary for independent verification. The NFMS will meet the MRV requirements under the Paris Agreement and is being supported by the UNREDD program¹⁸

Myanmar’s MRV requirements

¹⁷ See UN-REDD Programme at <http://www.unredd.net/about/what-is-redd-plus.html>

¹⁸ Source: Franz Arnold. Technical specialist. UN-REDD program, UNDP

Countries across the globe adopted an historic international climate agreement at the U.N. Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) in Paris in December 2015. In anticipation of this moment, countries publicly outlined what post-2020 climate actions they intended to take under the new international agreement, known as their Intended Nationally Determined Contributions (INDCs). INDCs are the primary means for governments to communicate internationally the steps they will take to address climate change in their own countries.

The word “intended” was used because countries were communicating proposed climate actions ahead of the Paris Agreement being finalized. However, as countries formally ratify the Paris Agreement and look forward to implementation of these climate actions – the “intended” is dropped and an INDC is converted into a Nationally Determined Contribution (NDC). On 5 October 2016, the threshold for entry into force of the Paris Agreement was achieved. The Paris Agreement entered into force on 4 November 2016. Myanmar is expected to ratify this treaty in 2017.

Under the Paris transparency framework, developing country obligations are twofold. All countries are required to:

1. regularly submit national greenhouse gas emission inventories, and
2. report on progress toward achieving their NDC for mitigation¹⁹.

The reports will occur on a biennial basis for all countries, except the least developed countries (LDCs) and small island developing states (SIDS) who will report at their discretion.

Myanmar has submitted its INDC in 2015 and is currently preparing its NDC for release in 2017. It is expected that it will identify the specific mitigation actions below:

- **Forestry Sector**

- National Permanent Forest Estate Target. By 2030, Myanmar’s permanent forest estate (PFE) target is to increase national land area as forest land.

- **Energy Sector**

- Renewable energy – Hydroelectric power. Increase the share of hydroelectric generation within limits of technical hydroelectric potential and instead of the development of fossil fuel based power generation.
- Renewable energy – Rural electrification. To increase access to clean sources of electricity amongst communities and households currently without access to an electric power grid system. The Project will support the scale-up of low carbon energy through grid connections and renewable or hybrid energy for village-scale mini-grids and off-grid solar home systems to replace current fossil fuel sources of electricity and lighting including diesel and kerosene²⁰.
- Energy efficiency – industrial processes. To mitigate GHG emissions in the rapidly developing industrial production sector by reducing energy consumption by 20% by 2030 against the base year of 2012
- Energy efficiency – cook stoves. To increase the number of energy efficient cook stoves distributed in order to reduce the amount of fuel wood used for cooking.

Under the Paris Agreement, Myanmar will have to regularly provide information necessary to track progress made in implementing and achieving its NDC goals listed above as well as a national inventory report of emissions. It is also expected to provide information on climate impacts and adaptation, as well as information on financial, technology transfer, and capacity-building support needed and received.

¹⁹ See article 13 of the Paris Agreement at: http://unfccc.int/paris_agreement/items/9485.php

²⁰ See Document PAD1410 at <http://documents.worldbank.org/curated/en/home>

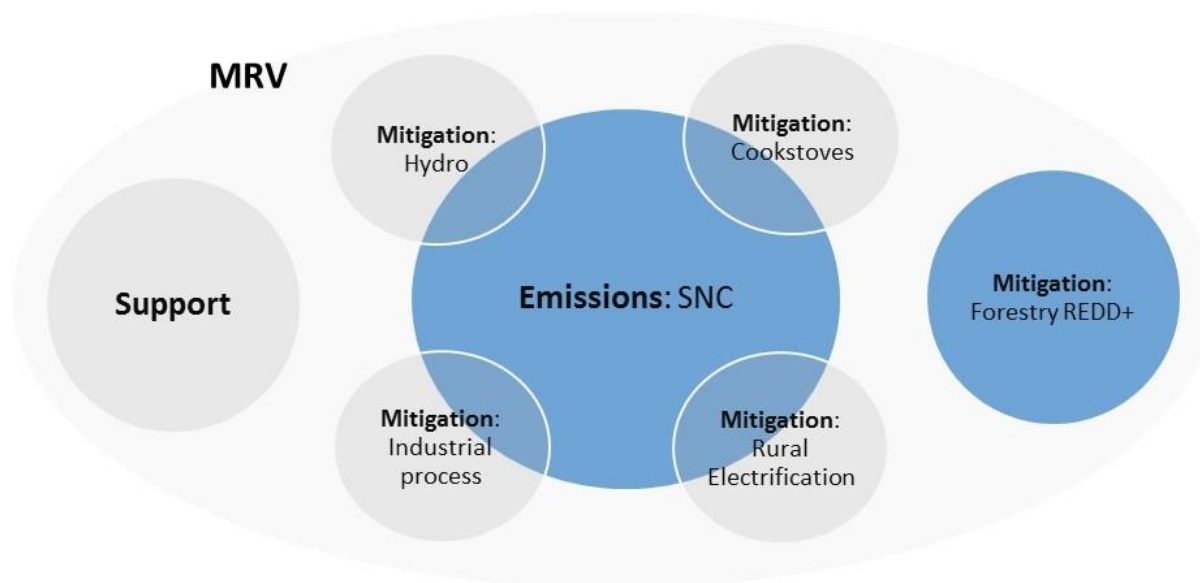
Gaps in current MRV activities in Myanmar

