Initiative for Climate Action Transparency - ICAT

PROCEDURES

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 3:1 PROCEDURES FOR THE MRV SYSTEM OF RENEWABLE ENERGY (REVERSE AUCTION) POLICY IN CAMBODIA

DISCLAIMER

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

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)

Acknowledgement

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 the introduction of grid-connected solar PV systems, is one of the mitigation actions proposed by RGC in its NDC to UNFCCC. Having an Internationally recognized and transparent system for the Measurement, Reporting and Verification (MRV) to evaluate the Greenhouse Gas (GHG) effect 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 for 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 kind 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

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RE type: Solar

Policy type: Competitive bidding – Reverse Auction policy

Procedure: P1_PRS_EDC

Approved by:

OVERVIEW

Roles and responsibilities of the personnel involved in monitoring and reporting of data required for analysing the GHG effect of reverse auction policy are outlined in this procedure. The procedure shall serve as a manual to describe in the activities to be carried out to ensure comprehensive and accurate monitoring, reporting and verification (MRV) of the project activity.

Measure to be taken only once over the assessment period (2021-2030)

1. MRV focal point of the EDC shall fill the following data tables in monitoring logbook once over the assessment period

Table 1-1 Data monitoring template on auction demand and auction design

Year	Policy implementation	
Name of the policy		
Policy type	Stand-alone policy	Description
	Systematic auctioning policy	Description
	Other	Description
Auction type	Technology-neutral auction	Description
	Technology-specific auction	Description
	Other	Description
Filled by		
Approved by		
Date		

Table 1-2 Data monitoring template on qualification requirement

Longevity of the power purchase agreement			**Years**		
Qualification requirements					
1	**Required qualifications to apply for the auction**				
2	**Required financial qualifications**				
3	**Resource Availability**				
	Feasibility study has conducted	Yes		No	
	Land provided by the EDC	Yes		No	
	Transmission access provided by the EDC	Yes		No	
5	**Instruments to promote local socio-economic development**				
Filled by					
Approved by					
Date					

Table 1-3 Data monitoring template on winner selection process

Winner selection process		
1	Name of the project	
2		

	What is the bidding procedure for the auction	
3	What are the requirements of minimal competition	
4	What are the winner selection criteria	
5	What are the clearing mechanism and marginal bids	
6	Payment to the auction winner	
Filled by		
Approved by		
Date		

Table 1-4 Data monitoring template on contract signed by the seller

Sellers' contractual liability requirements	
Name of the project	
Commitments to the signed contract	
Contract schedule	
Remuneration profiles and financial risks	
Nature of the quantity liabilities	
Settlement rules and underperformance penalties	
Delay and underbuilding penalties	

Filled by	
Approved by	
Date	

Table 1-5 Data Monitoring Templates on Electricity tariff data

Electricity tariff for solar power (USD/kwh) (Average value for assessment period)	
Filled by	
Approved by	
Date	

2. MRV focal point of the EDC shall fill the following data tables in monitoring logbook annually.

Table 1-6 Data monitoring template on actual solar installed capacity under the policy

Year	
Installed solar capacity or solar capacity addition (MW)	
Filled by	
Approved by	
Date	

Table 1-7 Data monitoring template on net electricity supplied to the grid

Year		
Quantity of electricity exported to the grid		MWh
Quantity of electricity imported from the grid		MWh
Net electricity supplied to the electricity grid from solar power plant		MWh
Filled by		
Approved by		
Date		

3. Completed data collection templates shall be approved by the officer in charge of the respective department.
4. Based on the requirement, completed data collection template/logbook shall be submitted to the data collection team of the existing working group at the Ministry of Mines and Energy

2 PROCEDURE for DATA MONITORING at EAC – P2

RE type: Solar

Policy type: Competitive bidding – Reverse auction policy

Procedure: P2_PRS_EAC

Approved by:

OVERVIEW

Roles and responsibilities of the personnel involved in monitoring and reporting of data required for analysing the GHG effect of reverse auction policy are outlined in this procedure. The procedure shall serve as a manual to describe in details the activities to be carried out to ensure comprehensive and accurate monitoring, reporting and verification (MRV) of the project activity.

Measure only once over the assessment period (2021-2030)

1. MRV focal point of the EAC shall fill the following data tables in monitoring logbook once over the assessment period

Table 2-1Data monitoring template on actual electricity demand and T&D loss

Year[1]					
T&D loss (%)					
Electricity demand (GWh)					
Filled by					
Approved by					
Date					

[1] At least for five years prior to the base year of the assessment

Table 2-2 Data monitoring template on electricity generation

Electricity generation technology	Solar
Year	
Annual Capacity factor (%)	
Levelized Cost of Electricity (USD/kWh)	
Filled by	
Approved by	

Table 2-3 Data monitoring template for consumer tariff

Year					
Consumer tariff of electricity (USD/kwh)					
Filled by					
Approved by					

Note: If consumer tariffs are available for the assessment period, officers may use the values directly. If the values are not available, may use past values after studying the fluctuations. Officers may use last available value if the past years values are continuously increasing. If the past values are varies, officer may use an average value.

