Status of Monitoring Reporting Verification Scheme in Ghana

Prepared under The Initiative for Climate Action Transparency (ICAT) in Ghana

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1. Background to report

In 2017, Ghana joined the initiative for Climate Action Transparency ICAT project countries. ICAT provides tools for policymakers and stakeholders to collect more robust and consistent data on emissions, mitigation and adaptation efforts, capacity building and support. Ghana's ICAT project is led by the Environmental Protection Agency (EPA) and will focus on assessing the impacts of renewable energy actions to it NDCs. This report on the "status of MRV system in Ghana" is to provide basic understanding of the way the domestic MRV system operates, identify gaps and efforts being made to addressed them. The report has been prepared using existing reports and personal interview with stakeholders.

2. Climate change in Ghana

Climate change is still top government agenda. Ghana's unique geographic location in the tropics makes the country particularly vulnerable to climate change. Key economic sectors such as agriculture, energy, infrastructure, water, etc. are sensitive to climate risks. For instance, in the energy sector, Ghana can no longer depend on hydro dam alone to meet its rising electricity demand because of its unreliability and limited potential to expand. The obvious practical choice was to diversify electricity generation to include use of fossil fuel (crude or gas-fired thermal plants). In the next decade, the focus will be on injection of renewable electricity on the public grid. It is for these reasons that the two previous national medium-term development frameworks (GSGDA 1 and 2) recognized climate change issues as one of the key development challenges that required policy attention. In this regard, many Metropolitan, Municipal and District Assemblies (MMDAs), donors and civil society organization (CSOs) tailored their programmes to help tackle the prioritized climate change topics. Majority of the policies and programmes being implemented seek to stop deforestation; promote scaling up of renewable energy, facilitate penetration of sustainable land and water management technologies; capacity development and enhancing engagement and outreach.

The national climate change policy (NCCP) and its master plan are the leading climate policy document of the country. The NCCP seeks to translate the policy visions to concrete actions. The NCCP also focuses on providing strategic direction to guide implementation of climate change programmes at all levels of the economy. The President of the Republic launched the NCCP in 2015 after approval from the cabinet and currently being implemented under the supervision of the national climate change implementation committee hosted by the Ministry of Environment, Science, Technology and Innovation (MESTI). Since then, institutional participation in climate change has seen remarkable improvements. As at now, five Ministries, Departments and Agencies (MDAs) including Ministry of Finance, Forestry Commission, NADMO, EPA, Ministry of Agriculture and Energy Commission have either set-up a special climate change units or a desk to give special attention to specific climate change issues in those sectors/institutions.

For instance, at the Ministry of Finance (MoF), the Real Sector Division, acts as the National Designated Authority (NDA) for the Green Climate Fund (GCF), which is a special-purpose vehicle to mobilize international finance to support climate change programmes. So far, the work of the GCF NDA had been on the development of the GCF project pipeline. Seven project and readiness

projects are currently being prepared and are at the project development stage. The project are as follows:

- Building resilience landscapes (EPA and MoFA are the proponents with UNEP as the Multilateral Implementing Entity);
- Scaling up the solar rooftop programme and productive use of energy (Energy Commission is the proponent with UNEP as the Multilateral Implementing Entity)
- Shea Landscape REDD+ Project (Forestry Commission is the proponent with UNDP as the Multilateral Implementing Entity)
- Enhancing access to sustainable groundwater resources (University of Ghana, Earth Science Department)
- Drought Early Warning and Forecasting System; and "Improving resiliency of crops to drought through strengthened early warning within Ghana" (Water Resources Commission is the proponent with UNEP as the Multilateral Implementing Entity)
- Bus Rapid Transit Project for Accra (Ministry of Transport is the proponent with UNEP as the Multilateral Implementing Entity).
- Preparation of national adaptation plans (NAPs) (EPA is the proponent with UNEP as the Multilateral Implementing Entity)

In addition, the NDA facilitates the process of getting Ecobank Ghana Limited to become National Implementing Entity (NIE) of the Green Climate Fund. Ecobank has reached advance stage of the designation process. This year, the Ministry of Food and Agriculture (MOFA) launched its "Climate Smart Agriculture Action Plan to advance the effort of climate-producing agriculture production systems in Ghana. The Forestry Commission also launched the National REDD+ Strategy in 2016 to show direction on how the efforts stop or avoid deforestation and forest degradation. In that respect, the Commission is working with the World Bank to design and implement a first-ever result-based payment Cocoa REDD+ Programme with the view to sell the accrued carbon to the Bio-carbon Fund managed by the World Bank. In July 2017, the World Bank officially admitted Ghana into the programme after submission to the World Bank technical panel. The Ministry of the Lands and Natural Resource has received funding from the Climate Investment Funds (CIF) to pilot some of the interventions to address the drivers of deforestation and degradation in Brong Ahafo and Western Regions. This is being implemented through the Forest Investment Fund (FIP) with support from the World Bank. Additional funds from the CIF has been allocated to Solidaridad Ghana to support community engagement in the REDD+ process through the Dedicated Grant Mechanism (DGM).

The Ministry of Energy/Energy Commission is very much engaged in the climate change space. Apart from establishing dedicated unit and team to work on climate change issues in the Energy Sector, various policies and programme are being implemented in renewable energy, LPG promotion, development of natural gas infrastructure and energy efficiency to underpin Ghana's emission reduction commitments. Renewable energy is receiving bigger boost from government. Recently, government announced specific policy initiatives to give additional impetus to realizing the 10% renewable energy target. These are: renewable energy master plan; moratorium on new power purchase agreement except renewable energies; putting major government building on

solar PV, revising FIT scheme, renewable energy fund, design net metering scheme, decentralising mini-grid generation and grid code for distribution and introducing competitive bidding for renewable energy procurement. In addition, bioenergy strategy, LPG master plan are also in the offing. Furthermore, many of the universities and research institutions have introduced climate change courses or programmes and research themes to support capacity building and knowledge generation. Some of the institutions are; University of Ghana, University of Development Studies, Koforidua Technical University, Accra Technical University, Kumasi Technical University, KNUST (Energy Centre) and University of Energy and Natural Resources. Most of the technical universities have courses on renewable energy technologies.

3. Climate change governance

Ghana is visible in the international climate change arena. Ghana joined the United Nations Convention on Climate Change (UNFCCC) in September 1995 and since strived to ensure its implementation in the country. Recently, Ghana joined more than hundred (100) countries to adopt both the Sustainable Development Goal and the Paris Agreement in 2015. A year after, Ghana ratified the Paris Agreement and has already started preparing an investment strategy for its nationally determined contributions (NDCs), which is expected to be implemented by 2020. All of these steps demonstrate the seriousness Ghana attaches to tackling climate change. Nevertheless, a lot of work remains to be done to translate the nice policy initiatives into concrete actions on the ground.

