Initiative for Climate Action Transparency - ICAT

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Summary of Ghana ICAT's Project

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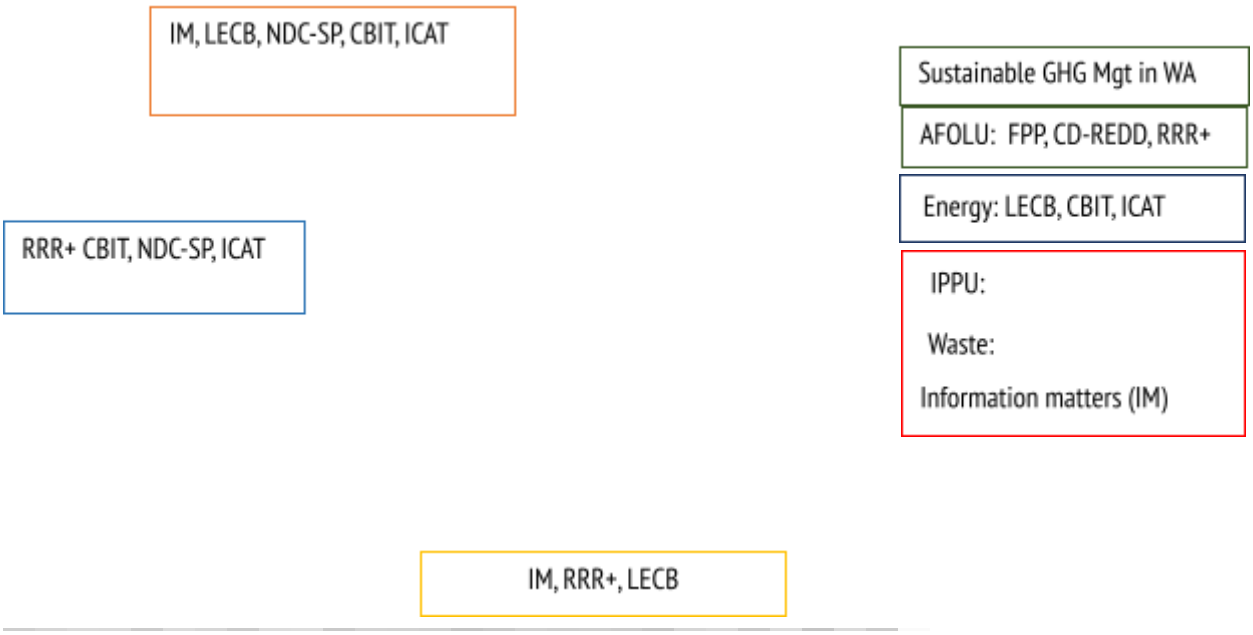
1. Introduction

1.1 Context of ICAT Support

Ghana is an active participant in the initiative for climate action transparency (ICAT), which is a global effort to developing countries to strengthen their domestic transparency arrangement and make them ready to implement the Paris Agreement. Ghana's ICAT project focuses on a niche area of the assessment of climate policies and measures. The ICAT technical support target at addressing one of the priority capacity needs Ghana identified in the summary report produced by the technical team of experts during the first technical assessment of the biennial update report submitted to the UNFCCC[1]. The ICAT support specifically responds to the capacity gap in the domestic MRV. To avoid duplication of the ICAT support and demonstrate its value-addition, the team has developed a capacity dashboard to give the big picture of the effort towards strengthening the domestic MRV system (Figure 1).



[1] https://unfccc.int/resource/docs/2016/tasr/gha.pdf

1.2 Climate change in Ghana

The issues of climate change and development are both topical in Ghana. Significant work has gone into laying out the climate policy framework for the country in the decade. Consequently, the Ministry of Environment, Science, Technology and Innovation (MESTI) produced the national climate change policy to give strategic direction to address pressing climate change issues. Not only Ghana has incorporated climate change into the current national medium-term development plan, but some sector and district plans align neatly with it. It is worthy of recognising the works by the ministries of energy, transport, agriculture, land and natural resources, water and sanitation and local government for taking concrete steps to highlight climate change as a priority area of action. The ministries have either incorporated climate change into their sector policy and plans and established structures to deliver the climate outcomes. Some are already implementing concrete programmes on the ground towards achieving sector goals. For example, the Ministry of Food and Agriculture prepared the national climate-smart agriculture action and has been able to secure funding for the implementation of sustainable land and water management for farmers in the vulnerable savannah drylands. Another example is the initiative the Ministry of Energy is championing to diversify from liquid fuel to natural gas for electricity generation in Ghana.

Similarly, the Ministry of Finance (MoF) and the National Development Planning Commission (NDPC) play facilitating roles. Both the MoF and the NDPC work closely with MESTI as the lead ministry of climate change. While the NDPC sets the broad policy framework to incorporate climate change, MESTI and EPA coordinate the policy and technical work on climate change and then MoF leads in mobilising of climate finance. MoF work on climate finance focuses mainly on the Green Climate Fund (GCF) and the tracking of national and international climate financial inflows. Another critical initiative on climate finance is the establishment of a
One hundred million SDGs Delivery Fund and a $200 million Green Fund, to complement the government's efforts at tackling climate change and funding the implementation of the SDGs.

All these moves point to the positive direction of progress in dealing with climate change, but it still not enough. There are a lot more the government promises to do in the nationally determined contribution (NDC) to Paris Agreement. Although Ghana has made great efforts when it comes to policy and several pockets of initiatives on climate change, the time has come for more concerted and coordinated action. That is why the NDC offers a fantastic opportunity to scale up the initial policy and groundworks to bring considerable transformation in the entire economy. That is why now, attention has shifted to implementing national climate action, not in silos but an integrated manner with the effort to localise the sustainable development goals. Such that as the various government MDAs[2] roll-out their specific NDC programmes, the benefits contribute to achieving both climate protection and development outcomes. Therefore, Ghana's strategy is to get the whole government and society involved in implementing the climate actions in the NDC.

Often, the scale of climate actions is not defined only the volume of policy work, but by a careful blend of political will, capable public institutions, motivated private sector and vibrant CSOs. An optimal combination of these factors can surely deliver ambitious climate action at all levels of society. However, adopting the whole government approach to support the NDC implementation requires accountability, trust and ability to

[2] Ministries, Agencies and Districts

increase ambition. One of the ways to build confidence in the government's policies to deliver the NDC on time and have a widespread impact is to have a robust and functional climate transparency system.

2. State of Ghana's climate change transparency system

The culture of climate reporting is gaining roots in Ghana. After, barely a decade of introducing the Ghana climate ambitious reporting programme (G-CARP) as a domestic transparency arrangement, the country has chalked some significant achievements. First and foremost, Ghana is among the few developing countries to have successfully published three national communications, two biennial update reports and the accompanying international consultation analysis (ICA). The feat has been possible due to progress made in the rolling out of the G-CARP arrangement that backs the timely data collection, process and analysis and reporting. The components of the G-CARP are institutions, data management, tools and method and capacity development work together to report on GHG inventories, mitigation action and their effects, support and as expected in future under the Enhanced Transparency Framework (ETF), NDC progress and adaptation. But the improvements in the G-CARP components has not been at the same level. Generally, the MRV of GHG, mitigation action and support elements have seen relative improvements due to EPA reforms. Among them, the GHG aspect is the most advanced compared to the other two components.

2.1 Institutional reforms in GHG MRV

Regarding the GHG MRV, the decentralisation of the inventory task from an ad-hoc to a more permanent team at the line ministries had contributed to the relative success. With these reforms, the line ministries took over the primary inventory task in their sector and work together with the EPA. This approach has been beneficial because it is the surest way to get buy-in from the line ministries as part of the mainstreaming strategy. The idea of transferring the GHG inventory task to the sector ministries was informed on the understanding that once the ministries are capable of compiling their GHG inventory in the long run, it will be an incentive for continuous reporting and influence policy. Even though some progress has made in terms of institutional governance, more work needs to be done to sustain the institutionalisation process by further looking into strategies of accelerating the process of fully implementing institutional arrangement.

2.2 Data management issues in the GHG MRV

Another critical aspect of the GHG MRV setup receiving serious attention regards data management. The topics broadly cover data generation and sharing, data quality and data archiving.