The development of Myanmar's SNC is only at the beginning stages. Its exact content has not yet been decided. Interviews conducted in Myanmar with those responsible for the SNC indicate that they do intend to report mitigation actions occurring in Myanmar but for the reasons listed below, this may not be sufficient to meet the MRV requirements:

1. The SNC, by definition, is a one-time calculation and report of GHG inventories, adaptation and mitigation actions. Although it is the intention to make this a permanent facility that feeds into the BUR, GHG inventory, etc. The mitigation actions planned for the NDC will be ongoing and will require regular monitoring.
2. Most planned mitigation actions will occur after the SNC has been submitted. For instance, for the SNC, if we assume that this will report all mitigation actions, it can only report those actions prior to the SNC. Mitigation actions beyond that reporting period will have to be reported by a subsequent national communication or other reporting vehicle as determined by upcoming negotiations.
3. The planned mitigation actions for the NDC may not be the same as those listed in the SNC
4. Mitigation actions may simply be listed in the SNC without calculation of GHG reductions.
5. At the time of the drafting of this document, it was not known if and what methodologies were going to be used for the calculation of GHG reductions.
6. It is not planned for the SNC to report MRV of support

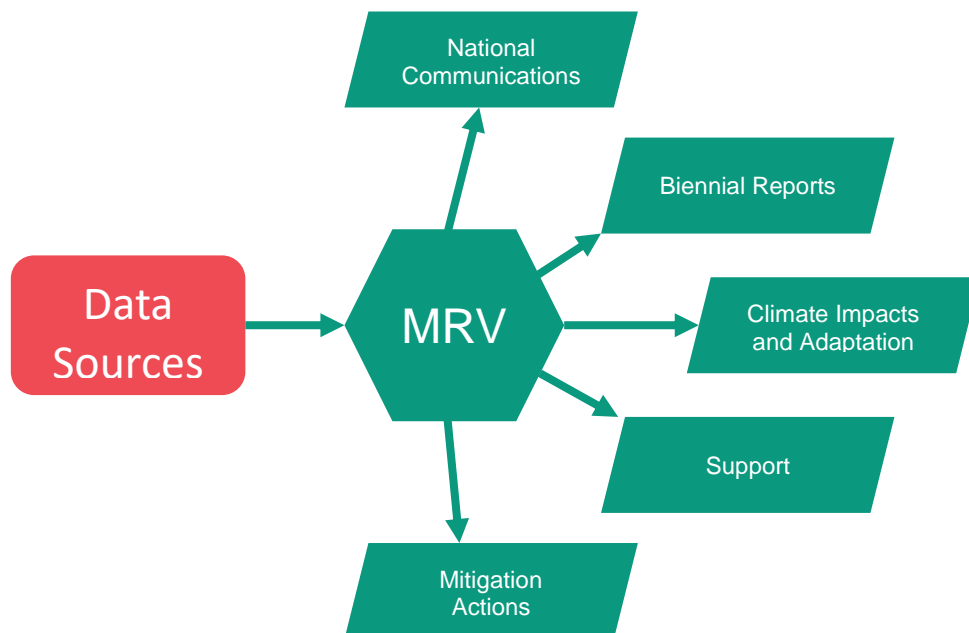
The SNC will fulfil part of Myanmar's MRV obligations in that it will report a national greenhouse gas emission inventory. MRV obligations under the REDD+ program will fulfill another part, but together, they only form two components of a greater MRV system needed. Figure 3 illustrates all the MRV components required for Myanmar and the relationships between them.

Figure 3: Myanmar's MRV requirements under the Paris Agreement



Each circle represents a distinct MRV obligation. The solid blue circles are MRV activities that are currently being implemented and supported, that is, MRV of GHG Emissions with the SNC and MRV of Mitigation Actions with REDD+. The other circles represent MRV obligations that will be required and may be partially covered in current activities such as with the mitigation actions of hydro, cook stoves, rural electrification and industrial process, or not covered such as the MRV of support.

Essentially, the current MRV activities in Myanmar are fragmented, ad-hoc and incomplete. Ideally, MRV should be systematic so the NDC focal point can know what’s happening at any one time. It should be viewed as a process that will be fed by the various data sources, and used to produce national communications and biennial reports, and also to be able to track mitigation actions, climate impacts and adaptation, as well as financial, technology transfer, and capacity-building support needed and received.



Under the Paris agreement, the national greenhouse gas emission inventories are to be prepared per the latest IPCC good practice guidance. However, the MRV rules on the progress toward achieving NDC mitigation actions and tracking support have not been drafted yet. As such, it is impossible to know precisely what those MRV requirements are until the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA) has adopted its rules by the end of 2018. Despite this uncertainty, there are several assumptions that can be made about future MRV rules that would allow Myanmar to start preparing now for the eventual adoption of a MRV system. This will be the focus of sections below.

Stakeholder and Situation Analysis

MRV Essentials

MRV is central to effectively implementing the NDCs submitted under the Paris Agreement. The previous sections describe the different types of MRV, the status of MRV in Myanmar, the requirements under the Paris Agreement, the gaps between them, and suggested that, ideally, MRV is not a series of disjointed activities but a unified systematic process.

Even though all the rules have not yet been formalized, the essential building blocks of MRV systems including establishing *institutional arrangements*, *data management systems*, and *building capacities* remain the same.