The Ministry of Environment, Science, Technology and Innovation (MESTI) is the lead Sector for environment and climate change issues in the country. Apart from the Minister and his deputy, the Environment Directorate specifically takes charge of the implementation of the national climate change policy and the master plan approved by cabinet in 2015. In addition, MESTI host an inter-sectorial national climate change steering committee (NCCSC) that oversees the implementation of the climate change policy. The NCCSC is made of 18 or more representations of line ministries, CSOs, private sector and the academia. The EPA's Climate Change Unit is at the centre providing technical backstopping and coordinating technical work of the MDAs/MMDAs involved in climate change. In this regard, the Agency is the host of the UNFCCC Focal Point to the UNFCCC. The climate change unit at the EPA coordinates Ghana's participation in the international negotiation process, contributes to the multilateral technical work on climate change and above all facilitates capacity building on series of topics on climate change. The Unit is also responsible for the international climate change reporting particularly to the UNFCCC.

In the energy sector, the Ministry of Energy has a Renewable and Alternative Energy Directorate that coordinates policies on renewables. The Directorate focused on: (a) conventional RE, bioenergy and nuclear and clean coal. Within the directorate there is a focal person on climate change who is a member of the NCCSC and the team preparing the Ghana's implementation implementation plan. At Energy Commission's renewable energy division also play major role in technical regulation of the renewables market. The commission is host to the SE4ALL secretariat that oversees the implementation of Ghana's SE4ALL agenda. The flagship renewable energy initiatives are: annual renewable energy fair, rooftop solar programme, solar lantern replacement programme, solar mini-grids for inland communities and solar capacity expansion.

4. Domestic Monitoring Reporting and Verification System in Ghana

Better policies and investments choices driven by quality data are what it takes to turn NDCs to ground actions. Therefore, monitoring, reporting and verification (MRV) system must be an integral part of any successful climate policies. It is a systematic way of instilling the culture of transparency and being accountable when implementing climate change programmes. With MRV, it is possible to improve climate policy choices by evaluating potential effects of actions, tracking implementation progress, assess impacts of climate actions. These attributes of MRV can help build mutual trust governments and development partners as well as offer the basis for upping ambition of climate actions and gather evidence to inform policy revisions. MRV system can also facilitate domestic and international reporting using good quality data, rigorous methodology and protocols for accounting, and tracking.

The Bali Action Plan (BAP) introduced "enhanced climate reporting" which sets out global MRV architecture. It established a clear process for developing countries to prepare and submit national communication every 4 years and biennial update reports followed by consideration through two-tier international consultation and analysis (ICA). Apart from introducing new timelines for reporting, it also encouraged national government to establish domestic monitoring reporting system. The Paris Agreement (Article 13) introduced enhanced transparency framework (ETF) with a few new additional reporting requirements. In response to the call to establish a domestic monitoring reporting (MRV), Ghana launched a Climate Ambitious Reporting Programme (G-CARP) in 2013. The aim G-CARP was to facilitate the establishment of an integrated climate data management system that is capable of supporting preparation of national and international reports including GHGs, climate actions, supports and tracking NDCs goals.

The Ghanaian G-CARP has four components: (1) institutional arrangement and engagement, (ii) data management (iii) methods and tools (iv) skills development and work together as national system for the domestic MRV system. Although on paper, the G-CARP system is well designed to suit to the Ghanaian situation, implementation of the various components on the ground is at different levels. The MRV of GHG has seen major reforms over the years with the view to improve on its functionality. The institutional arrangement has been transformed from adhoc to a decentralized structure where line ministries are given primary responsibility to compile sector GHG inventories. For instance, within the energy sector, the Environmental Protection Agency as the coordination institution has signed a memorandum of understanding with the Energy Commission to lead in the compilation of the Energy sector emissions regularly.

They do so with the support from Ministry of Transport and the Volta River Authority – a state-own electricity producer. Similarly, in the area of data management, a GHG data collection template has been developed and in use and a climate change data hub (http://climatedatahubgh.com/gh/) has been established to improve data archiving and public access. The hub has five portal dedicated to host information on GHG, climate change projects, policies and measures, GCF Pipeline, and NDCs and streamed live since 2015. Although there have been some major gains in the GHG data management, more needs to be done especially looking at the new additions of the MRV tasks following the Paris Agreement. The improvement

efforts should seek to further strengthen (a) data generation and sharing platform; (b) documentation and archiving; (c) data retrieval and access and (d) data quality and (e) IT infrastructure. Any reforms introduced to improve the way the data management structure functions must aim at building on what already exist. Another important dimension is to look into the possibility of working towards integrating functionality of the existing data generation platforms. Although it is evident that achieving full integration of the data generation platform will take some time primarily because, they were set up or operate for different objectives at different level of automations. Any effort to promote data sharing integration must first recognise the functional differences in the existing data platforms and on that basis develop specific interventions to address them. The table 1 provides an overview of key data generation platforms:

Table 1: Status of data generation platform in Ghana

Institutions	Data platform	Data Type	Frequency	Format
Ministry of Food and Agriculture (SRID) [a]	Agriculture fact and figures	Food, livestock data	Annual	Pdf online
Energy Commission (Strategic Planning and Policy Division)	Energy statistics,	Energy production, Consumption pattern	Annual	Pdf online
	Energy outlook,			
	Energy information database		Regular updates	Online database
Forestry Commission	Forestry Inventory	Forestry production, harvesting, land use and change data, land disturbances data	Unknown	Offline
	REDD+ Registry	Forestry mitigation projects	Upcoming	Proposed to go online
Ghana Statistical Service	Ghana Living Standard Survey	Household data	5 years	Pdf online
	Population Census	Demographic data	10 years	Pdf online
National developing planning commission	National Annual Progress Report (APR)	Annual	Annual	Hard copy
	SDGs progress report	Comprehensive SGD data	Upcoming	Unknown
Environmental Protection Agency	Annual Climate change report	Climate change data	Proposed	Proposed online
	Biennial update report	GHG and mitigation data	Bi-annual	Online
	National Communication	GHG, mitigation, adaptation data	4 years	Online
	Akobenn[1] and EIA Reporting	Environmental performance data	Bi-quarterly	Online
Driver Vehicle and Licensing Authority	Vehicle registration and road-worthy database	Vehicle population	Annual	Offline, data copies
Ministry of Local Government and Rural Development	Sanitation database	Solid and liquid waste water	Unknown	Unknown

[a] SRID = Statistics Research and Information Directorate.

When it comes to skills improvements and development of tools and methods, real progress has been made. Through the UNFCCC expert review training programme, nine national experts have undergone certification process of becomes reviewers of annual GHG inventory of annex 1 Parties in the following sectors: (a) Energy-3, (b) Waste -2, (c) IPPU – 2, (d) LULUCF- 2, (e)

[1] Environmental Performance and Rating System for industry being implemented by EPA Ghana.

Agriculture – 1 out of which 3 have reached lead reviewer status. In addition to the UNFCCC training programme, Ghana has also benefited from capacity building programme from the Low emission capacity building project; (ii) Information matters project, (iii) Sustainable GHG Management Project in West Africa, (iv) Capacity Development for REDD Project and the (v) FIRM project. The scope of support received under these initiates have been well coordinated and targeted to ensure that they address capacity needs as it relates to enhancing monitoring, reporting and verification without duplication of efforts. Under the low emissions capacity building (LECB) project implemented by the UNDP, Ghana received financial and technical support, institutional strengthening in the energy sector, conducted survey to collect activity data on commercial generator use, developed QA/QC plan and organized series of training workshops on selected topics on MRV for GHG and actions. The LECB has already helped Ghana to further improve capacity of the energy sector GHG inventory. The LECB project is ending and there is a hope to continue with the phase 2 of this project with a focus on NDCs implementation.

