

Initiative for Climate Action Transparency – ICAT



IMPLEMENTATION PLAN

MRV SYSTEM FOR RENEWABLE ENERGY POLICY CAMBODIA

Initiative for Climate Action Transparency - ICAT –

MEASUREMENT, REPORTING AND VERIFICATION SYSTEM FOR RENEWABLE ENERGY POLICY IN CAMBODIA

DELIVERABLE 3: IMPLEMENTATION PLAN OF THE MRV SYSTEM FOR RENEWABLE ENERGY (REVERSE AUCTION) POLICY OF CAMBODIA

DISCLAIMER

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, photocopying, recording or otherwise, for commercial purposes without prior permission of UNOPS. Otherwise, material in this publication may be used, shared, copied, reproduced, printed and/ or stored, provided that appropriate acknowledgement is given of UNOPS as the source. In all cases the material may not be altered or otherwise modified without the express permission of UNOPS.

This publication has been produced as part of a component of the Initiative for Climate Action Transparency project (ICAT) implemented by UNEP DTU Partnership (UDP). The views expressed in this publication are those of Consultants, and do not necessarily reflect the views of the GSSD or UDP.

PUBLISHED BY

General Secretariat of the National Council for Sustainable Development: Department of Climate Change (GSSD)

PREPARED UNDER

Initiative for Climate Action Transparency (ICAT) project supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, the Children's Investment Fund Foundation (CIFF), the Italian Ministry of Ecological Transition (IMET) and ClimateWorks.

The ICAT project is managed by the United Nations Office for Project Services (UNOPS)



Acknowledgment

The Royal Government of Cambodia (RGC), being an important player to tackle the adverse effects of climate change and to reduce global warming, ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and the Paris Agreement in 2017. The country also submitted its Nationally Determined Contributions (NDCs) to UNFCCC in 2017.

Increasing the share of renewable electricity, especially through introduction of grid-connected solar PV systems, is one of the mitigation actions proposed by RGC in its NDCs to UNFCCC. Having an Internationally recognized and transparent system for the Measurement, Reporting and Verification (MRV) to evaluate the Greenhouse Gas (GHG) effects of such mitigation action is an essential requirement.

UNEP DTU Partnership is providing technical assistance to RGC under this ICAT project, which aims to design an MRV system for a selected renewable energy policy in Cambodia, which will support to improve transparency and capacity building in the country. A Team of National Experts, and International Experts of Climate Smart Initiatives (Pvt) Ltd (ClimateSI) was selected to support the Cambodian team with the project.

Appreciating the invaluable contribution extended from all the stakeholders related to the assignment, we would like to extend our sincere thanks and gratitude to:

H.E. Tin Ponlok, Secretary General, General Secretariat of the National Council for Sustainable Development

H.E. Sum Thy, Deputy Secretary General, General Secretariat of the National Council for Sustainable Development

Officers of Ministry of Mines and Energy and national experts including

Dr. Hak Mao,

Mr. Sum Cheat

Mr. Heng Kunleang

for assisting with this assignment by granting necessary approvals, making relevant officers available for participation for the discussions, and providing necessary information.

We appreciate the contributions and continued support extended by the participants of the discussions while attending to their routine duties.

We would also like to appreciate Dr. Fatemeh Bakhtiari and Dr. Jyoti Prasad Painuly, Senior Researchers of UNEP-DTU Partnership, for their contribution in supervising, reviewing, editing, and providing valuable inputs to improve the quality of this report.

- General Secretariat of the National Council for Sustainable Development

List of Acronyms

BTR	Biennial Transparency Report
BUR	Biennial Update Report
CDKN	Climate and Development Knowledge Network
CoP	Conference of Parties
EAC	Electricity Authority of Cambodia
EDC	Electricite du Cambodge
ETF	Enhanced Transparency Framework
GSSD	General Secretariat of the National Council for Sustainable Development
GHGs	Greenhouse Gases
IPPs	Independent Power Producers
LCOE	Levelized Cost of Electricity
MEF	Ministry of Economy and Finance
MoE	Ministry of Environment
MME	Ministry of Mines and Energy
MoP	Ministry of Planning
MRV	Measurement, Reporting and Verification
NC	National Communication
NCSD	National Council for Sustainable Development
NDCs	Nationally Determined Contributions
PEC	Provincial Electricity Company
RE	Renewable Energy
REEs	Rural Electricity Enterprises
REF	Rural Electrification Fund
SD	Sustainable Development
UDP	UNEP DTU Partnership
UNFCCC	United Nations Framework Convention on Climate Change

Table of Contents

Acknowledgment	iii
List of Acronyms	v
1 Introduction.....	1
1.1 Background.....	1
1.2 Objective.....	2
2 Implementation approach.....	2
2.1 Establish Institutional Arrangement for MRV Implementation Plan	3
2.1.1 Existing Institutional Arrangement for an MRV system for energy and climate change sectors	3
2.1.2 Institutional Arrangement for MRV of renewable energy policy.....	6
2.1.3 Roles and Responsibilities of stakeholders.....	7
2.2 Assess data needs and gaps.....	10
2.3 Design of MRV system.....	11
2.4 Data Management.....	12
2.4.1 Data Quality	12
2.4.2 Data Management System	13
2.4.3 Legal arrangement on implementation of reverse auction policy for grid connected solar power generation.....	15
2.5 Capacity building.....	17

2.6	Improve the system overtime.....	18
3	Road map for implementation	19
4	References.....	21
Annex 1: Additional tasks to be carried out before the implementation of the MRV system.....		22

List of Tables

Table 1	Responsibilities of the MRV coordination unit	7
Table 2	MRV related responsibilities of the existing working group at the MME	8
Table 3	Responsibilities of the MRV expert committee.....	9
Table 4	Availability of required data for GHG impact assessment	10

