INTERNATIONAL MONETARY FUND

GHANA

TECHNICAL ASSISTANCE REPORT—DIAGNOSTIC MISSION ON MACRO-RELEVANT CLIMATE CHANGE STATISTICS

October 2023

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TECHNICAL ASSISTANCE REPORT

GHANA

Report of the Diagnostic Mission on Macro-relevant Climate Change Statistics (June 26–30, 2023)

SEPTEMBER 2023

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State Secretariat for Economic Affairs
SECO
Economic Cooperation and Development

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Acronyms and Abbreviations

EPA   Environment Protection Agency

GHG   Green House Gas

GSS   Ghana Statistical Service

IOTs   Input-Output Tables

MESTI   Ministry of Environment, Science, Technology, and Innovation

NDPC   National Development Planning Commission

SUTs   Supply and Use Tables

Section I. Summary of Mission Outcomes and Priority Recommendations

1.   **A diagnostic mission was conducted during June 26–30, 2023, to develop a roadmap to guide the compilation of climate statistics for Ghana to address policy needs.** The mission was conducted under the auspices of the Swiss State Secretariat for Economic Affairs (SECO) funded Environment and Climate Change Statistics Capacity Development Program, a two-year project with the objective to assist countries in developing timely and internationally comparable statistics to support the design and monitoring of policies to address the environmental, financial, economic, and social implications associated with climate change. These objectives align with the Data Gaps Initiative 3 for the G20 countries and its extension beyond these countries as well as the implementation of the System of Environmental Economic Accounting, Sustainable Development Goals regarding climate and energy issues, and measuring *Beyond GDP*.

2.   **Discussions were conducted during plenary and bilateral sessions with key national stakeholders representing data compilers and users to take stock of work already undertaken on environment and climate change related statistics for Ghana, ongoing capacity development initiatives with other agencies, policy needs and data gaps, and data sources.** These discussions were facilitated by provision of introductory training on environmental accounting and climate change indicators. Participating agencies included the Ghana Statistical Service (GSS), Ministry of Finance, Ministry of Environment, Science, Technology, and Innovation (MESTI), Environment Protection Agency (EPA), Energy Commission, National Development Planning Commission (NDPC), and the Bank of Ghana.

3.   **There was agreement on the need to develop air emissions accounts as well as physical and forward-looking transition risk indicators.** While the former will require significant coordinated compilation tasks by the GSS, the Energy Commission, and the EPA, the latter are more experimental and could be envisaged as a data stewardship component using statistics readily available from international databases. Air emissions are a key criterion in climate mitigation policies. Emission inventories which are available for Ghana from 1990 to 2019 will need to be converted into air emissions accounts in line with the System of Environmental Economic Accounting Central Framework, the internationally agreed statistical framework.

4.   **Secondary priorities including mineral and energy resource and energy statistics, as well as carbon footprints, were identified and it is expected that project participants will agree on a roadmap for their compilation during a second phase of the project after Air Emissions Accounts are compiled.** These statistics will also guide policies by providing a better understanding of challenges relating to the impact on the economy of the energy transition from fossil fuel to low-carbon technologies. With deposits of oil, lithium and other minerals, Ghana faces both economic and environmental challenges as well as opportunities which need to be measured using a systematic statistical framework. Carbon footprints provide a better understanding of the impact of consumption on air emissions by considering the role of international trade in the global supply chain. Other indicators could be developed in the possible next phase of the project.

5.   **National Supply and Use Tables (SUTs) and Input-Output Tables (IOTs) underpin the compilation of several climate change indicators, and an important enabling step will be to build capacity for regular intermediate updating of these tables to facilitate ongoing compilation**

according to a regular cadence. While there is strong inter-agency collaboration including for data sharing, and a good deal of available source data, some of the indicators that have previously been compiled, including "*The 2013 Environmental Extended Physical Supply and Use Tables for Energy Accounts in Ghana,*" are based on the latest national accounts data (with a reference of 2013) and technical assistance will be required to compile intermediate supply use tables to bridge gaps between national accounts updates. Among other benefits, this will facilitate the compilation of up-to-date climate change indicators on a regular basis, support efforts to mainstream climate change into Government development agenda, and presents an opportunity to address data gaps, which will assist in the further development of a multi-module national development model.

6.   **The GSS, which is at the center of the national statistical system, will continue to coordinate the collaboration between agencies participating in this project in close consultation with the EPA.** A technical coordinating group will include key stakeholders from the agencies participating in the plenary sessions and be chaired by the GSS and the EPA. Meetings will be held as needed.

7.   **To support progress in the development of macro-relevant climate change statistics, the mission made the following priority recommendations.**

TABLE 1. Priority Recommendations

Target Date	Priority Recommendation	Responsible Institutions
December 2023	*Finalize 2019 SUTs and IOTs.*	GSS
December 2024	*Compile 2019 Air Emissions Accounts for publication.*	GSS EPA
December 2024	*Prepare 3 experimental Forward-looking Physical and Transition Risk Indicators for publication.*	GSS EPA NDPC

8.   **The development work should be initiated as soon as possible by the relevant institutions so that recommendations can be implemented within the recommended timeframe.** Further details on the priority recommendations and the related actions/milestones can be found in the action plan under Detailed Technical Assessment and Recommendations.

