ClimaSouth

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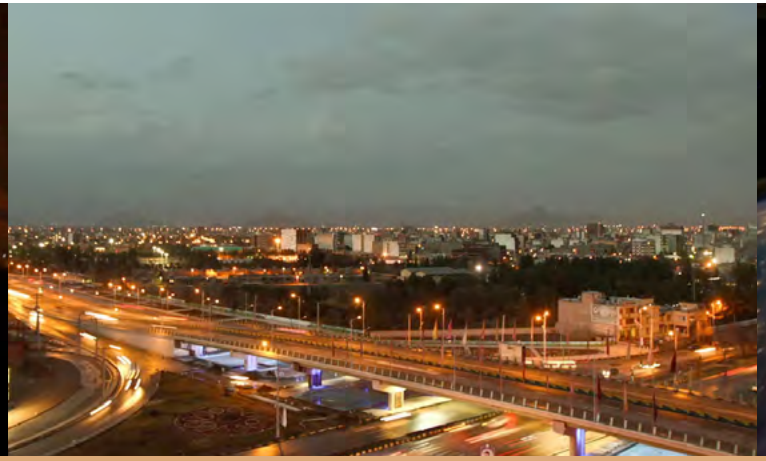
Euro South Mediterranean Initiative:
Climate Resilient Societies
Supported by Low Carbon Economies


An Introduction to National GHG Inventories Measurement, Reporting & Verification (MRV)

Project funded by the European Union

Project implemented by
AGRICONSULTING CONSORTIUM
Agriconsulting Agrer CMCC CIHEAM-IAM Bari
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FOREWORD

The Mediterranean region has been identified as a climate change hotspot by the Intergovernmental Panel on Climate Change (IPCC). Most countries in the region are already experiencing rising temperatures, increasing water scarcity, more frequent droughts and forest fires, as well as growing rates of desertification. A common understanding is thus emerging in the region that fighting climate change is essential, by employing both mitigation and adaptation measures. These may also open new opportunities for further economic development, particularly those associated with low carbon options. The EU-funded ClimaSouth project supports climate change mitigation and adaptation in nine Southern Mediterranean partner countries: Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia. The project assists partner countries and their administrations in transitioning towards a low-carbon society while building climate resilience and promoting opportunities for sustainable economic growth and employment. The project also supports South-South cooperation and information-sharing on climate change issues within the region, as well as closer dialogue and partnership with the European Union.

As part of its efforts to enhance climate change strategic planning, the ClimaSouth project is producing a series of handbooks tailored to the needs of the Southern Mediterranean region. The key users targeted include relevant government departments at operational and policy levels, climate change units and committees, decision-makers, meteorological services, members of local government, the private sector and civil society. The ClimaSouth handbooks are based on peer-to-peer seminars held by the project, which are designed to support national administrations in the development and implementation of climate change policy; they further help stakeholders in the region to engage more effectively in the global climate change framework. Climate change information is gradually improving, but not enough yet. Data are available to some extent to guide strategic climate change response measures at the global and regional levels, but their overall management and analysis need to become much more effective.

This third handbook reflects the content presented and the discussions held during a first ClimaSouth 'GHG Inventory and MRV Seminar'. We hope that it will contribute to improving the knowledge of both policy-makers and technicians alike on these issues, and will assist them in addressing future GHG management issues.

We wish you a fruitful reading.

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CLIMASOUTH HANDBOOKS

Handbook N. 1: Building Capacity & Mainstreaming Climate Change Policy
Handbook N. 2: Improving Climate Information
Handbook N. 3: An Introduction to Greenhouse Gas Inventories and MRV
Handbook N. 4: Long-range Energy Alternatives Planning System (LEAP) & Greenhouse Gas (GHG) Modelling
Handbook N. 5: Low-Emission Development Strategy (LEDS)
Handbook N. 6: Downscaling Climate Modelling for High-Resolution Climate Information and Impact Assessment
Handbook N. 7: Connecting Downscaling, Impacts and Adaptation: A Summary

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LIST OF ACRONYMS

AR 5	5e rapport d'évaluation du GIEC
BUR	Biennial Update Report
CGE	Consultative Group of Experts
CLRTAP	Convention on Long-Range Trans-boundary Air Pollution
CO_2eq	Carbon Dioxide equivalent
COP	Conference of the Parties
EF	Emission Factor
EFDB	Emission Factor Data Base
EMEP CORINAIR	Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)
ENP	European Neighbourhood Policy
GHG	Greenhouse Gas
GPG	Good Practice Guidance
GWP	Global Warming Potential
HFCs	Hydro fluorocarbons
IAR	International Assessment and Review
ICA	International Consultation and Analysis
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
ISPRA	The Joint Research Center in Ispra (Italy)
KCA	Key Category Analysis
LEAP	Long range Energy Alternative Planning

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LECB	Low Emission Capacity Building programme
LEDS	Low Emission Development Strategy
LULUCF	Land use & Land Use Change and Forestry
MoU	Memorandum of Understanding
MRV	Measuring, Reporting and Verification
NAI	Non-Annex 1
NAIIS	Non-Annex 1 Inventory Software
NAMA	Nationally Appropriate Mitigation Actions
NEAR	(Directorate General for) Neighbourhood and Enlargement Negotiations
NCSP	National Communication Support Programme
NFI	National Forests Inventories
PFCs	Perfluorocarbons
QA/QC	Quality Assurance/Quality Control
REDD	Reduced Emissions from Deforestation and Forest Degradation
SFM	Sustainable Forest Management
SNC	Second National Communication
TFI	Task Force for Inventories (IPCC)
TNC	Third National Communication
TSU	Technical Support Unit/IPCC-TFI
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

1. INTRODUCTION

The overall objective of the ClimaSouth programme is to support the transition of ENP South countries (Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia) towards low-carbon development and climate resilience, in a context of sustainable and democratic development, by enhancing regional cooperation, information-sharing and capacity-development on climate change mitigation and adaptation. The specific mitigation purpose states that *"Strengthening institutional mitigation capacity towards low-carbon development, including 'Measurement, Reporting and Verification' (MRV), 'Low Emissions Development Strategies' (LEDS), and 'Nationally Appropriate Mitigation Actions' (NAMAs)* where not covered by other Technical and Financial projects partners. Analysis and lessons learnt from stakeholder's consultations carried out during the ClimaSouth inception phase (February-June 2013) led to the key findings related to the GHG inventory and modeling (Table 1). The majority of ENP South countries have prepared at least one national communication. The ClimaSouth project Inception Report concluded that that the quality of greenhouse gas (GHG) inventory systems remains limited in this region.

TABLE 1. Summary of the key findings related to GHG inventory and modeling in the ENP South countries.

Subject	Status	Capacity Needs
GHG Data collection	Lack of institutional capacity/institutional arrangements and national experts for GHG data collection & management	Strengthen institutional capacity and national expertise for data collection & management
MRV	Lack of capacity for Measurement, Reporting and Verification (MRV) on GHGs using national and international standards	Building MRV capacity; MRV tools to be included in the formulation of NAMAs, LEDS
GHG Data analysis	Low to medium experience in data assessment on the sectoral level but very low on the national level	Need to deepen expertise in data analysis at the sectoral level and expand it to the national one
GHG Mitigation modeling	Low experience in mitigation modeling in energy/transportation/agriculture, industry and other sectors using modeling packages	Strengthen capacity to use modeling software packages in the development of mitigation scenarios

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Several global and bilateral initiatives are already providing technical support/training on GHG reporting to developing countries. The following two programmes are particularly relevant:

- **National Communications Support Programme** (NCSP)[1] funded by the Global Environment Facility (GEF) and jointly managed by the UNDP and UNEP. National Teams implement the project at the country level.
- **Low-Emission Capacity Building Programme** (LECBP)[2] launched in January 2011 as part of a joint collaboration between the European Union (European Commission and Member States) and the UNDP. Since its inception, the LECB Programme has grown both in scope and breadth, including 25 participating countries and enhanced technical support through generous contributions from the European Commission, the German Federal Ministry for the Environment, the Australian Department of Climate Change and Energy Efficiency, and USAID. This collaborative, country driven programme aims to strengthen technical and institutional capacities at the country level, while at the same time facilitating inclusion and coordination of the public and private sectors in national initiatives addressing climate change.

In this context, ClimaSouth activities aim to support the UNFCCC process by providing support in synergy with these existing initiatives, using the same tools, complementing the support needed and targeting national teams to address specific needs. In this context, a training session was organised in June 2014 in Genoa to help ENP South countries to:

establish a sustainable GHG inventory process;

efficiently manage this process, including documentation and archiving;

improve and update GHG inventories on a regular basis;

enhance the capacity of professionals in GHG inventory reporting;

enhance efficiency and ensure optimal use of scarce financial and human resources.

The regional GHG Inventory workshop was organised by ClimaSouth. The target audience was government officials from the project's partner countries that are involved in general aspects of GHG inventory planning, preparation and management, since it is recommended that a significant part of a country's inventory improvement efforts focus on documentation and archiving, which is critical to the long-term sustainability and institutionalisation of the inventory process.