List of Figures

Figure 1:	Implementation approach of MRV system	2
Figure 2:	Institutional arrangement of electricity sector.....	4
Figure 3	Institutional arrangement of NCSD.....	5
Figure 4:	Proposed Institutional Arrangement for implementing MRV system.....	6
Figure 5	Proposed data management system	15
Figure 6	Points considered for planning	18
Figure 7	Road map for implementation of renewable energy policy MRV, Source: Author.....	20

1 Introduction

1.1 Background

Arrangements for national reporting have evolved throughout the history of the UNFCCC and Kyoto Protocol, into a comprehensive Measurement, Reporting and Verification framework (MRV). At the twenty-first session of the CoP to the UNFCCC, the Paris Agreement (PA) was adopted and it entered into force on 4th November 2016. Article 13 of the Paris Agreement established an Enhanced Transparency Framework (ETF) for action and support in order to build mutual trust and confidence among the Parties and to promote the effective implementation of the Paris Agreement. Key elements of the ETF include NC, BUR, BTR and NDC.

For the purpose of meeting these international reporting requirements for the energy sector, Initiative for Climate Action Transparency (ICAT) with the technical support from UNEP DTU Partnership has agreed to facilitate developing a national MRV system for renewable energy policy in Cambodia.

MRV system is developed based on the ICAT Renewable Energy Methodology. Reverse auction policy applied for solar energy generation was selected as the policy for the MRV development. As reverse auction policy promotes the solar energy generation of the country, proposed MRV system can be used to track the NDC implementation and promote grid connected solar power generation as a strategy to achieve the 16% emission reduction from energy industries in 2030 compared to the baseline.

After a comprehensive assessment of reverse action policy for grid connected solar power generation in Cambodia and documentation of an MRV system, the country needs to take the next important step to implement the proposed MRV system. Successful implementation of any MRV system requires an enabling environment which encompasses strong legal architecture, adequate institutional, human, technical and financial capacity and regular stakeholder engagement.

1.2 Objective

This report on designing an implementation plan for the establishment of renewable energy policy MRV in Cambodia is a part of the third deliverable in developing an MRV system for renewable energy policy in Cambodia.

Objective of this report is to design an implementation plan for the MRV system for renewable energy policy in Cambodia

2 Implementation approach

Renewable energy MRV system of Cambodia includes an MRV framework, procedures, protocol and the implementation plan. In order to implement the proposed MRV system, it is vital to attend to supplementary elements such as building capacities on MRV; improving the system over time, based on the experience gained; etc. As such, success of the proposed MRV system mostly depends on the implementation of the proposed recommendations in the implementation plan.

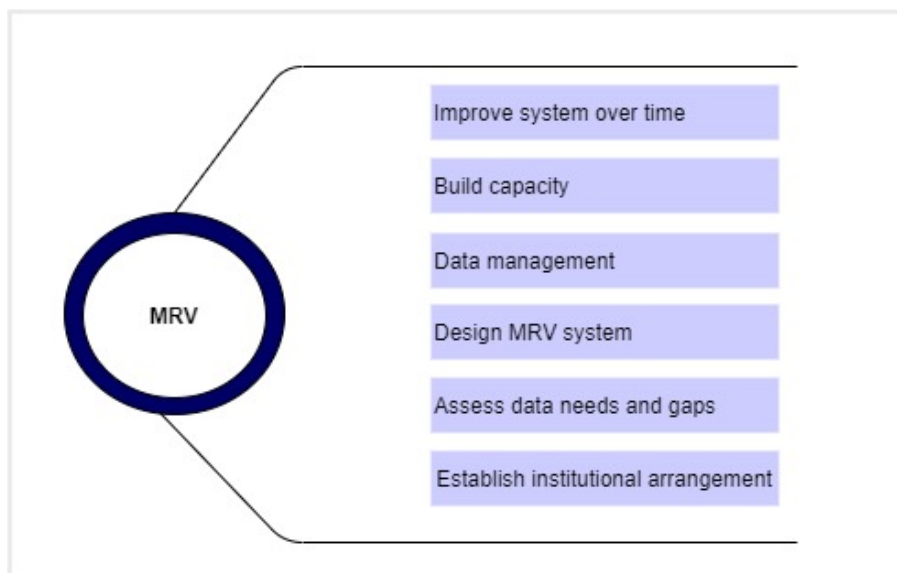


Figure 1: Implementation approach of MRV system

Source: CDKN, 2020

Key steps of implementing an MRV system are illustrated in Figure 1. A systematically established institutional arrangement is required to oversee and coordinate the MRV system. Data requirement for the analysis of the GHG impact needs to be identified based on the selected methodology. MRV system needs to be developed by including the methodology, and reporting and verification requirements. A data management system to manage the data, including data collection and processing, quality assurance, and quality control needs to be established. Necessary legal and regulatory arrangements need to be introduced. Capacity of the stakeholders need to be improved for the successful implementation. MRV system needs to be updated continuously based on the national and international reporting requirements. Steps shown in Figure 1 are described in the sections that follow.

2.1 Establish Institutional Arrangement for MRV Implementation Plan

2.1.1 Existing Institutional Arrangement for an MRV system for energy and climate change sectors

Current institutional arrangements of both energy and climate change sectors are considered to develop the proposed institutional arrangement for the implementation of the MRV system.