Section II. Detailed Technical Assessment and Recommendations

TABLE 2. Action Plan

Priority	Action/Milestone	Target Completion Date
Outcome: **New Climate Change Statistics are Compiled**		
H	Finalize intermediate 2019 SUT and IOT Tables.	December 2023
H	Compile 2019 Air Emissions Accounts for publication.	December 2024
H	Take stock of progress and decide on next priorities.	June 2024
H	Publish three experimental Forward-Looking Physical and Transition Risk indicators.	December 2024

A. INTRODUCTION

9.   This Swiss State Secretariat for Economic Affairs (SECO) funded project will assist Ghana to compile relevant environmental and climate change statistics. It has three main outputs: workshops to assist in program design, training in the development of environmental and climate change statistics and a direct delivery component. Significant methodological work has been undertaken at the international level over the last decade. However, data gaps exist in Ghana. While source data are available, work is needed to update key macroeconomic frameworks such as SUTs to support the compilation of updated priority climate related statistics.

10.   The current diagnostic mission was conducted during June 26–30, 2023, to develop a roadmap to guide the compilation of environmental and climate change statistics for Ghana to address policy needs for data. Discussions were conducted during plenary and bilateral sessions with key national stakeholders representing data compilers and users to take stock of work already undertaken on climate change related statistics for Ghana, ongoing capacity development initiatives with other agencies, policy needs and data gaps, and data sources. Participating agencies included the Ghana Statistical Service (GSS) – including staff from both the environmental and economic accounts units, Ministry of Finance, Ministry of Environment, Science, Technology, and Innovation (MESTI), Environment Protection Agency (EPA), Energy Commission, National Development Planning Commission (NDPC), and the Bank of Ghana. The development of capacities will be further supported by workshops on deliverables of the project. These workshops will include technical and conceptual aspects of the climate change statistics.

B. POLICY PRIORITIES IN RESPECT OF ENVIRONMENT AND CLIMATE CHANGE

11.   **The Government of Ghana has published a *National Medium-Term Development Policy Framework 2022–2025* to guide the management of economic development.**[1] The framework focuses on economic growth; digitization; science, technology, and innovation; urbanization and infrastructural deficits; youth unemployment; public health; emergency preparedness, and the fight against pandemics; and climate change. It notes that "the country continues to record disasters such as epidemics, floods, wildfires…coastal erosions (and) landslides" and that "the ocean claims between 1.5 to 4 meters of 560 kilometers of coastline annually."

12.   **To strengthen the enabling environment for climate change resilience and meet its commitments under the Paris Agreement, Government has introduced several measures.** These include "reducing greenhouse gases emissions including development of Green House Gas (GHG) emission accounting system, development of a Nationally Determined Contribution implementation plan, development of frameworks for incorporating climate change issues into environmental impact assessments processes and incorporation of climate change issues into the national system for annual progress reporting…among others."

13.   **However, the Framework notes that "efforts to mainstream climate change into Government development agenda have not been as successful as expected" due to limited political commitment and awareness among other reasons.** Staff also noted an insufficient level of in-depth analysis on the link between the environmental factors and their economic implications and that this current project presents an opportunity for a holistic analysis including linkages between various sectors of the economy. It is also worth noting that while as part of government efforts, the Ghana Energy Commission has built synergies between relevant United Nations frameworks and initiatives including the Energy Accounts, there is a need to strengthen coordinated efforts for a wider set of analyses.

14.   **Additionally, a bilateral meeting with the Director-General of the National Development Planning Commission revealed that the project presents an opportunity to identify and address data gaps, which will therefore assist in the further development of a multi-module national development model.** This model has macroeconomic functionality to aid economic forecasting, sectoral planning, and ultimately facilitate policy analyses but the development process has been challenged by gaps in environmental data for effective forecasting and analysis.

C. STAKEHOLDERS, DATA SOURCES AVAILABLE AND STATISTICS CURRENTLY BEING PRODUCED

15.   **The following Ministries and agencies are compiling statistics on the different aspects of environment and climate change:**

- Ghana Statistical Service (GSS); both Agriculture and Environment, and National Accounts Divisions;

- Ministry of Finance;

- Ministry of Environment, Science, Technology, and Innovation (MESTI);

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[1] This section draws heavily from the Framework which can be accessed at https://ndpc.gov.gh/media/MTNDPF_2022-2025_Dec-2021.pdf.

- Environment Protection Agency (EPA);

- Energy Commission;

- National Development Planning Commission (NDPC);

- The Bank of Ghana;

- Ministry of Energy;

- Forestry Commission;

- Ministry of Agriculture.

16.   There is no regular publication of environment and climate change data, but several publications have been released in the past:

- The Asset Accounts for Mineral Resources in Ghana for 2006–2014, with support from the World Bank and released in 2017;

- The 2020 Environment Statistics Compendium—an update is ongoing; and

- The 2013 Environmental Extended Physical Supply and Use Tables for Energy Accounts in Ghana, with support from United Nations Economic Commission for Africa (UNECA) and released in 2019.