2.2.1 Data generation and sharing

Concerning data generation and sharing, Ghana still faces some challenges in the areas of cost and access. Ghana statistical service (GSS) has the overall mandate of managing public data. GSS execute their role by generating data via surveys, census, citizen and administrative data for public use. But the datasets, especially those from census and surveys, are not produced at regular frequency since they depend on the availability of funding. Usually, the technical ministries and agencies generate administrative data submit to the GSS. As a result, line ministries have established data platforms to publish administrative data used in the GHG inventory. Some government institutions[3] supply activity data for the inventory via online or on request. But the frequency of the data supply is not entirely in line with the GHG inventory timeline. So, there most times that data is either missing or not collected at all. There is also the issue of documentation

[3] Energy Commission, Ministry of Agriculture, Forestry Commission, and the Driver Vehicle Licensing Authority

of the methodology for data collection. Since most of the administrative platform predates the GHG inventory, the data collection set up does not directly respond to the needs of the inventory. In the end, the format of the dataset is not suitable for the inventory eventually discarded.

There are also instances where the metadata detailing out the administrative data are collected is not published. Therefore, it is difficult to understand the context of the data to inform the estimation of uncertainty levels. Some of the administrative data require regular surveys, but again due to the lack of funds, the organisation is responsible for the resort to projection estimates and expert judgement to come up figures for the inventory. All of these data challenges would eventually contribute to the high uncertainties in the GH inventory estimates. Research is another important source of activity data for the inventory. But a couple of problems still militate smooth access to research data. The cost of generating research has become a source of concern. Most researchers justifiably hold the view that until research data is used for the purpose it was initially collected for, it is difficult to share with the inventory compilers. Unless the inventory compilers are willing to share the cost of the research, getting research data ahead of the scientific publication would be challenging. The implication is that if it takes several months to publish scientific papers, the dataset from the research would not be available until a later date. The option is not good enough for the planning of the inventory. Another option the inventory compilers can consider is to support relevant research at the universities to generate the needed data. In this case, the compilers would support graduate and post-graduate study into related areas. But many stakeholders still hold the view that this approach is not the sustainable way of addressing the problem.

2.2.2 Data quality issues

The underlying data supply problems manifest in poor data quality for the inventory. Generally, the inventory relies on the administrative data supplied by government institutions. Only a few instances that multilateral data bodies like the International Energy Agency (IEA), Food and Agriculture Organisation (FAO) and World Bank (WB). Implying that the overall quality of Ghana inventory would largely depend on the rigour of data the government organisation supply. The weakness in the data supply has led to an inconsistent data format, missing data, outdated data and inaccurate data. Contradictory data format arises when the institution collects the data in analogue form. When this situation occurs, the inventory compilers spend additional time to digitise the paper version and could be a source of transpositional errors. However, by now, almost all the GHG inventory datasets are in digital formats.

Non-existing or missing data are among the top challenges in MRV set up. Across all the inventory sector, the common problem is lack of data. Either is there time series gaps, or the desired data has never been part of the existing data. In that case, international dataset or the IPCC methodology helps to fill the data gap. The problem is usually prevalent with data that date far back into the 1990s. Mostly, the missing or non-existing data is not part of the dataset a ministry collects or due to lack of resource the responsible institution was not able to obtain the data in question. There are a few cases of data loss where the institution is not able to retrieve the data at all. When it happens this way, the inventory compilers draw the attention of the relevant organisation to devise a practical way of retrieving the lost data. For example, the DVLA supplies vehicle registration data from 1995 to-date. But it is not possible to get the vehicle before 1995 because DVLA did car re-registration in 1995. So all the cars the existed between 1990 to 1994 had to be classified to suit the 1995 registration year. Therefore, the DVLA data would have a gap for the 1990-1994 period due to the new registration in 1995.

Besides, some of the datasets are outdated because it is no longer useful to the supplier of the data. So, the data supplier ceases to publish even it the data is helpful to the inventory. The data supplier sees collecting that cost to the organisation so would not allocate resources to collect them. In that case, if the inventory compiler still sees the need for that dataset, then it has the responsibility to convince the data supplier to continue publishing the data a shared cost. Some of the institutions may be willing to fund the data collection on condition that when the final inventory report is published, it would be duly recognised. One classic example of this scenario applies to data from industrial. Most of the time, the data industry supply to regulators are specific to meet legal requirements and do not wish to go the extra mile to collect additional data. So when the regulator no longer needs the facility typically stop publishing them. In that regard, the industry would only stick to the legally mandated data and not spend resources on auxiliary data that would be useful for the inventory.

Any extra effort to push the industry operator to supply the inventory-relevant data is likely second-rated. Inaccurate data is not a widespread challenge, but when it occurs, the inventory compilers take it seriously. It happens through primary data collection, poor instrument reading, transpositional errors and administrative mishaps. The inventory team has a practical method to detect outliers or irrational trends and correct them. In all cases, when the group find incorrect figures, it follows the simple procedures to fix, expunge or replace with a new dataset. The QA/QC plan contains the routines for detecting inaccurate data and correcting them. Each member of the GHG inventory team is privy to the recommended way to tackle wrong data and how to document them. Often, inaccurate data also occurs when there are no proper checks on the data before it is finally published. When the team detect issues that relate to the QA/QC system at the data supplier's end, the specific matter of concern is brought to the attention of the data owner.

2.2.3 Data documentation archiving

Documentation and archiving is a central data management issue. There are still challenges as to how the GHG inventory team follow the recommended data documentation and archiving protocol. The QA//QC plan outlines what to document, when, by whom and how in a consistent manner. Even though the inventory team has clear procedures for documentation and archiving in the QA/QC plan the adopting them has not gotten to the desired level yet. There is a need for more awareness of the consistent use of the agreed protocols among the team members as well as those who would join later on. Nevertheless, Ghana start work on the establishment of an online database[4] to host climate data. The data hub has a dedicated GHG inventory portal that contains inventory estimates, activity data, emission factors and reports.

2.3 Tools and methods for GHG inventory

Since the introduction of G-CARP, Ghana adopted 2006 IPCC guidelines for the GHG inventory in line with the relevant UNFCCC decisions. The transition from using the previous 1996 IPCC guidelines and 2003 good practice guidance to the current 2006 methodology was mostly smooth. The change over to the 2006 IPCC guidelines happened seamlessly as the national experts involved in the inventory received training on the methods and data requirements of the new guidelines. On the whole, new guidelines introduced realignment of the agriculture, forestry and land-use inventory areas into a single sector to ensure greater consistency. Besides, there were some few additions of new categories in the energy and the industrial processes sectors.

[4] http://climatedatahubgh.com/

So, the adoption of 2006 guidelines was not just a one-off decision but carefully planned steps to gradually introduce it to the users and at the same time prepare them on how to the tool. The first time, Ghana used the 2006 IPCC guidelines, together with the 1996 IPCC guidelines in the areas of the inventory data, was readily available. Then over the years, the team rolls out the new method to cover the inventory categories that do not apply.

Ghana plans to explore using the IPCC 2019 guidelines to be consistent with science before the submission of the first biennial transparency report in 2023. The adoption strategy would be similar to the previous approach of introducing the new methodology in phases and backed by rigorous training and reliable data. Ghana would need training support for the transition to the 2019 guidelines. Ghana started using the IPCC GHG inventory software in early 2000 when preparing the second national communication to the UNFCCC[5]. Later on, the UNFCCC also produced the GHG inventory software for non-Annex I Parties (NAIIS)[6], but Ghana did not use it. The earlier version of the IPCC inventory software is limited tier 1 until recently that the IPCC taskforce on GHG inventory (TFI) updated software to allow for tier accounting.

Nonetheless, the IPCC is not flexible enough to allow for a seamless time-series inventory, so Ghana currently uses an excel spreadsheet to back the IPCC software. In the immediate future, the team would be considering the feasibility of adopting a customised online IPCC software, completely shift to using an excel spreadsheet or continue to use the IPCC software. Whichever option is selected would depend on the factors like software transparency, utility, cost and rigour. In the end, the appropriate inventory software the team opt for must bring improvement in the inventory work.