[1] http://ncsp.undp.org/

[2] http://www.lowemissiondevelopment.org/

2. BACKGROUND AND LEGAL PROCESS

Why produce National GHG emission & removal inventories?

A GHG inventory is an estimate of emissions and removals of greenhouse gases (GHG) from given sources or sinks, from a defined country in a specific period. In the context of the UNFCCC, GHG inventories provide national and annual estimates. The GHG inventory is part of the scope of the UNFCCC's National Communications and the Biennial Update Report (BUR). These reports submitted to the UNFCCC are mandatory and meant to provide information to the COP, donors and investors on potential mitigation projects, and to other stakeholders. The GHG inventory is necessary to monitor progress in an open and transparent manner for any international agreement that sets emission limits or targets. Developing GHG inventories on a regular basis is also important for policy formulation and implementation by making it possible to:

- identify the sectors, sources, and activities responsible for greenhouse gas emissions;
- understand emission and removal trends;
- make decision at the national and sub-national levels (planning tool);
- develop cost-effective mitigation policies;
- monitor progress towards policy goals;
- inform on best practices and mitigation technology needs;
- provide the foundation for emissions trading schemes;
- inform the public.

GHG inventories are also useful for scientific understanding and progress. They provide input for mitigation and other models. They help us understand the link between environmental pollution and effects and sources of pollution. GHG inventories and their analyses are basic tools for establishing low-emission development strategies and action plans to cut emissions and contribute to the implementation of articles 2, and 4.1.a & b. of the Climate Convention.

Key UNFCCC COP Decisions related to GHG inventories and reporting

- In 1996, COP 2 adopted the guidelines for initial national communications for non-Annex I Parties under **Decision 10/CP.2**.
- In 1997, COP 3 under **Decision 2/CP.3** reaffirmed that **Parties should use the Revised 1996 IPCC Guidelines**.
- In 2002, COP 8, under **Decision 17/CP.8** adopted new guidelines for the preparation of national communications from non-Annex I Parties, which are contained in the annex to this decision. In addition, non-Annex I Parties are encouraged to apply the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC GPG 2000) to improve transparency, consistency, comparability, completeness and accuracy in their GHG inventories.
- In 2003, COP 9 adopted **Decisions 13/CP.9** regarding use of the *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry* (IPCC GPG 2003). According to this decision, non-Annex I Parties are encouraged to apply the IPCC GPG 2003 as appropriate and to the extent possible, in preparing their GHG inventories.
- In 2007, COP 13 adopted **Decision 1/CP.13**, by which NAI Parties should ''Establish a GHG national inventory system" and strengthen their GHG reporting capacity.
- In 2010, COP 16 adopted **Decision 1/CP.16**, by which NAI Parties should submit a **Biennial Update Report** (BUR) every 2 years, starting in December 2014. The report should also include national GHG inventory information on mitigation actions and their effects, on national needs and on support received. The submitted BURs will undergo international consultation and analysis.
- In 2011, COP 17 adopted **Decision 2/CP.17** stating the funding mechanism for preparing these reports (the GEF); in addition, the UNFCCC Biennial Update Reporting guidelines for Parties not included in Annex I to the Convention was adopted, as well as the Modalities and guidelines for international consultation and analysis, in annexes III and IV, respectively.
- In 2013, COP 19 adopted **Decision 1/CP.19** that invites all parties to *"initiate or intensify preparations of their* ***Intended Nationally Determined Contributions" (INDCs)****, and* **Decision 21/CP.19**, which invites developing country parties to use, on a voluntary basis, the General Guidelines for domestic ***measurement, reporting and verification*** **(MRV)** of domestically-supported, nationally-appropriate mitigation actions.

BOX 1. Key UNFCCC COP Decisions related to GHG inventories and reporting

BOX 2. Reporting Requirements For Non-Annex I Parties

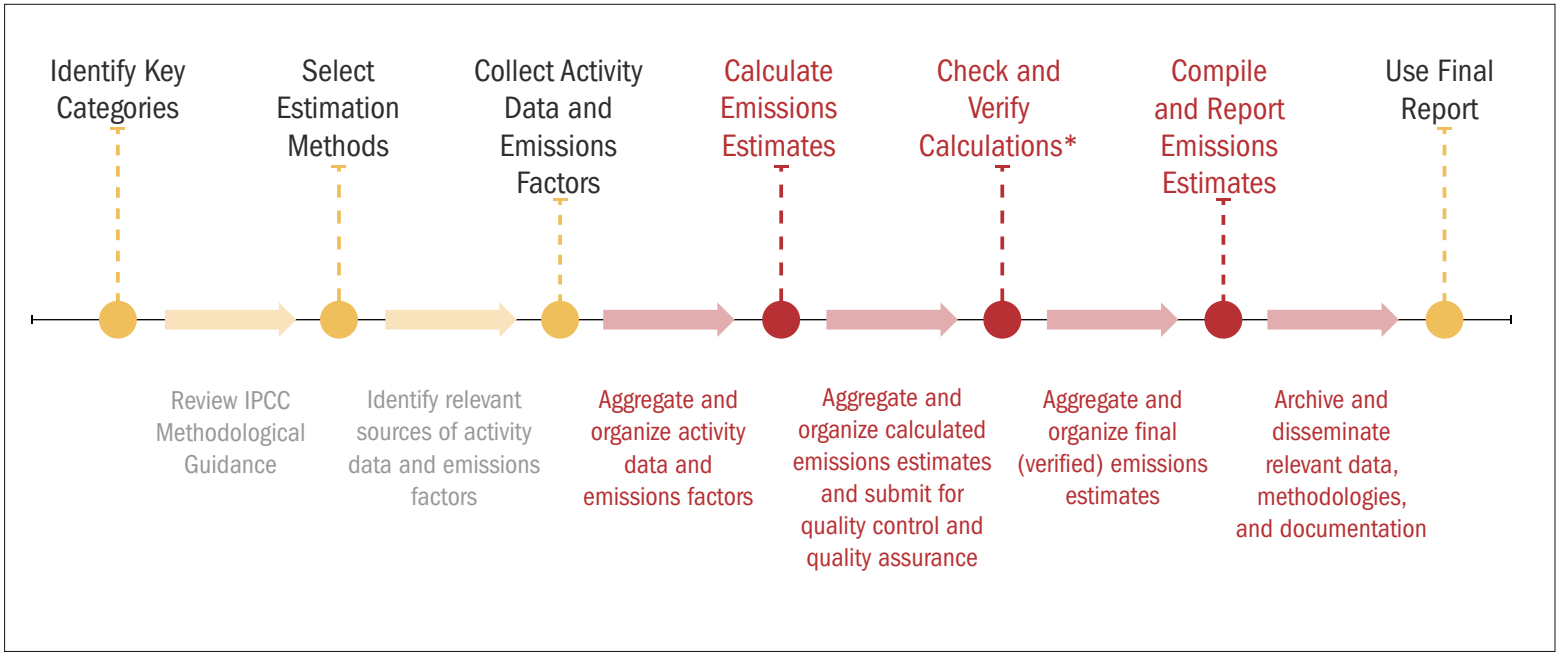
1996 - Decision 10/CP.2: National Communications	2011 - Decision 2/CP.17: Annex III: Biennial Update Reports (BUR)
(I) National circumstances (II) **National greenhouse gas inventory** (III) General description of steps to implement the Convention (a) Programmes and measures related to mitigation • General requirements • Methods and assessment/analysis (results) (b) Programmes and measures related to adaptation • Vulnerability and assessment not differentiated (IV) Constraints and gaps and related financial, technical and capacity needs (VI) Other information relevant to the achievement of the objective of the UNFCCC	(I) National circumstances and institutional arrangements (II) **National greenhouse gas inventory: National Inventory Report (NIR)** (III) Mitigation actions and their effects • Methodologies and assumptions • Objectives of the action and steps taken or envisaged to achieve this action • Progress of implementation of the mitigation actions and the underlying steps taken or envisaged, and the results achieved, such as estimated outcomes (metrics depending on type of action) and estimated emission reductions, to the extent possible • International market mechanisms • **Description of domestic MRV arrangements** (IV) Constraints and gaps, related financial, technical and capacity needs, description of support received and needed (V) Level of support received to enable the preparation and submission of BURs (VI) Any other information relevant to the BUR

Source: UNFCCC secretariat presentation

As of December 2014 then, non-Annex I Parties are expected to submit reports every two years (except for Least Developed Countries & Small Island Developing States, for whom the reporting is at their own discretion). They will contain, among other inputs, a recent inventory of national GHG emissions and removals (UNFCCC, 2011). Such decisions mean that the entities/institutions responsible for preparing the GHG inventories need to do more than produce GHG estimates at irregular intervals. These new requirements (see Box 2 comparing the 1996 requirement to the most recent ones approved in 2001) make