Ghana also received support from the German Government through the GIZ-supported information matters project (IM project). The project specifically targeted at providing additional capacity through training on selected topics in the BUR preparation. The CD-REDD project, Japan-sponsored forest preservation programme and the sustainable GHG in West Africa project together focused on the following areas in the AFOLU sector inventory: (a) improvement in country-specific data collection campaigns, (b) hand-on learning by doing approaches and (c) tailor-made expert trainings. Table 2 presents a summary of status of donor projects and capacity building support received by Ghana for the period 2011-2016, to address capacity needs aimed at enhancing transparency through climate action monitoring, reporting and verification.

The structures of the MRV of support, MRV of actions and the tracking of NDC goals have not developed as the GHG of MRV. When it comes to MRV of support, the Ministry of Finance has the mandate to track all domestic and international climate inflows. In this regard, the real sector division of the Ministry of Finance which also acts as the NDA of GCF received support from the GCF readiness programme to prepare climate finance tracking tool and guidance on MRV of finance. In these two documents, the steps for tracking and reporting domestic and international climate finance were defined with clear roles and responsibilities. Although the two documents have come out with the strategies rolling out MRV of support, it is yet to be fully implemented. The implementation would require the involvement of all sectors ministries and local government institutions are that captured in the national climate change policy. At this stage, it is not clear what is holding the Ministry of finance real sector division and the budget division from getting the line ministries and local government to use the budget codes to track the government expenditure on climate and report them.

In the meantime, during the preparation of biennial update reports and national communications, we usually send questionnaires to government institutions, CSOs and universities to collect data on international climate inflows. The latest survey was done in 2015 and with the commencement of new reporting cycle, a new set of questionnaire will be sent out January, 2018 to collect additional data to update what was reported in 2015. In the end, the results from the survey is reported in the BURs and later on published on the climate change data

hub. With respect to the implementation of MRV of climate actions (policies, measures, projects, etc.) not much have been practically achieved on the ground. However, during the first biennial update report a standard template based on world resources institute policy protocol, was used to collect data on specific 12 mitigation interventions[2]. This one-off exercise was useful initiative to compile information on progress of implementation of mitigation action, investments made, impacts attributed to the project and background information. An automated data capturing form on climate action has been put online for public access[3]. A major gap we have identified is about the inability of the system to effectively aggregate the cumulative effects of individual mitigations as well as evaluating policy measures. This could be solved by using GACMO in the future. In all these there has not been any conscious effort to evaluate sector policies and measures. The tracking progress of implementation of NDC and goals require a lot of technical support to be able to get them running on the ground. It is important to figure out how MRV of NDC must be designed, defined roles and responsibilities, how it will be integrated into the existing domestic MRV and above all how the entire domestic MRV must be made to work.

With the level of progress in operationalising domestic MRV, we have been able to successfully produce three national communications, 1 biennial update report and completed the first international consultation and analysis (ICA) process. In 2017, we started and completed technical assessment of our REDD+ forest reference level. With support from GEF, Ghana was able to prepare and submit its Initial (INC), Second (SNC) and Third National Communication (TNC) under the UNFCCC. The latest reports – i.e. the TNC, the first biennial update report and the national inventory report were completed and submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in July 2015. Ghana successfully completed the international consultation and analysis (ICA) process after submission of its initial BUR1. The technical analysis of the BUR took place from 16-18 November 2015 in Bonn, Germany; while the facilitative exchange of views workshop was convened by the Subsidiary Body for Implementation (SBI) on 20 and 21 May 2016 in Bonn, Germany. The following capacity building needs were identified during the ICA process, and were included in the Third National Communication (TNC) report submitted to the UNFCCC.

- Use of the 2006 IPCC Guidelines and agriculture and land use (ALU) software for AFOLU GHG accounting, especially training on the use of the 2006 IPCC Guidelines and software, data processing and management strategies and training on the use of ALU and IPCC software;
- Improvement and strengthening of the GHG national system, particularly capacity-building on GHG data management and institutional arrangements;
- Improvement of the GHG inventory report;
- Development of a marginal abatement cost curve;

[2] Sample template used to report information on mitigation actions and their effects is attached as annex 1. The template contains specific information on selected mitigation, status of implementation, impacts and the emission reductions.

[3] This is url address of the online site where is hosted: http://mestiqna.igreengrowthsolutions.com

- Improvement in mitigation baseline setting;
- Continuous training of GHG experts, especially new experts on GHGs at the international level;
- Development of mitigation scenarios for the non-energy sector, especially marginal abatement curves;
- Improvement of forestry-wide mitigation and ensure linkages with the REDD-plus1 forest reference level, including setting a common baseline with the REDD- plus forest reference level;
- Capacity-building for technology transfer and diffusion, including: improving the capacities of farmers, engineers, technicians and artisans; creating awareness and knowledge exchange; and facilitating sharing of lessons learned from pilot technology adoption initiatives;
- Improvements in the institutional arrangements;
- Uncertainty assessment for activity data and emission factors;
- Improvements of completeness checks and methods for estimation of emissions from product use as a substitute to ozone-depleting substances;
- Assessment and monitoring of the effects of GHGs on the policy level mitigation actions.

Ghana is presently preparing its Fourth National Communication (FNC) and Second Biennial Update Report (BUR2) through GEF funding. Throughout these processes a good amount of interest, capacity and experience have been gained within the country that can serve as foundation to build on. It has also generated interest among line ministries on emissions related modelling approach in climate planning. Nonetheless a lot remains to be done to make the existing system work better and also respond to the new enhanced transparency framework. This means strengthening the national system to become formidable, durable and fully functional in the long run.

5. Emissions modelling initiatives

The growing clamor for evidence-based climate planning makes emission modeling a worthwhile and important information source. Usually in Ghana, the culture of feeding policy-making processes with hard-core evidence to enrich its substance, improving targets and making them responsive to real-life problems, have been touted up to the roof. This means a lot remains to be done to get to a desirable level. This has come about because of several factors such as lack of capacity, poor data systems, messaging and communication, systemic institutional inertia and political will. Planning is an important task of the public administration set-up which is backed by institutions and the legal mandate. At the national level, the National Development Planning Commission (NDPC) is the lead government institution that facilitates national development planning on regular basis. Once the NDPC is done with the formulation of the national medium term development plan, the line ministries and the local government follow with the sector plans. Both the NDPC, sectors and the local government are involved in monitoring effectiveness of polices and measures to inform future policy reformulation.