2.4 GHG inventory capacity development

Continuous capacity development is one of the strategies to mainstream GHG inventories. Ghana is implementing a three-prong capacity development interwoven approaches. The approach is premised on the thinking that as GHG inventory task is fully decentralised to line ministries, their capacities and interest must widespread, sustained and incentivised over time. So, those national experts who are already part of the inventory undergo refresher training on advance GHG inventory topics to update their knowledge on current trends. Usually, the experts attend international and domestics training programmes on GHG inventories. After the training experts deploy the new skills to improve the inventory. Another approach of capacity transfer and development is via learning-by-doing. New entrants to the inventory team get the opportunity to work closely to experts and learn on the job. By this, the new experts get to know of the inventory stages, including QA/QC plan procedure and reporting. For example, when the Forestry Commission took over the sector inventory, new experts joined the team who learnt on the job after working experienced inventory experts who guided them on the inventory process.

As the inventory team expands, this approach would be a rational way to build the capacities of new entrants and prepare them to take over the inventory in future. Even though some considerable progress has been made in this regard, the strategy still needs to be streamlined to bring in greater efficiency. Ghana needs to come up with a comprehensive GHG inventory capacity development plan that would be responsive to the future international and domestic climate change reporting needs. The third leg of the approach is the strategy to nominate experts to join UNFCCC experts review training for Annex Parties annual GHG

[5] https://www.ipcc-nggip.iges.or.jp/software/index.html

[6] https://unfccc.int/greenhouse-gas-inventory-software-for-non-annex-i-parties-naiis

inventories. With this policy, Ghana bagged more than ten qualified expert reviewers for the Agriculture, Energy, Industrial Process, LULUCF and the Waste sectors. Currently, Ghana has four lead reviewers who co-manages the review process and teams they join. The international training of experts helps to increase the knowledge of the national experts on the inventories and also serves as a learning process for the national experts who get the chance to see how other countries approach the national inventories. It is also the surest way of building the confidence of the national experts as they get exposed to the international best practices in the inventory and also work with world-class experts.

2.5 Mitigation actions and support

The MRV of action and support component of the GCARP is not as developed as the GHG MRV. The reason is that reporting of information on climate action and support only started when the UNFCCC introduced biennial update report (BUR) into the international MRV architecture in 2012 at COP 17. It is by then that countries had to establish a domestic MRV to include the GHG, actions and support. The national efforts led to the establishment of the GCARP to respond to the changes in the international MRV system. The addition of MRV of mitigation action and support meant that the national arrangements must be able to generate a new stream of datasets regularly. Also, with the new dataset, the national team must have the requisite expertise and tools to be able to assess the effects of mitigation actions. Since 2015, Ghana has successfully prepared two BURs containing information national GHG inventory, mitigation actions and effects, support and domestic MRV. The compilation process has helped to strengthen the capacities of the national experts.

The broad strategy is to expand the GCARP system to cover mitigation actions and support element without establishing new structures. It is more efficient to use the existing structure to report on the new features in the BUR because it is cost-effective and the most practical way to get the entire government involved in the reporting. Building on the existing governmental structures allows the EPA as the coordinating institution to orient GCARP to address the additional BUR reporting elements. Incorporating the new items require supplemental training, data and methodology.

Data on mitigation actions are collected from multiple sources at the project level before they are aggregated into the sector and nationally. Bits and pieces of this mitigation data exist within the sector and require considerable effort to assemble. Another important aspect is the reporting of data on the sustainable development impacts of climate mitigation actions. Many reasons explain the difficulties of reporting on the sustainable development benefits of climate actions. The key ideas relate to the inability to collect sufficient data at different levels and the absence of a reliable methodology to assess the impacts.

Nonetheless, emerging literature can be useful in this regard. For instance, the ICAT project recently published a guidance document on qualitative and quantitative approaches to assessing the sustainable development benefits of climate action. This work is an important piece that Ghana intends to adopt to guide the subsequent reporting of socioeconomic impacts of mitigation actions in the BUR. Saudi Araba has also reported comprehensively on the socioeconomic effects of mitigation policies in its BUR1. Ghana should consider some of these approaches in future BURs. Below are some of the measures Ghana introduced into the G-CARP respond to reporting of mitigation actions and their effects.

2.5.1 Development of data collection form

The two years of reporting mitigation actions and their effects as part of the BUR was new to the MRV team. The team used to communicate on the assessment of emission reductions potentials and co-benefits of mitigation policies and measures in the national communication. Even though reporting on mitigation actions and effects was new, there were some complementarities with the mitigation assessment bit of the national communication. In both cases, there are three distinct steps of data collection and processing, assessments of either mitigation potential or the effects of actions and reporting of results. So, the preparation of the BUR1, the team developed a form to guide the respective ministries to collect the foundation data on mitigation actions. The collected data enabled the team to fill the standard reporting table for mitigation actions. With data, the team started to build a database of mitigation actions in the upon which future BURs can use. All the data forms are achieved in an online database for easy reference. The forms capture three groups of data. The first set covers the background information involving the scope, scale and status of the mitigation action in question. Furthermore, the form further collects data on the progress of the implementation and achievements of each mitigation action selected for reporting. After using the forms for two BURs, there still areas that need improvements. The team observed that some of the line ministries are not able to use the form to collect data continuously. Further probing into the issue revealed some of the reasons that prevent the line ministries to neither not completing the forms at all nor used it only for once. The factors are as follows: having too many questions in the questionnaire; not easy to get time-series data to satisfy to complete it; non-existing data and lack of general understanding in the use of the forms. The identified reasons must inform any effort to improve the utility of the forms.

2.5.2 Establishment of a database of mitigation actions

In each BUR preparation cycle, the information on mitigation actions and their effects need updates. The updates cover the revision of previously reported data and new information on the implementation progress of mitigation actions. Therefore, the latest BUR contains information on updates of previous measures and the new ones. The database comprises information on all the mitigation actions supplied by the data owners at the time of preparing each BUR. Typically, the pieces of data on the mitigation action are either published as part of a more extensive project report or through regular surveys. There are a few cases where the data supplier also uses expert judgement to fill gap areas in the dataset. It is an online database that hosts information on all mitigation actions[7] and makes the summary data publicly available to all users. The more detailed version of the dataset is not available on the online database because of issues of confidentiality. However, the reporting format for the BURs provides the option for publishing the data in an expanded tabular form.

Undoubtedly, the mitigation actions database has great utility in very many respects. Apart from making it possible to have records of mitigation actions the public can appreciate the climate efforts of the government, it is also a useful tool for having credible and transparent data for climate reporting. For instance, with the database, it would be possible any third-party reviewer to have a more in-depth look into dataset behind the mitigation action and their effect section of the BUR. It also allows the team to retrieve data for the updates in the future when it becomes necessary to do so. Even when a new team takes over the assessment, the database would make it easy for them to build on whatever data is available. Thus, the database has great value for the report, but there are still a couple of challenges Ghana still dealing with the view to bring more improvement. One major area of concern is the irregular manner of data collection and

[7] https://climatedatahubgh.com/ders/

supply. Most of the data owners do not have a systematic programme for the data collection data on mitigation action so, they tend to rely on ad-hoc strategies. For the majority of the mitigation action that is project-based depend on data, supply is consistent during the project implementation but when the project completes, and the implementing institution did not mainstream the data supply stream into the existing system, then data access becomes a huge challenge. The bottom line is that there is no meaningful effort to generate continuously in the intervening years of the BUR preparation cycle.

Another critical area of concern is the ability of the EPA to update mitigation database regularly due to lack of data from the mitigation institutions. Often, the reasons the data owner cite is the lack of adequate funds for continuous data collection. Any future effort to strengthen the functionality of the database must take into account the identified priority gaps.

