

IPCC Software for 2006 IPCC Guidelines – Phase II

Invitation to Tender

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1 Introduction

This document provides the general design and specifications for the Phase II development of the IPCC software for the IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Phase I of this project has already produced software that implements the guidance for the Energy sector. Phase II will implement the guidance for the remaining sectors and in addition will also implement a number of additional features. The IPCC task Force on Inventories is considering a Phase III and this, if implemented, would add a range of features such as multi-language support, additional Quality Control, more reporting and graphing options and additional input/output features.

Phase II will provide software that completely implements ALL of the IPCC 2006 Guidelines. Thus, this software will be able to be used to compile complete inventories. It will have a minimal set of Quality Control features but will include range and completeness checks, Key Category analysis and Uncertainty analysis.

1.1 Phase I

Phase I of the software has been written by SPIRIT a.s., Bratislava, Slovak Republic under contract to the IPCC. This software is a demonstration version covering only the Energy Sector (without the reference approach). The specification for this phase I software was provided in:

1. The software requirements document provided by the Technical Support Unit (TSU) of the IPCC's Task Force on Inventories.
2. The tender received from the successful contractor, SPIRIT a.s.
3. The clarifications issues by the TSU
4. The detailed software design written by SPIRIT a.s.

A panel of interested users reviewed this preliminary version of this software. Following modification the software a review meeting was held in Geneva 15-17 April 2008. This meeting identified issues to be addressed in Phase I and agreed that, following the implementation of the issues, work should commence on phase II.

2 Specific Details for Phase II

2.1 IPPU Sector

IPPU Sector module can be developed in a similar way to that for Energy Sector module. It should be noted that there are three spreadsheet calculation sheets for F-gases (Category 2.F.) that were developed by the 2006 GLs authors. These models should become part of the software.

2.2 AFOLU Sector

AFOLU categories can be considered in two groups (from a software development perspective):

1. Categories that depend on a disaggregated land area classification e.g. Biomass,

DOM, Soils and Biomass Burning

2. Categories that depend on nationally aggregated data, e.g. N₂O from soils; Liming; Urea Application; Livestock and manure management; and Rice

This will be reflected in the software. The software will follow the worksheets in the guidelines and implement Tier 1 methods. These can be filled directly by hand either by entering data, defaults of national factors. (These could be extended in some cases in a potential phase 3 e.g. DOM in forests remaining forests where the Tier 1 default is zero.)

For stock change categories (3B) where there is no Tier 1 worksheet (as the default is zero change) we should have a “worksheet” for the entry of data calculated elsewhere, in order to extend the flexibility of the software in line with the text of the guidelines.

For the land use categories 3B, entering land areas will be a problem. The approach proposed is given in section 2.2.1. The users name each land use class tin their country (each is a subclass of one of the IPCC classes: Forest Land, Grassland, Crop Land, Wetlands, Settlements and Other Land.). For each of these land classes the user select one of number of ecosystem types and a number of other parameters that defines that land class (These parameters are discussed in Annex A). This enables the software to present a manageable list of defaults for the use to select. The use must either select a value from the defaults (or enter their own value) for all of the parameters needed to estimate that land type. This effectively defines each land type.

The software can then construct the land use change matrix that can be filled in for either Approach 1 or 2 by the user. The software then fills in most of the worksheets needed and estimates the emissions and removals.

Finally, the user will need to complete worksheets relating to sectors 3C to complete the land use and land use change emissions.

Worksheets for 3A – Livestock and an interface to the HWP spreadsheet will also be needed.

2.2.1 Possible Approach for AFOLU stock-change sectors (3B)

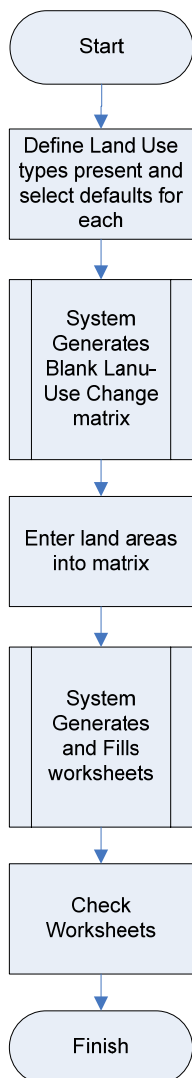


Figure 1

There are a number of steps needed to estimate emissions and removals from this sector. While some can be automated, there is a significant data entry requirement for users. This software will implement the methods and worksheets in the 2006 IPCC Guidelines; it will not help on assessing or determining the areas of each land user.

The software implements the IPCC methods following a number of principals:

- It implements TIER 1 methods (or Tier 2 where this is the tier 1 method using national data).
- Defaults from the 2006 Guidelines for each land use type will be available to the user – or they can be overwritten by national information.
- The software will deal with Approaches 1 and 2 for representing land areas.

The software assumes the user will have collected data on land use areas, at two points in time, according to the IPCC Guidelines. These specify that all land should be:

1. Divided into “*managed*” and “*unmanaged*” land. Emissions are only estimated for changes on unmanaged land IF they are followed by a conversion to a different land use.
2. Separated into six “land use” categories. These are: *Forest Land*, *Cropland*, *Grassland*, *Wetland*, *Settlements* and *Other Land*. Each of these should be stratified (sub-divided) into areas of similar characteristics as far as the available data allows. These sub-categories are not specified by the IPCC guidelines but should be applied consistently over time.

Therefore the proposed approach in the software is to firstly define these sub-categories for a specific country and select the parameter values to be used for each (selected from defaults or entered directly by the user). Secondly the land areas need to be entered. These can be according to approach 1 or 2 from the IPCC guidelines.

Approach 1: where only the total area of each land use category and sub-category is entered at the beginning and end of the time period. The areas of specific transitions between land use sub-categories are not needed.

Approach 2: where the areas of each land use are entered as well as the areas of transition between each sub-category. This forms a matrix of data.

The third step is for the software to create the necessary worksheets and fill them in the required data. The user can then check this.

The software follows a number of logical steps (figures 1 and 2):

- 1) The user defines the land use types in their country. Each is given a unique (arbitrary) name and the IPCC land use class, ecological zone and soil type characteristics are specified (all from menus)(Figure 2). Then the user will select additional values from menus which differ according to the IPCC land use class (there are no additional parameter for Settlements and Other Land) (Figure 3)

The aim of this step is to provide the software sufficient information to limit the possible default values to a few choices. Then the software will present these values and the users can select from these or overwrite them with their own data. These default values are all contained in the 2006 IPCC Guidelines.

- 2) This is repeated until all land is covered (including unmanaged land¹)
- 3) The user specifies approach 1 or 2².
- 4) The software generates the land-use table or matrix needed for either approach (Table 1).
- 5) The user enters the area of each land use (and land use conversions for approach 2) into the table.
- 6) The software generates all the required spreadsheets and pre-fills them with the land areas and default factors.
- 7) The worksheets can than be reviewed by the user.

¹ Unmanaged Land is needed to ensure complete coverage of a country. All of a countries area should be entered. However, no emissions or removals are estimated form unmanaged land unless a disturbance (natural or anthropogenic) results in a land use change.