Institutional arrangements

Institutional arrangements must be in place to coordinate participation of stakeholders. Clearly defined roles and responsibilities of key organizations within the government departments and agencies will ensure the smooth flow of information to all entities measuring, reporting and verifying the GHGs. Developing a robust institutional framework that encompasses the relevant institutional entities as well as the necessary staff, systems and processes, is essential for an effective MRV system. However, the approaches that countries have taken vary widely, and while there is no single set of institutional arrangements that can be considered “best practice” as of now, there are a number of commonalities in how countries have chosen to approach institutional arrangements:

1. Coordinating body/ Lead institution

In most cases countries have designated a lead institution, often the Ministry of Environment or equivalent to coordinate the MRV system and direct the activities of other actors in this area.

2. Inter-ministerial body/ Steering Committee

This body promotes coordination across key stakeholders and also ensures input into other national processes and plans.

3. Technical Coordinator(s)

The technical coordinator, which may take the form of a team or individual, often sits within the lead institution and is responsible for the technical outputs of the MRV system. Technical coordinators may also be designated for each of the sectoral working groups

4. Sectoral Working Groups

Countries also often designate separate working groups to conduct MRV activities within a specific sector. These teams comprise a combination of governmental institutes, research organizations and other public and private sector bodies.

Data management systems

Estimating GHG emissions almost always relies, in one way or another, on the basic function of the product of activity Data (AD) and an emission factor (EF). The quality of the estimate will depend heavily on the quality of the data and hence on a country’s data management system. Data management systems should consider different sets of indicators, be transparent, use harmonized methodologies and deliver data in a timely manner. Some countries have developed a centralized system for data management with all information centralized within the lead institution for compilation and analysis. In other countries much of the data management, collection and storage takes place in a more decentralized way.

Building capacities

There are several technical elements involved in MRV and many developing countries need strengthened capacity to fulfill their commitments regarding transparency. Depending on the type of MRV, different resources and capacities may be required. Under the Paris Agreement, the Capacity building Initiative for Transparency (CBIT) has been established to strengthen institutional and technical capacity, and support developing countries in establishing effective MRV systems.

By supporting Myanmar in establishing its institutional arrangements, data management systems, and capacities, the bulk of the work in building an MRV system would be complete and the country will be well prepared for any MRV rules decided upon down the road.

It is with this in mind that the research and interviews into current MRV activities in Myanmar was conducted.

The Methodology

In preparation of GGGI's mandate to build an MRV system for Myanmar's NDC requirements, a detailed stakeholder and situation analysis was conducted examining its current institutional arrangements, data management systems, and capacity. Building on current analysis and engagement undertaken in Myanmar to date, the method chosen to undertake this situation analysis was research into current activities related to MRV as well as a series of interviews with government staff, domestic and international consultants and foreign organizations such as UNDP, and UN Habitat.

Results of the detailed stakeholder analysis

To initiate the situation analysis, a series of interviews was planned in Nay Pyi Taw in the fall of 2016. A series of questions was sent to Myanmar's NDC focal point (Environment Conservation Department) in advance and was designed to assess the status of its institutional arrangements, data management systems, and capacity. Questions were distributed to all relevant ministries, departments and agencies, followed up by face to face meetings. The questions and groups met can be seen in Annex 1 to this report and the answers were consolidated and abridged into the sections below.

Institutional Arrangement

The Environment Conservation Department (ECD) of the Ministry of Natural Resources and Environmental Conservation (MoNREC) is the focal point for climate change issues in general, with the NDC and any MRV activities that ensue. It is also responsible for engaging other ministries and departments in addressing climate change.

The existing capacity of ECD requires reinforcement, while capacities in other ministries and agencies also require dedicated support to be able to integrate climate change and MRV needs into respective Programs. The consistent exchanges through the Technical Working Group (TWG) of the Myanmar Climate Change Alliance (MCCA) between 2015 and 2016, have significantly increased the participation of several sectoral actors, and inter-ministerial coordination in assessing the impacts of climate change on different sectors. ECD plays an important coordination role as concerns about climate change escalate and has used the TWG of MCCA effectively to this end. This initiative was originally designed to develop the Myanmar Climate Change Strategy, but has in fact evolved into a platform of coordination, which has also served the development of the NDC, the dissemination of the new climate change projections, and other issues. This platform will require further institutionalization, beyond the life of its original mandate, as it is the first actual mechanism to consistently discuss climate change action in Myanmar at the national, sub-national, and local levels²¹.

ECD is currently receiving support from the GEF to develop its SNC while the Forest Department is receiving support from the UNREDD program to develop its National Forest Monitoring System. Both of these initiatives will satisfy the MRV requirements for the national GHG inventory and for forestry mitigation actions listed in the NDC, but are ad-hoc and leave several gaps in a complete MRV system. Nevertheless, the institutional arrangements being developed under those initiatives can be utilized and reinforced to serve a greater MRV process that will satisfy NDC requirements.