Table 2: Summary of information on project status, and capacity building and technology support received by Ghana for the period 2011-2016

Project	Donor	Description of Activity	Climate Relevance	Status	Amount ($)	Remarks
Low emission capacity building project	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), European Union (EU), Australian Government through UNDP	Develop up to 2 bankable NAMAs, strengthen national system for GHG, engage private sector and support INDC development.	Mitigation, GHG MRV and NDC	On-going till 2016. Possibility of phase 2	350,000	Preparation of phase 2 underway. Targeted budget $300,000
Information matters project	German Federal Ministry for Economic Cooperation and Development (BMZ), GIZ	Training on GHG data management, emission baseline and domestic MRV. Third Party Review of National GHG Inventory Review – Energy Section. Opportunity for experience sharing in the preparation of BUR.	Mitigation (GHG Inventory Energy Sector)	On-going till 2016	Unknown. Global TA programme	Phase 2. TA for BUR2 preparation with focus on waste sector.
Sustainable GHG Management Project in West Africa:	Australia, USA, Netherlands, UK, Belgium, New Zealand, UNFCCC, FAO, UNDP, UNDP	Third Party Review of National GHG Inventory Review – AFOLU Section. Training on Land use mapping using Google map engine tool. Hands on training workshop on development of land use map.	Mitigation (GHG Inventory AFOLU sector	On-going till end of 2017	Unknown. Global TA programme	Project implementation slowed down.
Capacity Development for REDD Project:	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). International Climate Initiative, Coalition for Rainforest Nations (CfRN).	Hands on training on Use of 2006 IPCC guidelines and ALU software for AFOLU GHG Accounting. Improvement of GHG Inventory Report- Third Party Review of National GHG Inventory Review – AFOLU Section.	Mitigation (GHG Inventory AFOLU sector	2012-2014. Possibility of Phase 2	Unknown. Global TA programme	Phase 2 not started yet.
FIRM project	Stockholm Environment Institute	Development of low carbon development strategy. Development of 2 NAMA projects. Training on Long-range energy alternatives planning system.	Mitigation	2013-2016	300,000	one year extension to 2017 with $70,000

Majority of the institutions undertake some level of modeling to get results to inform the planning and monitoring processes. With the coming on board of low emission development, particularly the NDCs, as an integral part of the existing planning, more than ever before, ex-ante and ex-post assessment are crucial. Some level of knowledge and capacity exist in country on the use of low emission development tools and modeling approaches. At the national level, during the initial stage of the formulation of the 40-year plan as well as green economy assessment, the NDPC and Institute for Statistical Social and Economic Research (ISSER) with support from the Millennium Institute had training and experience from the use of Threshold 21 integrated model.

In most sectors, couple of low emissions development (LED) modelling approaches have been adopt as either a one off exercise or continuous process. For example, in the energy sector, the Energy Commission in its regular preparation of the strategic national energy plan (SNEP) commonly uses the LEAP model. The Commission had been using the LEAP model frequently anytime there is revision in the SNEP. When the LEAP data is finalized, the Environmental Protection Agency (EPA) then introduces the requisite environmental loadings to the energy demand projections and scenarios in order to estimate the GHG emissions from it. Recently, under the CCAC initiative on SNAP for which Ghana is a beneficiary, a new customized version of LEAP has been used coupled with integrated benefit calculator with the capability of reflecting the emission implications for health, crop and long-term climate change. Apart from the baseline emissions and projections, mitigation scenarios are also visualized through multi-criteria analysis. The EPA recently, adopted the COPERT V transport modeling to estimate vehicular emissions. In the land-based sector, we once tried to use ALU but it was not entirely successful due to its complexities and data-intensive nature of the model. That said, it is important to note that these individual models and the results from them are extremely relevant for LED planning and decision making.

The question is how to cut through such a highly technically complex results and make it meaningful to decision-makers. Another important challenge is that, because there is no one single model window that can accommodate the dynamics of all the sectors, we are forced to use different set of tools in each sector. However, we can use GACMO to unify all the sector options. The challenge arising is the difficulty in putting individual model results together to construct a coherent narrative in addition to the fact that managing uncertainties under condition of using multiple model can be a serious constraint. In addition, getting access to good quality data can be a major challenge. The problem is that in most cases, datasets are missing, or are of poor quality and incomplete. This has led to using wide assumptions, adopting tier-1 approaches and retooling the model to fit the situation. All of these contribute to the lack of full confidence in the modeling results in the country. It is also important to point out that, capacity to use the tools and adopting them for regular use is a major challenge. A lot more hands-on training is required for experience and new user of the tools.

6. Gaps and Barriers with the existing MRV System

The G-CARP system focused a lot more on GHG than the other elements like MRV of support, actions and tracking NDC goals. Besides, it is also important to expand the coverage of the G-CARP to include transparency activities to (a) regularly plan and implement NDCs, (b) track progress of implementation and effectiveness of climate actions, & (c) track the progress of achievement of NDC goals. The G-CARP system is not operationally aligned with the national M&E system coordinated by the national development planning commission (NDPC). Another challenge is that the information generated from the GHG MRV is not adequately utilized in decision-making and policy formulation processes. Some of the reasons that have been cited for poor uptake of output from the MRV relate to lack of requisite capacity, inadequate incentives, poor data systems, poor messaging and communication, systemic institutional inertia and limited political will. For example, there was an instance where GHG inventory results unravelled policy incoherence, but due to poor coordination among relevant institutions, inconsistencies in the said policies could not be resolved. This was probably borne out of the limitations to redirect government policy to respond to the findings of the GHG inventory partly because general environmental issues are largely second rated which gives impetus to focus on short-lived development gains at the expense of environment.

Some of the challenges experiences in the G-CARP include:

- Difficulty and slow pace in establishing data sharing. For instance, the data compiled remains with the lead person for each sector and is not shared because there are no formal arrangements for this to take place.
- For confidential data and in cases where data providers incurred cost in generating data, the EPA is constrained in fully assessing these data – especially information from the private sector and industries.
- Lack of understanding of the detailed inventory process and reporting and accounting methodologies.

7. Areas for long-term improvements in the G-CARP

Apart from the gaps we have identified above, it is important to point out specific potential areas in the G-CARP that need improvements. Summary of the gaps are provided below:

7.1 Choice of accounting matrix

Accounting metric is pivotal to the enhanced transparency framework. It covers a host of standard protocols and guided steps on assessing the effects of climate policies and measures, tracking progress of NDC goal, monitoring climate finance inflows and communicating the overarching impacts depend on a number of factors. Thus, in the selection of accounting metric, tools and methodology we must look out for their capability, suitability, applicability, and flexibility to meet the vast diversity in Ghana's NDCs. The key challenge we are likely to face is how to make a realistic choice of accounting metric and monitoring approaches that can squarely fit our unique national situation and be able to bring all diverse 31 NDC actions (20 GHG reduction options) into a common accounting metric. Its scope and scale, implementation status,

complexities in coverage as well as multiple funding and reporting channels define the diversity of the NDC action.

7.2 Monitoring system

Monitoring impacts and progress of actions is key to reporting and must be incorporated into the mainstreaming process. If we are able to fully include the monitoring functions into the existing institutions and in particular, the APR process, development of indicators, tracking progress etc., would not be a challenge. Specifically, as part of the NDC monitoring system, Ghana should be able to do assessment of GHG effects of actions, adaptation building, sustainable development effects, progress made, support (need, received, result and impacts of support).