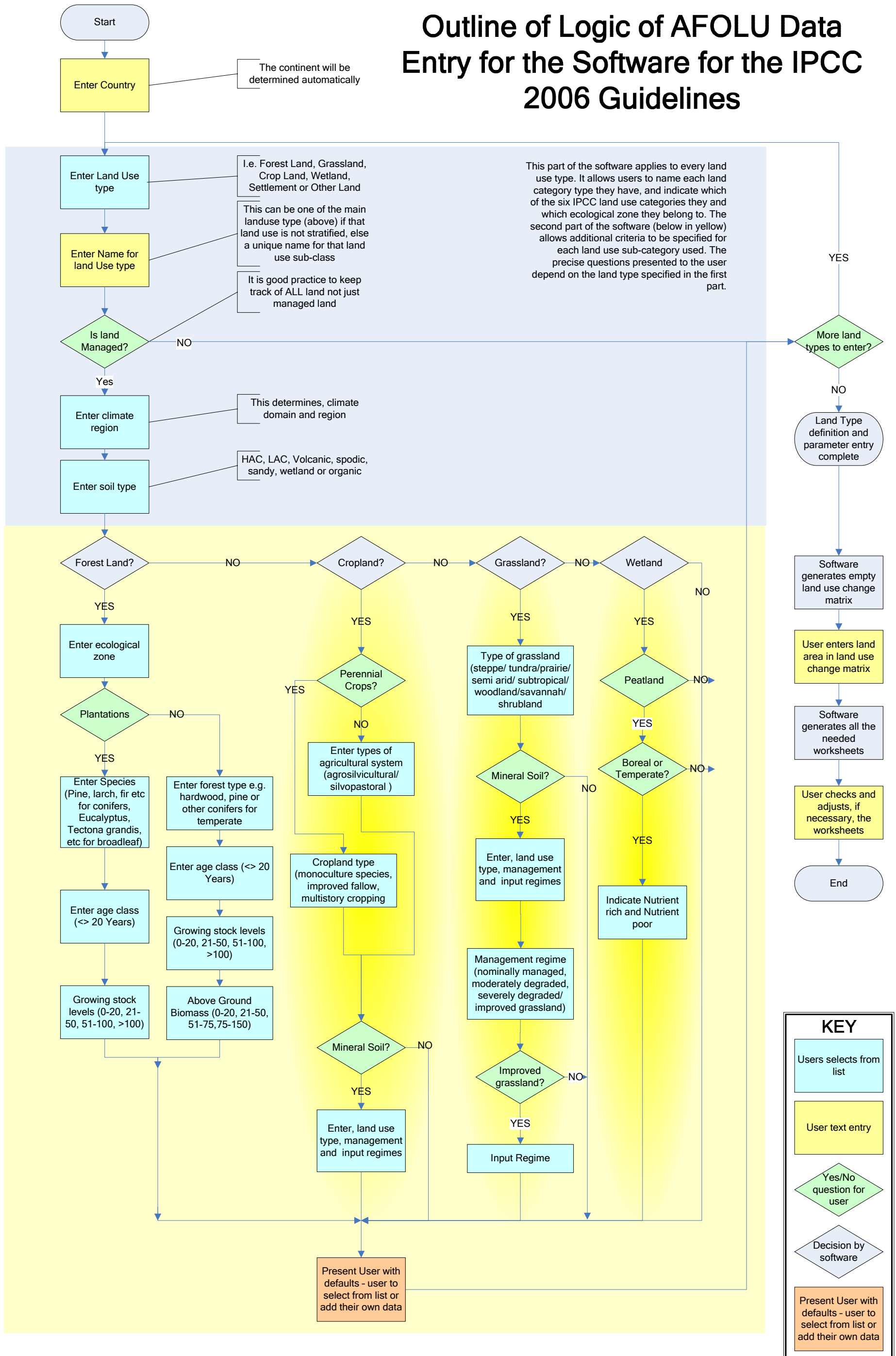
²I am not clear if this is needed. If the approach 2 matrix is created and the users want approach 1 then all they need to fill-in is the totals row/column, see Table 1.

Initial / Final		Forest Land			Grassland			Cropland	Wetland			Settlement	Otherland	Final Area
		Unmanaged	Broadleaf	Plantation	Unmanaged	Unimproved	Improved	All	Unmanaged	Peatland	Reservoir	All	Unmanaged	
Forest Land	Unmanaged	10												10
	Broadleaf		5											5
	Plantation	1	2	5		1								9
Grassland	Unmanaged				2									2
	Unimproved				1	6			1					8
	Improved						5							5
Cropland	All				1		21							22
Wetland	Unmanaged								1					1
	Peatland								1	6				7
	Reservoir									0.5				0.5
Settlement	All										3			3
Otherland	Unmanaged											1		1
Initial Area		11	7	5	4	7	5	21	2	7	0.5	3	1	73.5
Net Change		-1	-2	4	-2	1	0	1	-1	0	0.0	0	0	0

Table 1 Example of Land Use Change Matrix. The software generates the land use categories (white cells at top and left) from information entered in previous stages. For Approach 2 all the green cells should be used and the yellow cell filled in by the software. For Approach 1 the yellow cells are used. The orange cells can be calculated by the software as a QC check.

Figure 2 Defining Land Uses

Outline of Logic of AFOLU Data Entry for the Software for the IPCC 2006 Guidelines



The form consists of the following fields and parameters:

- Country: XXXXXXXXXX (User Entered text field to identify forest type)
- Continent: YYYYYYY (Software fills in form Country Name)
- Forest type name: Some Forest or other (Country Name Inherited from First Sheet)
- Continent Type/Age Class: Insular ≤20 y
- Ecosystem Type: Temperate mountain systems (User selects from drop down list)
- Plantation: Yes
- Forest type: firs and spruces (User selects from drop down list)
- Growing Stock Level (m3): 21-40
- Carbon fraction of aboveground forest biomass
- Ratio of below-ground biomass to above-ground biomass (R)
- Default biomass conversion and expansion factors (BCEF)
- Emission factors for drained organic soils in managed forests
- Above-ground biomass in forests (User Selects from Drop Down Lists or enters own data. These become available after fields above are filled in and a selection of all the available data is presented for that forest type.)

Figure 3 Example land sub-class entry screen. There will be one for each of the 5 land use classes each with appropriate parameters. This does not show the format or layout but indicates functionality. The software developer will design the precise layout to increase usability which should be consistent with the rest of the software.

2.3 WASTE

Waste Sector module can be developed in a similar way to that for Energy Sector module. It should be noted there is a First-Order Decay (FOD) model that was developed by the 2006 GLs authors. This model should become part of the software.

2.4 OTHER

Only a data entry sheet is needed here.

2.5 Other Features for Phase II

A number of general features are also needed in Phase II.

- Reference Approach will be implemented in phase 2. The menu option for this should be under Quality Control not Worksheets.
- Time series. Currently users can only see one year at a time. They need to see time series. The software will present tables of Activity data x Year and Emission factor x Year. These should be editable as it will be a way of checking and correcting numerical errors. Users should also be able to bulk import time series data – both activity data and emission factors.

- When importing data the software will either:
 - Replace existing data for that sector
 - Add data as additional row with new data so the final inventory is the sum of the import and existing data. Identifiers on the imported records are needed – use filename in comments field.
- Currently, only XML import is available. Bulk upload of data in other, simpler, formats (xls and/or csv) is required. This needs to be able to import time series as well as single year data.
- Export to spreadsheets and import from spreadsheets desirable.
- Time series analysis tools: graphs, outlier detection
- Display value of similar parameters in different sectors for QC by users.
 - Biomass burnt (in Energy & AFOLU sector)
 - Waste as energy (in Energy & waste sector)
 - Methane recovery from waste (in Energy & waste sector)
 - Woody waste and HWP (Waste and AFOLU)
 - Natural gas: combustion and fugitives (Energy)
 - Non energy use of fuels, (Energy & IPPU) particularly:
 - Iron & Steel
 - Ammonia

3 Maintenance

One output of phase 1 was a maintenance plan for the software. Work on phase II should refine this plan in the light of software developments.

4 Training and Documentation

In order to assist users of the software some training will be needed. To aid this process the software developers will need to develop:

- A software documentation manual.
- A training manual
- Assist TSU in producing demonstration datasets
- Develop ideas for the help system

5 Contractual issues

5.1 Timing

Following signing of the contract:

- **Month 7:** A preliminary version (“2.A”) is available for distribution to selected users for review. This version should implement all the sectors. Comments should be received within one month.
- **Month 9:** A revised version (“2.B”) is available. This should address all the comments and should implement all the sectors and required features.
- **Month 10;** A review meeting will be held to discuss the software and the reviewers comments and views.
- **Month 12:** A version (“2.0”) of the software is produced suitable for release to general users.

5.2 Specific Deliverables

The following deliverables are required:

- Versions 2A, 2B and 2.0 of the software as defined in section 5.1 above.
- Software documentation manual
- Training manual

5.3 Term

This Agreement shall be valid 12 months. Delivery of material shall be made in a timely manner. This Agreement can only be modified by consultation and agreement between IGES and the successful contractor.