²¹ Myanmar Climate Change Strategy and Action Plan (MCCSAP) 2016-2030. Unofficial version, July 2016

ECD is in the process of forming working groups and establishing contacts with all the relevant ministries, agencies and departments related to the SNC. They plan on forming five inter-ministerial working groups:

1. GHG inventory and mitigation
2. Vulnerability assessment and adaptation
3. Environmental sound technology
4. Research and systematic observation
5. Education, training and public awareness

These working groups are expected to begin meeting early 2017. In addition, ECD has asked other ministries to determine the focal points but they have not yet been established. It is important to keep in mind that these working groups are meant to meet for the SNC and share any REDD+ progress. As was seen in sections above, there are several shortcomings to those programs when it comes to a MRV system, mainly due to the MRV of mitigation actions with its sustainable development co-benefits, and MRV of support. It would be critical to support the institutional arrangements to include those.

The level of cooperation between departments and ministries is very positive. However, many ministries are less concerned about climate change issues and will hence be unresponsive to demands for MRV. For example, ECD and the ministries involved with the SNC met in September where ECD requested that each ministry appoint a representative to form a working group. As of April 2017, there were 117 participants in total of five TWGs.

Another issue with the institutional arrangements in Myanmar is the lack of institutional memory. Myanmar's first and only GHG inventory and national communication was in 2008 and based on 2000 data. Most of the people involved in that calculation are retired. The individuals currently responsible for the SNC were not involved in the first and have little experience in producing inventories. However, they are currently receiving training in IPCC good practice guidance, are actively involved in mutual learning events facilitated by the Workshop on GHG Inventory in Asia (WGIA), and plan on hiring consultants that were involved in past GHG calculations.

The MRV activities under the UN-REDD program will be self-sufficient and the communication between departments seems quite effective. UN-REDD representatives joined in SNC TWG and have supported the SNC Teams in term of capacity building on GHG Inventory and REDD+ concepts and principles including MRV.

The institutional arrangements being developed for the SNC and REDD+ are in their infancy and remain untested. Diverse supporting capacity building and learning exchanges being developed with different international partners (ex. FAO, UNEP, UNFCCC, WGIA, UNREDD, EU-MCCA) will continued to improve capacities, but there is need to ensure that these are well-integrated to meet the needs for all MRV requirements for the NDC. It is important that the working groups being formed to develop the SNC and REDD+ incorporate all other MRV related issues.

Data management

Myanmar's has a decentralized statistical organization. The Central Statistics Organization (CSO) out of the ministry of planning and finance, was established under the Statistical Authority Act of 1952. This act empowers the CSO to:

- Collect a wide range of economic and social data to serve the statistical needs of the nation.
- Delegate responsibility for the collection of particular data sets to authorized individuals and agencies of the government.
- have access to any relevant records or documents in the possession of any person, or entity to obtain any information or return for the purpose of the collection of any statistics under the Act

Currently the CSO collects national data on a monthly and yearly basis on general economic indicators such as income, prices, import, and export. Recently, they are also requesting departments to supply information on CO2

equivalent emissions from different sectors which will be used for publication in the 2017 Statistical Year Book. However, not all data requested for 2011 to 2016 is available. In addition to CSO's data, each ministry will collect data specific to its sector. Ministry data is held within that ministry and is generally not shared unless it's specifically requested by another. Inter-ministerial requests for data are made to the CSO who then passes it to the appropriate ministry. CSO will then receive the data then pass it on to the requester. There are significant delays between the time data is requested and received.

ECD has the authority to request data from other ministries but they do not often respond quickly and sometimes do not fully comprehend the request. Furthermore, there seems to be a low capacity on data management. Interviewees had opposing responses to questions on data availability and procedures to acquire it, on its quality, frequency and location. As part of the National Strategy for Development of Statistics (NSDS), ECD has established an Environmental Statistics Working Group to improve this data sharing. Since December 2016, they have held three meetings.

The process for collecting Activity Data for the purposes of generating GHG calculations is outside normal data collection activities and tends to be costly and unsustainable. It usually involves long delays and often has to be followed up. Official letters are sent from ECD to each ministry who then send their own letters to the companies and other entities requesting data.

From the first national communication, data was eventually acquired to produce a basic GHG inventory but it was very laborious and costly to collect. Often, several personal visits to the source of the data (ministry, association or private company) over several months had to be done in order to acquire the data. In a few instances, proxy data had to be pieced together to reconstruct missing data.

There is certain data that is collected with a regular frequency, but it's often ad-hoc. Each ministry is responsible for its own data collection so the frequency and methods will be variable. When interviewed in Nay Pyi Taw, ministry and departmental representatives all indicated that the necessary activity data to produce GHG estimates is being collected but that acquiring it requires formal procedures. For instance, important activity data, typically needed in the calculations of GHGs, is fuel use by fuel type for energy. According to the ministry of electricity and energy, this data is currently being collect with regular frequency. Other ministries have also indicated that they collect appropriate activity data crucial for MRV. Confirming precisely what data exists in Myanmar was beyond the scope of this stakeholder analysis but any future MRV support will have to do so.

CSO complies with data collection protocols, but other ministries may not, so there is a need for standardization and to develop guidelines for other ministries to follow. The government of Myanmar is planning to enact a new statistical law aiming to better define the organization of the national statistical system, to assign the responsibilities of the different actors (CSO, line Ministries) and to establish the CSO as the lead institution regarding statistical activities. It will give CSO the power to collect statistics from the other statistical actors and information for statistical purposes. It also details the principles of objectivity, accuracy, relevance, statistical confidentiality and transparency that statistical activities shall follow.