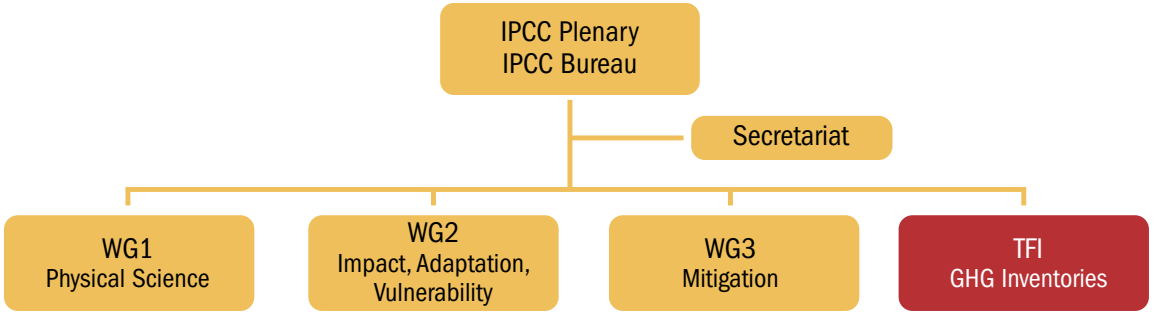
it necessary to strengthen the GHG reporting capacity of ClimaSouth countries to produce ***'High-Quality GHG inventories'*** on a regular basis, which, according to the IPCC Guidelines, should be complete, consistent, comparable, transparent and accurate (IPCC GPG, 2000). It is important to note that the GHG inventory submitted in the first BUR shall cover, at a minimum, the inventory for a calendar year no more than four years prior to the date of submission, or more recent years if available. In subsequent BURs, the GHG inventory shall cover a calendar year that does not precede the submission date by more than four years. To achieve such a result, it is recognised that a national GHG inventory data management system is a critical element in obtaining the needed final product. (See Figure 1 below).

FIGURE 1. Steps in a General National GHG Inventory Development Process and Possible Roles of a Data Management System



Source: Data management systems for national greenhouse gas inventories: Insights from ten countries, World Resources Institute, 2015 *(figure redrawn)*

3. TOOLS AVAILABLE FOR DEVELOPING GHG EMISSIONS INVENTORIES



3.1 The IPCC Guidelines

3.1.1 Overview of the guidelines

Any international agreement to limit climate change must set emission limits/targets and monitor progress in an open and transparent way. Currently, most national emissions can only be estimated, so we need a consensus on the best way to calculate these estimates. To do this, we need reliable, generally accepted and comparable methods and guidelines. The International Panel of Experts on Climate Change (IPCC) developed such methods and guidelines. The "IPCC National Greenhouse Gas Inventories Programme" was managed from 1991 by the IPCC in collaboration with the Organisation for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA) until 1998, when the **Task Force for Inventories** (TFI) was set up. The objectives of the TFI are to develop and refine internationally agreed-upon methodologies and software for the estimation and reporting of national GHG emissions and removals; and to encourage the widespread use of these methodologies by countries participating in the IPCC and by Parties to the UNFCCC. The TFI is responsible for assessing and developing inventory methods and practices which are scientifically sound and relevant to all countries, noting particularly the lack of information in developing countries. Japan hosted the **Technical Support Unit** of this task force (TFI-TSU)[3] at the Institute for Global Environmental Strategies (IGES) in 1999. The Emission reduction commitments set in the Kyoto Protocol raised the importance of national GHG inventories. The objectives of these Guidelines are:

- To assist NAI Parties in meeting their reporting requirements;
- To encourage the presentation of information in a consistent, transparent, comparable and flexible manner;
- To facilitate the presentation of information on the platform required for the preparation of national communications;
- To serve as policy guidance to the operating entity of the financial mechanism of the Convention, for the timely provision of the financial support needed by NAI Parties in order to fulfil their reporting requirements; and
- To ensure that the COP has sufficient information to carry out its responsibility for assessing the implementation of the Convention by the Parties.

BOX 3. Inventory estimation.

The basic idea in inventory estimation is simple but its application can be complex:

Emission estimate (**E**) = Emission Factor (**EF**) * Activity data (**AD**)

E is the Emissions or removals from a human activity, **EF** is the emissions or removals per unit activity, e.g., the mass of carbon dioxide per ton of cement produced, and **AD** is the extent of human activity, e.g., the amount of cement produced.

[3] www.ipccc-nggip.iges.or.jp

The Revised 1996 and the 2006 Guidelines, both approved by the COP, provide methodologies for making estimates of national anthropogenic emissions and removals of greenhouse gases. These methodologies are used to assist Parties to the UNFCCC in fulfilling their commitments to develop inventories of anthropogenic emissions and removals of greenhouse gases not controlled by the Montreal Protocol. The IPCC Guidelines contain global or regional default values of emission factors, mostly for Tier 1 methods. The 2006 Guidelines also allow for more complex modelling approaches, particularly at higher tiers, which need country-specific emission factors and parameters. The Revised 1996 IPCC Guidelines were updated and completed by the **"Good Practice Guidance"** (GPG 2000) and by **"GPG-LULUCF"** (GPG for Land Use and Land Use Change and Forestry, 2003).They introduced the concept of Good Practice. Inventories using this concept are *"those that contain neither over- nor under-estimates, so far as can be judged, and in which uncertainties are reduced as far as is practical"* and those that are *"Transparent, Accurate, Complete, Consistent, Comparable, and efficient in resource use"*. The GPG-LULUCF introduced comprehensive coverage of all land by dividing it into 6 land-use categories.

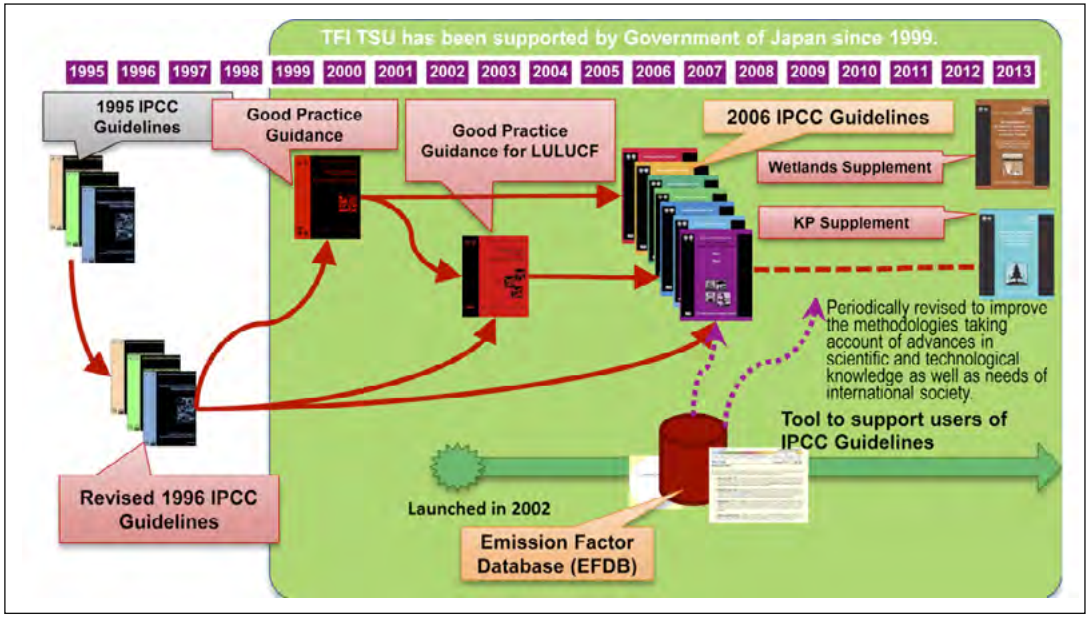
The 2006 IPCC Guidelines update and expand the Revised 1996 guidelines, while maintaining consistency:

- The main categories and sub-sectors were restructured to clarify and simplify inventories and to reduce the chance of double-counting;
- The "Agriculture" and "Land Use and Land use Change and Forestry" (LULUCF) modules were merged into one module: "Agriculture, Forestry and Other Land Uses"(AFOLU);
- The "Industrial Processes" and "Solvent Use" modules were merged into one module," Industrial Processes and Product Use" (IPPU);
- The *good practice guidance* was integrated for clarity and ease-of-use.

The new Guidelines do not pre-empt accounting choices and all the information needed is retained. They include:

- updated default values and methods;
- methods for additional categories and direct greenhouse gases;
- the best globally applicable methods reflecting the latest science.

FIGURE 2. Summary of changes to the IPCC Guidelines and other tools



Source: UNFCCC Secretariat

BOX 4. The Revised 1996 IPCC Guidelines

The IPCC Guidelines were first accepted in 1994 and published in 1995. UNFCCC COP3, held in 1997 in Kyoto, reaffirmed that the ***Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*** should be used as "methodologies for estimating anthropogenic emissions by sources and removals by sinks of greenhouse gases" in calculating legally-binding targets during the first commitment period. It contains **three volumes**, each of which provides assistance to analysts in the preparation of national GHG inventories.