Key players of the electricity sector of Cambodia are

1. Ministry of Mines and Energy (MME)
2. Electricity Authority of Cambodia (EAC)
3. Electricite Du Cambodge (EDC)
4. Ministry of Economy and Finance (MEF)
5. Independent Power Producers (IPPs)
6. Rural Electricity Enterprises (REEs)
7. Provincial Electricity Company (PEC)

As illustrated in Figure 2 below, developing policies, plans and technical standards for the electricity sector is a responsibility of MME. EAC functions as the regulator and safeguards the

rights of the consumers in the energy industry. The EAC has authority to issue rules, regulations, and procedures on power market operations while it is responsible for awarding licenses and setting tariffs. EDC, is a state-owned utility carrying out the functions of generation, transmission and distribution of electricity. The EDC purchases electricity from Independent Power Producers (IPPs) and sells electricity to Rural Electricity Enterprises (REEs) as well. IPPs and REEs are privately owned while all other organizations in the industry are government entities. MEF is the focal point for structural reform, international economic and financial cooperation and integration, lobbying for foreign aid, preparing plans for borrowing and repayment of foreign loans; and facilitates long-term and concessional finance.

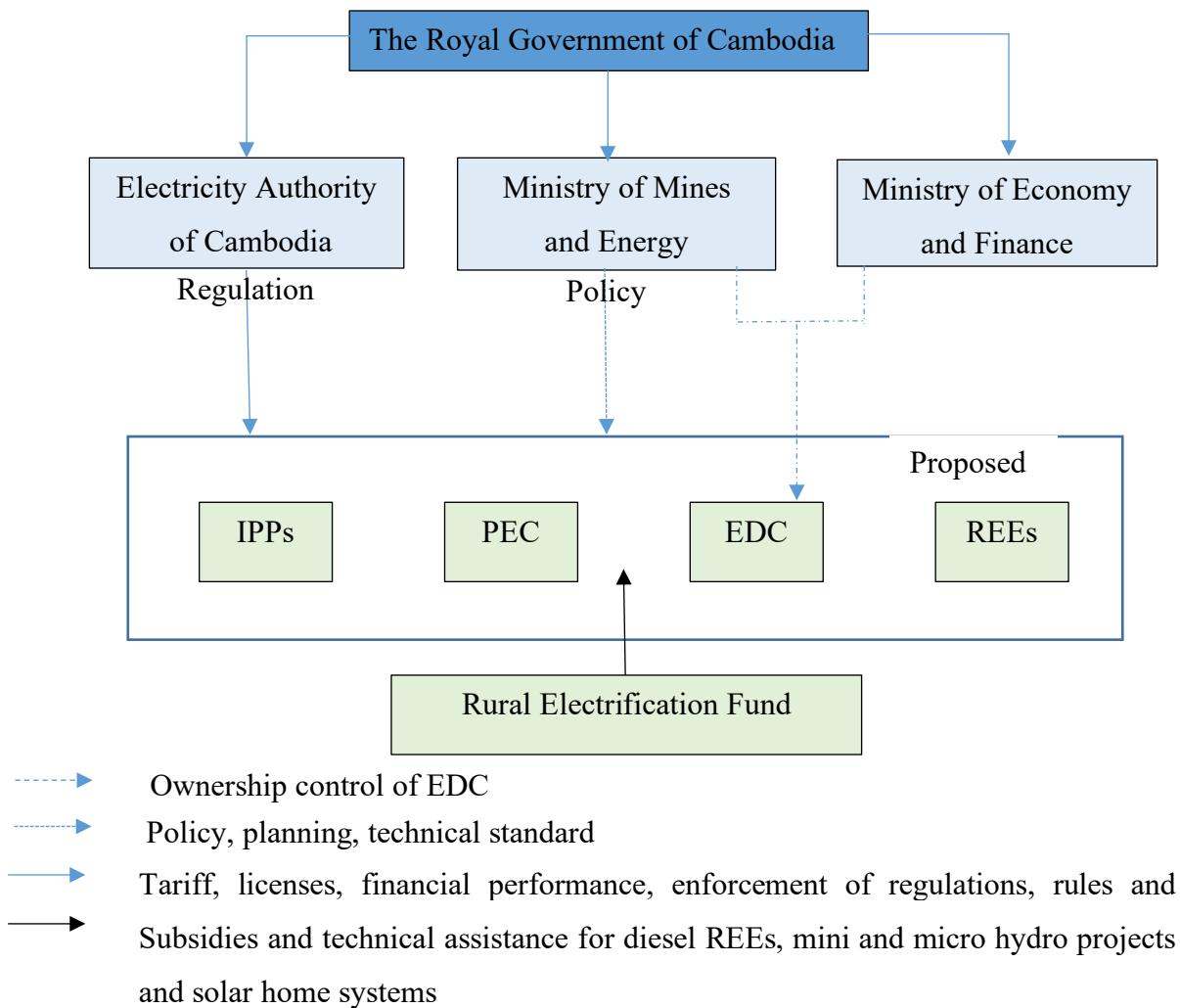


Figure 2: Institutional arrangement of electricity sector

Source: MME, 2019

Four institutions are directly involved in addressing climate change related matters of Cambodia: 1. Ministry of Environment (MoE); 2. National Council for Sustainable Development (NCS); 3. General Secretariat of the National Council for Sustainable Development (GSSD); and 4. Department of Climate Change (DCC)

The MoE, which is the national focal point to the UNFCCC, functions as the institutional head to environment and climate change related matters. NCS is mandated to prepare, coordinate and monitor the implementation of policies, strategies, legal instruments, plans and programmes related to all areas of sustainable development and to monitor and report on Cambodia’s implementation of its international commitments to the respective international bodies. GSSD is responsible for the preparation and implementation of legal instruments, policies, strategic plans, action plans, programmes, and projects related to sustainable development.

DCC is responsible for data collection, compilation and preparation of GHG inventory, BUR and NDCs of the country.