2.5.3 Adoption of a mitigation assessment tool

Ever since Ghana started communicating the BUR IN 2015, it had relied on two main mitigation assessment tools. Initially, In the early stages of reporting, Ghana adopted the LEAP model for the analysis of mitigation potential of climate policies. Recently, Ghana has started using the GACMO and WRI policy measure protocol for the assessment of action and its effects. With the GACMO model, the Ghana team can calculate the GHG impact and co-benefits of mitigation actions. The input data for the GACMO model are the GHG inventory results, macro-economic indicators and mitigation policy action obtained from the database. So, far Ghana has used the GACMO in three national assignment. The first major task Ghana used the GACMO tool was in the areas of improving the analytical rigour the NDC baseline. Enhancing the technical basis of the NDC baseline involved streamline the processes for the development of the baseline to make it clearer and more transparent for the stakeholders. Additionally, Ghana has used the GACMO tool in the assessment of mitigation actions and their effects in the BUR2 and the on-going preparation of the fourth national communication. Nevertheless, there is more room for improvement when it was coming to using the GACMO tool. Ghana had adopted the tool and already started to use in other areas extensively. For instance, Ghana developed an NDC accounting tool out of the MRV component of the GACMO tool.

2.5.4 Continuous training

If all the desired MRV components are established, and the requisite capacity is non-existence, the MRV system cannot function efficiently. Thus, continuous training is the cornerstone of Ghana's MRV strategy. As far as Ghana is concerned, capacities are at two interwoven levels. The institutional capacity is the top level and focuses on strengthening the capability of organisations to manage the MRV process and deliver critical outputs on time. Another aspect of capacity relates to individual skill development. That is why Ghana adopted the strategy for continuous training on transparency. It involves making sure that all the national experts constantly receive the essential training on relevant transparency topics. More importantly, the continuous capacity is supposed to help develop the critical skills set for participating in the enhanced transparency framework by 2024.

2.6 Key challenges in the existing MRV system

It is also worthy of recognising the considerable improvements in the national arrangements in the last ten years. That is why Ghana been able to provide four standalone national greenhouse inventory reports (NIRs) that provide comprehensive and reliable information on emission estimates and methodology. Having acknowledged the achievements in making the national system performs better, it is also useful to take note

of the critical issues that still need to be resolved across all the sectors. The key issues have been listed below:

- Slow policy uptake of inventory results
- Inadequate funding
- Slow mainstreaming processes
- Non-existing or missing activity data
- The predominant use of default emission factors
- Use of tier 1 methodology for key categories
- Incomplete uncertainty assessment
- Missing sub-categories

Slow policy uptake of inventory results – Ghana was among the first few developing countries to publish standalone national inventory reports though it is not a requirement by the UNFCCC. The NIR details out the comprehensive information on the end-to-end steps for compiling the GHG inventory estimates at the national and sector levels. At the international level, Ghana is seen among the forerunners that produce proper inventories, but it is not clear the extent the information is used in climate policy, investments and research. Mostly, the inventory process is known among the climate change community in Ghana, but it is not widely popular among the populace especially decision-makers.

Therefore, one critical area that deserves attention is making the inventory process and results more visible within the government and among the major stakeholders. One way to address this issue to begin to prepare a summary of the typically 300-page NIR into a three-pager for policymakers. The three-pager must aim at summing the key findings and policy messages from the inventory that require further action. The general public should also be engaged to create awareness on the inventory results. With this, the Ghana team can consider preparing education materials (policy briefs, brochures) and share the content on social media. The new focus would be to facilitate the adoption of the key findings from the inventory. Some of the factors that can aid in the adoption of the inventory results must include the following:

- Ensure high confidence in the inventory results by adopting a robust methodology in conformity with the TCCCA (Transparency, Completeness, Consistency, Comparable and Accuracy) principle.
- As much as possible, use country-specific or plant-level activity data and emission factors to increase the credibility of the inventory results.
- Identify critical persons or groups of persons in the various line ministries who can help to facilitate the adoption of the key findings from the inventory. It must be noted that the strategy for each ministry must differ looking at their unique circumstances. So, the approach must not be one-size-fit-all but must be tailor-made to suit the particular needs of the line ministries.

Inadequate funding for the inventory – the national GHG inventory is 100% donor-funded. Presently, the headline funding for the national GHG inventory is from the Global Environment Facility (GEF) with a few ones from bilateral donors. The current funding levels are not adequate to cover the full cost of preparing the inventory regularly. And considering the fact under the ETF, the frequency of reporting and the level of security of the national reports would get intense; it is important to mobilise additional funding from national and international levels. The conditions surrounding the GEF funding do not allow using the funds to support primary data collection even it one of the principal area investments is needed. This implies that

additional funding from sources other than the GEF must be explored. The Ghana team must start to look beyond the GEF funding for the inventory in the future. It is essential to explore emerging funding sources, private sector, and the national budget. Therefore, when selecting the strategies to mobilise funding, due regard should be given the unique features of the identified funding sources. The priority should be given to accessing additional funding from the national budget since the government is a lead partner. It would require getting the various line ministries to incorporate the GHG inventory into the sector plan and annual plans so that they can budget for them. This is a critical source of funding for sustainable GHG inventory.

But convincing the line ministries to incorporate the GHG inventory into the strategic programming would not be easy to do. First, the line ministries must appreciate the importance of the inventory results and the value addition that can be obtained from incorporating the inventory into the sector programme. It must also be noted that even if the line ministries agree to adequately budget for the work of the GHG inventory in their sector, the rollover of the cost must be gradual over a given period. This approach would lessen the cost burden on the line ministries and avoid any potential push back. The involvement of the private sector in raising long-term funding to support future GHG inventory is crucial, especially as Ghana has initiated processes to rope in the facility operators in the national system. In this regard, the Ghana team should come up with a clear fund-raising strategy from the three sources. Generally, a substantial proportion of the investments into the national system for the GHG inventory at the initial stage (Figure 2). Once a formidable system has been established the investment in the subsequent years would not be as much as the formation years. The primary cost points for the inventory include data generation and management, automation, acquisition of analysis tools, training and awareness.

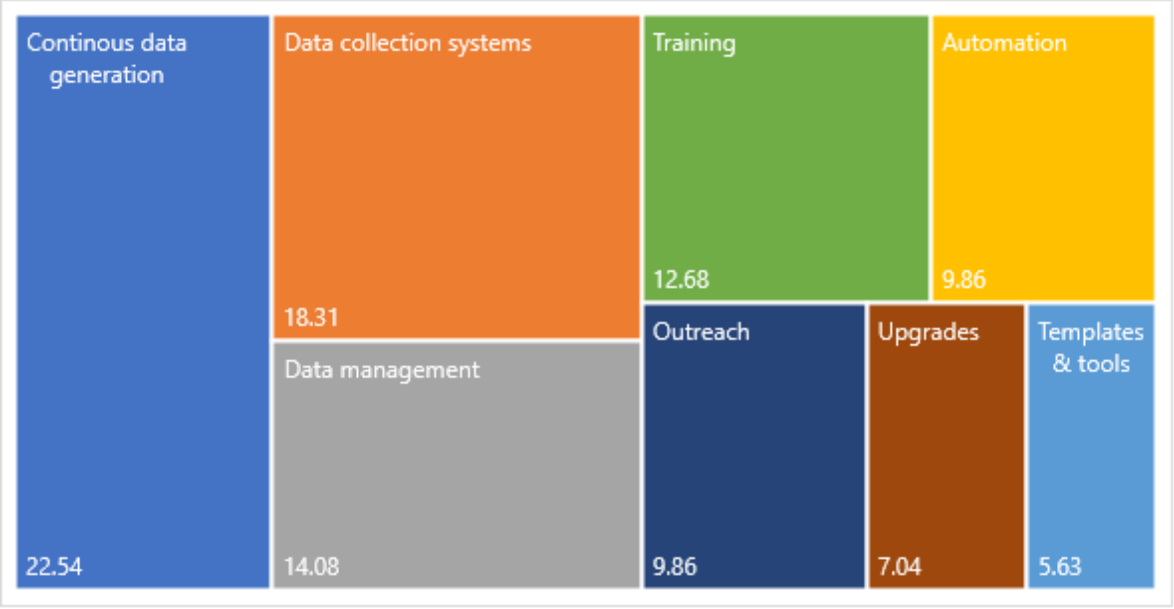


Figure 2: Cost points of the GHG inventory preparation expressed in percentage. The length and breadth of each box indicate the relative importance of the areas that need consistent funding to support the long-term sustainability of the national system