The Reporting Instructions (Volume 1) provides step-by-step directions for assembling, documenting and transmitting completed national inventory data consistently, regardless of the method used to produce the estimates. These instructions are intended for all users of the IPCC Guidelines and provide the primary means of ensuring that all reports are consistent and comparable.

The Workbook (Volume 2) contains suggestions about planning and getting started on a national inventory for participants who do not have a national inventory available already and are not experienced in producing such inventories. It also contains step-by-step instructions for calculating emissions of greenhouse gases, from six major emission source categories. It is intended to help experts in as many countries as possible to start developing inventories.

The Reference Manual (Volume 3) provides a compendium of information on methods for estimating emissions for a broader range of greenhouse gases and a complete list of source types for each. It summarises a range of possible methods for many source types. It also provides summaries of the scientific basis for the inventory methods recommended and gives extensive references to the technical literature.

The IPCC-TFI also produced two other supplements in 2013:

- ***The 2013 Revised Supplementary Methods and Good Practice Guidance arising from the Kyoto Protocol*** *(KP Supplement)* provides supplementary methods and *good practice guidance* for estimating and reporting anthropogenic greenhouse gas (GHG) emissions and removals resulting from LULUCF activities under Article 3.3 and Article 3.4 of the Kyoto Protocol for the second commitment period, 2013-2020. The supplementary methods are additional guidance to produce the supplementary information needed in greenhouse gas inventories to meet the LULUCF rules for the Kyoto Protocol.
- ***The 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*** *(Wetlands Supplement)* extends the content of the 2006 IPCC Guidelines by filling gaps in coverage and providing updated information reflecting scientific advances, including updating emission factors. It covers inland organic soils and wetlands on mineral soils; coastal wetlands, including mangrove forests; tidal marshes and seagrass meadows; and constructed wetlands for wastewater treatment. The coverage of the *2006 IPCC Guidelines* on wetlands was restricted to peatlands drained and managed for peat extraction, conversion to flooded lands, and limited guidance for drained organic soils.

Finally, the IPCC-TFI developed an **"Emission Factor database"** (EFDB), which is a library of a wide range of well-documented emission factors and other parameters to help users (inventory compilers) select those that best reflect their national circumstances. It supplements all the IPCC

Guidelines/GPG and it is available through the internet and in CD-ROM format. Efforts are continuously being made to get a wider range of EFs (expert meetings for data collection, literature search, etc.). Once an emission factor in the database has been identified, all information in the data record will be available to the user. This information will allow the user to establish whether or not the emission factor is applicable in the inventory under construction and, in many cases, what the uncertainties are. The online version of the EFDB is also a platform for the exchange of relevant data for greenhouse gas inventory compilers. The EFDB is open to all relevant proposals on emission factors or other parameters. To ensure that data included in the EFDB meet a set of criteria, new data proposed for the EFDB are evaluated by an Editorial Board. The EFDB website offers users the ability to propose new emission factors online, both for single data or for so-called mini-batch input (up to 20 new emission factors simultaneously). The EFDB can also accept bulk data proposals, using electronic formats agreed-upon in advance with the Technical Support Unit (TSU) of the IPCC National Greenhouse Gas Inventories Programme (IPCC-NGGIP).

3.1.2 The GHG sectors in the IPCC Guidelines

As described under 2.1.1, the Revised **1996 IPCC Guidelines** contain guidance on GHG emissions from f**ive sectors**:

- **Energy**: The preparation of a GHG emissions inventory relevant to the energy sector consists of two main sections; namely, *fuel combustion and fugitive emissions* from the production and distribution of fossil fuels. It covers all sectors of the economy that use fuels to produce heat or power (energy industries, other industries, transportation, agriculture, housing, services, etc.).
- **Industrial Processes**: Emissions resulting from *chemical reactions involved in processes* (the production of cement, some food and beverages, aluminum, etc.). They include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions from the production of mineral compounds, chemical industries and metal production. The fluorinated gases are perfluorocarbons, PFCs (e.g., CF4 and C2F6), HFCs (e.g., HFC-125 and HFC-134a), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).These industrial gases are emitted by-products and fugitive emissions from aluminium (Al) and magnesium (Mg) manufacturing processes, as well as emissions from their production and consumption.
- **Agriculture**: CH_4 emissions due to *enteric fermentation, manure management*, N_2O from *agricultural soils*, and CH4 from *wetlands and rice cultivation*.
- **Emissions or removals from LULUCF** (Land use & Land-Use Change and Forestry) represent the *change in the carbon stocked* in forestry biomass.
- **Waste**: these are mainly CH_4 emissions from *land disposal and the composting of solid organic waste*, from *waste water treatments*, *N_2O from human sewage*, CO_2 and N_2O from *solid waste incineration*, etc.

3.1.3 The methodologies

The IPCC Guidelines contain "default" methodologies for the estimation of greenhouse gas emissions and removals. Users are encouraged to go beyond these minimum default methods where possible. IPCC methods use the following concepts:

- **Good Practice**: In order to promote the development of high-quality national greenhouse gas inventories, a collection of methodological principals, actions and procedures were defined in the guidelines and collectively referred to as *good practice*. The *2006 Guidelines* retain the concept of *good practice*, including the definition introduced with *GPG2000*. This has achieved general acceptance amongst countries as the basis for inventory development and says that inventories consistent with *good practice* are those which *contain neither over- nor under-estimates so far as can be judged, and in which uncertainties are reduced as far as practicable.*
- **Tiers**: A *'tier' is a* ***level of methodological complexity***. Usually three tiers are provided. Tier 1 is the basic method, tier 2 intermediate and tier 3 most demanding in terms of complexity and data requirements. Tiers 2 and 3 are sometimes referred to as *higher tier* methods and are generally considered to be more accurate.
- **Default data**: Tier 1 methods for all categories are designed to use readily-available national or international statistics in combination with the provided default emission factors and additional parameters that are provided, and therefore should be feasible for all countries.
- **Key Categories**: The concept of *key category* is used to identify the categories that have a significant influence on a country's total inventory of greenhouse gases; A ***Key Category*** is defined as one that is prioritised within the national inventory system because its estimate has a significant influence on a country's total inventory of GHGs, in terms of absolute level, the trend, or the uncertainty in emissions and removals. Also, national circumstances may point at additional key categories (relevant even if they do not fully meet the requisites above) based on a qualitative analysis. The quantitative approach may use either tier 1 or tier 2 methodologies. The qualitative approach deals with hidden key categories and depends on expert judgment that uses qualitative criteria extracted from national circumstances (such as unpredicted growth in a sector of the economy, implying unexpectedly high emissions, etc.). Key Categories should be the priority for countries during inventory resource allocation for data collection, compilation, quality assurance/quality control and reporting. It is **good practice** to:

  Clearly document the results of the KCA in the inventory report;

  List the criteria under which each category was identified as key; e.g., level, trend or qualitative;

  Indicate the method used to undertake quantitative KCA: tier1 and/or tier 2;

  Report results using the IPCC tables.
- **Decision Trees**: Decision trees for each category help the inventory compiler navigate through the guidance and select the appropriately tiered methodology for

their circumstances based on their assessment of *key categories*. In general, it is *good practice* to use higher tier methods for *key categories*, unless the resource requirements to do so are prohibitive.

- **The uncertainty assessment** Users are encouraged to provide uncertainty ranges or other statements of confidence or quality along with the point estimates. The procedures for reporting uncertainty information are discussed in the Greenhouse Gas Inventory Reporting Instructions. An important goal of IPCC inventory guidance is to support the development of national GHG inventories that can be readily assessed in terms of quality. It is good practice to implement QA/QC and verification procedures in the development of national GHG inventories to accomplish this goal. The QA & QC roles & responsibilities of an inventory compiler:
  - Defines specific responsibilities and procedures for the QA/QC and verification activities: planning, preparation, and management;
  - QA/QC procedures may be delegated to other agencies or organisations (e.g., central statistics agency);
  - Responsible for ensuring that the QA/QC plan is developed and implemented.

It is also good practice for the inventory compiler to designate a **QA/QC coordinator**.

All this material is available in French and in English online (including software and templates) at:

http://unfccc.int/national_reports/non-annex_i_natcom/training_material/methodological_documents/items/349.php

3.2 Other information available

3.2.1 "Toolkit" for non-Annex I Parties for preparing national communications and Biennial Update Reports (BUR)"

In 2013, a very clear and succinct toolkit[4] was published by the UNFCCC Secretariat with a view to strengthening the process of reporting national communications and BURs from non-Annex I Parties.

In the past, most developing countries have often relied on consultants and external experts to assist in preparing their national communications. This has impeded archiving and institutional capacity building.

Structure of the Toolkit

1. **Introduction** - provides the context for the reporting requirements under the Convention
2. **Purpose of Institutional arrangements** - highlights the importance of the institutional arrangements in meeting the reporting requirements
3. **Building sustainable institutional arrangements** - provides the key elements and considerations that are relevant for establishing and sustaining the efficient functioning of institutional arrangements
4. **Best practices and lessons learned from the national communications process** - relevant and beneficial for the reporting process going forward
5. **Reporting** - provides an overview of what could be reported on institutional arrangements in BURs.