17.   In addition, Ghana has developed a National Capital Accounting (NCA) Framework, which included stepping up efforts to bridge existing data gaps, harmonizing the NCA data ecosystem, and identifying key policy questions to create strong linkages and integration of NCA activities into decision-making. The World Bank's Global Program on Sustainability, in partnership with the United Nations Statistics Division provided technical assistance. Key preliminary results of land accounts, ecosystem extent accounts, and ecosystem services account were presented at the high-level national NCA forum on June 15, 2023. The final report of land and ecosystem extent accounts and ecosystem services accounts were expected to be released by the end of 2023. The overall objective is to strengthen capacity for natural capital accounting and its use for policy, development, and investment planning in Ghana.

D. ENABLING THE DEVELOPMENT OF ENHANCED CLIMATE CHANGE STATISTICS

18.   The Supply and Use Tables (SUT) should be updated to enable the compilation of air emissions accounts. The latest set of SUT are for 2013 and no longer reflect the current structure of the economy. The SUT also underpin several other indicators and support the compilation of energy accounts, as well as the environmental activity indicators by providing more granularity for the compilation and analysis.

19.   The intermediate SUT update should be completed during 2023 using readily available source data. The GSS is about to start a rebase of national accounts using the SUT framework. This exercise will provide a new set of estimates but is unlikely to be completed before 2025. In the meantime, a partial update, supported by technical assistance, would provide intermediate estimates, and support the upcoming rebase of national accounts. Readily available data from administrative sources, balance of payments and government finance statistics can be used for a partial update. Emission inventories data are available up to 2019 coinciding with latest year before the COVID-19 pandemic which had a major impact on the structure of the economy. Since partial updates include modelling techniques relying on

fixed ratios, a post-pandemic year should be avoided and instead the SUT updated to 2019. The key data sources needed to update the SUT are presented at Appendix B.

20.   Compiling Input-Output Tables (IOT) will provide estimates needed for other indicators that could be compiled including an updated set of Environmental Extended Physical Supply and Use Tables for Energy Accounts in Ghana, and carbon footprints, as well as improving date quality more generally. The economic multipliers which are derived from the IOT are required to compile carbon footprints. Data inconsistencies such as product or margin allocations can be identified in the IOT which require the derivation of basic price estimates. Therefore, intermediate IOT should be compiled for 2019 in addition to the SUTs.

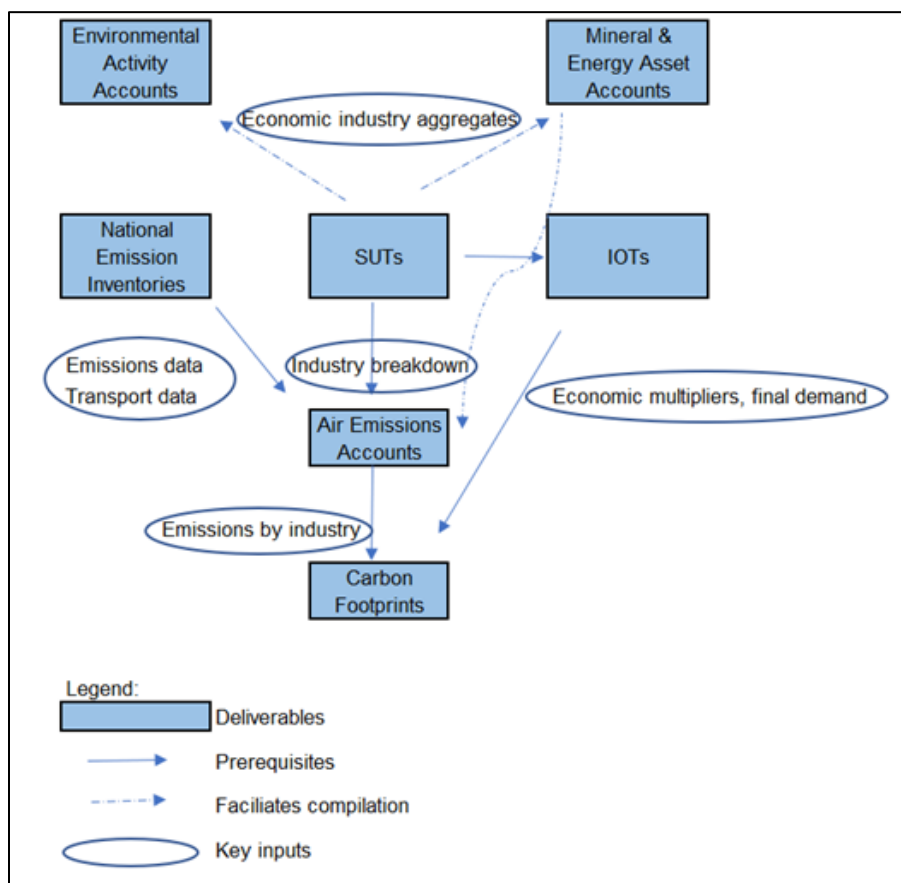**Figure 1.** Data and Compilation Flows for Key Deliverables

TABLE 3. Status of Data Availability

Data items	Availability
Physical flow accounts	For agriculture only, compiled with support from the Food and Agriculture Organization. To be released by the end of 2023
Land Accounts	By the end of 2023
National Inventories (UNFCCC)	2019
National Carbon Footprints	Limited availability for a few reporting units
Energy Accounts	2013
Energy Statistics including Energy Balance	Up to 2022
Environmental Activity Accounts/ Environmental Expenditures	Underway
Mineral and Energy Asset Accounts	2013

Recommended Action:
▪ The GSS should update the SUT and IOT on an intermediate basis to 2019 during 2023.