7.3 Reporting framework

Currently, there are many level of climate reporting within the country, to project funders and to the UN bodies so if Ghana's intention is to harmonise the existing multiple reporting then it would require great deal of collective effort by all stakeholders. First of all, we must have recognized that because reporting to multiple sources may require using different format, content and level of details attempting to use integrated reporting to single entity may not be realized in practice. However, what is vital is striving to ensure consistency in what is reported, the underlying assumptions and the data used. There have been cases where large differences have been observed in data of similar activity reported to different international institutions. Although the indications are that, the elements of the NDCs reporting regime would not significantly differ from existing MRV, few new additions in terms of content, frequency of report and review processing may see some changes. In effect, what is means is that any efforts to improve the way the reporting is done must reflect the changing dynamics of reporting. Some of the issues that need to be taken into account are; the type and depth of information to be reported, frequency of reporting, the content and methodology to adopt for the reporting and even more so is what becomes of the reports once they are submitted to the appropriate UNFCCC bodies. Thus, both the existing international reporting and review guidelines and methodology are critical.

Another important aspect of reporting that need serious attention in the country is the idea of making the reporting process and the report itself relevant to the domestic audience. Once the processes and report are visible to both the public and the key actors and users, it stands the chance of attracting additional value and relevance in country. The plan is to engage the various stakeholders during the consultation stage of the report preparation and after the reports are completed. Usually the reports are bulky and highly technical in nature. One of the ways to ensure that the technical content reach wider audience is to prepare brochure and policy briefs out of the main report for dissemination. There is also additional recommendation for EPA to lead a national process to start compilation of annual climate change report. The annual climate report will be a major mouthpiece for government to communicate with the key stakeholders and the public on climate vulnerabilities, opportunities and actions taken especially on the progress NDCs implementation, successes, challenges, and efforts to address them, support, and capacity received and needed.

8. Stakeholder feedback on MRV of NDCs

Early implementation of Ghana's NDCs is the surest way to meet the target it set for itself under the Paris Agreement. None of these would happen without a functional institutional arrangement. In order to strengthen institutions to contribute to the implementation of the NDCs, the EPA conducted an online survey targeting key actors in the climate change space. A semi-structured electronic survey questionnaire was administered through survey monkey online platform to Ministries, Departments and Agencies, academia, private sector and financial institutions, CSOs and representatives of international organizations. The online survey was conducted in the month of April 2017 and gave respondents ample time to fill out the questionnaire, which required an average on 50 minutes to complete.

Of the fifty-seven (57) individuals, that successfully received the questionnaires, forty-two (42) fully completed the questionnaires within the stipulated time. In all, there were thirty-one (31) set of questions in the questionnaire with five (5) being open-ended questions and twenty-six (26) closed ended or multiple-choice questions. The questionnaire was based on four broad group of questions. There were: (a) institutional involvement in NDCs process, (b) institutional arrangement for sustainable development and climate change; (c) Institutional gaps, barriers and efforts to address them and (d) NDCs institutional design and functionality. Both the desktop study and online survey were fact-finding activities to collect pieces of information from variety of sources. Some of the feedback on capacity needs and the involvement of key line ministries in the implementation of the NDC provided valuable insights to design capacity building programme like the ICAT. During the survey when the respondents were asked about how the line ministries would be engaged in implementing the sector NDCs, most of the institutions emphasized the importance of organizing regular awareness programme and appointing sector NDCs contact persons to facilitate any of such engagements (Figure 1).

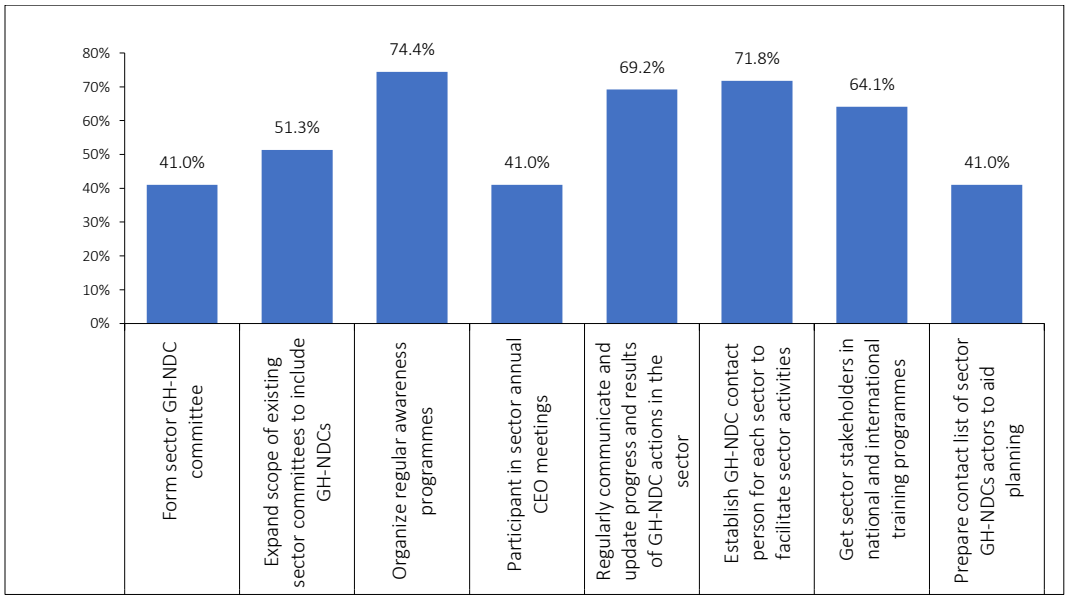

Figure 1: Strategies to facilitate greater sector stakeholder involvement

These are only suggestions and are not meant to substitute the laid down processes the sectors will follow in making their own internal appointment. At least the message from the institutions is that within each sector, there must be a dedicated team to handle the NDCs. Some of the activities they can consider doing is influencing decision-making, making the NDCs visible in the sector, mobilizing people within the ministry and the sector, forging new or strengthening existing partnership, facilitating capacity building, mainstreaming NDCs into the sector structures. Incorporating the NDCs actions into national development plan is an important step to get them implemented by all the relevant sectors. With respect to capacity needs the institutions indicated addressing the capacity needs of most of the actors would be a good way to ensure greater participation in NDCs implementation. They further offered suggestions on the requisite capacities for the NDCs as below (Figure 2)

- Develop tools for tracking progress of implementation and train stakeholders on how to use them.
- Organize tailor-made training on specific topics such as preparation on investment plans, assessment of effects of policy measures.
- Develop and use data collection protocol regularly.
- Establish a functional IT platform for data sharing and reporting.
- Prepare common reporting template and guidance on how to use them regularly.

These findings are useful inputs to inform the development of training manuals, data collection and reporting template and data management system. With such resounding support for the development of tools for the training on NDCs progress implementation tracking, it is important to treat as a top agenda on any NDCs implementation agenda. Developing common template for data collection, tracking progress and reporting for the adoption for sector has been identified as one of the important capacity needs. Since more sectors will be involved in NDCs planning, implementation and reporting, it will be important to have a common template to gather data and report progress.