Annual Activities

2. MRV focal point of the EAC shall fill the following data tables in monitoring logbook annually.

Table 2-4 Dada monitoring template for emission factor

Grid emission factor		**tCO_2e/MWh**
Electricity generation technology	**Generation (GWh)**	**GHG emissions (tCO_2e)**
Coal		
Hydro power		
Fuel oil		
Solar		
Wind		
Biomass		
Total		
Filled by		
Approved by		
Date		

2. Completed data collection templates shall be approved by the officer in charge of the respective department.
3. Based on the requirement, completed data collection template/logbook shall be submitted to the data collection team of the existing working group at the Ministry of Mines and Energy

3 PROCEDURE for DATA MONITORING at MME – P3

RE type: Solar

Policy type: Competitive bidding – Reverse auction policy

Procedure: P3_PRS_MME

Approved by:

OVERVIEW

Roles and responsibilities of the personnel involved in monitoring and reporting of data required for analysing the GHG effect of reverse auction policy are outlined in this procedure. The procedure shall serve as a manual to describe in details the activities to be carried out to ensure comprehensive and accurate monitoring, reporting and verification (MRV) of the project activity.

Measure only once over the assessment period (2021-2030)

1. MRV focal point of the MME shall fill the following data tables in monitoring log book

Table 3-1 Data monitoring template for policy cap

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity demand _Projected[2] (GWh)										
Recorded by										
Approved by										
Date										

[2] For the assessment period (e.g.: 2021 -2030)

Table 3-2 Data monitoring template on electricity demand (Projected)

Year[2]	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Policy cap (MW)										
Recorded by										
Approved by										
Date										

Table 3-3 Data monitoring template for T&D values (Projected)

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
T&D loss - Projected[2] (%)										
Recorded by										
Approved by										
Date										

Table 3-4 Data monitoring template to analyze the technical barriers to promote RE technologies

Type of RE technology	Solar	
Barrier category	Technical barriers	
Note *Severity – 1 for lowest impact, 5 for highest impact*		

Barrier	Existence of the barrier	Description about the barrier	Severity of the barrier to policy according to expert judgment	Severity of the barrier to policy according to other stakeholders	Availability of policies that may help to overcome barriers

Technical standards (e.g., uniform engineering or technical criteria, methods, processes and practices) are lacking for some RE technologies					
Lack of sufficient technology providers					
Insufficient transmission and distribution infrastructure to connect new RE capacity to the grid, especially where RE resource potential is highest					
Other					
Filled by					
Approved by					
Date					

Table 3-5 Data monitoring template to analyze the regulatory and policy barriers to promote RE technologies

Type of RE technology	Solar				
Barrier category	Regulatory and policy uncertainty				
Note *Severity – 1 for lowest impact, 5 for highest impact*					
Barrier category	**Existence of the barrier**	**Description about the barrier**	**Severity of the barrier to policy according to expert judgment**	**Severity of the barrier to policy according to other stakeholders**	**Availability of policies that may help to overcome barrier**
Insufficient clarity of policies (existing / under development)					

Insufficient transparency of regulations (Existing /I under development)					
Other					
Filled by					
Approved by					
Date					

Table 3-6 Data monitoring template to analyze the Institutional and administrative barriers to promote RE technologies

Type of RE technology	Solar				
Barrier category	Institutional and administrative				
Note *Severity – 1 for lowest impact, 5 for highest impact*					
Barrier	**Existence of the barrier**	**Description about the barrier**	**Severity of the barrier to policy according to expert judgment**	**Severity of the barrier to policy according to other stakeholders**	**Availability of policies that may help to overcome barrier**
Lack of strong and dedicated institutions to carry out policies					
Permits for new RE plants are difficult to obtain					
Approval procedures are lengthy and cumbersome					
Lack of spatial planning for RE					

Unclear procedures and responsibilities and/or complex interactions and lack of coordination between various authorities involved					
Other barriers in the energy system, such as existing industry, infrastructure and energy market regulation/ intellectual property rights/ tariffs on international trade/ allocation of government financial support					
Filled by					
Approved by					
Date					

Table 3-7 Data monitoring template to analyze the Market barriers to promote RE technologies