Source : UNFCCC Secretariat *(figure redrawn)*

[4] An electronic copy of the toolkit is available here <http://unfccc.int/2607.php>

The learning that emerges from this reporting process, the information and data gathered, and the improvement of specific capacities, are lost to the ministry and Party in question. Developing the internal capacity could help avoid reliance on external consultants and will encourage the stability of institutions and their staff. Institutional ownership is a key factor in the sustainability of national communications and in the preparation of the BUR, and could contribute to the capacity building of these institutions.

Choosing and Maintaining an Appropriate Coordinating Body

The location of the national coordinating body within the government has been a key factor and influences the effectiveness of institutional arrangements, the credibility and clout of the coordinating body and hence the extent to which the BUR is integrated into the broader climate change planning process. The location of the national coordinating body will differ from country to country. It is generally located in the ministry responsible for climate change and/or environmental issues, or within a specific organisation/agency responsible for coordinating the climate change policy.

Countries may consider using a variety of optional tools to organise and define their institutional arrangements; a series of predefined templates (originally developed by the US EPA) and adapted by the CGE to assist national teams are proposed:

Functions of Sustainable Institutional Arrangement

PLANNING	Appointing teams, identifying contributing organizations	Establishing coordination mechanisms, agreeing to approval process	Planning funding allocation and budget, etc
PREPARATION	Holding first coordination meeting, consulting stakeholders, agreeing to millestones and timelines	Overseeing schedule and milestones, holding check-in meetings	Collecting and validating any relevant data
REPORTING	Reviewing first drafts	Compiling and finalizing all information, editing and creating document, preparing for approval process and submission	
DOCUMENTING AND ARCHIVING	Establishing procedures to ensure regular and systematic documentation and archiving in order to enhance transparency and ensure sustainability of the process		
EVALUATION	Identifying lessons learned, strengths and weaknesses, opportunities for improvement		
NATIONAL CONSULTATION PROCESS	Validation of the report through consultation with national stakeholders		
APPROVAL AND SUBMISSION	Getting the report approved by relevant approving government authority and submitting it to the UNFCCC secretariat		

Source : UNFCCC Secretariat *(figure redrawn)*

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- To assess and document the strengths and weaknesses of existing institutional arrangements;
- To ensure continuity and integrity.

Stakeholder involvement:

Engaging a broad range of stakeholders is important to the reporting process.

- Given the increased frequency of submission, BUR preparation can help to establish greater continuity and institutionalisation for the report preparation process as well as the processes of collaboration and information exchange.
- It is important that clear roles and responsibilities be defined throughout the engagement.
- Identifying incentives for the continuous engagement of stakeholders is recommended since countries are increasingly engaging non-governmental organisation groups and the private sector, which provides access to information and raises awareness of reporting activities.

Reporting on institutional arrangements in Biennial Update Reports (BURs):

Developing countries are required to describe their institutional arrangements in their BURs and national communications. There is flexibility in determining the level of information to be provided. Beyond meeting reporting requirements and describing Parties' institutional arrangements in their BURs and national communications, it is also important that information and best practices be shared, including continued information-sharing on best practices in establishing institutional arrangements, such as:

- An overall description of the institutional arrangements;
- Relationship to the broader climate-change development process and other institutional arrangements related to the Convention;
- Any lessons learned or recommended practices;
- A description of any adjustments or changes made to existing or new institutional arrangements as a result of the BURs;
- Cost implications of the institutional arrangement process;
- Any capacity-building needs undertaken as part of the institutional arrangement process;
- Constraints and gaps, and related financial, technical and capacity needs, including a description of the support needed and received. 2.5 Overview of cross-cutting issues: Key Category Analysis (KCA), Uncertainty assessment, QA/QC procedures, addressing data gaps.

The toolkit concludes that:

- Robust, effective and sustainable institutional arrangements are needed to be able to respond to the enhanced reporting requirements, in both the number and frequency of reports, under the Convention;

- Most countries already have some form of institutional arrangements in place – build on and enhance them;
- Awareness and political buy-in play significant roles;

and most importantly;

- There is no **"one size fits all"**; institutional arrangements will depend on national circumstances and the respective capabilities of each country.

3.2.2 The UNFCCC 'non-Annex I Inventory Software' (NAIIS)

The UNFCCC secretariat also developed an Excel-based software programme to assist non-Annex I Parties in estimating and reporting their GHG inventories as part of their national communications. All the elements of a national GHG inventory prescribed by Decision 17/CP.8 are included; it is based on the IPCC inventory software programme, version 1.1, which used the Tier 1 methodologies for estimating GHG emissions and removals for all source categories included in the Revised 1996 IPCC Guidelines, and further complemented by the GPGs. In June 2013, the secretariat converted the current Excel-based version of the software programme (v.1.3.2)[5] into a web-based application (NAIIS) which provides greater flexibility and security for maintaining data. The main objectives of the upgrade are:

- to facilitate NAI Parties in maintaining GHG inventory systems on a continuous basis, by offering a tool for inventory team management (maintaining information), KCA, limited QA/QC, and robust archiving and to simplify and streamline the inventory management process in the country;
- to improve the user-friendliness of the tool and resolve the issues raised by Parties using version 1.3.2 of the Excel-based software programme;
- to enable the simultaneous entry of data in different sectors and locations and facilitate the use of multi-year GHG inventories;
- to remove dependency and compatibility issues with different operating systems and languages and ensure greater flexibility and security for maintaining data;
- to keep data more easily adaptable to changes in technology.

The authorised users (with password[6]) of the application are the members of the national team(s) of non-Annex I Parties involved in the preparation of their national GHG inventories, and each user is assigned a role. There are three types of access rights (roles) to the NAIIS application:

- **The National Focal Point (NFP)** will be responsible for identifying the members of the team and is the only one who has the right to approve the submission of any GHG inventory. NFPs will have the option to grant access rights to the 'Project Manager' and 'Sectoral Experts' for their country;

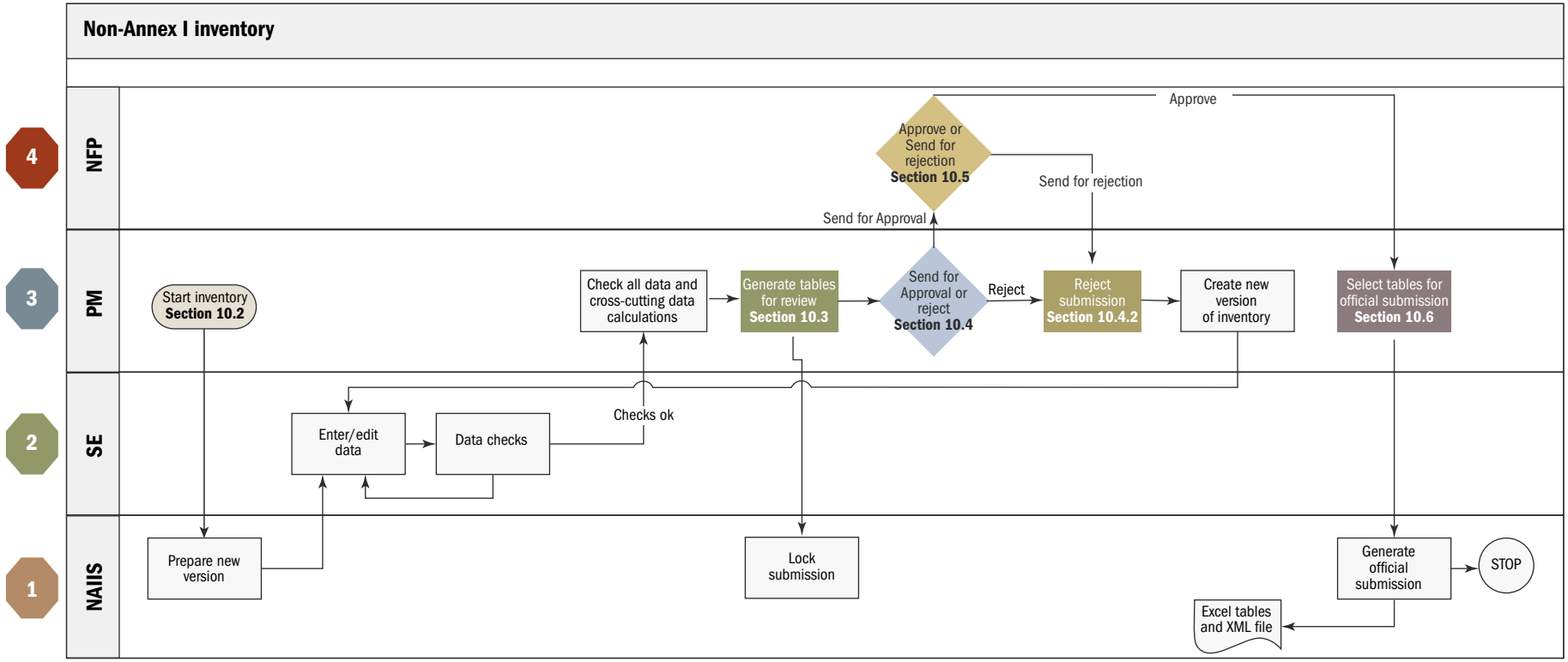
[5] http://unfccc.int/national_reports/non-annex_i_natcom/training_material/methodological_documents/items/349.php

[6] Form to complete to obtain access: http://unfccc.int/national_reports/non-annex_i_national_communications/non-annex_i_inventory_software/items/7628txt.php

- **The Project Manager (PM)** will have the right to enter/edit data in all sectors, as well as to generate an official submission to the UNFCCC, and grant access rights to the 'Sectoral Experts' for their country;
- **Sectoral Experts (SE)** will have the right to enter/edit data in their respective sector(s).