5.4 Payment

The agreed amount of funds for this task will be paid as follows.

On signing contract	30%
On submission of version “2.A”	30%
On submission of version “2.B”	20%
On conclusion of Phase II	20%

Each payment will be made after IGES agrees the work has been completed successfully in accordance with the agreed terms.

5.5 Copyright and ownership

All intellectual property rights resulting from any work to be performed under any contract related to the IPCC 2006 GHG Inventory Software shall be vested in the IPCC, including, without limitations, the right to use, publish, translate, sell or distribute privately or publicly any item or part thereof. Neither IGES nor the successful contractor nor their personnel shall communicate to any other person or entity any confidential information made known to it by the IPCC in the course of the performance of its obligations under the terms of the successful contractor nor shall it use this information to private or company advantage. This provision shall survive the expiration or termination of any Agreement. The ownership of the products shall reside in the IPCC and the IGES.

5.6 Primary contacts

The primary contact for IGES is Mr Kuniaki Makiya.

5.7 Application of Law

This agreement shall be construed in accordance with the laws of Japan.

5.8 Termination

In the event that IGES judges the successful contractor unable to execute the duties described in above, IGES may terminate this contract with successful contractor. In this case, IGES reserves the right to request reimbursement of all or part of the remuneration already paid to contractor by IGES.

5.9 Special Terms

During the course of this agreement both parties may be privy to confidential information and/or trade secrets of the other party, or information that could be applied directly for commercial or other purposes. Both IGES and the successful contractor will warrant not to disclose any such information gained directly or indirectly as a result of this agreement to any other party at any time.

Annex A. AFOLU Parameter Descriptors

1. Land use types
 - Forestland
 - Cropland
 - Grass land
 - Wetlands
 - Settlements
 - Other land
2. Climate regions(see Table 4.1, Pg. 4.46, Vol.4(1), *2006 IPCC Guidelines*)
 - Tropical Wet
 - Tropical moist
 - Tropical dry
 - Tropical montane
 - Warm temperate moist
 - Warm temperate dry
 - Warm temperate moist or dry
 - Cool temperate moist
 - Cool temperate dry
 - Cool temperate moist or dry
 - Boreal moist
 - Boreal dry
 - Boreal moist or dry
 - Polar moist or dry
3. Soil types(see Table 2.3, Pg. 2.31, Ch. 2, Vol4(1), *2006 IPCC Guidelines*)
 - High Activity Clay(HAC)
 - Low Activity Clay(LAC)
 - Sandy soils
 - Spodic soils
 - Volcanic soils
 - Wetlands soils
4. Ecological Zones(see Table 4.1, Pg. 4.46, Vol.4(1), *2006 IPCC Guidelines*)
 - Tropical rain forest
 - Tropical moist deciduous forest
 - Tropical dry forest
 - Tropical shrubland
 - Tropical desert
 - Tropical mountain systems
 - Subtropical humid forests
 - Subtropical dry forest
 - Subtropical steppe
 - Subtropical desert
 - Subtropical mountain systems
 - Temperate oceanic forest
 - Temperate continental forest
 - Temperate mountain systems
 - Boreal coniferous forest
 - Boreal tundra woodland
 - Boreal mountain systems
 - Polar
5. Plantation species types(See Table 4.8, Pg. 4.54, Ch. 4, Vol.4(1), *2006 IPCC Guidelines*)
 - Broadleaf
 - Pinus
 - Eucalyptus
 - *Tectona grandis*
 - Other
6. Forest types (See Table 4.5, Pg. 4.50, Ch. 4, Vol.4(1), *2006 IPCC Guidelines*)
 - Pines
 - Larch
 - Firs and spruce
 - conifers
 - Hardwoods
 - Natural humid tropical forests

7. Types of perennial crops (See Table 5.3, Pg. 5.9, Ch. 5, Vol.4(1), 2006 IPCC Guidelines)
 - Oil palm
 - Mature rubber
 - Young rubber
 - Young cinnamon(7 years)
 - Coconut
 - 2-year improved fallow
 - 1-year improved fallow
 - 6-year fallow(average)
 - Alley cropping
 - Jungle rubber multistory system
 - Gmelina-cacao multistory system

8. Types of agro-forestry systems (See Table 5.2, Pg. 5.9, Ch. 5, Vol.4(1), 2006 IPCC Guidelines)
 - Agrosilvicultural
 - Silvopastoral

9. Cropland mineral soils (See Table 5.5, Pg. 5.17, Ch. 5, Vol.4(1), 2006 IPCC Guidelines)
 - Land use regime
 - Long term cultivated
 - Paddy rice
 - Perennial /tree crop
 - Set aside(<20 years)
 - Management regimes
 - Full-tillage
 - Reduced tillage
 - No-till
 - Input regimes
 - Low
 - Medium
 - High without manure
 - High with manure

10. Types of grasslands (See Table 6.1, Pg. 6.8, Ch. 6, Vol.4(1), 2006 IPCC Guidelines)
 - Steppe/ tundra/prairie
 - Semi-arid
 - Subtropical/tropical
 - Woodland/savannah
 - Shrubland

11. Grassland mineral soils (See Table 6.2, Pg. 6.16, Ch. 6, Vol.4(1), 2006 IPCC Guidelines)
 - Management regime
 - Nominally managed(non-degraded)
 - Moderately degraded
 - Severely degraded
 - Improved grassland
 - Input regime
 - Medium
 - High

12. Types of Peatlands (See Table 7.4, Pg. 7.13, Ch. 7, Vol.4(1), 2006 IPCC Guidelines)
 - Nutrient rich
 - Nutrient poor

Annex B. Phase 1 Specification

Annex B (a) Additional Points

Exchange of emails between Simon Eggleston (TSU) and Jozef Skakala (SPIRIT)

Jozef Skakala

Many thanks for your revised proposal. I have one point I would like to clarify.

In section 2.4.c you state that "The implementation of relevant Time eries input / reporting will be postponed to the phase 2."

Does this mean that while that the interface to input time series as a block of data and any time series outputs will not be implemented in Phase 1 the database itself will be designed for dealing with time series so that the interface will be able to enter data for different years one by one?

Thanks

Simon

--

Yes, exactly - the database will be "multi-year" n the section 2.4.c we propose not to implement reporting time series e.g. in charts ... and we propose the interface will be able to enter data for different years one by one

However as I see in your invitation page 9 - there exists a case in energy sector "Abandoned underground coal mines" where input of time series data is required

I don't know how important is to do it in one screen? It looks to be a programming complication - but if important, we can involve this task to phase 1

We are free to discuss this in design phase and to find some compromise solution to be implemented

Best regards

SPIRIT a.s.

J.Skakala

Annex B (b) Responses to questions received from interested parties under section 3.1.1 of the "Invitation for Proposals for the IPCC 2006 GHG Inventory Software"

1. What is the budget for this project?

Interested parties should submit their proposals for the resources required, taking into account the needs of the project and that funds from the IPCC are limited.

2. Is the call for tenders (dated April 13, 2007) valid? If so, what is the new project timeline?

April 13, 2007 is the date the invitation was issued. The deadline for submission of proposals is 22 May.