E. CLIMATE CHANGE MITIGATION AND ADAPTATION MEASURES

Introduction

21.   There was agreement on key priorities to develop air emissions accounts as well as physical and transition risk indicators. While the former will require significant compilation tasks, the latter are more experimental and could be envisaged as a data stewardship component using statistics readily available from international databases. Other indicators could be developed at a later stage of the project, and it is expected that project participants will agree a roadmap for the second phase of the project after Air Emissions Accounts are compiled. An overview of the indicators, their use for policy makers, and methodological data and methodological requirements are provided below.

Air Emissions Accounts

22.   There was agreement on the need to develop a comprehensive set of air emissions accounts as a priority. Air emissions accounts present information on gaseous and particulate substances released to the atmosphere by resident establishments and households as a result of economic processes (production, consumption, and accumulation). They are structured by industry (various levels of detail) and by household and are consistent with national accounts estimates of value added and output.

23.   Air emissions accounts have various policy uses, the most important being their use in monitoring the effect of climate mitigation policies. They can be integrated with annual estimates of Output or Gross Value Added at constant prices to derive GHG emission intensities by industry—a key indicator in monitoring the effectiveness of climate mitigation policies and understanding the level of

decoupling between greenhouse gas emissions and output. The accounts will also be of relevance to the assessment of the bilateral agreement between Ghana and Switzerland under Article 6.2 of the Paris Agreement, which allows public and private institutions to collaborate to invest in climate change mitigation interventions in Ghana and exchange carbon credits with Switzerland for payment while maintaining the development benefits in the country. Ghana and Switzerland signed a bilateral agreement in November 2020 to cooperate in the area of climate change under Article 6 of the Paris agreement. The agreement sets the framework conditions for Swiss private sector to invest into climate friendly technologies which will assist Ghana to implement its climate actions and plans under the Nationally Determined Contributions. Ghana has also been cooperating with Sweden, Singapore, and South Korea on initiatives to reduce emissions.

Forward Looking Physical and Transition Risk Indicators

24.   Participants in the plenary sessions also prioritized an assessment of the potential to develop Forward Looking indicators of Physical and Transition Risk Indicators which quantify the potential impact that climate hazards can have on physical structures and populations as well as the impact climate mitigation strategies can have on business income and financial markets. While the methodological guidance on physical and transition risk indicators is still being developed as part of the G20 Data Gap Initiative 3, Recommendation 5, significant progress has been made over the last number of years (e.g., models developed by the Network for the Greening of Financial System) to standardize the models and pathways that support the compilation of these indicators.

25.   Indicators will focus on the potential for developing estimates of the potential loss (measured in terms of income, asset values, and populations) arising from climate hazards like rising storms, drought conditions or flooding caused by rising sea levels and those arising from climate mitigation policies such as carbon pricing. Work in this area could be envisaged as a data stewardship component using statistics readily available from international databases. Some examples are provided at Appendix C. The compilation of carbon footprint would also support the preparation of a carbon pricing model to assess the impact of a carbon tax on inflation for example.

Carbon Footprints

26.   The compilation of Air Emissions Accounts and updated IOT will facilitate the compilation of carbon footprints—a broad measure of emissions that includes direct and indirect emissions by resident establishments as a result of economic (production, consumption, and accumulation) processes. Carbon footprints are broken down by output industry and contributing industries as well as by demand category The data are generally presented as annual estimates.

27.   Carbon footprints have various policy uses including identification of high versus low emitting industries and the identification of the consumption of products that result in high levels of emissions. They also facilitate the assessment of individual corporate scope 1, scope 2, and scope 3 emissions relative to the industry average. The main source data required to produce carbon footprints include:

▪   Input-output tables (specific issues are discussed in the Appendix A of this report);
▪   Direct measures of emissions;
▪   Air Emissions Accounts.

Environmental Government Revenues by Type

28.   There is potential for compiling environmental government revenues by type. Governments obtain revenues through the management and protection of natural resources and levying of environmental taxes. These revenues are likely to be impacted when economies transition away from fossil fuel-based energy supplies. On the other hand, substantial reserves of Lithium will positively impact GDP and therefore government revenues from growing economic activities. These data will help monitoring the change in government revenue streams as governments adopt climate mitigation and adaptation policies. Environmental revenues by type are outlined in the *Government Finance Statistics Manual 2014*, *the System of National Accounts 2008,* and the *System of Economic and Environmental Accounting*.

Mineral and Energy Asset Accounts

29.   There was a broad agreement among the participating agencies on the importance of Mineral and Energy Asset Accounts. The anticipated energy transition is expected to have significant repercussions for the use of natural resources and therefore, their changes in value over time which will impact public and private income which rely heavily on natural resources. In the Ghana context, the economic value of deposits of oil and gas are expected to diminish over time and gradually be substituted by renewable energy sources. On the other hand, deposits of Lithium have significant value as a key input to Li-ion batteries.

30.   A potential outcome of energy transition is a redistribution of natural resource wealth which may have implications for the revenue generating capacity of government. Mineral and Energy Asset Accounts present physical and monetary values of natural resource wealth and changes therein (holding gains and losses, depletion of natural resources). The methodology to account for these resources is well developed in both the *System of Environmental-Economic Accounting* and the *System of National Accounts 2008.* Mineral accounts can be developed using national accounts and ideally SUTs data which provide detailed activity estimates for production, value added, contribution to GDP. They can also be used to better understand the generation of income from natural resources with a breakdown of primary income components between compensation of employees and operating surplus.