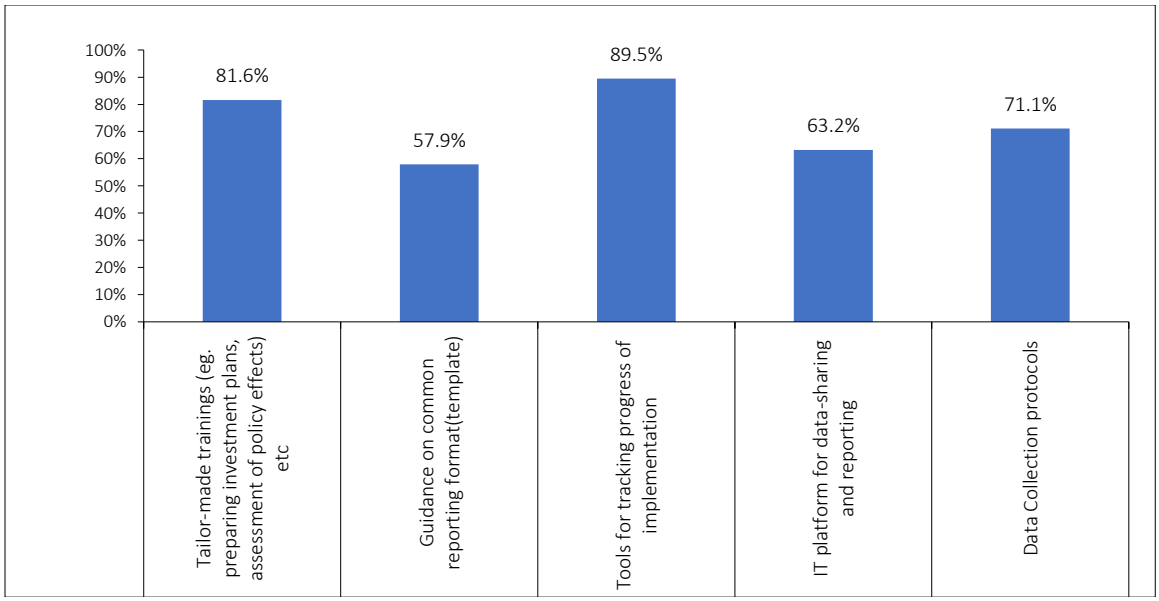

Figure 2: Preference of envisaged capacity needs

In this respect, when developing a new common template, it will be useful to take into account the diversity of the NDC actions. This means that when preparing the templates for tracking and reporting, the scope, level of implementation and the ability of the sector to adopt for use must be taken into account. Once the template is developed and adopted, before it is put to use, the stakeholders must be trained. In order to facilitate the training and use of the template, it may be useful to prepare an operational manual to guide consistent approach of data collection, tracking and reporting.

The institutions indicated the need to have specific training on investment planning, funds raising and assessment of effects of NDC actions. These training needs are crucial for both public and private actors to build their capacities to effectively implement their sector NDCs. Although the training programmes are important, the institutions also pointed out that such training must be practical, relevant and adopt hands-on approach. In addition to the tailor-made training on specific topics, the institutions also indicated the need to have a functional IT platform to facilitate data sharing and reporting. Although the EPA has, established climate change data hub to host comprehensive data on the NDCs what is left to be done is to ensure that the NDCs are connected to the central database. The individual databases are operated by relevant organizations (Ghana Statistical Service, Agriculture Fact and Figure, REDD+ Information System, Energy Information System, Vehicle population data at DVLA and GCNet[4]) must be evaluated to understand how its architecture, data models and operating protocol can be integrated into a single database. There is no doubt that such integration can happen overnight, it will rather take consistent effort among the partners. Probably a phase-out approach can be adopted with the view to start with a light version of integration on pilot basis.

[4] Ghana Community Network Services Limited (GCNet) is an Information and Communication Technology Public-Private Partnership with a mandate to provide e-Solutions to Government.

9. Establishment of Network of MRV champions in line Ministries

The notion of appointing MRV champions in the NDC sectors were crystallised from the finding of the institutional survey. These champions will mainly be the contact persons in the NDCs ministries, department and agencies. This mean is that, in sectors where there is no dedicated desk for climate change, it would make sense to assign a schedule officer to work on them. On the other hand, if there is a desk officer already working on climate change, he or she could be tasked to take up the NDCs as part of their duties. When appointing MRV champions it is important to consider the following points even though it is not exhaustive or prescriptive.

- Level of interest or commitment or relevance of the desk officer or team in climate change issues
- If it is team, the team lead must be of Director status to be able to bring people to work together to influence decision-making in the sector.
- If it is a desk or unit manned by an officer or a group of officers, he/she must have the necessary experience and of high rank to positively influence decision in the stakeholder
- The desk officer, unit or the team must be able to provide leadership on how to mobilize financial resources to support NDCs.

Since the ICAT project focuses on renewables, the selection network of champions will be limited to the energy sector. We have identified potential champions from Ministry of Energy; Energy Commission; Electricity Company of Ghana, DENG Ghana Limited (RE Business) Civil Society (Africa centre for energy policy and Research centre (Energy Centre of Kwame Nkrumah University of Science and Technology). Broadly the champions are outstanding personalities or individuals who passion or have proven experience in pushing for the adoption of renewables and Energy Efficiency (EE) in the sphere they operate. In general, the selected champion will be encouraged to continue what they are doing to making policy environment attractive for investment into RE & EE. Where possible the scope of area they operate in promoting RE will be expanded to include facilitating greater stakeholder engagement, experience sharing, data sharing and advocacy.

The representatives of the Ministry of Energy will be the “star champion” who will serve as the NDC contact person and also coordinate the activities of champions in the sector. At this stage, we have identified two personalities within Ministry of Energy to be the star champions – Mrs Gifty Tettey and Engineer Seth Manu from the Renewable and Alternative Energy Directorate respectively. They were selected based on the recommended lists of criteria the institutions put forward during the survey. Gifty is suitable because she represented the Ministry in the preparation of the NDC implementation plan and have a lot of policy and project experience when it comes to renewables. She has rich knowledge on the roles of renewables in the NDCs and can facilitate access to data from the sectors. She is well networked so when it comes to mobilising key stakeholders in the Renewable space her influence count greatly.

Seth would be a great champion when it comes to policy advocacy on renewable in the NDC. He led in the preparation of a flagship investment plan for “scaling up renewable energy programme” (SREP) which is already receiving funding from the climate investment. Investment

priorities in the SREP are neatly aligned with the Renewables in the NDCs. Therefore, his involvement in the champions network would add value to how it would function. At this stage, we anticipate that champion network will focus on facilitating access to renewable data support the assessment of renewable energy action in the NDCs, mobilising stakeholders and capacity building enhance their advocacy and fund raising skills to support RE implementation. In the long run throughout the ICAT project, high quality could be generated to support the effort of putting RE on the higher pedestal of the Ministry's RE agenda.