3. Is the document \"Invitation for Proposals for the IPCC 2006 GHG Inventory Software\" still valid?

Yes

- 4. Is the principle contact listed in the 2006 document (Mr Hiroyuki Ishitobi) still valid? If so, what is his e-mail address?**
While Mr Hiroyuki Ishitobi will be the principal contact for IGES for contractual matters any communications on this invitation should be made to Dr Simon Eggleston at <2006software@iges.or.jp>
- 5. Is there a formal application procedure?**
- 6. Is there any initial application required for companies going to submit the Proposal? Or it's enough if potential contractor would send Proposal to the address of Head, Technical Support Unit IPCC National Greenhouse Gas Inventories Programme C/o Institute for Global Environmental Strategies (see paragraph 3.1.2 of the Invitation for Proposals for the IPCC 2006 GHG Inventory Software and http://www.ipcc-nggip.iges.or.jp/public/2006gl/tender_software.htm)?**
Details of the application procedure are given in sections 3.1.1 and 3.1.2 of "Invitation for Proposals for the IPCC 2006 GHG Inventory Software" and will comply with the requirements of IGES under Japanese law. There is no initial application required.
- 7. What supporting documentation do you require?**
See section 3.1 of "Invitation for Proposals for the IPCC 2006 GHG Inventory Software"
- 8. Does the software updated by UNFCCC supersede the IPCC 1996 GHG software? Can we use UNFCCC software as the reference for our understanding and to respond this RFP?**
The software updated by the UNFCCC Secretariat does supersede the IPCC 1996 GHG Software by including corrections and the Good Practice Guidance for Land Use, Land-Use Change and Forestry. While the software is useful as a reference, the Software to be developed should not be constrained by the approach and software platforms used.
- 9. Would the new software require have to support migration of data from the current software? If yes, you want to support IPCC 1996 or UNFCCC data or both?**
No
- 10. Importing data from external sources (other systems) is not a requirement. Please confirm.**
No – apart from the bulk import specified in section 2.1.8 of Invitation for Proposals for the IPCC 2006 GHG Inventory Software
- 11. Importing data from MS Excel is not required. Only export to MS Excel (in a pre-defined format) is required. For any import, files exported by the system in limited pre-defined formats (e.g. XML) will be provided. Please confirm.**
See section 2.1.8 of Invitation for Proposals for the IPCC 2006 GHG Inventory Software – it is not necessary that data import from Excel is possible but as a minimum import from text files (comma separated variable in a format to be defined by the software developer).
- 12. 2006 IPCC guideline - "V2_x_An1_Worksheets.pdf" lists only 6 worksheets for energy input module but page 9 of RFP(table 3) refers 11 worksheets as calculation pages. Do we use the reporting table formats from the guideline document for the missing worksheets? Some of the missing worksheets in 2006 guidelines are 1A3, 1A4, 1A5, 1B3, 1C1,1C2, 1C3 etc**
Section 2.6 and table 2.16 in volume 2 of the 2006 Guidelines discuss the worksheets. The first worksheet is repeated for multiple sectors as shown in table 2.16. (1A3, 1A4, 1A5), 1B3 is an "other" category where no methods can be specified so a simple data entry form should be provided which includes entry for a description of the category. Emissions from 1C are based on measurements so a worksheet is not needed. Therefore a data entry sheet based on the reporting table "Table 1.4a Energy Background Table: 1C CO2 Transport, Injection and Storage" should be used (as stated in table 3 in Invitation for Proposals for the IPCC 2006 GHG Inventory Software).

- 13. The new system will be internationalized (language-enabled) to allow support for additional languages in future. i.e. User Interface can be created in UN languages, however, for data input/output -**
- a. Numerical data & other key character data (e.g. Notation Keys) will only be in standard format / English.**
 - b. Textual data e.g. comments in Reference Information can be in UN languages. Please confirm.**
 - a) Yes the use of notation keys as specified in English is mandatory.
 - b) Reference information and other textual data must be in any UN language. It would be preferable for the user also to be able to input in any language installed on their system.
- 14. We assume at least e-mail facility is available for the end users to exchange inventory data –please confirm**
Yes
- 15. Where would the Data Management Core be located? Is this**
- a. one per country (i.e. aggregated at country level) or**
 - b. one per region or**
 - c. one globally**
- A – one per country
- 16. Does region level data collection also need to be supported?**
V1_2_Ch2_DataCollection.pdf, section 2.2.3 does specify some guidelines related to regional inventory data.
Regional (sub-national) data collection is not needed at Tier 1 (the methods the software should implement.)
- 17. Section 2.1.8 of the RFP - The data modules will then need to be brought together and reconciled with the central data management module. Any specific reconciliation procedure (replace, aggregate etc) to be used? or are these same as the QA/QC checks?**
Clearly the individual sectors will need to be aggregated to provide the national inventory. If the reconciliation reveals duplicates for specific individual sectors then the software should prompt users for the appropriate action (reject all or accept one option).
- 18. Can multiple users enter same worksheet of an input module simultaneously?**
No
- 19. We understand that when specifying reference sources, it is only free-form text (in the documentation box). There is no requirement for the users to be able to embed (as attachments) reference sources (documents, files etc) during the data input process. Please confirm.**
Yes
- 20. Can Reporting Tables be produced from input modules directly? Or will these only be produced post data consolidation, QA/QC checks?**
Not from input modules directly but only through data consolidation and QA/QC checks.
- 21. How many users will use the software? A split by users of Input Modules, Data Management Core (Analysis & Output functions) would be useful. Additionally, an indication of frequency of usage will also be helpful.**
This depends on the country and its resources. In principle there can be a central body that would use the data management core and output functions. Input modules would be used by individual sector experts. However, where resources are limited these roles could be combined into one person. The aim will be to produce an inventory each year.
- 22. Who would be responsible for operational aspects (e.g. backups, archrivals') of the system (especially Data Management Core)?**

This would be part of the role of the body with responsibility for compiling the overall inventory.

23. Any security requirements? We understand that Username will need to be captured. But are there any specific authentication & authorization requirements?

There are no specific requirements beyond recording the username and changes as noted in section 2.2.1. We do not anticipate that the system will store confidential data.

24. Section 2.2.1 of the RFP - The system should have a data version control. This will record the user name of who made changes to the database and the date of the change. Do you also need the system to track data changes (e.g. before and after image of data)? Do you need the ability to maintain multiple versions of datasets for each year?

No, multiple versions of the datasets are not required. Users will be instructed to export data as a archive for backup. Back-up and security should be part of the wider inventory process.

25. Training users/TSU members is out of Vendor's scope. If any assistance in training is required, it will be costed separately

Yes (note sections 2.1.6 and 2.2.7 for documentation required)

26. Archive requirements– How many years of data and inventories that the system is expected to maintain?

This is depends on the country: some inventories go back to 1970. Typically users would store inventories annually from 1990 to 2020. Each inventory consists of the latest year and all previous years. Thus several inventories would imply multiple copies of data for each year (e.g. an inventory system for 1993 could contain:

1990 Inventory – Data for 1990

1991 Inventory – Data for 1991 and revised 1990

1992 Inventory – Data for 1992 and revised 1990, 1991

1993 Inventory – Data for 1993 and revised 1990, 1991, 1992)

27. We assume testing machines will be provided by TSU - please confirm

We anticipate distributing copies of the software to testers in their own countries for use of their own machines – thus replicating actual intended use.

28. What are the problems faced with current software on non-English version of Microsoft Windows? We assume that the problems that may occur are more to do with non-English version of MS Excel rather than the OS.

We have identified problems with non-English versions of Excel that are unable to run programs and macros written for the English version of Excel. We are unable to state that there are no operating system errors.

29. MS Excel spreadsheets is not the best solution for the new software but the database system should be used (as written in your specification chapter 1.4). However there exists a combined solution where the frame of the program and database operations will be programmed in the native language like C/C++ and some complicated tables like worksheets (with cell dependences and background calculations) will be implemented in the embedded Excel. Excel will be used as pure user interface where in the same time all the data will be stored into the database. This solution can essentially spare the table's development time and improve flexibilities for future changes in the worksheets. This solution requires that MS Office Excel must be preinstalled on the target computer. Is this technology acceptable for you or not?

Any solution will be considered on its merits (including this one). Proposals should demonstrate that they are compatible with the requirements in the invitation to tender –

inter alia: sections 2.1.4, 2.1.5 and 2.1.7. Proposals may assume users will have MS Office (Word and Excel) installed – though not the latest versions of Office or Windows.

- 30. The UNFCCC CRF Reporter is a software solving most of your requirements and functions. CRF Reporter does not implement Reporting according to 2006 IPCC Guidelines but the used user interface and technology could be an inspiration. Which features of the CRF Reporter technology and functions are those you don't like? Consequently which CRF Reporter limitation would you like to implement otherwise in the new IPCC2006 software?**

The CRF reporter³ is aimed at reporting while the software we want from this proposal is aimed at estimating emissions. In fact is more analogous to the UNFCCC inventory software⁴ itself based on IPCC software for the 1996 Guidelines. One of the outputs from the software should be INTO the CRF reporter (sections 1.3 & 2.2.4.v). It is difficult to pick out individual features from the CRF reporter as it is the overall usability and functionality that matter. However the hierarchical tree structure for displaying the sectors does demonstrate to users the relationships between the individual sectors.