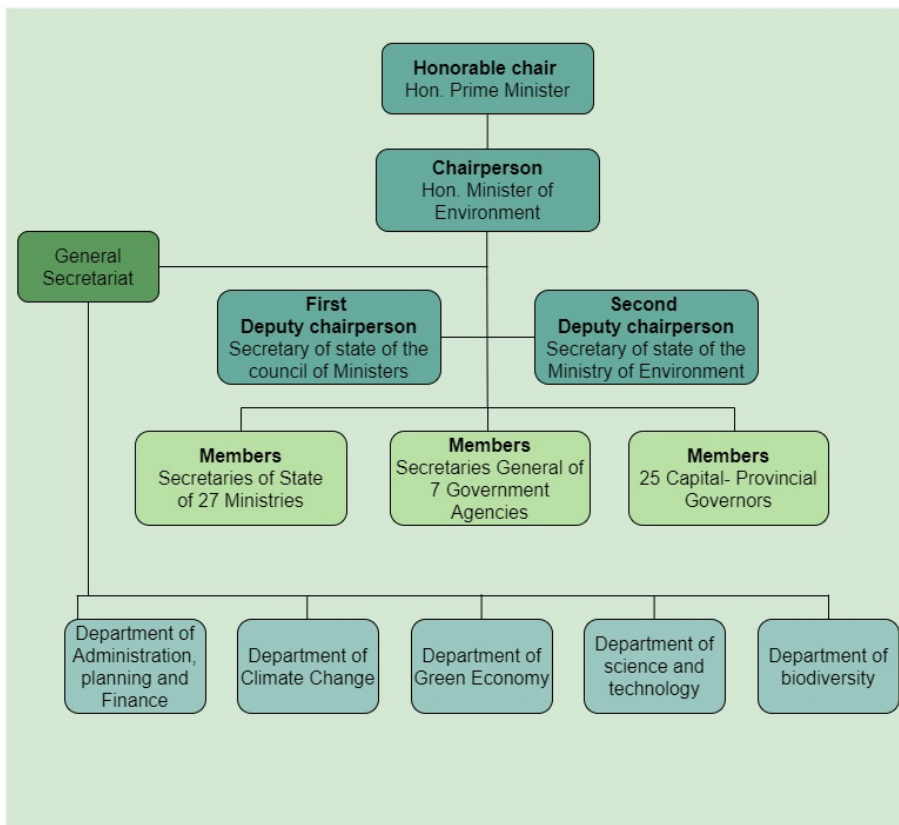


Figure 3 Institutional arrangement of NCS

Source: Department of Climate Change, 2014

2.1.2 Institutional Arrangement for MRV of renewable energy policy

Like most policies, the reverse auction policy for grid connected solar power generation in Cambodia affects multiple economic sectors and multiple stakeholder groups across different levels of governance. Therefore, it is important to establish a proper coordination mechanism in order to implement the MRV system of the policy in an effective and efficient manner. This coordination requirement is addressed by the proposed institutional arrangement by setting clear roles and responsibilities for all relevant actors; and laying procedures that guide them.

The proposed institutional arrangement for the implementation of the MRV system is shown in Figure 3 below.

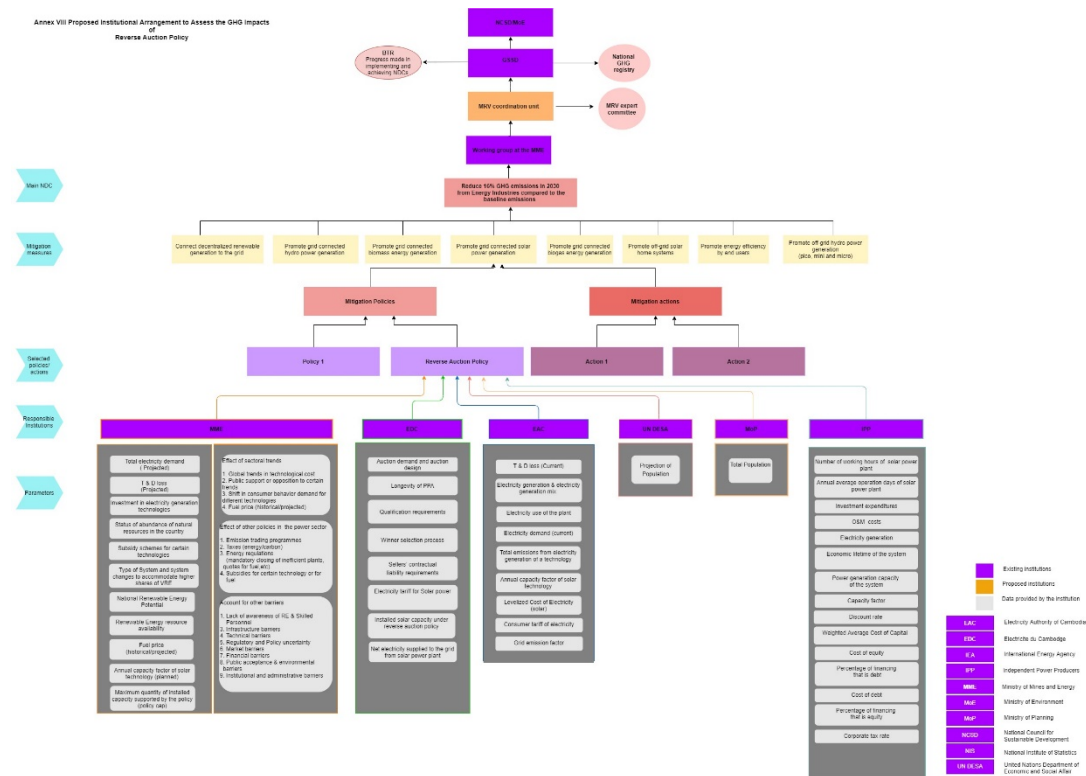


Figure 4: [Proposed Institutional Arrangement for implementing MRV system](#)