The data management system in Myanmar is adequate enough to produce one-time reports on GHGs but involve long delays and unsustainable costs. However, it will need to be bolstered in order to have access to more timely, accurate and relevant data to support a MRV system so as to produce the necessary reports needed to comply with the NDC requirements. The new statistical law should help to these ends but it will be necessary to ensure that the appropriate data is collected, following standard and robust methodologies, and efficiently delivered to NDC focal points.

Capacity Building

Generally, awareness and capacity to plan and deliver climate change strategies is low at all levels. The capacity to generate MRV data is inadequate. The capacity need assessment, carried out for the

MCCSAP, shows that Myanmar has inadequate institutional, policy and legal framework including inadequate focus on climate resilient planning, implementation and monitoring and evaluation²². The evaluation from the stakeholder and situation analysis conducted in Myanmar concurs with these findings, especially when it comes to the technical requirements for MRV.

The primary goal of any capacity building should be to strengthen the in-country capacities for climate change reporting, particularly related to MRV of mitigation actions, sustainable development benefits, as well as of support received and required. Training should focus on ECD and CSO, all ministries, agencies, and departments relevant to the NDC (MONREC, Ministry of Electricity and Energy, Ministry of Agriculture, Livestock and Irrigation, Ministry of Transport and communication, Ministry of construction. In addition, the Naypyitaw, Yangon and Mandalay City Development Committees). The specific needs and priorities in these areas need to be identified and tailored, and capacity building programs consisting of in-country workshops/trainings, followed up by non-internet based virtual training with practical guidance documents reinforcing the training programs need to be developed and implemented.

Implications for the Global Green Growth Institute

GGGI has a two-year mandate to build a MRV system for Myanmar's NDC requirements. The MRV system will have to regularly provide information necessary to track progress made in implementing and achieving NDC goals as well as a national inventory report of emissions. In addition, it will also have to provide information on climate impacts and adaptation, as well as information on financial, technology transfer, and capacity-building support needed and received.

Given that the rules have not yet been formalized, GGGI can advance its mandate by focusing on the essential building blocks of MRV systems such as the institutional arrangements, data management systems, and building capacities.

Institutional arrangements

GGGI can reinforce the institutionalization of the working groups now being formed to manage the SNC and REDD+ activities. ECD is in the process of forming the following five groups:

- 1) GHG inventory and mitigation
- 2) Vulnerability assessment and adaptation
- 3) Environmentally sound technology
- 4) Research and systematic observation
- 5) Education, training and public awareness

Reinforcing the institutionalization of the working groups refers to:

- Adding an MRV expert to the working groups to support topics currently not being covered, that is, MRV of mitigation actions with its sustainable development co-benefits, and adaptation, and MRV of support, to the topics discussed within these working groups
- Providing technical support to the working groups with regular follow-up. There should be an individual or entity responsible for this who has a clear mandate and timelines to follow through with the support for the duration

²² Myanmar Climate Change Strategy and Action Plan (MCCSAP) 2016-2030. Unofficial version, July 2016

GGGI's mandate. This individual or entity should also keep track of international developments on MRV and update the groups accordingly. It is expected that this individual or entity will be foreign to Myanmar so in addition to him or her, it is suggested that a domestic individual is engaged to assist the institutional arrangements expert and to ensure the transfer of knowledge and institutional memory.

Data management systems

Given the challenges acquiring data in Myanmar's decentralized statistical system, a data management system will have to be designed in order to have access to timelier, accurate and relevant data to support a MRV system so as to produce the necessary reports needed to comply with the NDC requirements, and to keep ECD up to date. Even though the precise rules for MRV are not known, the data needs should be the same regardless, so the precise data required can be based on current international protocols for mitigation actions and support (e.g. Clean Development Mechanism methodologies).

Ideally, the data management system should centralize data collection, facilitating interaction between ECD, providers and verifiers, and support^{23,24}:

- tracking of progress against mitigation actions and support
- aggregation and storage of activity data, emission factors, and calculated emissions, mitigation actions and support activities;
- data analysis and calculations;
- documentation of procedural information and methodologies;
- Data review, consolidation, and analysis for ECD, sharing among government agencies, and others; and
- archiving of datasets, calculations, documentation, relevant studies, communications among inventory team members, and final submitted reports.

The data management system can be set up and managed by an individual or entity responsible for the data with a clear mandate and timelines to follow through with the support for the duration GGGI's mandate. It is expected that this individual or entity will be foreign to Myanmar so in addition to him or her, it is suggested that a domestic individual is hired to assist the data management expert and to ensure the transfer of knowledge and institutional memory.

Capacity

The primary goal of any capacity building should be to strengthen the in-country capacities for climate change reporting, particularly related to MRV of mitigation actions and adaptation, sustainable development benefits, as well as of support received and required. Training should focus on ECD and CSO, all ministries, agencies, and departments relevant to the NDC. The specific needs and priorities in these areas need to be identified and tailored, and capacity building programs consisting of in-country workshops/trainings, followed up by non-internet based virtual training with practical guidance documents reinforcing the training programs need to be developed and implemented.

²³ World Bank. 2016. Greenhouse Gas Data Management: Building Systems for Corporate/Facility-Level Reporting. Partnership for Market Readiness, World Bank, Washington, DC. Available online at: <https://openknowledge.worldbank.org/bitstream/handle/10986/23741/K8658.pdf?sequence=5&isAllowed=y>

²⁴ Damassa, T. and J. Blumenthal with S. Elsayed. 2015. "Data Management Systems for National Greenhouse Gas Inventories: Insights from Ten Countries." Working Paper. Washington, DC: World Resources Institute. Available online at www.wri.org/publication/data-management-ghg-insights.