- 31. We have noticed the inconsistency between the Proposal delivery date - 22 May 2007 (see paragraph 3.1.2 of the Invitation for Proposals for the IPCC 2006 GHG Inventory Software) and Contract timeline accordingly to which the Contract sign date planned for April 2006 (see paragraph 3.3 Figure 6 of the Invitation for Proposals for the IPCC 2006 GHG Inventory Software). Could you please clarify this inconsistency as it's critical for project planning purposes to be presented in the Proposal?**

The project will start as soon as contracts can be exchanged. Clearly this will be delayed from the original plan. The following milestones can be adjusted appropriately except the COP14/MOP4 meeting that is fixed. Subsequent milestones can also be adjusted, however we still intend to hold the review meeting in early 2008.

- 32. Could you please update us with appropriate links to web pages which were mentioned in paragraph 3.3 item 2 Start Phase 1b of the Invitation for Proposals for the IPCC 2006 GHG Inventory Software?**

- 33. The Invitation for Proposals for the IPCC 2006 GHG Inventory Software has two 'Error! Reference source not found.' which prohibits the reader to locate the hyperlink or reference. One error is page 11 in section 2.1.2 Modular structure and the second on page 19 in the stage 2. Start Phase 1b.**

These are both references to Figure 2.

- 34. Please confirm that 'at its premises' from page 18, 3.3 Timing item 1 Phase 1a :(Design) 'At the end of this stage the developer will present the design to the TSU at its premises' means at our offices in Ottawa, Canada or does this mean the TSU offices in Japan?**

This means the TSU office in Hayama, Japan.

Simon Eggleston

Head TSU,

IPCC National Greenhouse Gas Inventory Programme

IGES, Hayama, Japan

³ http://unfccc.int/national_reports/annex_i_ghg_inventories/reporting_requirements/items/3901.php

⁴ http://unfccc.int/resource/cd_roms/na1/ghg_inventories/index.htm

**Annex B (c) Extract from IPCC2006 GHG Inventory Software, Revised
Proposal SPIRIT a.s.**

1. Project objectives

This document is a response to the invitation for Proposals for the IPCC 2006 GHG Inventory Software and was revised to accommodate reduced budget announced by e-mail from June 27th. The objectives are to facilitate GHG Inventory compilers, trainers and reviewers with the software fulfilling the IPCC2006 Guidelines. Primary target user groups are the Parties with limited resources without their own inventory systems willing to apply default methods.

The software should be simple distributable, manageable with minimum hardware and Internet connectivity requirements on one side and having rather complex distributed management of different input, QA/QC, export, import and reporting modules on the other side. The software should use database without requirements on additional licensing fees. The total number of input and calculation tables will be about 170 notwithstanding this proposal deals with energy sector tables only. The database should store national inventory data for time series - worst-case since 1990. The software should enable single user data input, calculation and validation, however occasionally sectoral experts could input and calculate particular IPCC sector data on a separate software installation with the option to export/ import these particular data to the aggregate national inventory database. All the emission factors and other parameters defined in the IPCC2006 Guidelines should be involved. The output in the CRF data XML reporting format should be available.

2. Proposed solution

With reference to strict requirements defined in the specification as well as our long term experience in the similar projects (mentioned in the chapter 3.) we propose following implementation:

2.1 Software technology

Microsoft Access DataBase file format (mdb) will be used. This format was approved in the various relevant software tools as CollectER, CRF Reporter or EFDB CD. This format best fits the requirements of the specification. Any other alternatives have considerably more requirements on PC hardware, much more complicated database distribution, setup and management. Some of the other alternatives require additional licensing on PC or their future upgrade and windows compatibility may be questionable.

User interface will be programmed in C# language to enable stable and smart executable code. This approach was approved in many related projects mentioned in §5. The ActiveX Data Objects (ADO) standard technology will be used to access mdb database. The XML standard will be used to export, import and report data as usual. The Microsoft .NET Framework 2.0 will be used to program smart reporting and calculation tables. The MS EXCEL should be preinstalled on the PC in case a spreadsheet export will be used.

InstallShield technology will be used to prepare distribution of setups and upgrades.

PC Pentium min.256MB RAM and Microsoft Windows 2000/XP/Vista is expected to be used.

2.2 Software properties

- Modular structure of the software covers Input modules divided into Energy, F-Gases Foams / Refrigeration / Fire Protection, IPPU, HWP, AFOLU, SWDS enabling separate data input for sectoral inventory experts and consequently export/import particular inventory data between separate database installations.
- The Energy input module will enable to fill Energy Worksheets by activity data values (or notation keys), activity data uncertainties and comments. The preloaded emission factors and other parameters will be filled into worksheets from database and emissions are consequently calculated. The energy reporting tables are filled upon these calculations by aggregate emissions. The energy reporting table could be printed or send to the Excel spreadsheets.
- Data import/export module enables to load year/sector particular data into XML format or other way to load year/sector particular data from XML into database. The known CRF XML format will be used which enables to transfer data into UNFCCC CRF national submission.
- QA/QC module covers completeness check, numerical value check on numbers limited to reasonable values or a notation key. Emission factors and other parameters check, if the input data is outside the range defined by the default value and its uncertainty are flagged to the user.
- Uncertainty analysis functions using an error propagation method
- Key Category Analysis (KCA) functions for identifying key categories, levels and trends

Other software properties

- User logging functions, database versions management and change log register writing user name and date/time of data change
- Transparent calculation i.e. formula displayed on the screen
- Multi Language support - which allows future translation of the User Interface and Textual data into the additional UN languages.
- Freely distributable software with minimum hardware and Internet connectivity requirements
- Software documentation - User manual in printed form as well as OnLine help
- Backup/ restore database function

Terms of implementation

- The emission factors and other parameters will be preloaded into database provided the electronic tables suitable for bulk import are available
- Numerical value check will be implemented on the assumption, that the particular range data will be exactly defined
- Cross reference definition between IPCC2006 category and current CRF category will be available to enable XML CRF export
- Some software functions will be defined in more detail within analyses and design phase of the project and the exact implementation plan will be agreed from both sides

2.3 Testing and maintenance

An initial version of the software will be made available to a small group of tester, nominated by the TSU, to review the software and check its operation and usability.

Next version will be developed in association with testing by users. A report about the maintenance requirements of the software will be prepared by contractor within final stage of the project.

Within the testing phase SPIRIT Inc. will be participating per internet or phone immediately without any delay. The upgrades and enhancements of the software which are in accordance with defined task will be made immediately.

2.4 Reduction of phase 1 task specification

Because there is a restricted budget available for software Phase 1 implementation in the year 2007, we propose a slide reduction of task specification:

- a) The implementation of Energy - Reference Approach tables will be postponed to the Phase 2
- b) The KCA implementation will be simplified to analyze and reporting of a list of key categories
- c) The implementation of relevant Time series input / reporting will be postponed to the phase 2