Source: Author

2.1.3 Roles and Responsibilities of stakeholders

Data required to assess the impact of the RE policy need to be gathered from different institutions such as MME, EAC, EDC, MoP and IPPs. Therefore, it is important to establish a common unit to collect, process, report and verify data in a manner complying with international standards. Current study proposes to allocate these responsibilities to the existing working group at the ministry. This group will consist of teams for data collection, QA/QC and technical support. An MRV coordination unit will be established at GSSD to provide guidance and training to stakeholders on accurate collection, recording, reporting and analysis of data; and calculating the GHG impact of policies or actions. MRV coordination unit may include an MRV expert representing each sector (i.e. MRV expert of energy industry, transport sector, manufacturing industry, forestry, agriculture, etc.). MRV expert committee is responsible for verification of the GHG calculations. Following tables provides roles and responsibility of each unit in detail.

Please refer to MRV framework for renewable energy policy of Cambodia for more detail

Table 1 Responsibilities of the MRV coordination unit

Responsibilities of the MRV coordination unit
Provide guidance and training to stakeholders for: i) collecting, recording, reporting, and analysing data accurately; and ii) Calculating GHG impact of mitigation policies and actions
Channel technical and financial support for MRV of RE policy
Establish extensive and effective communication channels with the stakeholders
Plan and conduct all coordination and consultation activities with government and if appropriate non-government stakeholders in relation to MRV of policies, strategies and mitigation actions
Build capacities of the stakeholders and keep track of capacity-building efforts, domestic (unilateral) as well as international
Conduct an evaluation exercise to identify key lessons learnt and areas for improvement.

Compile and integrate all the sectoral MRV reports and transform them into a cohesive document to be submitted to UNFCCC
Incorporate reporting from all line ministries and their regulatory bodies and keep an updated registry of relevant actions (e.g. policies and projects)
Collect and aggregate information on new RE policies, and direct those to the MRV process
Maintain and update the registry of all the RE projects in the country
Reflect on progress of policy implementation and adjust to new circumstances
Keep the MRV expert committee informed of progress and emerging issues
Establish guidelines for quality control and the quality assurance of collected data and develop and oversee the implementation of a quality assurance/quality control strategy for the entire MRV process
Mediate between parties when concerns surface, for example, over a disagreement in terms of responsibilities or a potential conflict of interest

Source: Adapted from National MRV framework for transport sector in Sri Lanka, 2019

Responsibilities of the existing working group at the MME regarding the MRV system are presented in Table 2 below.

Table 2 MRV related responsibilities of the existing working group at the MME

Responsibilities of existing working group at MME
Coordination of the flow of information from individual institutions and ministries for a collective assessment of impacts and multiple benefits of policies, strategies and actions
Calculation of GHG impacts of RE sector policies, strategies and actions

Quality assurance and quality control of data
Identifying all institutions that will be involved in data collection
Allocating responsibilities for all institutions ensuring that there is a clear lead for each institution, and establishing an institutional level formal approval process
Developing and monitoring a time frame and schedule for the preparation and submission of necessary data, including specific dates for deliverables
Documenting systematically, as appropriate, all the assumptions, data and methods used
Storage and safe keeping of data and calculations.

Source: Adapted from National MRV framework for transport sector in Sri Lanka, 2019

Responsibilities of the MRV expert committee are outlined in Table 3 below.

Table 3 Responsibilities of the MRV expert committee

Roles and responsibilities of MRV expert committee
Verify the emission reduction calculations done by existing working group at MME.
Provide necessary guidance and feedback to the existing working group at MME on calculations and selected methodologies.
Make recommendations for improving the process of data collection
Study and update the emission factors for relevant sectors
Provide recommendations on suitable methodologies to calculate the impacts of mitigation actions
Establish systems and procedures for the verification of reported impacts of policies

Source: Adapted from National MRV framework for transport sector in Sri Lanka, 2019

2.2 Assess data needs and gaps

In accordance with ICAT RE guidance, following data will be required to analyze the GHG impact of the reverse auction policy. Most of the data are gathered as part of regular data collection efforts by the institutions involved in the current reporting system.

Table 4 Availability of required data for GHG impact assessment

Parameter	Responsible organization	Publicly available	Only documented internally	Data requirement
Total electricity demand (Projected)	MME	Yes	No	Ex-ante
T & D loss (Projected)		Yes	No	Ex-ante
Investment in electricity generation technologies		Yes	No	Ex-post
Status of abundance of natural resources in the country		Yes	No	Ex-post
Subsidy schemes for certain technologies		Yes	No	Ex-post
Type of systems and system changes to accommodate higher shares of VRE		Yes	No	Ex-post
Fuel price (historical/projected)		Yes	No	Ex-post
Maximum quantity of installed capacity supported by the policy (policy cap)		Yes	No	Ex-post
Effects of sectoral trends		Yes	No	Ex-post
Effects of other policies		Yes	No	Ex-post
Account for other barriers		Yes	No	Ex-ante
Total emissions from electricity generation of a technology	EAC	Yes	No	Ex-post
Annual capacity factor		No	Yes	Ex-ante

Electricity use of the plants (Own use of electricity)		No	Yes	Ex-ante	
Electricity generation & Electricity generation mix		Yes	No	Ex-post	
Levelized Cost of Electricity		Yes	No	Ex-ante	
Consumer tariff of electricity		Yes	No	Ex-ante	
Auction demand and auction design	EDC	Yes	No	Ex-ante	
Longevity of the power purchase agreement		Yes	No	Ex-ante	
Qualification requirements		Yes	No	Ex-ante	
Winner selection process		Yes	No	Ex-ante	
Sellers' contractual liability requirement		Yes	No	Ex-ante	
Electricity tariff for solar power		No	Yes	Ex-ante	
Net electricity supplied to the grid from solar power plant		No	Yes	Ex-post	
Installed solar capacity under reverse auction policy		Yes	No	Ex-post	
Annual average operation days of solar plant		IPP	No	Yes	Ex-ante

Source: Author

Note: Data required to assess the ex-ante GHG impact are only needed once within the assessment period. For this study, ex-ante assessment is conducted for the assessment period of 2021-2030. Unless policy or the assessment period is changed, ex-ante data **need not** to be monitored. Data required to assess the ex-post GHG impact **need to** be monitored annually (mandatory).