Slow mainstreaming of the inventory into the national structures - Mainstreaming the GHG inventory into the routine of the line ministries is one of the vital strand efforts to make the inventory functional, relevant

and durable in the long run. The mainstreaming process to get the inventory steps into the governmental structures was part of reforms in the national system. The mainstreaming processes started almost a decade ago but have still not reached the desired level yet. The main aim of mainstreaming is to ensure that the inventory is considered a useful source of information to aid climate change policy. This would be achieved by systematically integrating the inventory tasks into the work routines of the line ministries and make a budgetary allocation to cover them. In the last ten years, steps have been taken by the EPA to facilitate the mainstreaming process by first decentralising the inventory tasks to relevant organisations under the ministries. The purpose was to let the ministries play a more significant role in the inventory, develop capacities, create awareness, inspire ownership of the inventory results and ultimately infuse stability or permanence in the institutional arrangement for the inventory. So far, decentralisation or transferring the frontline inventory task to the line ministries had been mostly successful, but then again, some administrative issues need to be tightened up. The EPA has oversight over the inventory and still performs most of the general activities that cut across the sector, such as data request, QA/QC protocol, recalculations, key category analysis. On the other hand, inventory planning, preparation, and management have been assigned to line ministries.

As part of the arrangement of transferring the inventory, the EPA prepared a memorandum of understanding (MoU) to guide the relationship with the institutions that are involved in the inventory. Certain aspects of the MoU have not been fully operationalised yet, and this is still a barrier to the mainstreaming process. Even though the inventory task has been transferred to the ministries, it has not been fully embedded into the work programme of the respective ministries. Another classic example is that for the expert who is working on the inventory in the sector the time spent on the inventory work is not included in the staff performance appraisal despite the fact the institutions officially nominated them as schedule officers for the inventory. The current situation sometimes makes the officer prioritise other tasks from their institution over the inventory tasks that have been assigned to them. As Ghana prepares to participate in the ETF regime, having capable institutions in the national arrangement to drive the transparency functions would be extremely useful.

Continuous training of staff from the line ministries that involved was part of the mainstreaming package. So far, six experts from four organisations have received training through the UNFCCC training of experts to participate in the review of annual GHG inventories for the annexe 1 parties in the areas of Energy, IPPU, Waste, IPPU, Agriculture, and LULUCF. Furthermore, seven more are going to receive online training on GHG inventory this year to boost the levels of expertise in the country. As far as we can judge, this strategy has pretty much worked looking at the achievements and must be continued in the coming years. For Ghana to derive maximum benefits from this strategy, the team must consider increasing the number of people who are trained every year through the UNFCCC training and certification programmes. But due to funding constraints, the UNFCCC usually limits the number of trainees to one to each country. So, if Ghana wants to train more people in the inventory, it can consider budgeting for it and pay for the training of extra expert. Another viable option is to collaborate with the University of Ghana's Sustainability and Climate Change Studies programme to train more people on the various inventory topics. This approach is a viable option because it may be cheaper and sustainable in the long term. Therefore, the team must consider the following suggestion to hasten the mainstreaming process fully functional:

- Continue to train the experts from the line ministries as a way incentive to sustain their interest and add value to career progression.

- If funding is available, sponsor more people to be trained through the UNFCCC training programme.
- Explore the option of collaborating with the University of Ghana to train the students on GHG inventory and management.
- Revise the existing MoU to get the line ministries to commit more resources to support the inventory.
- Collaborate with the inventory institutions to include the time the experts spend on the GHG inventory in the staff appraisal.
- Encourage the line ministries to add one or two persons to support the work of the inventory sector inventory expert as a backup.

Predominant use of tier 1 method and default emission factors - Ghana's inventory estimate is dominated by the use of tier 1 methods and default coefficients. Except for the Land, Aluminium Production and Solid Waste that the GHG are estimated using higher tier methods and country-specific factors the rest of the relatively large proportion of the inventory relies on tier 1 and default factors. Even though the use of tier 1 and default factors is not wrong, but it can introduce significant levels of uncertainties in the inventory estimates. And this can affect the confidence in the inventory, especially the key categories which contribute most to the overall emissions estimates. The bottom-line is lack of access to credible country-specific data in the country. Investing in continuous data collection in the country is one of the surest ways to resolve this methodological issue. From the consultations made as part of this work, it is clear to us that the inventory team has already identified some of the things that need to do, but the issue is about access to funding. Some of the issues are as follows:

- Collection of activity data on the consumption of F-gases, particularly SF6.
- Collection of activity data and emission factors to support the development of a tier 2 method for road transport.
- Support in the expansion of the current facility-level carbon accounting programme, considering lessons learned from the current voluntary carbon accounting programme by the public electricity utility.
- Development of solid waste and wastewater balances to better understand the flow of solid waste and wastewater from the point of generation to the end site (e.g. solid waste disposal sites in the case of solid waste, or seas, rivers or lakes in the case of wastewater);
- Data collection to improve upon the current expert judgment in the allocation of manure into various manure management systems.

Incomplete uncertainty assessment - Uncertainty assessment in the inventory has been partially implemented in the current inventory. According to the NIR4, uncertainty assessment was conducted only for the Land category of the inventory due to several reasons. The main reason was that since the data (activity data and emission factors) for the inventory are obtained from secondary sources that do not publish the accompanying metadata, it makes it difficult to estimate the uncertainty levels. So, going forward, the focus must be on developing concrete category-level plans to collect the necessary uncertainty values for AD, EFs, and parameters.

3. The strategic focus of Ghana's ICAT Project

3.1 Scope of Ghana's ICAT Project

The ICAT project is part of the national strategy to strengthen the overall operational performance of the G-CARP system. The focus is on addressing some of the technical challenges in the MRV of mitigation action in the renewable energy area. With the ICAT project, the technical capacities of key stakeholders involved in the operationalisation of the G-CARP initiative improved. Besides, the functional assessment of the impacts mitigation policies and measures has seen significant improvement with the adoption of the GACMO model. After the successful application of the GACMO tool, Ghana adopted the tool as the primary analytical software for the revision of the baseline of NDC as well as for the continued climate reporting to the UNFCCC. Furthermore, Ghana further developed an NDC progress monitoring tool by building on the MRV sheet of the GACMO tool in a full-fledge standalone application. Now, the national institutions are using the GACMO tool and NDC progress monitoring tool as a software package for the G-CARP system.

3.2 Major outputs and achievements

3.2.1 Establishment of MRV data champions

Data owners are the bedrock of the G-CARP system in Ghana. They are supposed to supply critical datasets on the broad range mitigation actions in the NDC to aid in the evaluation of implementation progress and impacts. Ghana uses the results of the assessment to inform policy discussions and to meet international climate reporting obligation. As part of the ICAT project, Ghana has established twenty data champions in nine sector ministries and CSOs to facilitate the smooth flow of mitigation data. The ICAT project also contributed to the enabling work of the data champions by first defining their clear roles and responsibilities and building their capacities. As of now, the data champions are actively involved in reporting of progress of sector NDC and serve as contacts point for in their respective sectors during the preparation of the international climate reports (Figure 3).