Energy Commissions is the main technical regulator of the Energy sector. They have set up a renewable energy division headed by Mr. Otu Danquah. The directorate's operations on renewables including issues licencing (so far they have issues more than 100 Solar PV licenses which translate in more 5,000 MW but only 12 of the project have hit the ground running); awareness and engagement on RE (Organises annual renewable energy fair to showcase developments in the RE businesses, mobilise stakeholder. So far three RE fairs have been organised). The Energy Commission is implementing government's flagship programme on solar rooftop programme, Ghana-China RE technology transfer and the SE4ALL agenda. Thus including them in the network of champion will be useful. That, the EPA and Ministry of Energy would have to finalizing the process of selecting the other member of the network.

When it comes to Energy Efficiency issues, the Energy Commission play a key role. They have a dedicated unit responsible for climate change and energy efficiency manned by Mr. Kofi Agyarko and Kennedy Amankwa. Two officer also work closely with Dr. Joseph Essandoh who head the strategic planning and policy division of the commission. Their involvement as data champion can be of great help in getting access to data on energy demand projections and energy efficiency initiatives. The commission has worked hard to put in place standards and labelling measures that seek to ban importation of old inefficient electronic appliance (mainly Fridges) and introduce markets regulation of appliances. In addition, they are actively implementing awareness on energy conservation for businesses, government agencies and residents. They also partner with a number of Energy Service Companies to provide energy efficiency solutions in buildings. There is a large constituency of actors in the non-energy sectors (forestry, transport, waste etc) in the NDCs and the data champions must be included in the network. The list of possible data champions has been provided in Table 3.

9.1 Establishing the network of champions

Now that potential champions have been identified, the next thing to do is to establish the network. First of all, an initial contact meeting with all the potential champion will be organised. The meeting will be convened by the ICAT team in EPA to discuss role and responsibilities and the reporting lines. Once the modalities of the network of champion are agreed upon, the EPA will write official letters to the network detailing out roles and responsibilities of each and every one. Once the EPA responses are all positive, then the network will map out their activities for every quarter. For now, the plan is to let the network members focus on liaising data sharing on renewables & EE; participate in capacity building activities especially those that relate to the assessment of renewable energy & EE actions and effects. The anticipation is that the ICAT project would as much as possible support the activities of the network of champions. The

GACMO model can here be used in the following way: Each MRV Data Champion will be responsible for the technology module in GACMO, that covers the GHG reduction option the champion is responsible for. The Data Champion will also be responsible for the size of the mitigation option in the future target years and responsible to insert the number of implemented units in the MRV sheet.

Table 3: Draft list of MRV Data Champions

List of MV Data Champions in Ghana				
Mitigation Actions	**Institutions**	**Action 1**[5]	**Action 2**	**Action 3**
Increase small-medium hydro installed capacity up to 150-300MW	Renewable and Alternative Energy Directorate, Ministry of Energy	Seth Mahu	Gifty Tettey	Wisdom Ahiataku-Togobo
Attain utility scale wind power capacity up to 50-150MW				
Attain utility scale solar electricity installed capacity up to 150-250MW				
Establish solar 55 mini-grids with an average capacity of 100kW which translates to 10MW				
Scale up the 200,000 solar home systems for lighting in urban and selected non-electrified rural households				
Increase solar lantern replacement in rural non-electrified households to 2 million				
Scale up adoption of LPG use from 5.5% to 50% peri-urban and rural households up to 2030.	Renewable and Alternative Energy Directorate, Ministry of Energy	Seth Mahu	Gifty Tettey	wisdom Ahiataku-Togobo
	Renewable Energy Directorate, Energy Commission	K. A Otu-Danquah	Paula Edze	
Scale up access and adoption of 2 million efficient cook stoves up to 2030	Renewable and Alternative Energy Directorate, Ministry of Energy	Seth Mahu	Gifty Tettey	wisdom Ahiataku-Togobo

[5] Actions would be based as part of the process of collecting data for the preparation of the sector annual progress report to the national development planning commission. In addition, the champion already supplies and share some related data with the EPA under the national communication process.

	Renewable Energy Directorate, Energy Commission	K. A Otu-Danquah	Paula Edze	
	Global Alliance for Clean Cook stoves (Alliance)	Kwesi Baffour Sarpong		
Scale up 120 MSCF natural gas replacement of light crude oil for electricity generation in thermal plants.	Strategic Planning and Policy Division, Energy Commission	Dr Joseph Essandoh	Salifu Addo	
	Volta River Authority	Ben Sackey		
Expansion of inter and intra city mass transportation modes (Rail and bus transit system) in 4 cities	Ministry of Transport	Daniel Essel	Akwasi Prempeh	
Continue 10,000ha annual reforestation	Plantation Department. Forest Services Division. Forestry Commission	Hugh Brown	Yaw Kwakye	Mohammed Yakubu
Double 10,000ha annual reforestation/afforestation of degraded lands translating to 20,000ha on annual basis.				
Support enhancement of forest carbon stocks through 5,000ha per annum enrichment planting and enforcement of timber felling standards.				
45% emission reduction through result-based emission reduction programme in cocoa landscape.				
Improve effectiveness of urban solid collection from 70% to 90% by 2030 and disposed all to an engineered landfills for phase-out methane recovery from 40% in 2025 to 65% by 2030	Built Environment, Environmental Protection Agency	Joy Hesse Ankomah		
Scale up 200 institutional biogas in senior high schools and prisons nation wide	Ministry of Environment, Science, Technology and Innovation	Peter Dery		
	Ministry of Energy	Gifty Tettey		

Double the current waste to compost installed capacity of 180,000tonne/annum by 2030.	Zoomlion Ghana Limited	Dr George Rockson		
Scaling up of installation of power factor correction devices in 1,000 commercial and industrial facilities (capacitor banks).	Energy Efficiency and Climate change, Energy Commission	kofi Agyarko	Kennedy Amankwa	
Abatement of fluorinated-gases (HFC-22 and HFC-410) from stationery air-conditioners	Ozone Unit, Environmental Protection Agency	Emmanuel Quansah	Joseph Baffoe	

This list is a working document that will be improved and changed over time.

9.2 Barriers and Gaps

The table below are possible gaps and barriers the network of champions is likely to encounter and suggested ways to address them.

Table 4: Barrier and gaps of the network of champions

Barrier /Gaps	**Measure to address**
Lack of capacity on the assessment of renewable mitigation & EE actions and their effects.	Tailor capacity building to needs of champions
No system in place to support regular data collection in progress of implementation of renewable energy & EE actions.	Design and test system for continuous data collection on implementation of renewables
Limited time to work on ICAT related activities because of overloaded work	Request network members to have alternate person who can support them in the activities of the ICAT
Interest in the network of champion may wane after the project is there is no sustainability plan in place	Ensure that the activities of the network is mainstreamed into the work culture of the institutions they represent.

10 Next step on ICAT Activities

- Initiate contact meeting with suggested network members
- Draft letter of nomination to network members
- Share copy of LEAP files on NDC baseline with Jorgen Fenhann as part of the revision of the baselines, in order to start the work on using the GACMO model, developed at UNEP DTU Partnership, as the unifying MRV tool.
- Discuss the modalities for the assessment of renewable energy & EE mitigation and effects.