Type of the RE technology	Solar				
Barrier category	Market barriers				
Note *Severity – 1 for lowest impact, 5 for highest impact*					
Barrier	**Existence of the barrier**	**Description about the barrier**	**Severity of the barrier to policy according to expert judgment**	**Severity of the barrier to policy according to other stakeholders**	**Availability of policies that may help to overcome barrier**
Inconsistent pricing structures that put renewables at a disadvantage					
Asymmetrical information between market actors					

Market power and subsidies for fossil fuels					
Blockage of incumbent actors and limited access of new actors to the market					
Import tariffs and technical barriers that impede trade in renewables					
Access to market					
Other					
Filled by					
Approved by					
Date					

Table 3-8 Data monitoring template to analyze the financial/ budgetary barriers to promote RE technologies

Type of RE technology	Solar				
Barrier category	Financial/ Budgetary				
Note *Severity – 1 for lowest impact, 5 for highest impact*					
Barrier category	**Existence of the barrier**	**Description about the barrier**	**Severity of the barrier to policy according to expert judgment**	**Severity of the barrier to policy according to other stakeholders**	**Availability of policies that may help to overcome barrier**
Absence of adequate funding opportunities and financing products for RE					
Financing is unreasonably costly for RE technologies					
Concerns about possible devaluation of assets					
Disproportionately high transaction costs in relative terms					
Available Total budget					
Other					

Filled by		
Approved by		
Date		

Table 3-9 Data monitoring template to analyze the Infrastructure barriers to promote RE technologies

Type of RE technology	Solar				
Barrier category	Infrastructure barriers				
Note *Severity – 1 for lowest impact, 5 for highest impact*					
Barrier category	**Existence of the barrier**	**Description about the barrier**	**Severity of the barrier to policy according to expert judgment**	**Severity of the barrier to policy according to other stakeholders**	**Availability of policies that may help to overcome barrier**
Lack of flexibility of the energy system (i.e., of the electricity grid to integrate or absorb RE)					
Energy markets are not prepared for RE (i.e., integration of intermittent energy sources, grid connection and access is not fairly provided)					
Higher grid connection costs for RE					
Other					
Filled by					
Approved by					
Date					

Table 3-10 Data monitoring template to analyze the impact of lack of awareness and skilled personnel to promote RE technologies

Type of RE technology	Solar				
Barrier category	Lack of awareness of RE and skilled personnel				
Note *Severity – 1 for lowest impact, 5 for highest impact*					
Barrier category	**Existence of the barrier**	**Description about the barrier**	**Severity of the barrier to policy according to expert judgment**	**Severity of the barrier to policy according to other stakeholders**	**Availability of policies that may help to overcome barrier**
Insufficient knowledge about availability, benefits and performance of renewables					
Insufficient numbers of skilled workers and lack of training and education					
Lack of general information and access to data relevant to RE deployment (i.e., deficient data about natural resources)					
Lack of experience and expertise among the relevant stakeholders, including project sponsors and power producers, investors and financiers, and regulators and authorities					
Other					
Filled by					
Approved by					
Date					

Table 3-11 Data monitoring template to analyze the impact of Public acceptance and environmental barriers to promote RE technologies

Type of RE technology	Solar				
Barrier category	Public acceptance and environmental barriers				
Note *Severity – 1 for lowest impact, 5 for highest impact*					
Barrier category	**Existence of the barriers**	**Description about the barrier**	**Severity of the barrier to policy according to expert judgment**	**Severity of the barrier to policy according to other stakeholders**	**Availability of policies that may help to overcome barrier**
Lack of research into the more complex interactions between RE technologies and the environment					
Competition with other interests in the geographic area, such as fishing, shipping and aviation, recreational use of land, archaeological and historical heritage interests, civil and military airport interests					
Other					
Filled by					
Approved by					
Date					

Table 3-12 Data monitoring template to analyze the global trends in cost of different technologies

Year		
Electricity generation technology		**Levelized Cost of Electricity (LCOE) (USD/kWh)**
Coal		
Petroleum fuel	Diesel	
	HFO	
	Furnace oil	
	Other	
Solar		
Hydro		
Wind		
Biomass		
LNG		
Filled by		
Approved by		
Date		

Table 3-13 Data monitoring template to analyze the public perspective on the proposed technology

Past years (At least 5 yrs.)					
Electricity generation technology	**Project name**	**Previous electricity source of the targeted customers (Grid, off grid solar, off grid hydro, etc.)**	**Number of applicants for the tender**	**Any reported protest against the project**	**Any reported court cases against the project**
Coal					
Petroleum fuel					
Solar					

Hydro					
Wind					
Biomass					
Filled by					
Approved by					
Date					

Table 3-14 Data monitoring template to analyze effect of policies (existing & proposed) on promoting RE technologies