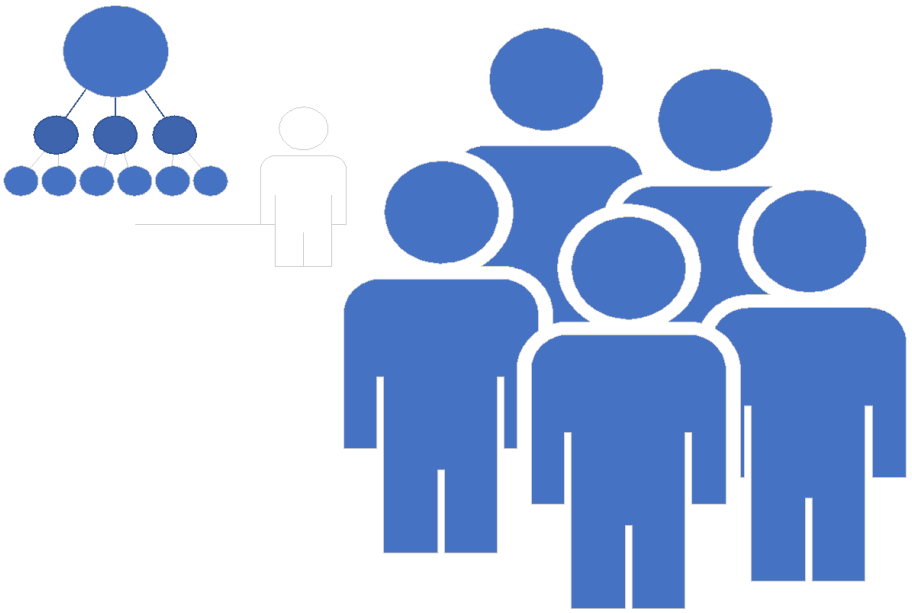


Figure 3: Overview of the representative of the data champions and the relationships with Ghana EPA and ICAT

They also play a critical role in the national effort to institutionalise the NDC implementation, monitor progress and reporting in sectors. Every year the network members fill the relevant sections of MRV template in the GACMO tool with data on the progress and achievement of the mitigation actions their respective areas. Then, the EPA uses the completed data in the GACMO tool to estimate the effects of mitigation action. The network members also contributed significantly to the revision of the NDC baselines by supplying technology and policy data in the respective sectors. Another critical achievement of the ICAT project is about building the capacities of the MRV data champions. After the establishment of the MRV data champions, the member received training on the GACMO tool. In the coming years, Ghana will continue to maintain the data champions and more importantly, further strengthening the coordination of the work of the network. Another area of interest is the training of the champions, especially on new transparency topics.

3.2.2 Customising GACMO Model for Ghana

GACMO is an open-source excel tool developed by UNEP-DTU Partnership in Denmark. The tool can be used in a wide range of areas because of the flexibility in its utility. In the case of Ghana, instead of only applying the GACMO to assess potential mitigation effect and co-benefits, it was decided, the tool would be used to enhance the technical rigour of the NDC baseline. So, with the technical support of UNEP-DTU, Ghana developed its own version of the GACMO model, taking into account the unique circumstance of the country. The development of the model was not from scratch but rather the team built on the generic GACMO template by populating the sheet with relevant data from national and international sources. The construction of the Ghana version of the model was five stages as follows:

- Identification of NDC mitigation technology options
- Establishment of emission baselines from national GHG inventory results and projections factors
- Building a marginal abatement revenue curve based on technical and economic data.
- Aggregation of the mitigation potential of selected NDC technologies.
- Framing the overall emission reduction target
- Development of MRV tracking template

The significant benefits for improving the NDC baseline is that the GACMO model offered a transparent approach for developing the baseline using country data both as the national and sectoral level in a systematic manner. It really enhanced the confidence in the baseline emissions by clarifying and documenting the underlying methodology and assumption. The GACMO also allowed stakeholder to objectively review the data, methods and assumption behind the baseline and provide feedback. Besides, when they finished using the GACMO tool to reconstruct the baseline, the result would be available for the future team to build on it to make necessary revisions where it is needed.

3.2.2.1 Identification of priority mitigation technology

Ghana has selected twenty-one mitigation technologies in the NDC (Figure 4). So, in the building of the GACMO, the team fed the NDC technologies into the individual technology assessment sheet of the model. The technologies range mitigation measures in the energy, transport, industry, waste and forestry sectors. For each technology, the team collected data on penetration rates, cost data on the reference and alternative technologies. This data aided in the calculation of the emission reduction potential and the cost savings, which was later used in building the overall mitigation target and the marginal abatement revenue curve.

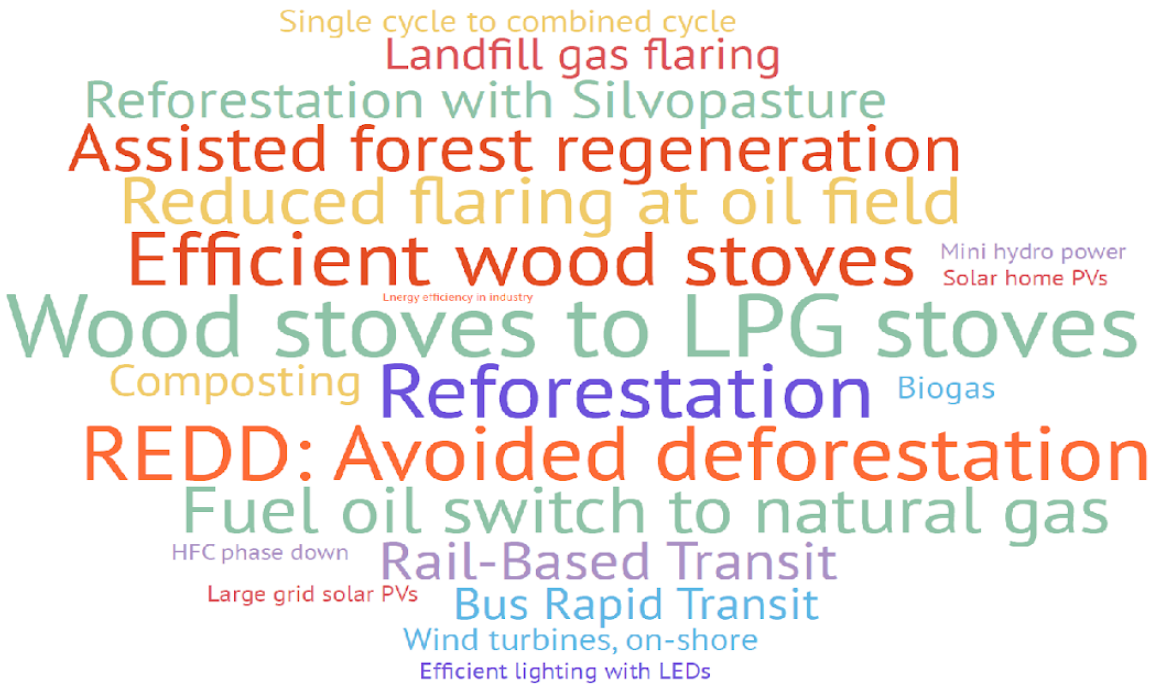


Figure 4: Word cloud of NDC mitigation technologies. Word size is indicative of emission reduction potential

3.2.2.2 Development of economy-wide emissions baseline

The baseline is a critical component for the calculation of the mitigation of potential climate actions. Primarily, baseline serves as the cardinal reference point upon which mitigation policies are compared to evaluate its overall effects. The baseline builds on the GHG inventory figure for 2016 and forecasts the 2030 emissions using a set for demographic and macro-economic factors. The projection represents the business-as-usual pathway where the current pace of the emission continues along the historical trajectory based on the current government development policies. Using the model, Ghana has been able to enhance the existing NDC by improving the methodology and the data. Now, with the revised baseline, any time the

team reports on the progress of NDC implementation to calculate the overall effect, it is possible to compare the results with the baseline to ascertain the extent to which Ghana is achieving its NDC target.

3.2.2.3 Marginal abatement revenue curve

Another utility of the GACMO model is its ability to automatically build an abatement revenue curve using the figures on the emission reduction and cost savings of the individual mitigation technologies. Information from the marginal revenue curve helped to beef up the prioritisation of the NDC mitigation actions. The screening process was an objective way of comparing the cost and emission reduction potential of the individual mitigation technologies to come up with a priority list. Once emission reduction potentials and the associated cost are evaluated, the results automatically populate the in marginal abatement revenue curve sheet. The information from this curve is crucial in understanding the cost barriers for rolling out the mitigation technologies.

3.2.2.4 Aggregation of the mitigation potential of selected NDC technologies

Apart from the marginal abatement revenue sheet in the GACMO, it is also possible in the tool to generate the aggregate effects of the individual mitigation technologies, compare to the baseline and come up with the target for the relative deviation from the baseline emission. Once again, with the GACMO Ghana been able to come to the emission reduction target for the country in the NDC.