This can be accomplished by an individual or entity responsible with a clear mandate and timelines to follow through with for training during the initial phases of GGGI's mandate and not for the entire duration.

Recommendations

Referring to figure 4 above, MRV system established in Myanmar should be systematic so the NDC focal point can know what's happening at any one time. It should be viewed as a process that will be fed by the various data sources, and used to produce national communications and biennial reports, and also to be able to track mitigation actions, climate impacts and adaptation, as well as financial, technology transfer, and capacity-building support needed and received.

The goal of this stakeholder and situation analysis was to assess the current institutional capacity and data availability, so as to build on the existing mechanisms and institutional roles and responsibilities, and to eventually introduce a MRV system for Myanmar. As such, the focus has been on identifying the gaps in its current MRV related activities and suggest a path forward on filling those gaps. It is important to note, however, that this paper's focus was not on how specifically to implement an action plan on filling the gaps but nevertheless, makes the following recommendations:

Recommendations for the two-year duration of GGGI's mandate to build a MRV system in Myanmar:

- Engage one or more persons, with expertise in MRV as it pertains to obligations under the Paris Agreement who will attend working group meetings and is responsible for overseeing the institutional arrangements. They must have a clear mandate and timelines to follow through with the support.
- It is expected that these individuals will be international experts so in addition to them, it is suggested that domestic individuals are engaged to assist the MRV experts and to ensure the transfer of knowledge and institutional memory.
- Engage one or more persons to set up and manage the data management system as it pertains to MRV under the Paris Agreement with a clear mandate and timelines to follow through.
- It is expected that these individuals will be international experts so in addition to them, it is suggested that domestic individuals are hired to assist the data management experts and to ensure the transfer of knowledge and institutional memory.
- Engage one or more persons to manage the institutional arrangements and data management experts and assume responsibility for the development of Myanmar's MRV system, and coordinate all efforts to that end. These individuals should also keep track of international developments on MRV and update the groups accordingly.

Recommendations for the initial phases of GGGI's mandate to build a MRV system in Myanmar:

- Engage one or more persons responsible for the capacity building program with a clear mandate and timelines to follow through with training. Training should focus on ECD and CSO, all ministries, agencies, and departments relevant to the NDC. The specific needs and priorities in these areas need to be identified and tailored, and capacity building programs consisting of in-country workshops/trainings, followed up by non-internet based virtual training with practical guidance documents reinforcing the training programs need to be developed and implemented.

The international experts engaged could be based outside of Myanmar with frequent travel to Nay Pyi Taw and Yangon as needed. The domestic assistants could be locally engaged and working full time on their mandate.

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Annex 1

MRV Scoping mission questions to Myanmar

September to December, 2016

Gap Analysis Questions

Elements	Questions to be considered
NDC / SNC	<ol style="list-style-type: none">1. Is your department involved in the target setting for the NDC?<ol style="list-style-type: none">a. How do you decide what mitigation actions are needed?b. What mitigation actions are planned for the 2nd NDC / SNC?c. How do you quantify the mitigation actions?d. What assumptions are used for baselines?2. Does Myanmar participate in any international or regional networks for knowledge exchange on NDC, SNC, MRV?3. Which sectors have been prioritized for mitigation actions?4. Will the mitigation actions listed in the SNC attempt to also capture non-GHG benefits, e.g. job creation, air quality, health, etc.? If so, please explain what metrics are used.5. Do you plan to measure and report support activities for the SNC or for donors? E.g. financial flows, technical knowledge, and capacity building6. Are processes for the validation/verification of MRVed mitigation action impacts in place?7. Are sufficient staff available at the institutions responsible for the SNC?8. Do the available staff need training in the methodologies and data needs for all sectors? This includes training in: IPCC, measuring emissions and baselines, measuring non-GHG benefits, e.g. job creation, air quality, health, etc., measuring support e.g. financial flows, technical knowledge, and capacity building.9. Do the available staff need training in both technical and content related reporting requirements and relevant tools
Agriculture, Forestry, REDD+	<ol style="list-style-type: none">10. At what stage is the REDD+ MRV system?11. How has it been envisioned to be incorporated into a national MRV system?12. What specific mitigation actions are planned for the 2nd INDC?
Institutional Arrangement	<ol style="list-style-type: none">13. ECD is responsible for the SNC and the NDC. They will need data from several departments/ministries.<ol style="list-style-type: none">a. How is data shared?b. What is the mechanism?c. Are there laws in place for data sharing?