Annex B (d) Invitation for Proposals for the IPCC 2006 GHG Inventory Software

Invitation for Proposals for the IPCC 2006 GHG Inventory Software

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Glossary

2006 Guidelines ¹	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i> , Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan
AFOLU	Agriculture, Forestry and Other Land Use, one of the 4 main sectors of the 2006 Guidelines
EFDB	The IPCC's Emission Factor Database
GHG or Greenhouse Gases	Greenhouse Gases. Here it refers, as a minimum, to all the gases for which methods are given in the 2006 Guidelines. Users should be able to add additional gases if they wish.
GPG 2000 ¹	<i>Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories</i> . Penman J., Kruger D., Galbally I., Hiraishi T., Nyenzi B., Emmanuel S., Buendia L., Hoppaus R., Martinsen T., Meijer J., Miwa K., and Tanabe K. (Eds). IPCC/OECD/IEA/IGES, Hayama, Japan
GPG LULUCF ¹	<i>Good Practice Guidance for Land Use, land-Use Change and Forestry</i> Penman J., Gytarsky M., Hiraishi T., Krug, T., Kruger D., Pipatti R., Buendia L., Miwa K., Ngara T., Tanabe K., Wagner F., IPCC/IGES, Hayama, Japan
GWP	Global Warming Potential, an index that approximates the time-integrated warming effect of a unit mass of a given greenhouse gas in today's atmosphere relative to that of a unit mass of carbon dioxide.
IGES	The Institute for Global Environmental Strategies, Hayama, Japan
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use – one of the 4 main sectors of the 2006 Guidelines
KCA	Key Category Analysis
NEU	Non- Energy Use of Fuels – e.g. fuels used for non-combustion purposes such as lubricants and as feedstocks
NGGIP	The TFI's National Greenhouse Gas Inventory Programme
PDF	Probability Distribution Function.
Revised 1996 Guidelines ¹	<i>Revised 1996 IPCC Guidelines for National Greenhouse Inventories</i> . Houghton J.T., Meira Filho L.G., Lim B., Tréanton K., Mamaty I., Bonduki Y., Griggs D.J. and Callander B.A. (Eds). IPCC/OECD/IEA, Paris, France.
TFB	Task Force Bureau of the TFI
TFI	The IPCC's Task Force on Inventories
TSU	Technical Support Unit of the TFI
UNFCCC	United Nations Framework Convention on Climate Change

¹ Electronic copies of all the IPCC Guidance referred to here can be downloaded from: <http://www.ipcc-nggip.iges.or.jp/public/public.htm>

1 Aim

This invitation invites proposals to produce software that automates the Tier 1 and 2 methodologies in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories² (hereafter “2006 Guidelines”). A phased approach is anticipated. The party providing the successful proposal (hereinafter “the contractor”) will be offered an initial contract for Phase 1. While future phases are anticipated they will require a decision by the IPCC plenary and so cannot be guaranteed.

This software will not impose any additional requirements onto users beyond those specified in the 2006 Guidelines to ensure a good practice inventory.

1.1 Background

This software is being produced by the Task Force on Inventories (TFI) in accordance with its mandate to:

- to develop and refine an internationally-agreed methodology and software for the calculation and reporting of national GHG emissions and removals;
- to encourage the widespread use of this methodology by countries participating in the IPCC and by Parties of the United Nations Framework Convention on Climate Change (UNFCCC)

The IPCC at its 25th Session in Mauritius approved a budget for this work to take place in 2007. It is expected that further funds will be available in later years subject to a decision by the IPCC Plenary.

The IPCC's TFI has just completed the production of the 2006 IPCC Guidelines on National Greenhouse Gas Inventories. This work has consolidated previous guidelines³ and inventory good practice guidance⁴ together with new scientific and technical information to form a complete and up-to-date guidance for compiling national greenhouse gas inventories.

This guidance gives methods, generally in three tiers in increasing complexity. The software will focus on the simplest method for each category - generally Tier 1 - as well as Tier 2 methods which are the same as Tier 1 but use national factors rather than the default parameters included in the 2006 Guidelines.

The Revised 1996 Guidelines were also accompanied by software, “IPCC Greenhouse Gas Inventory Software for the Workbook” which can be downloaded from our web site at: <http://www.ipcc-nggip.iges.or.jp/public/gl/software.htm>. The new software is intended to fill the same role but to improve a number of shortcomings in the earlier software.

1.2 Objectives

The objectives of the software are to:

- facilitate preparation of national GHG inventories according to 2006 Guidelines either for complete inventories or for separate categories or groups of categories.
- assist in training and inventory review

² **2006 IPCC Guidelines for National Greenhouse Gas Inventories**, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

³ Houghton J.T., Meira Filho L.G., Lim B., Tréanton K., Mamaty I., Bonduki Y., Griggs D.J. and Callander B.A. (Eds). **Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories**. IPCC/OECD/IEA, Paris, France.

⁴ Penman J., Kruger D., Galbally I., Hiraishi T., Nyenzi B., Emmanuel S., Buendia L., Hoppaus R., Martinsen T., Meijer J., Miwa K., and Tanabe K. (Eds). **Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories**. IPCC/OECD/IEA/IGES, Hayama, Japan. and

Penman J., Gytarsky M., Hiraishi T., Krug, T., Kruger D., Pipatti R., Buendia L., Miwa K., Ngara T., Tanabe K., Wagner F., **Good Practice Guidance for Land Use, Land-Use Change and Forestry** IPCC/IGES, Hayama, Japan

- harmonise reporting of greenhouse gas inventories
- archive data and complete inventories (which may consist of estimates for a number of years).
- have a limited working software in time for COP/MOP in Dec 2007.

The greenhouse gases (GHG) to be covered are listed in Table 1 and Table 2.

Table 1 Gases for which GWP values are available in the TAR⁵

Name	Symbol
Carbon Dioxide	CO ₂
Methane	CH ₄
Nitrous Oxide	N ₂ O
Hydrofluorocarbons	HFCs (e.g. HFC-23 (CHF ₃), HFC-134a (CH ₂ FCF ₃), HFC-152a (CH ₃ CHF ₂))
Perfluorocarbons	PFCs (e.g. CF ₄ , C ₂ F ₆ , C ₃ F ₈ , C ₄ F ₁₀ , c-C ₄ F ₈ , C ₅ F ₁₂ , C ₆ F ₁₄)
Sulphur Hexafluoride	SF ₆
Nitrogen Trifluoride	NF ₃
Trifluoromethyl Sulphur Pentafluoride	SF ₅ CF ₃
Halogenated Ethers	e.g., C ₄ F ₉ OC ₂ H ₅ , CHF ₂ OCF ₂ OC ₂ F ₄ OCHF ₂ , CHF ₂ OCF ₂ OCHF ₂
Other halocarbons	e.g., CF ₃ I, CH ₂ Br ₂ , CHCl ₃ , CH ₃ Cl, CH ₂ Cl ₂

Table 2 Additional gases for which GWP are not available in the TAR⁵

C ₃ F ₇ C(O)C ₂ F ₅
C ₇ F ₁₆
C ₄ F ₆
C ₅ F ₈
c-C ₄ F ₈ O

1.3 Users of software

The primary target groups of users are:

- Inventory compilers in all Parties to the UNFCCC with limited resources without their own inventory systems and who wish to apply default methods,
- Trainers and trainees on national GHG inventory compilation,

In addition a range of other potential users has been identified

- Reviewers of national inventories
- Academics/Researchers
- UNFCCC Secretariat
- Project developers

Many of the primary target users may have both limited resources and limited internet access. Users are expected to have some knowledge of 2006 Guidelines and to be computer literate and be familiar with spreadsheets.

⁵ *Climate Change 2001: The Scientific Basis. Contribution of Working Group 1 to the Third Assessment Report of the Intergovernmental Panel on Climate Change.* Houghton, J.T., Ding, Y., Griggs, D.J., Noguer, M., van der Linden, P.J., Dai, X., Maskell, K., Johnson, C.A., (eds.) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881pp

The software is expected to fill the same role as the “IPCC Greenhouse Gas Inventory Software for the Workbook” as updated by the UNFCCC for non-Annex 1 countries⁶. It will need to be able to export the estimated emissions into UNFCCC reporting software i.e. the “CRF Reporter” (see Section 2.2.4.v and footnote 14).

1.4 Technology

The proposal should specify the software technology to be used. This should be the best solution to the requirements outlined in this document. While the software for the Revised 1996 Guidelines was based on MS Excel there is no expectation that this would be the best solution for this new software which could, for example, use a database system.