Policies that have impact on assessment period			
Policy	**Availability**	**Applicability to the RE technology**	**Description**
Emission trading programmes			
Tax (Energy or carbon)			
Subsidies for electricity generation technology or for fuel			
Filled by			
Approved by			
Date			

Table 3-15 Data monitoring template to collect data on energy regulations

Name of the policy/law	Affected period	Objective of the policy/law	Description (effect of the policy/law, such as mandatory closing of inefficient plants, quotas for fuel,
Filled by			
Approved by			
Date			

Table 3-16 Data monitoring template to analyze the national energy generation potential

National energy generation potential (Trends for the assessment period)										
Energy generation potential (MW) of natural resource	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Coal										
Hydro										
Solar										
Wind										
Biomass										
Filled by										
Approved by										
Date										

2. MRV focal point of the MME shall fill the following data tables in monitoring log book annually

Table 3-17 Data monitoring template to collect historical and projected fuel price

Year									
Oil price (USD/ton)									
Coal price (USD/ton)									
Biomass price (USD/ton)									
Filled by									
Approved by									
Date									

Table 3-18 Data monitoring template to analyze the investment in electricity generation technologies

Year			
Electricity generation technology	**Project Name**	**Generation Capacity (MW)**	**Investment (USD)**
Coal			
	Total		
Petroleum fuel			
	Total		
Solar			
	Total		
Hydro			
	Total		

Wind			
	Total		
Biomass			
	Total		
Filled by			
Approved by			
Date			

Table 3-19 Data monitoring template to analyze the status of abundance of natural resources

Year		
Natural resource	**Energy generation potential (MW)**	**Description (Availability of the resource)**
Coal		
Hydro		
Solar		
Wind		
Biomass		
Filled by		
Approved by		
Date		

Table 3-20 Data monitoring template to analyze the current natural resource consumption of the country

Year		
Name of the power plant	**Type of the power plant (Fossil fuel/solar/hydro/etc.)**	**Description**

Filled by		
Approved by		
Date		

Table 3-21 Data monitoring template to analyze the system changes to accommodate higher share of variable renewable

Year		
System changes	**Availability**	**Description**
Demand-side management		
Energy efficiency and demand reduction policies		
T&D infrastructure (Including interconnection)		
VRE in grid codes		
Electricity markets (Capacity market mechanisms, and market-based measures for energy storage and demand-side management)		
Filled by		
Approved by		
Date		

3. Annual average capacity factor (Planned) of solar technology?
4. Completed data collection templates shall be approved by the officer in charge of the respective department.
5. Based on the requirement, completed data collection template/logbook shall be submitted to the data collection team of the existing working group at the Ministry of Mines and Energy

4 PROCEDURE for DATA MONITORING at POWER PLANT/IPPs (RE TECHNOLOGIES) – P4

RE type: Solar

Policy type: Competitive bidding – Reverse auction policy

Procedure: P4_PRS_PD_RE

Approved by:

OVERVIEW

Roles and responsibilities of the personnel involved in monitoring and reporting of data required for analysing the GHG effect of reverse auction policy are outlined in this procedure. The procedure shall serve as a manual to describe in details the activities to be carried out to ensure comprehensive and accurate monitoring, reporting and verification (MRV) of the project activity.

Measure only once over the assessment period (2021-2030)

1. MRV focal point/environment officer of the power plant/project shall fill the following data tables in the monitoring log book

Table 4-1 Data monitoring template on financial and technical characteristic of power plant

Year		
RE technology	Solar	
Project/Plant name		
Parameter	**Value**	**Unit**
Number of working hours of the power plant		Per day
Annual average operational days of the power plant		Days
Filled by		
Approved by		
Date		

If Levelized Cost of Electricity (LCOE) is not available, please fill the following table

Table 4-2 Data monitoring template on LCOE

Year		
RE technology		
Project /plant name		
Investment expenditure		USD
Annual O&M cost		USD
Electricity generation		MWh
Economic lifetime of the system		Years
Power generation capacity of the system		MW
Capacity factor		%
Discount rate/Weighted Average Cost of Capital (WACC)		%
Filled by		
Approved by		
Date		

If discount rate or weighted average cost of capital (WACC) is not available, please fill the following table

Table 4-3 Data monitoring template on WACC

Year	
RE technology	
Project /plant name	
Cost of equity	
Percentage of financing that is equity	
Cost of debt	
Percentage of financing that is debt	
Corporate tax rate	
Filled by	
Approved by	
Date	

2. Completed data collection templates shall be approved by the officer in charge of the power plant/project.
3. Based on the requirement, completed data collection template/logbook shall be submitted to the data collection team of the existing working group at the Ministry of Mines and Energy