-
14. Can you describe the working group / steering committee responsible / focal points / technical experts for the SNC, the NDC and Climate mitigation/adaptation in general?
 15. Who, what, when and how will the SNC be reported?
 16. Is there a process in place to engage stakeholders in the development of mitigation activities (e.g. financial institutions, NGOs, multilateral implementing agencies)?
-

**Data Availability &
Data Collection
Systems**

17. Are the key datasets that are required for GHG emissions estimation for different source sectors available? that is:
 - a. the Activity Data (AD) used in GHG emissions estimation e.g. total fuel combusted by type fuel, by sector; production (mass) of cement, lime, glass, refrigerants, and waste.
 - b. Are there any estimates for country specific emission factors?
 18. Is the data collection based on a voluntary or a mandatory basis? Does a national law exist that requires data reporting from, e.g. the private sector?
 19. Is there a need to establish data agreement with key data providers?
 20. What is the frequency of data collection (monthly, annual or ad-hoc basis?)
 21. Is data on sustainable development being collected?
-

Data Quality

22. Method of data collection – do you follow established guidelines and protocols?
 23. What Quality assurance and control (QA/QC) procedure is carried out by data suppliers on the data used to compile the GHG emissions?
-

**Capacities &
Technical Skills**

24. Do the skills and capacity required at each stage of the MRV process exist in Myanmar?
 25. How many highly technical staff in engineering, data management or statistics are in Ministry X?
 26. What is the general knowledge of MRV within the ministry? Do working level non-technical staff know what MRV is or have a general understanding of how it is implemented?
 27. Do you have recommendations on the means of capacity development that should be used and why? (Training, workshop, study visit, coaching, twinning, providing manuals, identification of best practices elsewhere)
 28. Would you be willing to send one or more of your staff to partner country to learn more about their MRV system? Would you be willing to host a staff member from a partner country who could provide expertise on MRV?
 29. What is the demand and supply for research data required for implementation of MRV?
 30. Are there currently any existing government training institutes? Could we partner with them for training on MRV?
 31. What kinds of training do new national government staff go through?
 32. What kinds of training do new Ministry staff receive? Could we potentially add a module or handbook on MRV to such training?
 33. Are there technical staff who have expressed an interest in learning more about MRV or being a part of its implementation? Are there any
-

incentives in place for staff who participate in trainings or commit to expanding their knowledge of MRV?

34. What results would you like to see at the end of a capacity development program for MRV?
- a.

35. Have budgets and human resources for the compilation and submission of the SNC been established, including resources for all related MRV activities?
-

Distribution

Institutions and individuals who participated in the stakeholder analysis

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 - Environmental Conservation Department
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Annex 2

Industry sector breakdown in Myanmar Sources of Emissions

Myanmar launched an Initial National Communication (INC) project in 2012 with the financial assistance from GEF/UNEP. The Greenhouse Gas (GHG) inventory and mitigation option analysis team (GHG study team), established in January 2012 successfully accomplished national GHG inventories for 2000 for the following sectors: energy, industrial processes and product use, agriculture, forestry and other land use, and waste sectors. These remain the main sources of GHG emissions in Myanmar.

Energy

The main sources of GHG emissions in the energy sector are fossil fuel combustion, traditional biomass fuel combustion, fugitive emissions from coalmining activities, and oil and natural gas system.

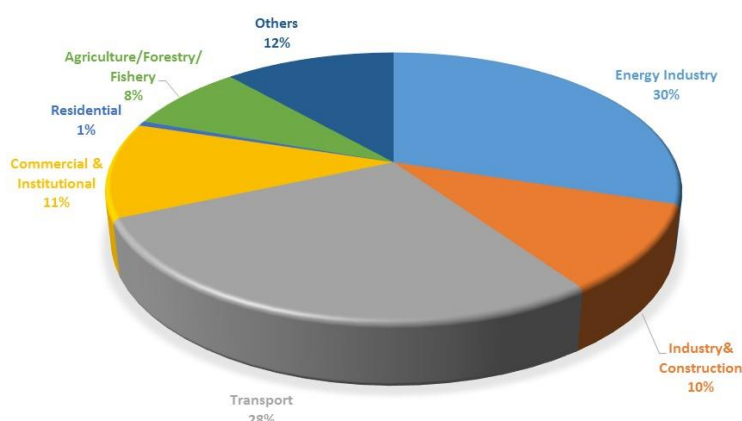
Fossil fuel combustion

Myanmar's commercial energy resources depended almost fully on hydropower and fossil fuels. The emission sources in the sector of electric power and

Heat supply were defined to be the power generation and heat supply of Myanmar's thermal power utilities while the emissions from auxiliary power plants and other sources of heat supply were reported in the relevant sectors. Machineries and equipment for fossil fuel combustion composed of gas turbines and combined cycle power plants, power generating boilers, industrial boilers, industrial kilns, household cooking ovens, farm implements, power-generation internal combustion engines, different kinds of aviation vehicles, road transport vehicles, railway transport vehicles, shipping transport vehicles, etc. energy industry and transport sectors shared the largest contributions.

GHG emissions from fossil fuel combustion in Myanmar in 2000 (Gg)

Sector	CO ₂ eGg
Energy Industry	2,323.02
Industry & Construction	809.63
Transport	2,170.64
Commercial & Institutional	888.55
Residential	42.87
Agriculture/Forestry/Fishery	627.9
Others	892.5
Total	7,755.11



Traditional biomass fuel combustion

It mainly consists of fuel wood consumed for domestic home cooking. About 95 percent of the rural household’s uses fuel wood for their home cooking. Total CO2 emission, total CO2 equivalent emissions from traditional biomass burned for energy was calculated at 28,297 Gg CO2e. This is four times the GHG emissions from the energy sector.

Fugitive emissions from oil and natural gas systems

Only methane emissions were calculated from oil and natural gas systems. Methane emissions from oil and natural gas systems were estimated to be 4.63 Gg (97.23 Gg CO2e).