See the graph below, which displays the workflow for using the NAIIS web application and the level of access (from 2 to 4) for the 3 types of users – SEs, PMs and NFPs.

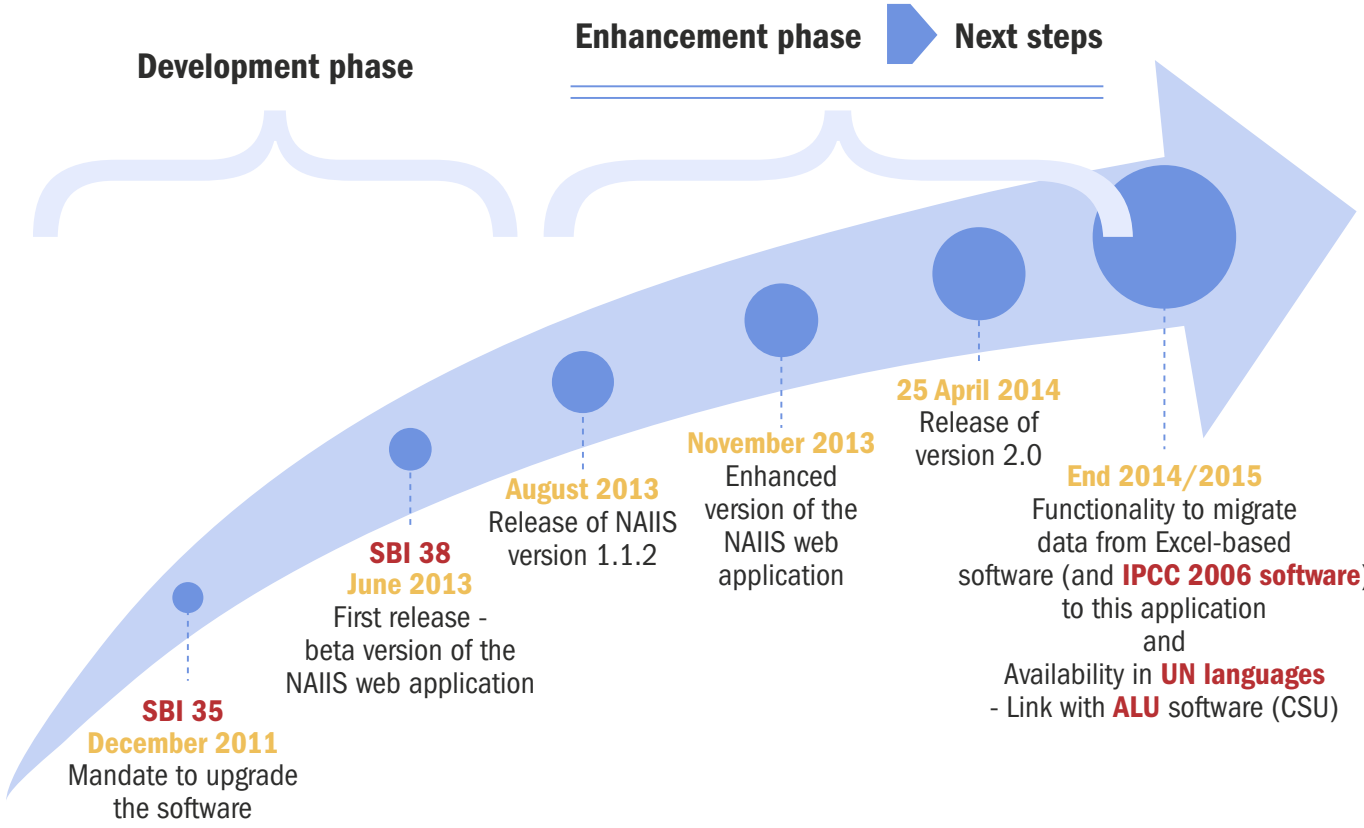
The Workflow for Using the Application



Source : UNFCCC Secretariat *(figure redrawn)*

- Since its first release in June 2013: approximately **42 non-Annex I Parties** have been granted access to the NAIIS for the development of their national GHG inventories.
- In June 2014, **acknowledging the usefulness** of the NAIIS, the Parties requested that the secretariat make the software available to non-Annex I Parties in other **UN languages by June 2015**.
- The English version of the NAIIS (version 2.0.0) will be available for user testing in UN languages in the coming months.
- Three regional user-training workshops (i) Asia; Pacific & Eastern Europe – ii) Africa – iii) Latin America & the Caribbean) will be organised in 2015/early 2016.

The road to a fully functional NAIIS web application



Source: Graph presented at the June 2014 ClimaSouth Workshop by the UNFCCC secretariat *(figure redrawn)*

4. KEY ISSUES WITH INVENTORY DEVELOPMENT IN NON-ANNEX I COUNTRIES

4.1 Data gaps

Data gaps may occur because 1) a new emission factor (EF) or method is applied for which historical data are not available, 2) new activity data become available, but not for historical years, 3) there has been a change in how the EF is developed or activity data are collected, or activity data cease to be available, 4) a new source or sink category is added to the inventory, for which historical data are not available and 5) errors are identified in historical data or calculations that cannot easily be corrected. These problems can especially be a challenge for agriculture and LULUCF sectors.

Splicing and gap-filling approaches, combining or joining more than one method or data series to form a complete time series, help minimise potential inconsistencies. It is good practice to perform the splicing using more than one technique before making a final decision and to document why a particular method was chosen. A summary of the splicing and gap-filling, outlining the main applicability requirements, is presented in the following table.

- **In the energy sector**, problems can occur concerning how to distinguish between energy and non-energy use

Approach	Applicability	Notes
Overlap	Data which requires that both the previously used and new methods be applied must be available for at least one year, preferably more.	• Most reliable when the overlap between two or more sets of annual estimates can be assessed. • If the trends observed using the previously used and new methods are inconsistent, this approach is not good practice.
Surrogate Data	Emission factors, activity data or other estimation parameters used in the new method are strongly correlated with other well-known and more readily-available indicative data.	• Multiple indicative data sets (singly or in combination) should be tested in order to determine the most strongly correlated. • Should not be done for long periods.
Interpolation	Data needed for recalculation using the new method are available for intermittent years during the time series.	• Estimates can be linearly interpolated for the periods when the new method cannot be applied. • The method is not applicable in the case of large annual fluctuations.
Extrapolate data	Data for the new method are not collected annually and are not available at the beginning or end of the time series.	• Most reliable if the trend over time is constant. • Should not be used if the trend is changing (in this case, the surrogate method may be more appropriate). • Should not be done for long periods.
Other Techniques	The standard alternatives are not valid when technical conditions are changing throughout the time series (e.g., due to the introduction of mitigation technology).	• Document customised approaches thoroughly. • Compare results with standard techniques.

of feedstocks in the Industrial Processes sector in their national GHG inventories. Non-energy-related physical and chemical processes in production activities leading to the transformation of raw materials and emissions of greenhouse gases (e.g., decomposition reactions) are considered as Non-Energy Use of feedstocks (NEU). It also includes feedstock in process reactions or stage processes that not only release heat but also act predominantly as reducing agents (e.g. metallurgical coke in the smelting of ores in metal production). Meanwhile the energy/heat required for initiating and/or sustaining chemical reactions kinetically and thermodynamically is accounted for under the energy sector.

- **In the industrial processes sector**, a major obstacle has been noted for advancing to tiers 2 and 3: a lack of knowledge about sources for processes and technical data acquisition. While data should be free of charge or inexpensive to obtain, there is an absence of legal instruments for regulating data exchange among industrial firms and research and statistical institutions. In addition, there is a lack of data consistency from different resources. Clarification requests and answers addressed the question of how to improve the process of preparing GHG inventories in IP by increasing the number of national experts benefitting from in-depth, sectoral, hands-on training (upon request by beneficiary countries).
- **In the waste sector in particular**, countries encounter problems largely related to the absence of data, the lack of access to data, a lack of processes to validate the data, as well as high uncertainty, such as:
  - Lack of data on generated solid waste and composition;
  - Emission Factor Default data not suitable for national circumstances;
  - Lack of time-series data for waste generation;
  - Lack of availability of disaggregated data;
  - Low reliability and high uncertainty of data;
  - Some common practices in the ENP South Countries, such as the use of open dumps or open incineration at waste disposal sites (recyclables, wood and paper, even organic waste informally disposed of) are not reflected properly either in the IPCC 1996 GL or in the GPG 2000.
- **In the LULUCF sector**, the use of time series of spatially explicit land use and cover datasets is required if tier 3 is aimed for in activity data. A common source of satellite datasets is the Global Land Cover Facility18[7] where Landsat imagery with a pixel resolution of up to 30m x times 30m can be downloaded at no cost. The land classification should be consistent with national land cover categories and forest definitions. The sound use of Geographical Information System (GIS) software such as ArcGIS is required to conduct the land cover change analysis and distinguish between areas in a land category remaining in this land category and land cover changes. The 2003 IPCC GPG, p.2.18ff, provides guidance on the development of land-use databases and tools for data collection. Terrestrial National Forest Inventories (NFI) are state- of- the- art for the assessment and monitoring of biomass stocks at Tier 2 and should follow good practices such as indicated in FAO (2004)19, Michalak et al. (2002)20 and Geir-Harald Strand et al. (2013).