Annex 1: Example of template used to report on mitigation actions and their effects in BUR1

Electricity Supply – Solar PV Electrification Programme		
General information	Name of action	Grid-connected solar installations
	Sector	Energy
	Scale	National grid and stand alone system
	Gas	CO_2
	Status	On-going
	Start Y	1999
	End Year	2018
Implementation information	Implementing entities	Ministry of Power – cluster of initiatives Off-grid/Mini grid installations and enabling activities Off-grid solar PV remote public institutions on lake side and island community – Government of Spain Off-grid solar electrification for remote public institutions (World Bank, GEDAP) Monitoring implementation of solar lantern and home systems by ARB Apex Bank (World Bank, GEDAP) Human Resource Development for disseminating solar PV (JICA) Establishment of Renewable Energy Feed-in Tariff system Designing and operationalization of renewable energy fund Installation of 9,536 solar systems in deprived off-grid communities in 2009 and other installations translate to *3,413.05 kWP.*
	Grid-connected solar installations	Ministry of Power – 50kWp (1998)
		Energy Commission - 4.25kWp (2008)
		Kwame Nkrumah University of Science and Technology - 24kWp (2008)
		Valley View University - 8.36 kWp (2010)
		Presby Women's Centre - 4.18 kWp (2010)
		Pure Company Ltd - 4.18 kWp (2010)
		Dr. George Puplampu Clinic – 4 kWp
		Trade Works Company Ltd (Office) - 33.85 kWp (2011)
		Wienco Gh Ltd - 42.77 kWp (2011)
		Noguchi Memorial Institute, Uni. Of Ghana – 715 kW (2013)
		Volta River Authority (VRA), Navrongo- 2,500 kWp (2013)
		Residences – 24.05kWp
		Elecnor foundation - 29.9kWp
		3S International Limited – 100kWP
		Total = 3,544kWp
	Solar Installation companies and Manufacturers	DENG; Ghana Ecotech Energy; Eco-solar & Construction Ltd; Jatropha Africa Ltd; The Blues Solar Company Limited; Power World Ltd.; Solar Light Company; SA.R.E. Ltd.; EcoZone Ltd.
Target	Establish 3.54MW national grid connected utility-scale solar systems in selected institutions and VRA installations. Installation of 9,536 solar systems in deprived off-grid communities from 2009 to 2014 and other individual standalone installations, which translates into 3.41MW.	
Programme objective	Assessment of effect of installation of solar Photovoltaic for electricity generation: 3.54 MW of solar power built by 2014 displacing option from crude-oil fired thermal base load on the national grid. The solar plants have 100% efficiency have electricity availability of 30% and a lifetime of 30 years. Determine whether or not the off-grid solar installation would have any direct GHG benefits considering uncertainties associated with the baseline. The overall installed capacity off-grid capacity of 3.41MW.	
Objectives of this assessment	(1) Understand what effect has occurred after the installation of solar system on the grid and off-grid; and (2) project future GHG savings from expansion of grid-connected solar systems.	
Defining project assessment boundary	Primary effect - reduction in GHG emissions by avoiding burning of additional light crude oil to generate thermal electricity for off-grid communities.	

	Significant secondary effect – reduction of indoor pollution from burning of kerosene or biomass for lighting and cooking respectively as a result of electricity generation from the off-grid solar PVs.
Identifying effects and mapping the causal chain	The Solar PV electrification programme seeks to put in place enabling financial, regulatory and technical framework to support penetration of solar PV share in the electricity generation mix. The solar PV electrification support installation of grid-connected and standalone home solar systems. Emission reduction from the grid-connected Solar system will be realized from the reduction in the burning crude oil to generate electricity on the national grid. With 3.54Mw generation capacity and availability of 30%, 9,303MWh/yr electricity would be produced with zero emissions. Additional 8,961MWh/yr off-grid solar PV electricity would be generated in homes, hospitals and non-electrified island communities. The off-grid solar PV electricity will dcrease burning of kerosene and biomass fuel.
Defining the GHG assessment boundary	The reduction in CO_2 emissions from avoided burning of crude oil to generate electricity on the national grid. This is expected to be significant and thus included in the GHG assessment boundary. The CO_2 emission savings from the grid connected solar PV arise from corresponding amount of crude oil that would be used to generate 9,303MWh/yr of electricity on the national grid. The emissions savings from the off-grid solar PV installations may arise, however the identification of the accurate baseline activities is difficult. Because of lack data and the uncertainties associated baseline, the emission reduction estimation from the off-grid Solar PV installation was excluded.
Baseline Emissions	*Baseline emissions* Fuel = Light crude oil Avoided electricity generated from light crude oil fired thermal plant = 9,303MWh/yr Average grid emission factor = 0.56tCO_2/MWh Baseline emission = avoided electricity generated from light crude oil fired thermal plant (9,303MWh/yr) x grid emission factor (0.56tCO_2/MWh) = 5,209.68tCO_2/yr
Emission savings from Mitigation options	*Mitigation options* With the assumption that, electricity generated from solar PVs have zero emissions. Thus emissions savings from the grid-connected solar electricity would be equivalent to the avoided emissions from the traditional grid-connected electricity. The total emission savings from this intervention amounted to *5.21ktCO_2/yr.* However, according to the projections in the strategic energy plan, by 2020 the total installed solar capacity would increase from 3.54MWh to 12.5MWh. This translated into the result in the table below:

Year	Solar PV installed capacity	30% availability	Electricity production (MWh/yr)	GEF (tCO2/MW)	Emission savings (kt/yr)	Cumulative Emission savings ($ktCO_2$)
2014	3.54	0.3	9,303.12	0.56	5.21	5.21
2015	5.033	0.3	13,227.51	0.7	9.26	14.47
2016	6.527	0.3	17,151.90	0.7	12.01	26.48
2017	8.020	0.3	21,076.30	0.7	14.75	41.23
2018	9.513	0.3	25,000.69	0.7	17.50	58.73
2019	11.007	0.3	28,925.08	0.7	20.25	78.98
2020	12.500	0.3	32,849.47	0.7	22.99	101.97

Monitoring Performance over time	Key performance indicators identified including: Number of Solar PV installation units. Annual questionnaires and pipeline applications at the Energy Commission for permitting Total grid-connected installed capacity of solar PVs Actual electricity availability dispatched to the national
Assessing uncertainty	Qualitative 100% efficiency of installed Solar PVs may not be realized. 30% electricity availability from installed Solar PVs may be lower or higher than expected Projected 12.5% increase in grid capacity of Solar by 2020 may not be realized. Average Grid Emission Factor may vary depending on which power plant are on stream.
Methodology	WRI GHG project protocol
Assumptions	Solar plants have 100% efficiency have electricity availability of 30% and a lifetime of 30 years. Electricity generation from solar has zero emission footprint. Emissions from baseline electricity would be avoided in the Solar PV scenario

Non-GHG Effects		Job creation opportunities for artisan and electricians for installation and regular service maintenance of the installed solar units. Contribute to realizing energy security objectives in the national energy policy.
Funding	Cost	Estimated Amount ($) – unknown
	Sources	Government of Ghana Mechanism
		Private sector – 100% private cost
		Donor - 0% Donor Channel - NA
Tech Transfer		Open Market