Environmental Activity Accounts

31.   Environmental activity expenditures are those expenditures whose primary purpose is to reduce or eliminate pressures on the environment or to make more efficient use of natural resources. These accounts can inform on the contribution of environmental activities on the economy by identifying these activities related to the environment and could be a precursor to identifying climate-related expenditures. Estimates of environmental activity expenditures (both public and private) can be used to understand the level of resources required to develop policies to mitigate the economic risk associated with climate change. Environmental expenditures can be broken down into two main categories: Environmental Protection Activities and Resource Management Activities. Most of these environmental transactions are recorded within the core national accounts framework but many cannot be easily identified owing to the structure of the accounts or the types of classifications that are used.

32.   Technical assistance in this area would focus on working with to incorporate additional breakdowns into the existing national accounts statistics for Ghana (e.g., supply and use tables) and re-aggregating the estimates of output, intermediate consumption, and value added to produce accounts like environmental protection expenditure accounts, resource management expenditure accounts, and environmental goods and services accounts.

Recommended Action:

▪ The GSS and EPA to develop Air Emissions Accounts for publication as a priority before December 2024.

F. COORDINATION

33. The GSS, which is at the center of the national statistical system, will continue to coordinate the collaboration between agencies participating in this project in close consultation with the EPA. Technical and planning discussions for the current mission were coordinated by the GSS. There is good cooperation between key stakeholders including on data sharing. A technical coordinating group will include key stakeholders from the agencies participating in the plenary sessions and be chaired by the GSS and the EPA. Meetings will be held as needed.

G. OFFICIALS MET DURING THE MISSION

TABLE 4. List of Participants

| #	Name	Institution
1	Bernice Serwah Ofosu-Baadu	Ghana Statistical Service (GSS)
2	Akosua Asare-Brewu	Environment Protection Agency (EPA)
3	Daniel Akwetey Lamptey	Environment Protection Agency (EPA)
4	Juliana Bempah	Environment Protection Agency (EPA)
5	Kwame Fredua Boakye	Environment Protection Agency (EPA)
6	Emmanuel Cofie	Environment Protection Agency (EPA)
7	Mercy Azoomah Issah	National Development Planning Commission (NDPC)
8	Vera Baffoe	National Development Planning Commission (NDPC)
9	Robert Mensah	Ministry of Finance
10	Priscilla Asabea Asare	Ministry of Finance
11	Gyimah Mohammed	Ministry of Environment, Science, Technology & Innovation (MESTI)
12	Bernard Walley	Bank of Ghana
13	Elliot Ansah	Ghana Statistical Service (GSS)

Appendices

APPENDIX A. METHODOLOGICAL OVERVIEW OF DELIVERABLES

Basic training was provided by the mission on the following deliverables and has been summarized in this appendix. Further training will be provided by the IMF.
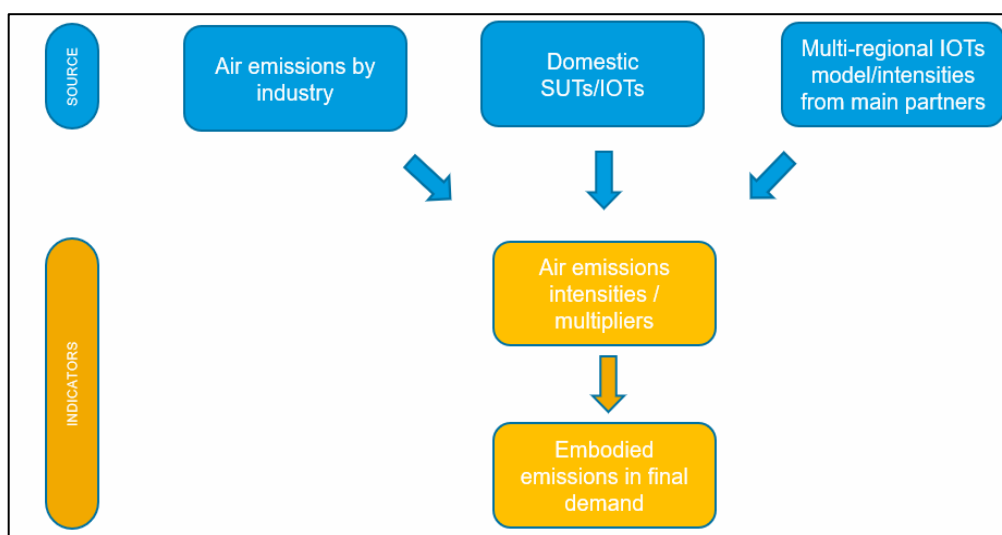
1. Air Emissions