2.3 Design of MRV system

The Royal Government of Cambodia (RGC), being a Party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Climate Agreement, needs to comply with the international reporting requirements in order to strengthen the global response to climate

change. As Article 13 of the Paris Agreement relies on a robust transparency and accounting system to provide clarity on action and support by the Parties, the Initiative for Climate Action Transparency (ICAT) is supported through UNEP DTU Partnership (UDP) to build capacity in order to establish a Measurement, Reporting and Verification (MRV) system in Cambodia through this project.

The Cambodian team, after consultation with stakeholders, selected Renewable Energy (RE) policy in Cambodia for the development of an MRV system. This will help tracking contribution of the RE to Cambodian NDCs and also to prepare Biennial Transparency Report (BTR). Grid connected solar power generation was selected as the priority within the RE sector to develop an MRV system. Further, reverse auction policy (a type of competitive bidding), which is one of the three types of policies for which ICAT RE methodology can be applied, was selected as the RE policy to be assessed.

Please refer to *MRV system for renewable energy policy in Cambodia* report for more detail.

2.4 Data Management

2.4.1 Data Quality

Quality assurance and quality control team which is proposed to be established under existing working group of the MME is responsible for assuring the quality of the collected data. This team will develop a QA/QC plan which defines the criteria and processes which will ensure and verify that data meet specific data-quality objectives throughout the Data Lifecycle. Such data quality objectives may be based upon and refined from the principles such as timeliness, completeness, consistency, comparability, accuracy, transparency and improvement. Please refer to section 4.3 of MRV framework for renewable energy policy of Cambodia for more details.

2.4.2 Data Management System

The proposed data management system was developed based on the existing institutional arrangement. This includes details on what, when and how data are to be collected and whom to be reported.

As illustrated in the Figure 5, EDC will provide the data regarding the design characteristics of the power sector policies and the electricity tariff data of solar technology, to assess the financial feasibility of the project. Solar power capacity installed under the reverse auction policy and net electricity supplied to the grid from each solar power plant will be reported annually to assess the ex-post GHG impact.

Annual report and energy balance of the country are published by the EAC annually. Electricity generation, electricity generation mix and own electricity use of the power plants can be extracted from those documents. Total emissions from electricity generation from different technologies, LCOE, consumer tariff of electricity and the annual capacity factor of solar technology will also be calculated and reported by the EAC. If projected electricity demand and T&D loss is not available, EAC will provide the current electricity demand and the T&D loss for the calculations. If data required to decide the fossil fuel technology that will be replaced by solar power is not available, grid emission factor of the country will be provided by the EAC for the ex-post calculation.

MME publishes a Power Development Plan of the country for a period of 5 to 10 years. This plan will provide the information on electricity demand, expected T&D loss and maximum quantity of installed capacity supported by the policy (policy cap). For estimating the financial feasibility of the power sector projects, MME needs to provide the data required to estimate the trends of the sector, effects of policies (excluding reverse auction policy) in the power sector, and how to account for other barriers. Information on investment in electricity generation technologies, subsidy schemes for certain technologies, abundance of the natural resources in the country, changes done for the electricity sector to accommodate higher share of VRE will also be provided by the ministry. Further, in the absence of a designed policy cap, MME will provide data on

national renewable energy potential and renewable resource availability to estimate the technical potential. If actual value is not available, planned capacity factor of the solar technology will be provided to calculate the specific field yield.

Independent Power Producers will provide the operation data such as annual average operation days to calculate the specific field yield. If calculated LCOE is not available for the solar technology in order to analyze the financial feasibility, data required to calculate the LCOE such as investment expenditures, O&M costs, electricity generation, economic lifetime of the system, power generation capacity of the system, capacity factor and discount rate will also be provided. If discount rate is not available, calculated weighted average cost of capital (WACC) or the data required to calculate the value such as cost of equity, percentage of financing that is equity, cost of debt, percentage of financing that is debt and corporate tax rate will be provided.

If country data for projected electricity demand is not available, current electricity demand and the T&D loss will be provided by EAC. Projected population need to be extracted from UN DESA data base and the population of the country can be collected from the NIS or the MoP.

Figure 5 below shows the proposed data management system for the MRV of RE policy.