3.2.2.5 Development of MRV tracking template

It is not enough to merely establish the emission, develop the mitigation potential for technologies and come up with an emission reduction target without having a system in place to track progress toward the achievement of the set target. That is why the MRV sheet in the GACMO model comes in handy for both the sector and national level users. Right now, Ghana is using the MRV sheet for the continuous tracking of the progress of implementation of mitigation action and their corresponding effects. All the institutions that are involved in the BUR, national communication and the monitoring of the implementation of NDC are using the MRV template. So every year, the sectors are to complete the MRV sheet of all the mitigation actions in their sector to enable the EPA to put them together for the national report. The output from this MRV sheet is used to report on mitigation actions and their impact and the mitigation assessments in both BURs and the national communication to the UNFCCC.

3.2.3 GACMO Training

After the development of the GACMO model to suit Ghana's data, policy and capacity needs, through ICAT more than forty national stakeholders received training on the GACMO. The training programme was also an opportunity to share the GACMO model results to broader stakeholders for inputs. The training was well received by the participants and further suggested the need to organised a series of a training sessions for more stakeholders.

3.2.4 Sustainable development assessment of renewable energy policies

As part of the ICAT project, Ghana has conducted a sustainable development impact for the solar rooftop programme. The SD assessment did not only make it possible to assess the socio-economic benefits of climate actions beyond emission reductions but also brought the financial benefit of the action. It is an innovative way to visualise the multiple impacts of climate action in a single dashboard to help improve communication and appreciate the full benefits of the action. The approach also highlighted the additional benefit cross-sectoral benefits of climate action over the implementation period. This new way of evaluating

the effect of climate actions would inform the Ghana team when it starts to revise the current NDCs next year. It would help to enhance the analytical rigour of the data undermining the revised NDCs. In another important lesson from this exercise is about the need to beef up communication aspects. Most times, communicating climate action impacts skew towards energy and mitigation benefits without highlighting the additional social and economic issues. It is a critical gap that must be addressed head-on.

At least the results from the sustainable development show far more other benefits of the solar rooftop programme are that usually not highlighted to policy-makers when making decisions. At least the assessment study has demonstrated that the real socio-economics of the solar rooftop programme that the general can relate to more than the unattractive energy and emission-led communication. The approach is crucial when it comes to making a compelling case to decision-makers in the finance and planning ministries for more allocation of financial resources to support the NDCs. The general public relates better to the socio-economic benefits of climate measure than the global perspective. Once the general public starts to help the NDCs, it enhances the chance to get them implemented. With the sustainable development results, it is possible to articulate the emission reduction potential and the socio-economic benefits (investment savings, job prospects, access to clean energy), for specific NDC interventions

3.2.5 Adoption and building on the GACMO model

The development of the GACMO model has been beneficial to Ghana in several areas. Apart from contributing to the improve the transparency and technical rigour of the NDC and reporting, it has also been a useful approach to building capacity both by learn-by-doing and peer or group learning. The tool has proven to be easy-to-learn, flexible, rigorous, less-data intensive, transparency, and above all can be adaptable to suit the unique sectoral situations in the country. These are the reasons why Ghana has adopted the GACMO to serve as the main tool for climate reporting and tracking of progress of NDCs. As a result, Ghana is currently using modelling in the following way:

- The MRV sheet in the GACMO has been adopted as the template the data champions uses to capture information on the progress of implementation of the mitigation actions in their respective sectors. Certainly, any future changes in the NDC emission figures would rely on the GACMO tool.

- The GACMO tool is the primary tool Ghana used in the assessment of mitigation actions and their effect when compiling its second biennial update report to the UNFCCC in 2018.

Besides, in the readiness to participate in the enhanced transparency framework by 2024, Ghana developed an NDC accounting tool which building on the baseline and MRV sheets in the GACMO model. The NDC accounting tool is a spreadsheet that all builds on the elements in the GACMO model to stakeholder to track the NDC progress and achievement at the sectoral and the national levels (Figure 5).

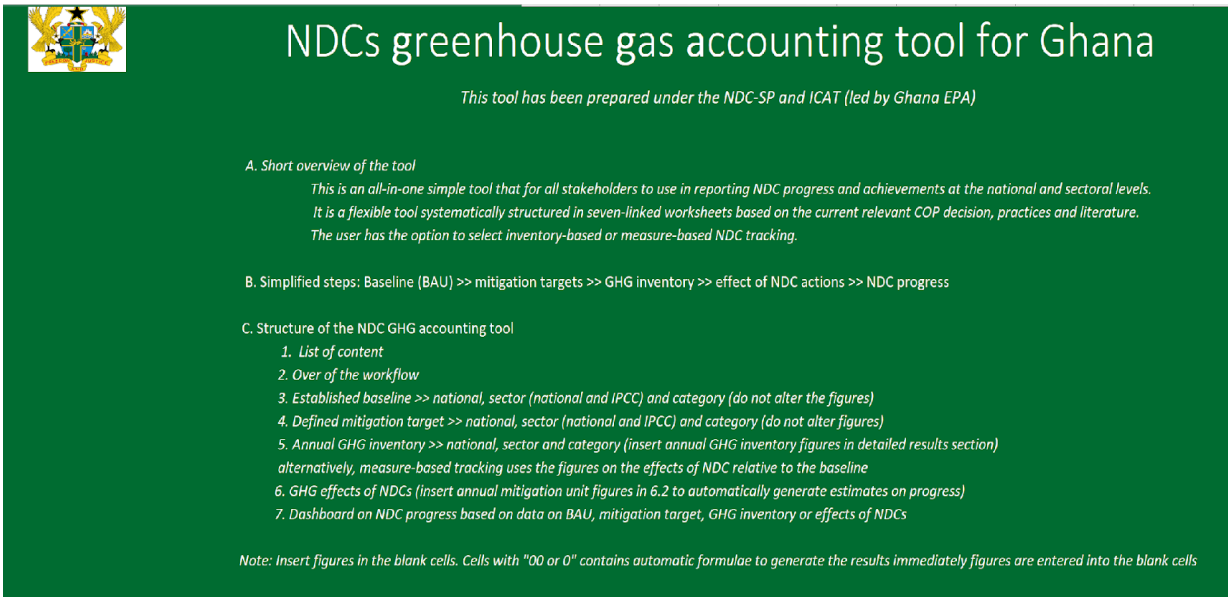


Figure 5: Screenshot of the NDC accounting tool for Ghana

The tool is based on the excel spreadsheet and makes it possible to estimate the NDC actions and effects quickly. It is a flexible tool that has structured the NDC accounting steps in seven linked worksheets, based on the current relevant COP decision, practices and literature (Figure 5). The user may select inventory-based or measure-based NDC tracking. The tool uses five main elements to determined NDC progress: (a) projected BAU emissions up to 2030; (b) original NDC targets; (c) annual GHG inventory; (d) NDC effects; and, (e) corresponding adjustment. With data on these five elements, NDC progress can be evaluated every year.
The two calculation options for tracking the NDCs are inventory-based and measure-based tracking. The annual GHG inventory figures at the sector or category level are compared with BAU emissions for the same year to evaluate the extent of the deviation. The relative differences between the two figures provide a conservative estimate of NDC progress. This option is favoured because it is consistent with IPCC guidelines, and developed countries have used it regularly. The latter option presents fewer uncertainties in aggregating the impact results from the category to the national levels. To avoid double-counting, it is always important to adjust emission reduction transfers that would have taken place over the same period

Measure-based tracking pools data on individual NDC actions and effects into an aggregate category or sector or national figures and compares it to projected BAU emissions or actual GHG inventory for a given year. The primary challenge of this approach is the uncertainties associated with aggregating GHG effects of individual NDC actions into category, sector or national figures. If for some reason, the national or sectoral prefer to use the measure-based inventory, it would be essential to note the data requirements for individual NDC actions. Variations in scope must be considered when setting out the accounting framework. Nevertheless, the team recognises that both options can be used when necessary. When using both approaches simultaneously, double-counting must be avoided. If users intend to use both methods, they would be required to populate the GHG inventory sheet and the relevant individual NDC measures sheet. When both are completed, the remaining sheets would be generated automatically in the overall NDC progress dashboard.