Air emissions are derived from emission inventories and economic aggregates obtained from the SUTs. Emissions inventories are based on the territory principle—considering emissions from the territory of a country regardless of the resident status of the emitter. Therefore, adjustments are necessary to comply with the resident principle used in the air emissions accounts. Each inventory source also needs to be assigned to the emitting economic activity—either the production activity or the household consumption category such as private transport, heating, or cooling. This allocation to economic activities is undertaken using the SUTs which show the detailed transactions between producers and consumers with a detailed breakdown according to the International Standard Industrial Classification (ISIC). The SUTs for Ghana have 98 industries. Production and consumption activity data are converted into emissions using internationally agreed conversion factors. Other conceptual differences exist between the emissions inventories and air emissions accounts such as air transport which is excluded from the inventories. Bridging items are used to address these issues, Energy data are also often used to supplement source data for the compilation of air emissions accounts.
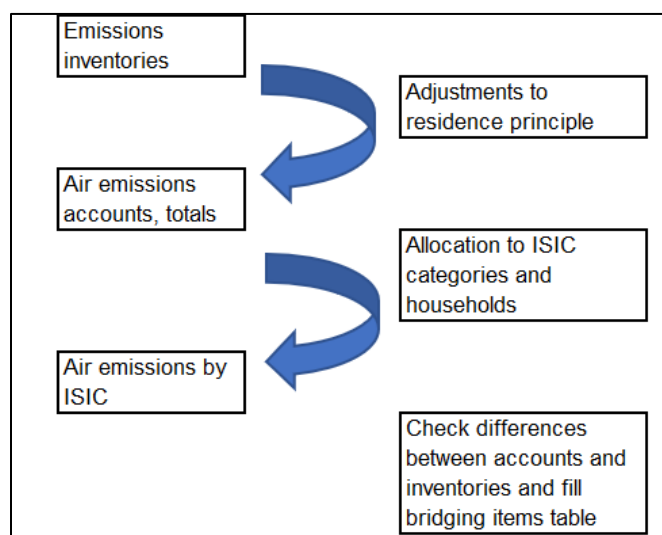
2. Carbon footprints

They are derived by combining emissions by industry with economic multipliers and final demand estimates from the IOTs. Economic multipliers are obtained from the IOTs which are derived from the SUTs. In the IOTs, transactions are reported by supplying industries at basic prices instead of being reported by products at purchasers' prices in the SUTs. When combined with air emissions, the air emission intensities can be applied to final use components such as household final consumption expenditure to obtain the related embodied emissions. These provide consumption-based estimates.

Specific emissions intensities should be used for imports depending on the country of origin. This require complex multi-regional input-output models which are available from international organizations. The IMF is developing such a model and could provide further assistance to develop IOTs and incorporate them in its model. If multi-regional input-output models are not used, all imports would have to be considered with the same emissions intensities which is incorrect. However, a simple approach based on similar intensities regardless of the country of origin might be acceptable as a first estimate.

3. Environmental Economic Accounts

Relevant estimates of activities contributing to environmental protection activities and resource management activities can be extracted from SUTs which provide production, value added and income components by industry. These activities should be estimated from SUTs, possibly using ratios because of the level of aggregation (SUTs have 98 industries in Ghana), depending on the scope of activities considered for these accounts. Contributions to environmental protection activities and resource management activities should be determined in conjunction with the compliers of SUTs who have a deep understanding of economic activities and classifications used in national accounts. While the economic activities contributing directly to the environmental protection and resource management could be determined from the SUTs, a broader contribution could be derived from the IOTs by considering the economic multipliers which also include contributions from supplying industries through intermediate consumption.
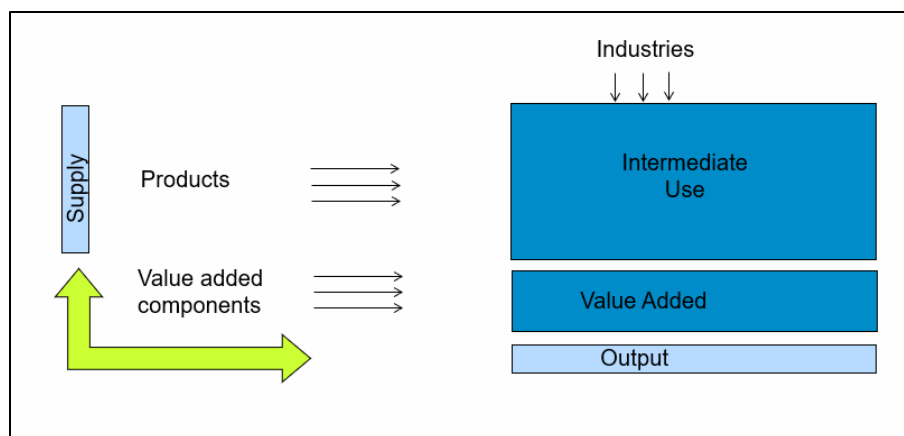
4. Mineral and Energy Assets Accounts

Indicators for measuring macroeconomic impact of natural resources on production, income, labor, terms of trade, etc. can be derived from the SUTs. The IMF has designed a statistical framework, the *Guide to Analyze Natural* Resources *in the National Accounts* to better understand the contribution of non-renewable natural resources to the economy. Although the framework focuses mainly on flows, it also covers asset accounts in the addendum items, and could contribute to the mineral and energy assets accounts.

5. Environment Government Revenues by Type

The following categories are presented:

      a.   taxes on energy (including fuel for transport);

      b.   taxes on transport (excluding fuel for transport);

      c.   taxes on pollution;

      d.   taxes on resources.