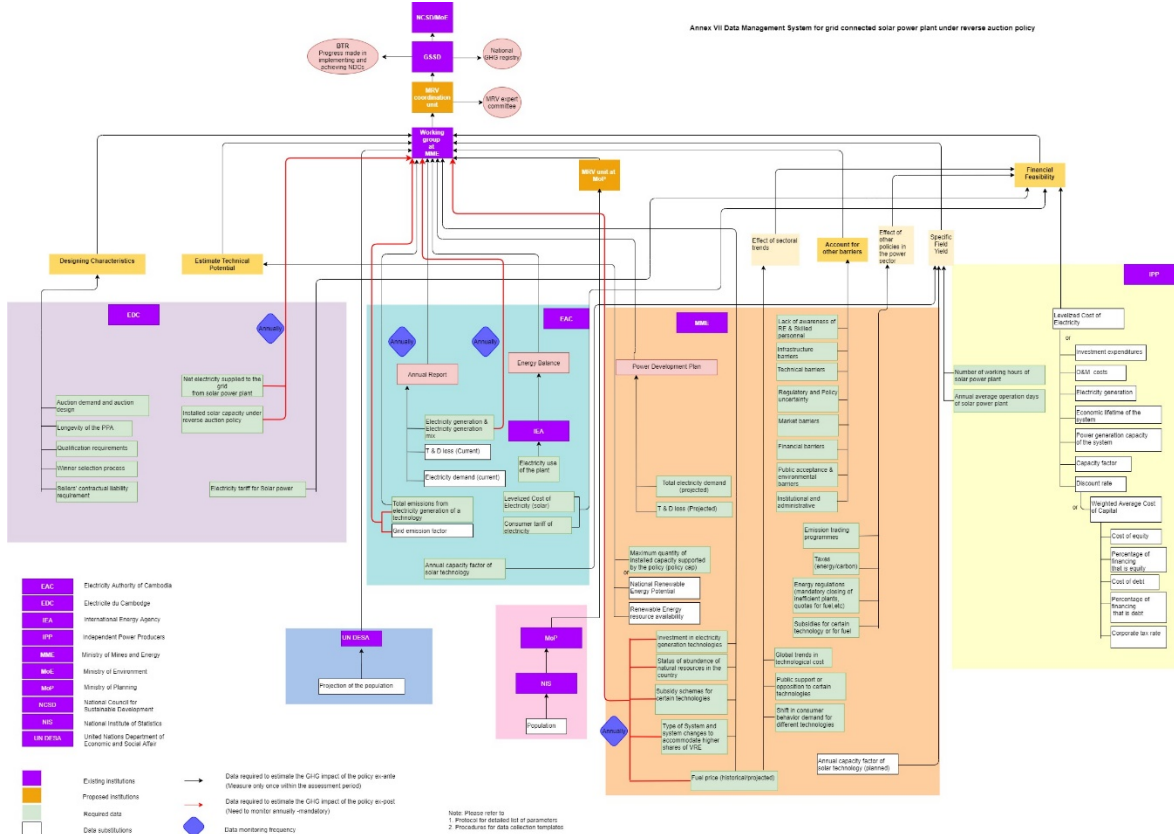


Figure 5 [Proposed data management system](#)

Source: Author

2.4.3 Legal arrangement on implementation of reverse auction policy for grid connected solar power generation

Along with the enabling factors which are essential for smooth implementation of the proposed MRV system, a well-defined legal architecture establishes the obligation to report for the institutions, which are required to submit data according to the MRV system. Establishment of a strong legal structure for data sharing also provides a basis for the institutional administrative compliance and enforcement arrangements for the system.

This section on legal assessment is limited to the implementation of the specific policy for which the MRV system has been developed. Possible data sharing methods between relevant institutions are explained in the chapter. It is emphasized and recommended to explore the national legal system on GHG related data sharing of the country, if Cambodia wishes to expand this MRV system for the entire energy sector, any other sector or for a national MRV system.

According to the data management system of the proposed MRV system, most of the essential data are publicly available. (Please see Table 4.1 of the report “Measurement reporting and verification system for renewable energy policy in Cambodia” for all the data needs and the availability). The complexities arise with the data that are not publicly available. Table 5 below shows the publicly unavailable data and the responsible organizations, which need to provide those to the existing working group at MME.

Table 5- Publicly unavailable data and the responsible entities

EAC	EDC	IPP
Annual capacity factor	Electricity tariff for solar power	Annual average operation days of solar plant
Electricity use of the plant (Own use of electricity)	Net electricity supplied to the grid from solar power plant	

Source: Author

According to Table 5, existing working group at the MME, needs to get internally documented data from EDC, EAC and IPPs. As EDC and EAC are public institutions, data can be accessed upon the official clearance. Cambodia follows a general process to exchange data between public institutions. The same process can be followed by the MME to get required data from EDC and EAC. As per the official process to exchange data between public institutions, first, MME needs to prepare and send letters of request to EDC and EAC signed by the Minister or the authorized senior management officer, clearly stating the type of data needed (please refer to Table 5 for the type of data needed). Then the institution that holds the data (EDC and EAC) shall prepare the requested data, issue their response through an official letter, and send to the requesting institution.

When dealing with data owned by private sector, a robust, accurate and reliable system is essential. In this particular MRV system, only private institutions, which should provide data, are the Independent Power Producers. At the moment, the country's normal practice is to request data of private institutions by a public institution through a request letter stating the needed information and the type of data. Then the private institutions that have the data shall prepare the requested data, together with a letter of response and send to the respective public institution.

However, it depends on the private entity's willingness to share the requested data if they are not legally bound by a valid agreement which requires them to provide the requested data or any data related to national security related aspects. Therefore, in order to collect the necessary data, the best option is to enter into an agreement between MME and IPPs. According to Table 5, only one type of data, which is not financially sensitive or confidential, is needed from IPPs. Since IPPs are not supposed to provide those data under any existing agreement with MME, it is recommended to enter into an agreement between MME and the IPPs to collect the data listed in Table 5 as it will ensure that the data will be used only for the RE MRV system.

2.5 Capacity building

Implementation of the proposed MRV system requires additional capacity building in a range of areas. Capacity-building includes the following activities.