Fugitive emissions from coal mining activities

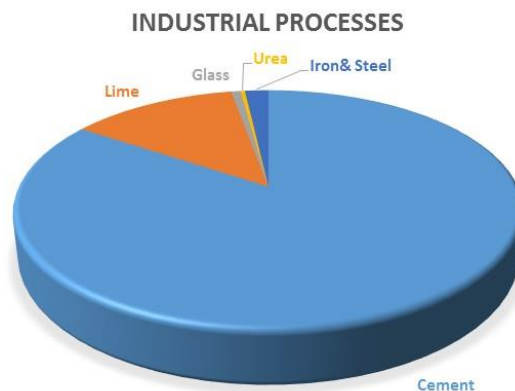
Only methane emissions were calculated from coal mining activities of Myanmar. Methane emissions from underground mining and surface mining were estimated at 0.53Gg (11.13 Gg CO2e).

Industrial Processes and Product Use Sector

GHG emissions from various types of industrial processes are not energy use related emissions. These emissions are related to physical and chemical transformations of materials, in which GHGs such as CO2, CH4, N2O and other gases are released. GHG emissions were worked out for industries namely, cement, lime, iron and steel, glass, urea, calcium carbide used in acetylene, and product uses.

GHG emissions from Industrial Processes and Product Use in 2000 (Gg)

Industrial processes	CO2eGg
Cement	203.23
Lime	30.74
Glass	1.74
Urea	0.8
Iron& Steel	4.34



Product Use	CO2eGg
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Carbide for Acetylene Production	0.35
Refrigeration & Air Conditioning	143
Electrical Equipment	71.7
Lubricant Use	7.39



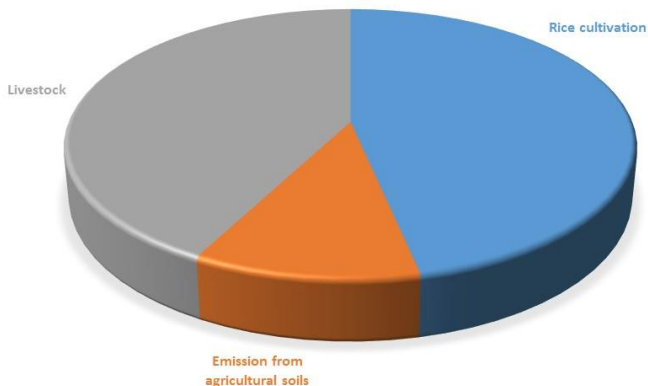
Agriculture Sector

Myanmar's economy mainly depends on agricultural production. Agriculture sector contributed 34% of GDP, 23% of total export earnings, and employed 63% of labor force in 2000. Seventy percent of the population reside in rural areas and are mainly engaged in agriculture, livestock and fishery sectors for their livelihoods.

Rice is a staple food and it grows well in all agro ecological regions of Myanmar. Flooded rice fields act as a major emitter of methane (CH₄), which has a higher global warming potential. In addition, N₂O is an important GHG produced in agricultural soils by microbial processes of nitrification and denitrification. Livestock is the other major source of emissions in Myanmar. Methane emissions mainly come from the enteric fermentation of ruminants, including dairy cattle, non-dairy cattle, and others.

Estimation of GHG emission from agriculture sector in 2000 (Gg)

Agriculture source	CO₂eGg
Rice cultivation	10651.8
Emission from agricultural soils	2542
Livestock	9648.31



Land Use Change and Forestry Sector

The forest resource assessment (FRA 2005) conducted by the Food and Agriculture Organization (FAO) in cooperation with the Forest Department (FD) of Myanmar has indicated that Myanmar is still endowed with a forest covered area of 52% of the country's total land area of 676,577 km². This is one of the highest forest cover in the Asia-Pacific Region.

Since forest represent a huge carbon stock, this sector is uniquely characterized by GHG emissions and removals (sequestration) where Myanmar forests remain a net carbon sink. The main sources of annual increases in biomass carbon stocks were natural forests, plantations, home gardens and roadside trees. Similarly, the main sources of loss

of carbon stocks by wood removal were harvested wood products, fuelwood removal, Biomass burning following land clearing, Site preparation for forest plantations, Shifting cultivation and deforestation.

CO2 emissions / removals from land use change and forestry sector in 2000 (Gg)

Activity	CO2 emissions	CO2 removals	Net CO2 emissions/removals
Natural forests		129,839	(129,839)
Forest plantations	1,863	11,750	(9,887)
Home garden trees		470	(470)
Roadside trees		162	(162)
Wood removal	n/a	n/a	n/a
Fuel wood removal	(Energy sector)		
Harvested wood products	n/a	n/a	n/a
Shifting cultivation	1,201		1,201
Deforestation	37,341		37,341
Total	40,405	142,221	(101,816)

Net GHG removal in land use change and forestry sector shows a major carbon sink of 101,816 Gg of CO2 in 2000 was removed from the atmosphere. CO2 removal by land use change and forestry sector can compensate the total emission by different sectors. However, the trend of net GHG removal is decreasing over time due to increased deforestation.

Waste Sector

The two significant sources of GHG emissions for the waste sector in Myanmar come from solid waste, including agricultural waste (mainly crop residues), livestock waste (farming manure), industrial waste and domestic/municipal waste, and domestic and commercial wastewater.

GHG emissions from the Waste sector in 2000 (Gg)