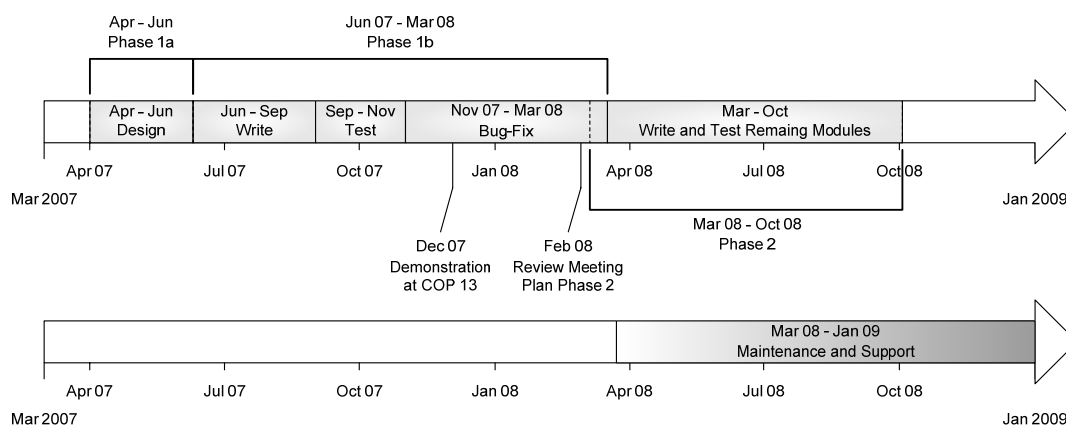
This document refers to “worksheets”. These are the printed tables in the 2006 guidelines that can be filled in to complete the calculations of emissions. This is NOT intended to indicate a spreadsheet should be used. Similarly reference is made to spreadsheets that accompany the 2006 Guidelines. These may be implemented as believed to be most appropriate, not necessarily as a spreadsheet.

2 Detailed Specification

The software is expected to be developed in phases (Figure 1).

- **Phase 1a.** Development of a detailed design for the complete system covering software environment, structure, features, and data flow as well as detailed software requirements. This will cover all items in Phase 1 and Phase 2 as well as potential future requirements listed in section 3.4.
- **Phase 1b.** Development of a fully working system but including only the Energy input module. It is expected that the TSU will organise a review meeting before the end of Phase 1 to consider progress and plan for phase 2.
- **Phase 2.** Completion of all input modules. The continuation of the project into phase 2, the start date and duration all depend on a successful outcome of Phase 1 and the conclusions of the review meeting.
- **Additional Phases.** May be needed to add additional features, depending on feedback from users.

Figure 1 Overview of this contract and possible future developments



⁶ The UNFCCC non-Annex I Greenhouse Gas Inventory Software Version: 1.3.2. Software and manual available from the UNFCCC at: http://unfccc.int/national_reports/non-annex_i_natcom/training_material/methodological_documents/items/349.php

It should be noted that as yet, the IPCC has not approved funding beyond the first phase so the product to be delivered should be fully working (though with only an Energy input module) as a stand-alone product but also one that is extendable in potential future phases. To this end this document describes some features which are not part of this first phase but which may be needed later, to assist in the development of a flexible, extendable system. This contract is therefore for Phase 1, (1a & 1b). "Phase 1" refers to items that should be included in the software produced by the successful contractor in 2007/8. Should the contractor believe that some proposed features in phase 1 are impossible to include in this first phase they should indicate this in their proposal.

2.1 Concept

This section describes the overall concept of the software. The following section will discuss the features in more detail.

2.1.1 Transparent Calculations

There is an overall requirement that the system should not be a "black box". That is, all the calculations and emission estimation methods should be open and transparent to the user, not hidden away in the software. This is important as it both increases the educational nature of the software and it increases understanding and ability to check the calculations. This will be possible by the calculation pages (where data is entered and emissions or removals estimated) appearing similar to the printed worksheets in the 2006 Guidelines.

2.1.2 Modular structure

The system should have a modular structure. There will be a central data management core (see **Error! Reference source not found.**). To input data there will be a set of modules covering all the emission and removal categories in the 2006 Guidelines. Further modules deal with features that assess the completed inventory such as uncertainty analysis, key category analysis, output functions, QA/QC and data output.

This approach will enable different users to input data and estimate emissions using different⁷ input modules simultaneously (perhaps in widely separated locations) then bring the different inputs together into one system. The central data management part should check and flag any conflicts between different modules when they are brought back together and force the user to solve them.

This will also allow additional modules to be added at later stages and should make the system easier to update and modify.

The data management core will have a complete, consistent treatment of time series. (Some of the modules themselves treat one year at a time.) All the data will be stored in one place in the data management core of the system.

The input modules are based on the worksheets⁸ in the 2006 Guidelines and, for a few sectors, the spreadsheets that accompany the 2006 Guidelines. The modules foreseen in phase 1 are (proposals may split these modules if this eases software development and use):

- Energy (worksheets) (Phase 1)
- Fluorinated Gases – Foams (based on existing spreadsheet) (Phase 2)
- Fluorinated Gases – Refrigeration (based on existing spreadsheet) (Phase 2)
- Fluorinated Gases – Fire Protection (based on existing spreadsheet) (Phase 2)

⁷ There may also be a need to input data into the same module but from different sectors simultaneously, e.g. for croplands and forests in the AFOLU module.

⁸ "Worksheets" – the printed tables in the 2006 Guidelines. This does not imply a spreadsheet must be used!

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- Remaining IPPU (worksheets) (Phase 2)
- HWP (based on existing spreadsheet) (Phase 2)
- AFOLU other than HWP (worksheets) (Phase 2)
- SWDS (based on existing spreadsheet) (Phase 2)
- Waste other than SWDS. (worksheets) (Phase 2)

For those modules based on the worksheets:

- modules will open with a screen to select the sub-category (i.e. the calculation page)
- the calculation page will open and users input the appropriate data. Help will refer to the appropriate chapter or section in the 2006 guidelines.
- the calculation page should look like the worksheets in the 2006 Guidelines as much as possible.
- users be able to enter data, a reference for the data and an optional comment
- users will then save the data and can select another sub- category (calculation page)
- each module will contain sectoral QA/QC checks on the data.

For the modules based on spreadsheets from the 2006 Guidelines they should follow the existing spreadsheets as much as possible but should guide the user to enter all the necessary data.