- Analyze the capacity building requirement of the country and stakeholders
- Conduct a needs assessment for capacity building
- A strategy that will be developed relevant to the capacity building to ensure meeting immediate and long-term capacity-building objectives
- Training and awareness programs can be conducted relevant to data collection, management and computation
- Explore emerging practices, common challenges and questions on the implementation of MRV by observing similar exercises in other countries

2.6 Improve the system overtime

A well organized plan is essential for the successful implementation of the MRV system. Figure 6 illustrates the questions that need to be addressed for staged planning.



Figure 6: Points considered for planning

Source: Adapted from implementation plan for transport sector in Sri Lanka, 2019

The implementation task depends on budget, technical considerations on data collection and management, institutional arrangement and capacity building. It is important to focus on the most relevant MRV tasks, to effectively manage the available budget. However, it is adequate to obtain the optimization of system functions while synchronizing the implementation tasks to the available budget. Adopting an internationally available tool or a domestic tool in national circumstances can potentially increase the efficiency of data collection, management and storage, as well as review for quality, evaluation and dissemination to the desired levels in the MRV systems.

The tool can be: excel-based tool for integrated data management system; and web-based tool for integrated data management system.

Establishing strong institutional arrangements with well-defined roles and responsibilities is essential for an efficient MRV system. Capacity building of the stakeholders will improve their competency. Skilled stakeholders will ensure that proposed MRV system will meet the international standards.

3 Road map for implementation

The roadmap for implementation of the RE MRV system can be categorized under five stages: Setup policy MRV system; setup next steps; pilot; refining; and operational.

First stage of the given road map is already completed. At the second stage, country may strengthen proposed MRV system by incorporating the legal frame work to address the data gaps. Improve it by adding the SD co-benefits of the selected policy. Digitalization of the MRV system will improve the efficiency and accuracy of the MRV system.

Building capacity of the stakeholders to maintain the MRV system and collecting their feedback based on the hands-on experience will be the main objectives of the pilot stage. At the refining stage, components of the MRV system may be improved based on the feedback collected at the pilot stage.

At the operational stage, existing working group at MME will assess the GHG impact of the selected policies based on the data reported by the respective institutions. Results will be directed to the expert committee through the MRV coordination unit. Monitoring reports will be generated annually based on the results. Monitoring reports from each sector of the country will be consolidated by the MRV coordination unit and directed to the GSSD for approval. GSSD will report to the international agencies based on the requirements.

MRV system needs to be updated according to the changes of the national and international reporting requirements and the governance structure of the country. Training for the stakeholders need to be conducted annually to educate them on the changes to the MRV system.

Setup Stage (MRV)	Setup Stage (Next step)	Pilot Stage	Refining Stage	Operational Stage
<p>MRV framework</p> <p>MRV protocol</p> <p>MRV procedures</p> <p>Institutional arrangement</p> <p>Data management system</p> <p>Data collection templates</p>	<p>Legal framework</p> <p>Include SD co-benefits in the MRV system</p> <p>Develop digitalized GHG MRV system</p>	<p>Providing training to the stakeholders on the MRV system</p> <p>Collect feedback from stakeholders</p> <p>Improve the MRV system</p>	<p>Assess outcomes of the pilot stage</p> <p>Improve the system based on the outcomes</p> <p>Improve data collection templates</p> <p>Improve the procedures for documenting and reporting</p>	<p>Fully operational system</p> <p>Publish annual monitoring reports</p> <p>Verify reported impacts annually</p> <p>Upgrading the MRV system</p> <p>Continue the annual training</p>
2020	2021	2021/22	2022/23	2023 onward



Figure 7 Road map for implementation of renewable energy policy MRV, Source: Author

4 References

CDKN (2020) *Planning for NDC implementation: A Quick-Start Guide | Measuring, reporting and verification*. Available at: <https://www.cdkn.org/ndc-guide/book/planning-for-ndc-implementation-a-quick-start-guide/measuring-reporting-and-verification/> (Accessed: 18 May 2020).

Department of Climate Change (2014) *NCSD STRUCTURE*. Available at: <https://www.camclimate.org.kh/en/policies/ncsd-structure.html> (Accessed: 27 April 2020).

MME (2019) ‘Workshop on SDG7 Implementation in Asia and Pacific: National Expert SDG Tool for Energy Planning (NEXSTEP) and the Asian Pacific Energy Resources Modeling Platform.’, in *Workshop on SDG7 Implementation in Asia and the Pacific*. Bangkok. Available at: <https://www.unescap.org/events/workshop-sdg7-implementation-asia-and-pacific> (Accessed: 29 April 2020).

Annex 1: Additional tasks to be carried out before the implementation of the MRV system

In addition to the roadmap for implementation of MRV system, the following tasks need to be carried out before implementing the MRV system to achieve a successful implementation. Following tasks are not within the scope of the current assignment. Therefore, these tasks can be carried out at the early stage of the implementation.

1. Implementation support
 - Financial support (Budget and funding for the implementation)
 - Technological and material support (Hardware, software, facilities, and materials required for the implementation)
 - Documentation support (Additional documentation needed to support the deliverable system)
 - Personnel support (Proposed staffing requirements and training for the implementation staff)
2. Implementation impact and issues
 - Brief any known issues or problems relevant to implementation planning
 - Describe how the implementation is expected to impact the network infrastructure, support staff, user community, etc.
3. The success of the implementation - identify the most vital aspects of the implementation and describe how aspects will be used to help to determine if the implementation is successful.
4. Escalation Plan
 - Acceptance
 - Identify the exit or acceptance criteria
 - Whether the implementation team should discontinue a rollout.
 - Initiate the contingency plan or continue with the implementation, based on any risks identified during execution.
 - Contingency Plan

5. Post Implementation

- Progress of the implementation
- Barriers faced and how to resolves those
- O & M cost
- Organizational structure for O & M
- Documentation and data management