The following environmental-related taxes were identified in Ghana:

Taxes	Status	Comments
Plastic excise tax	Implemented	An excise duty of 10% (previously 15%) of the ex-factory price on selected plastic and plastic products.
Sanitation and pollution levy	Implemented	Gh 0.10p (pesewas) on the price per liter of petrol/diesel to raise revenue to combat sanitation-related challenges.
Penalties on over-aged and higher engine vehicles (a proxy for CO2 taxation)	Luxury vehicle tax suspended	• The luxury vehicle tax to be redesigned into a vehicle emission tax. • Importation of cars older than 10 years has been banned and an import tax of 35% (from 10%) placed on new and used vehicles.

Taxes	Status	Comments
Electronic waste levy	Eco levy applied and collected on only 65 out of 365 items	Eco levy imposed on manufacturers or importers of electrical and electronic equipment.
Progressive water tariffs	Implemented	The progressive increase in water tariffs reflects the environmental costs of water resource withdrawal and distribution.

6. Forward-looking physical and transition risk indicators

As discussed during the mission these indicators are still experimental and the methodological and conceptual framework have yet to be established by the international statistical community. The Appendix C of this report includes source data that could be considered for the development of these indicators.
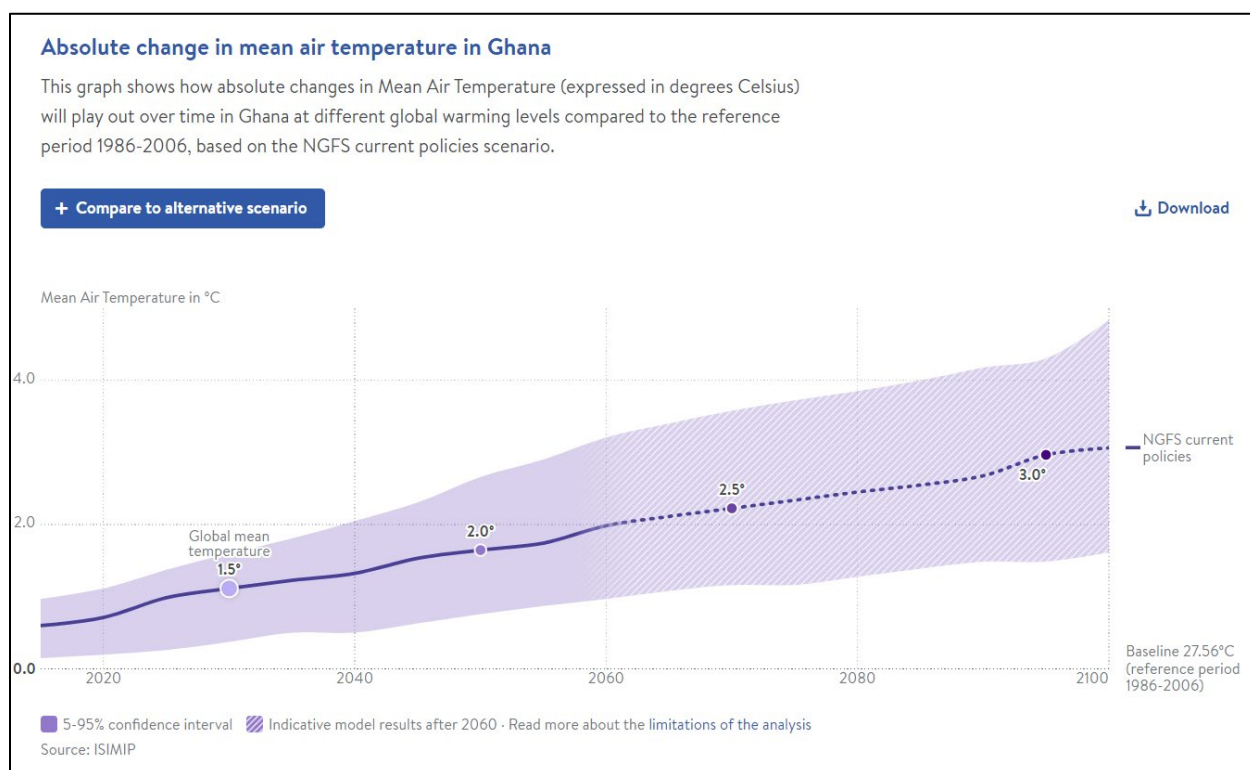
APPENDIX B. SOURCE DATA AND METHODOLOGICAL APPROACH FOR THE 2019 SUT UPDATE

The 2019 SUT update will incorporate readily available source data for 2019 and involve some modelling techniques for structural details where source data are either not available or not available at the required level of classification details. The existing classification used for the 2013 SUT will be used for 2013. Current prices estimate only will be compiled for this project. During discussions with the GSS the mission identified the following key data sources needed to update the SUT.