[7] http://glcf.umd.edu/data/landsat/ , http://landsat.usgs.gov/landsat8.php

4.2 Institutional constraints

Three important types of constraints have been identified in the development of GHG inventories by country representatives attending the ClimaSouth seminar: institutional, technical and awareness-related, namely with:

- the high turnover of staff working on GHG inventories, the lack of legal frameworks that would aid data collection and the difficulty of identifying data providers in ministries;
- the weaknesses in data management and archiving; undeveloped capacities that lead to a dearth of reliable data in appropriate formats; and the lack of effective QA/QC mechanisms;
- the lack of awareness on the part off policy makers and data providers; as a result, ing to the fact that the implications of the various parts of the NCs fail to be understood and do not translate to action.

5.CONCLUSIONS AND RECOMMENDATIONS

GHG modelling for developing countries is now needed and even more relevant after Parties to the UNFCCC agreed in 2013 to initiate or intensify the preparation of their INDCs. The first step intowards progressing towardson this objective is a learning phase on how to assess current, as well as and likely future GHG emissions, including the emissions reductions and costs that resulting from proposed mitigation policies and measures. Creating assessments that are sufficiently credible to pass muster with both national decision- makers and the international community is no easy task. Communication and exchange of knowledge at both regional and international levels should be enhanced and supported, especially with respectference to the experiences and best practices concerning the KCA and data gaps. This is particularly true with respect toon the choice of data, data sources, and emission factors among the countries of the region. A; specific focus on data and statistics collection, sensitivity analysis and the identification of data gaps and opportunities for improving national inventory systems, including the exchange of experiences, is also needed. To this endaim, a **close cooperation between climate change experts and sector experts** (particularly those directly engaged in the inventory preparation process) at the national level needs to be ensured. A **comprehensive and well-targeted training- needs assessment** should be carried out as a starting point to define **sector-training seminars** at the country level, with the aim of:

- providing further hands-on training sessions on the use of the IPCC Inventory Software, and;
- exploring the use of the web- based UNFCCC software programme (NAIIS).

Information and examples on incorporatingtion of adaptation measures and their impacts on the emission rates at the country level should be provided to promote their inclusion and their effects onto the inventory. AnThe analysis and the presentation of the reporting requirements, including their scheduling,e needs to be undertakencarried out (highlighting the specific aspects of the Biennial Update Reports and National Communications) to fully exploit the mechanisms' opportunities and foster the establishment of a comprehensive and robust MRV system at both national and regional levels. This will promote the exchange of experiences and information between the countries and enhance the capacities for thean efficient management of a GHG-Monitoring and Reporting system.

National training on inventory planning, preparation and management offers an important opportunity to raise awareness on how to coordinate teams from different institutions, since some of the trainees will be involved in the management of GHG inventories rather than the direct inventory itself. This also includes training on how to set up

expert judgment teams; it should be regarded as a starting point for a number of additional training sessionss, which need to be tailor-made for the Mediterranean Sea countries of the ENP ClimaSouth project.; Ffuture work should mainly be aimed at:

- DevelopElaborating detailed country-specific recommendations for preparing emission datasets by applying eligible methodologies, and sources of improved datasets to advance to tTier 2 and 3 emission estimatestions;
- Providing hands-on training sessions ion the use of the IPCC Inventory Software programme, which covers all country-sector specific categories comprehensively;
- Incorporating of adaptation measures into the national inventories and assessingment of their impact on emission levels;
- Providing country- specific training on BUR contents, scheduling, and benchmarking with national Communications.

Recommendations from trainees of the IP sector group

- The future work of trainees will dependrests upon the acquisition of funds for further training and the implementation of technical projects to advance to higher tTiers in the IP sector in national GHG inventories. A good opportunity in thisat regard could arise through good coordination betweenamong the UNFCCC secretariat and the on-going projects/initiatives such as BUR preparation projects funded by the Global Environment Facility (GEF) and the Low- Emission Capacity Building (LECB) programme funded by the EU & Australia.

Recommendations from trainees of the Waste sector group

- Technical assistance on statistics and categorisation issues is required to build a solid baseline of data and coherent waste categorisation.. The ENP South Countries have to initiate dedicated inventory programmes and provide infrastructural and technical support for sustaining theed inventory process. This may involve organising periodic inventories and, developing ment of nationally relevant emission factors. It is likely that many countries may not have the resources needed to initiate these research effortses. Countries may obtain data from other environmental or social studies.
- The provision of default values suitable to the ENP South Countries or a simplified, methodology less data- intensive methodology, will enhance both completeness and comparability. Some ENP South Countries have prepared their own methodologies and those experiences may be shared.

Recommendations from the Agriculture sector group

- Conducting a prior evaluation on the level of the technical level of participants in agriculturale GHG inventories and any specific issues they would like to seebe

included in the workshop and requesting participants to bring a set of national data, if available, in order to use it in the hands-on-session.

- Conducting follow up mini- workshops on demand for the agriculture sector. The focus would be more on problem- solving and case studies pertaining to each sub-region:; the Northern African (Morocco- Tunisia, Algeria, Libya) and Eastern Mediterranean (Egypt, Jordan, Israel, Palestine, Lebanon, Syria) regions.
- Expand the training in the agricultureal sector to capacity- building in the area of mitigation. There is a serious lack of information in this region on adequate mitigation options that are currently available in the agricultural sector.

Recommendations from the LULUCF sector group

The assignment of specialised external experts is considered the most effective way to improve the LULUCF section in the national GHG inventory of the countries of participants' countries step-wise. However, the close cooperation with the focal point and local sector experts needs to be ensured to provide parallel capacity building in parallel. Theis training provided was a starting point; additional training sessionss need to be tailor-made for the Mediterranean Sea countries. A comprehensive and well-targeted training needs assessment would make it possible to design allow designing a LULUCF- sector training seminar for 3 to 5 days with the following objectives:

- To developelaborate detailed country-specific recommendations for preparing LULUCF- sector datasets by applying eligible methodologies, and sources of improved datasets to advance to tTier 2 and 3 emission/removal estimateions, and
- To provide hands-on training sessions ion the use of the IPCC Inventory Software programme, which covers all country-specific land categories comprehensively.

Recommendations from trainees regarding the web-based UNFCCC software programme (NAIIS)

- The UNFCCC secretariat should facilitate the training of the national experts (in addition to those who are directly involved in GHG inventoriesy), to provide access to the NAIIS without affecting the confidentiality of the national GHG inventory process (e.g., a simulation package, e…etc.).
- The ClimaSsouth project could support funding to allow additional participants to attend the upforthcoming training workshops on web- based UNFCCC software.
- IPCC tools were used because **the NAIIS is not accessible for training purposes**. The bottleneck with the NAIIS is that the system is built for national data, which are entirely protected. This issue could be solved by creating a "dummyfake" country for training purposes. Under a request for official training needs, the UNFCCC could open up , under request for official training needs, spaces to use the real web-based NAIIS tool (e.g., an hypothetical country called "Training Land" name country for this training session), to be populated withof data by trainers for a realistic hands-on experience.

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ANNEX 1

Practical experience ion Key Category Analysis (KCA) and uncertainty assessment in Italy, Montenegro and Lebanon

The GHG Inventories of Italy, Montenegro and Lebanon offer case studies about the sharing of practical experiences ion Key Ccategoryies Analyseis (KCAs) and uncertainty assessment to demonstrate how Countries use the GHG inventories to i) help understanding the magnitude of the climate- change problem; ii)support the development of policy, and iii) as well as the report and monitor progress towards targets set by the international agreements to limit climate change and the related emission limits/targets.

Italy (Annex I country)

A **key category analysis** of the Italian inventory was carried out according to Approaches 1 and 2 described in the 2006 IPCC Guidelines (IPCC, 2006). These guidelines provide a harmonised method to deal with both sources and removals; some inconsistencies between the previous IPCC guidelines and Good on the Italian greenhouse gas inventory with respect toto establishing the uncertainties inof different emission categories were corrected, such as the uncertainty of total emissions for the base year and the latest inventory year, and the so-called 'trend uncertainty'. National emissions are disaggregated, as far as possible, into the categories proposed in the guidelines; other categories are added to reflect specific national circumstances.