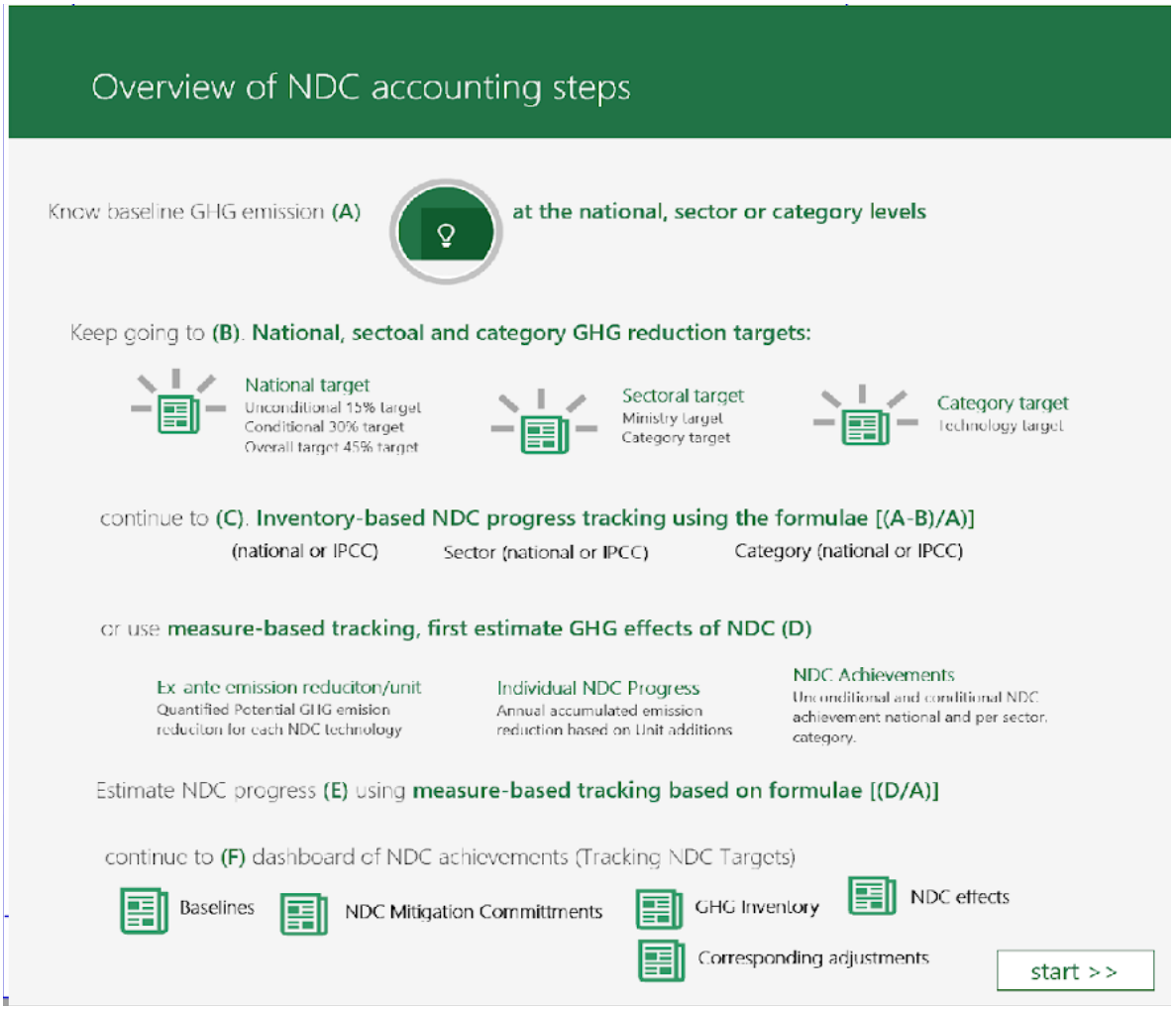


Figure 6: Overview of the NDC accounting steps

4. Best practices and lessons learnt

Generally, the ICAT project has been successful, when it comes it delivering of the project outputs and also having meaningful positive impacts on the strengthening of MRV of mitigation action in Ghana. Several factors account for the relative success of the project in Ghana. The critical success factors have been elaborated below;

4.1 Co-creation strategy

Over the last two decades, Ghana received technical assistance from several donors. The general approach of the majority of the technical capacity suppliers is top-down. That is to say that, the donor determines the model to deliver the capacity from their home-bases. The capacity-building model tends to be prescriptive and project-focus and does not meet the specific country need. In the end, the project is short-lived, and when the project ends, it is difficult to assess the impact of that investment in the long-run. There could be several reasons for this, but one striking issue is the inability of the capacity supplier to jointly come with the solution that can lasting impact over the long period.

That said, the ICAT project adopted a different approach which allowed the country to have a say from the start of the design of the work programme of Ghana's project. With this approach, the representative of UNEP-DTU partnership involved the Ghana team in the selection of the priority area of capacity need and

jointly come up with strategies to address them. Then, the team, with guidance from the UNEP-DTU came with realistic work programme after which the broader stakeholders were consulted to validate both the areas of focus and the work programme. To us in Ghana, not only did the co-creation approach enable the stakeholders to come up with an area that there is a real need, but it also facilitates the country actor to give full support to the project. This is because the stakeholders know that the end product of the capacity building would address a significant need for the country.

4.2. Use of hand holding-capacity development approach

Another typical feature of international capacity development is a touch-go approach. In most cases, the capacity supplier flies on a mission to the recipient country and organises couple training workshop for selected stakeholders then return. Even though the "touch-go" approach has some benefits in the transfer of capacity to developing countries, over the years it does not lead to far-reaching improvements. The benefits are short-lived and limited in focus. Ghana adopted the hand-holding approach which goes beyond a couple of training workshops to establish a working relationship with the UNEP-DTU partnership. The national team stayed in contact with the DTU representative who provided online support when the team encounter a challenge. The team also programmed regular online conference call with the person at UNEP who offer feedback and guidance on the technical work throughout the project. With this approach, the national team build their confidence and at the same time, receives valuable feedback to improve the technical quality of the work. The hand-holding approach proved to be workable under the ICAT project because both the UNEP DTU and Ghana understood from the very beginning the deliverable of the capacity building exercise would adopt by the country.

4.3 Learning-by-doing and group-learning

Both the learning-by-doing and the group-learning Ghana used in the ICAT project worked relatively well because it was hands-on. All along the team had the understanding of the final deliverable from the training exercise would be used in the real-life for the MRV work in future. So, the team was diligent and took the training seriously with the view that the end product will be the right quality product.

4.4 Continuous improvements of an open-source tool

The fact that the GACMO model was open-source and based excel spreadsheet was a significant success factor. With this, the team can independently verify the formulae behind the model and are free to make changes in them built much confidence in the model. It also meant that when the project ends, the team can continue to use the tool since there is no hidden propriety cost. With this, the EPA can make changes in the figures in the model when the new dataset becomes available without going back to consult the UNEP-DTU partnership. The team also has the freedom to integrate results from other models or even develop new model suit a specific demand for specific cities or sector on their own. The flexibility in the use of the model helped in making the project successful.

5. Barriers, gaps and areas for future improvements

The team observed the following shortcomings that must be addressed:

- **Need to improve the capability of GACMO tool to integrate sustainable development models –** With the current version of GACMO, it is possible to generate useful information on emission and cost savings but not no sustainable development. Therefore, it critical to explore practical options to

either develop new a tab for the assessment of sustainable development benefits of climate action or couple other models into GACMO to serve the same purpose.

- **Improve technology cost data** - Update the cost or investment data in the GACMO tool - the current cost and investment information in the GACMO is quite generic. Using the figure estimates the overall investment required for the mitigation actions NDC conservative. Ghana plans to work with UNEP-DTU to update the financial information in the model.

- **Refine GACMO data inputs** - Fine-tune the GACMO tool with newly published data from the various sector. The revision may as a result of updates of underlying data for the model with the view to improve its quality. This is important because it will be a significant input into the 2020 revision of the NDC.

- **Additional training** – It is possible that as Ghana prepares to develop the second NDC, some improvements will be made to the existing data. Once that one has been done, it would be essential to organise another training session for the broader stakeholders on GACMO