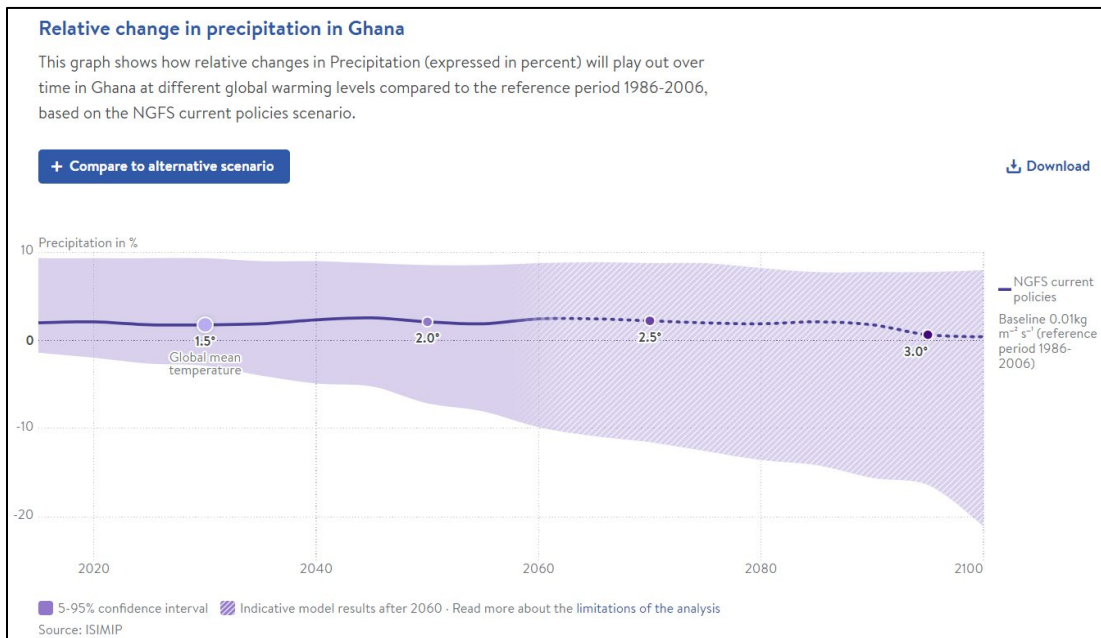| SUT Component	Source Data	Availability
Formal production estimates	Sales data from the value added tax database	Not usable for exempted supplies such as finance and insurance. The GSS should explore correspondence issues with the SUT industry classification.
Formal production estimates	Corporate income tax data	To be used to supplement the sales data from value added tax.
Imports and exports	Balance of payments and international merchandise trade statistics for details goods	The GSS should explore correspondence issues with the SUT product classification.
Government output and final consumption expenditure	Government finance statistics	
Taxes less subsidies on production	Government finance statistics	The product allocation of value added tax should not be based on points of collection but on non-deductibility of the tax.
Finance and insurance, central bank	Bank of Ghana	
Informal sector estimates	2013 estimates extrapolated using current methodologies used in national accounts	
Household final consumption expenditure	Existing national accounts estimates for 2019 for aggregates and 2016–17 GLS results	
Gross fixed capital formation	Based on existing national estimates for 2019	Further analysis will be needed to disaggregate estimates to the SUT product classification.
Trade and transport margins	Product allocation based on 2013 structure, supplemented by more recent information where possible	

APPENDIX C. EXAMPLE OF FORWARD LOOKING PHYSICAL AND TRANSITION RISK INDICATORS

1. Forward-looking risk indicators were highlighted as a key priority during the plenary discussions as well as during bilateral discussions with the NDPC and EPA. Existing indicators should be assessed by relevant stakeholders to assess their suitability for policy needs. The mission was unable to find forward-looking risk indicators from the National Disaster Management Organization (NADMO) and the Ghana Meteorological Authority (GMET).

2. The Climate Analytics is a global climate science and policy institute established in 2008 to bring analysis to bear on climate change. The Internet site https://climateanalytics.org provides a number of indicators that could be used to develop indicators for different types of risks with interactive maps and graphs. National and subnational climate impacts are considered over time at current emissions reductions levels (according to the scenario used by the Network for Greening the Financial System)[2] and in other policy relevant scenarios.

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[2] See details on NGFS at https://www.ngfs.net/en.

Maps are also available depending on different scenarios:

How is Precipitation affected by 2.5°C of warming?

This map shows the relative change in Precipitation (expressed in percent) at 2.5°C of global warming compared to the reference period 1986-2006.

Global warming level | 1.5°C | 2.0°C | 2.5°C | 3.0°C | Compare to different... ▾

Change in **Precipitation** in %

below -2.5%   -2   0   2   4   above 5.7%   ⧅ Insufficient model agreement

Relative change in precipitation in Ghana

This graph shows how relative changes in Precipitation (expressed in percent) will play out over time in Ghana at different global warming levels compared to the reference period 1986-2006, based on the NGFS current policies scenario.

+ Compare to alternative scenario   ⬇ Download

Precipitation in %

NGFS current policies

Baseline 0.01kg m⁻² s⁻¹ (reference period 1986-2006)

Global mean temperature

■ 5-95% confidence interval   ⧅ Indicative model results after 2060 · Read more about the limitations of the analysis
Source: ISIMIP

Relative change in labour productivity due to heat stress in Ghana

This graph shows how relative changes in Labour Productivity due to Heat Stress (expressed in percentage points) will play out over time in Ghana at different global warming levels compared to the reference period 1986-2006, based on the NGFS current policies scenario.

+ **Compare to alternative scenario**   ⬇ Download

Labour Productivity due to Heat Stress in pp

Baseline (reference period 1986-2006)

1.5°
Global mean temperature

2.0°

2.5°

3.0°

NGFS current policies

0

-10

-20

-30

2020   2040   2060   2080   2100

■ 5-95% confidence interval   ▨ Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP - Secondary Output