Both level and trend analysis are applied to the base year and to the last submitted inventory, including and excluding the LULUCF sector. In summary, the overall uncertainty in the national total emissions is equal to 3.4% for the year 2011; the uncertainty in the trend between 1990 and 2011 is equal to 2.6%. When considering the LULUCF sector in the analysis, the uncertainty in total GWP emissions and removals increases to 5.1% for the year 2011 and to 4.2% in the trend between 1990 and 2011. The uncertainty figures are used to carry out a key category analysis on the inventory, applying the IPCC Approach 2, whichthat helps prioritiseing activities to improve inventory quality and to reduce overall uncertainty. Key categories are categories which should receive special consideration in terms of methodological aspects and quality assurance and quality control verification. For categories with high uncertainty, generally, further improvements are planned whenever sectoral studies can be carried out. For example, last year, the prioritizsation of improvements related to the results of uncertainty analysis led to a revision of the net carbon stock changes and further activities are planned for the LULUCF sector to improve the accuracy and reduce the overall uncertainty. The category analysis applied to the inventory (without considering the LULUCF sector) lead to the identification of 27 key categories in total, both at level and trend. When considering emissions and removals from the LULUCF sector, 32 key categories were identified.

ISPRA developelaborated an inventory QA/QC procedures manualmanual, which: describes specific QC procedures, facilitates the overall QA procedures to be conducted, as

far as possible, on the entire inventory and establishes quality objectives,; quality- control checks and quality- assurance procedures applied both to the national inventory as a whole and at the sectoral level. Source- specific quality- control procedures are applied on a case- by- case basis, focusing on key categories and on categories where significant methodologyical and data revisions have taken place or where there are new sources.

Checklists are compiled annually by the inventory experts and collected by the QA/QC coordinator. General QC procedures include data and documentation gathering (separate project archive for each source category). All the information used for the inventory compilation is traceable back to its source. Quality assurance procedures are applied toregard some verification activities of the overall inventory as a whole and to others at the sectoral level. RRe-examinations are ensured by institutions, organisations, the CLRTAP, international agreements and, independent reviewers. Quantitative estimates of the uncertainties for the Italian GHGs inventory are calculated using a Tier 1 approach, which provides a calculation based on the error propagation equations: if the LULUCF sector is included in theto national figures, the uncertainty according to Approach 1 is equal to 4.9% for the year 2012, whereas the uncertainty for the trend is estimated to be 3.8%. A Tier 2 approach, corresponding to the application of a Monte Carlo analysis[8], has been applied to specific categories of the inventory but the results show that, with the information available at present, applying methods higher than the Tier 1 does not make a significant difference in the figures. It should be noted that different levels of uncertainty pertain to different pollutants. Estimates of the main pollutants are generally of a high level, but pParticulates mMatters emissions, especially those of small particle sizes, as well as, heavy metal and POP (Persistent organic pollutant) estimates, are more uncertain. For this reason, even though not quantified in terms of uncertainty, improvements are planned, especially for the specified pollutants. In terms of completeness, the iInventory covers all major sources and& main pollutants, included in the EMEP/CORINAIR guidelines; the only cases in which the allocation of emissions differs from the guidelines provided is where no sufficient data is available to split the information.

Montenegro (non-Annex I country)

The National Circumstances showed a country with a total population of less than one million inhabitants and a decreasing natural growth rate. The average annual growth rate for primary energy consumption has increased by 3% since 1997. In 2008, it increased 3.1%, with solid and liquid fuels used almost exclusively. In 2011, primary energy demand decreased by 2% compared to 2010. In this context, 14 Key Categories make up 95.3% of the total national emissions of GHGs. Benchmarking the two cases and the guidelines, notwithstanding the relatively basic structure of the system, the inventory preparation highlighted an obvious lack of data for several categories ("use of solvents"; "energy"- emissions from international aviation and maritime bunkers and from aircraft; "industrial processes" - asphalt production and consumption of halogenated hydrocarbons and sulphur hexafluoride; "land use change and forestry"; "waste") and the unavailability of input data needed to determine the indirect emissions of greenhouse gases (tier 1 methods). At the policy level, sectoral development plans

[8] Problem-solving technique used to approximate the probability of certain outcomes by running multiple trial runs, called simulations, using random variables.

and strategies generally do not consider the issue of climate change and therefore define no measures to reduce emissions. In addition, there are limitations to the level of accuracy of GHG emission projections, particularly in agriculture and forestry, and to a lesser extent in the waste/wastewater sectors. Other hindering factors include : a lack of experience, insufficient capacity, inadequate collaboration and limited information exchange among institutions, low levels of knowledge, a lack of funding for research programmes. The insufficient availability of financial resources in general represents a significant constraint and affects technical and scientific research on vulnerability to climate change and adaptation in all sectors. The sessions partially revealed the training needs of participants who are interested, but not necessarily in charge of compiling the sectoral assessment in their national GHG inventory.

Lebanon (non Annex I country)

As a non-Annex I party, Lebanon prepared and submitted its Initial National Communication (INC) in 1999 with the reporting year 1994 as the baseline for its national GHG inventory covering the period 1994-2000 using 1996 IPCC guidelines; it submitted the 2nd national communication in 2011 with the inventory year of 2000, covering the period 2000-2004 using 1996 IPCC guidelines and the GPG2000. The TNC occurs in reporting year 2005 covering the period 2005-2012 and using 1996 IPCC guidelines and the GPG2000. This case study focuses on the GHG Inventory for the agricultural sector. The inventory for the agricultural sector (2005-2012) includes trend analyses for 1994-2012. The following Improvements are reported:

- Imported beef was included in the activity data for non-dairy cattle and adjusted to 30 days alive;
- The broiler population was adjusted to 60 days alive;
- Emission factors for methane emissions from enteric fermentation and manure management were revised to be more appropriate for Lebanon;
- Manure management systems were surveyed;
- Included crop-specific fraction of crop residues removed from fields.

Description of Gaps and Constraints	Proposed Measures for Improvement
Activity Data Organisation • Data scattered across many agencies. • Lack of uniformity in data between different official resources.	• Centralisation of data management. • Coordination of the MOA statistics division with public, private, and international agencies. • Establishment of a scientific advisory team to facilitate data coordination and ensure data uniformity.
Activity Data Availability • Lack of data on fertiliser consumption, manure management systems (MMS), and utilisation of crop residues in different regions. • Lack of data for refining inventory to higher-tier levels.	• Data depths to be improved; some require data surveys. • Monitoring system is needed for manure management and crop residue utilisation. • Research is needed to refine data for higher-tier levels.
Activity Data Accessibility • Lack of institutional arrangements for data-sharing. • Delays in accessing and compiling data.	• Establish protocols and effective networking with data providers. • Involve industry and monitoring institutions.
Data on Emission Factors • Inadequate data for country-specific emission factors.	• Conduct research to develop measurements for local EFs.Should not be done for long periods.
Technical and Institutional Capacity Needs	• Provide training for the relevant institutions involved in planning, preparing, and analysing GHG inventories. • Conduct workshops on data management for the agricultural sector. • Provide training in the new inventory and mitigation software programmes.

ANNEX 2

Documentation

- www.unfccc.int/national communications
- www.ipcc.int
- http://www.ipcc-nggip.iges.or.jp/software/
- Tool kit for NAI: http://unfccc.int/2607.php
- Updated CGE Training Materials on National GHG Inventories Building Sustainable National GHG Inventory Management Systems, http://unfccc.int/national_reports/nonannex_i_natcom/training_material/methodological_documents/items/349.php
- US EPA "National System Templates: Building Sustainable National Inventory Management Systems" http://www.epa.gov/climatechange/Downloads/EPAactivities/Complete-TemplateWorkbook.doc
- NCSP/UNDP "Lessons Learned and Experiences from the Preparation of National Communications from non-Annex I Parties to the UNFCCC" http://ncsp.undp.org/news/lessons-learned-and-experiences-preparation-nationalcommunications-non-annex-i-countries
- Revised 1996 IPCC Guidelines;
- IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC 2000), and
- IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003);
- GPG-2000;
- Climate Change 2013: The Physical Science Basis. WGI contribution to the IPPC AR5 (Thomas Stocker & Qin Dahe, 259 Authors from 39 Countries, WGI Technical Support Unit Team;
- Conclusions of the IPCC Working Group I Fifth Assessment Report, R. K. Pachauri, 11/11/2013 Warsaw, Poland;
- Highlights of the New IPCC Report, Gian-Kasper Plattner, Head IPCC WGI TSU, 259 Authors from 39 Countries, WGI Co-Chairs and TSU Team;
- NAIIS Web Application (Release version 1.1.3) User Manual (As of 10 February 2014);
- Italy's 6th National Communication to the UNFCCC;
- Montenegro 's 1st National Communication to the UNFCCC;
- Data management systems for national greenhouse gas inventories: Insight from ten countries, World Resources Institute (Working paper, 2015).


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