Figure 2 Conceptual Diagram of Modular Structure of Propose Software

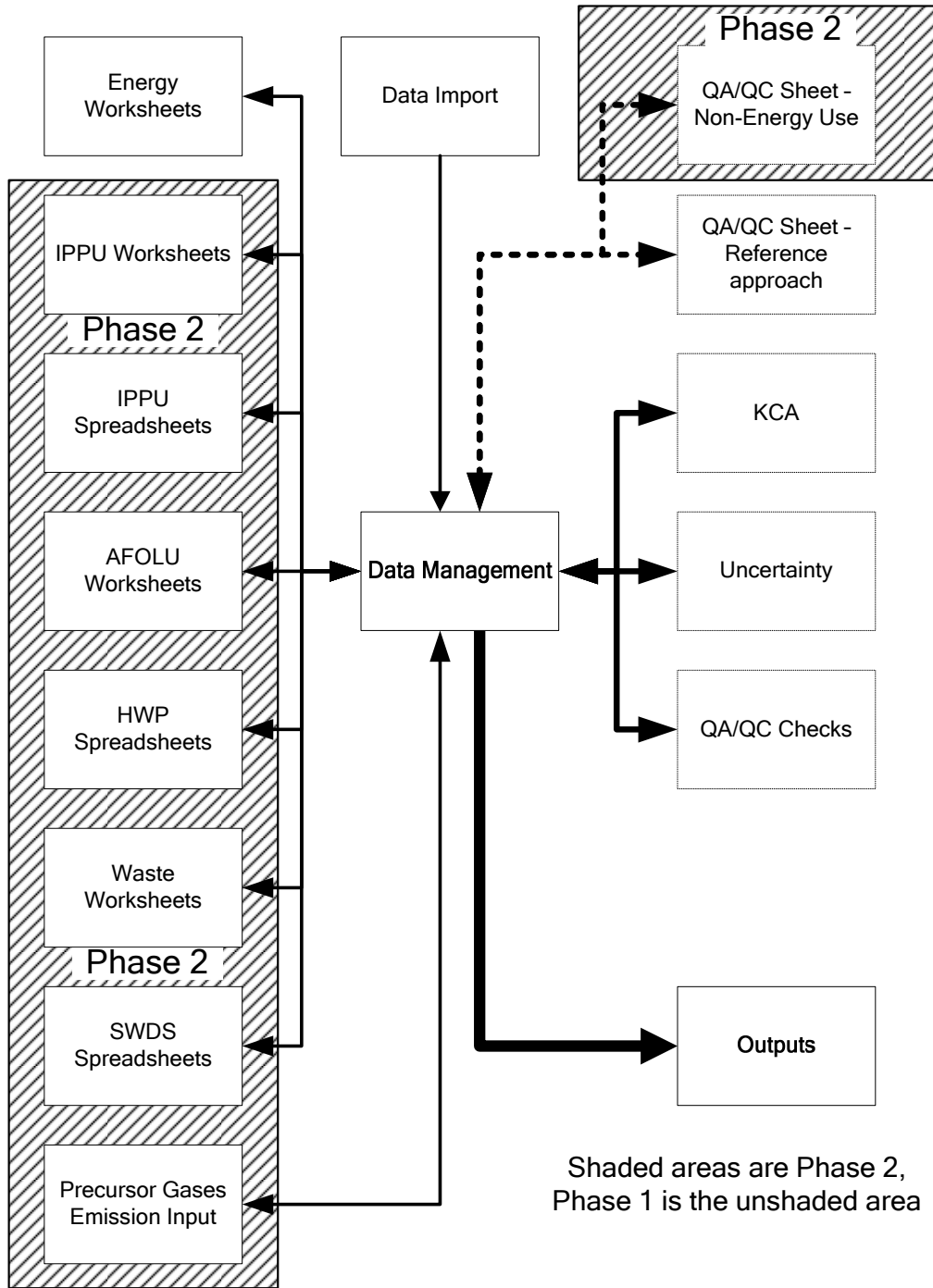


Table 3 Details of Potential Modules (references refer to sectors in the 2006 Guidelines)

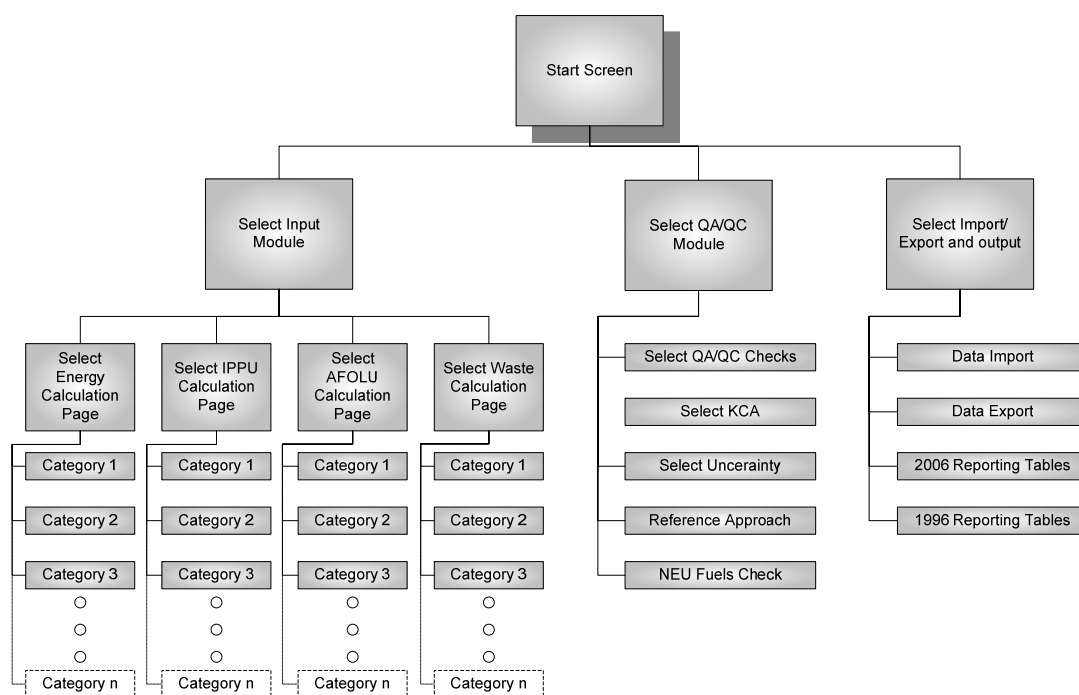
Module	Annual or Time series ⁹	Number of Calculation pages	Notes
Energy	Annual	11 (4 additional for Reference approach QA/QC)	Provide Annual Total Fuel Use from sum of fuel consumption data input by fuel type for QA/QC. Energy Balance Data can be entered into the Reference approach QA/QC sheet for comparison by users. "abandoned underground coal mines" should allow time series data entry For CCS use Reporting Table 1.4b as there is no worksheet in the 2006 Guidelines
Fluorinated Gases – Foams (2F2)	Time Series	1	Default data from global database to be provided
Fluorinated Gases – Refrigeration and Air Conditioning (2F1)	Time Series	1	
Fluorinated Gases – Fire Protection (2F3)	Time Series	1	
IPPU other than fluorinated gases above	Annual For 2F4, 2F5, 2F6, 2G2 and 2G3, users need to input data for two different years.	69 (2 additional for QA/QC checks on Non-Energy Use of Fuels)	Note spreadsheet to check Non-Energy Use of Fuels for QA/QC checks For "2B5 Carbide Production" and "2B7 Soda Ash Production", users should choose one from two calculation pages. (Users should not use both of those two pages.) For "2G1 Electrical Equipment" and "2G2c Other", users should be able to duplicate the tables to calculate emissions of different gases using the same calculation procedure as needed. There are no worksheets in the 2006 guidelines pages for the following source/sink categories: 2A5, 2B10, 2C7, 2D3, 2D4, 2E5, 2G4, 2H so the calculation page will be for data input only.
HWP	Time Series	1	Time series default activity data from FAO entered by user.
AFOLU other than HWP	Annual and time series	66	Provide annual total land areas as sum of individual land types as a QA/QC check Provide annual total numbers of livestock as QA/QC check Time series is needed for lands converted.
SWDS	Time Series	1	Spreadsheet contain default data
Waste other than SWDS	Annual	18	Provide annual total waste and waste per capita (including SWDS) as QA/QC check
Import Precursor Gases	Time Series		This facility is to enter data from other inventory estimates for these gases for reporting - not to do any calculations. The gases are: SO ₂ , NO _x , NH ₃ , NMVOC and CO.

⁹ For some sectors, emissions depend on activities in earlier years (e.g. emissions from waste placed in landfills can continue for many decades). This column indicates where a user should be able to enter time series data to estimate an emission in the current year. For these sectors, if time series data is not available, the simple default is for earlier years to be estimated from the current year's data and some surrogate (e.g. population) or other information (e.g. date of introduction). The details are given in the 2006 Guidelines. Thus the calculation sheets will need to deal with time series data in these cases. In the other cases, the calculation sheets will be for a single year, though the data import facility will need to be able to import time series.

2.1.3 Appearance

The proposal should indicate the general appearance of the screens used by the user to select the appropriate calculation page¹⁰ or other functions and can propose their own approach. One possible approach is that on starting the software an introduction screen will give the user a choice of data entry, data import/export or QA/QC (including KCA and Uncertainty), (note that accessing QA/QC choices before data entry is complete may not be meaningful so there should be a warning that the input data is incomplete.). This is followed (for data input) by screens to select the sector (Energy, IPPU, AFOLU or Waste) or the QA/QC action (KCA, Uncertainty, QA/QC checks etc.) (see Figure 3).

Figure 3 One Possible approach to the Software menus to select module



Whatever the introductory screens and module selection menus look like, the calculation interface must have a similar appearance to the printed worksheets contained in the 2006 Guidelines. Whatever software is used, the interface for the calculation page should have a spreadsheet-like operation with users able to enter/delete/change data in individual cells.

The operation of the input modules should mirror the printed worksheets in the 2006 Guidelines. This will ensure transparency and make the calculations being performed clear and understandable by the user.

2.1.4 Minimum hardware specification

As this system needs to run in places with limited resources it will need to run on a PC with the following specification (reliable internet connections cannot be assumed):

Hardware: Pentium CPU and 256 MB RAM

Operating System: Microsoft Windows 2000/XP/Vista

¹⁰ Each "calculation page" is similar to a printed worksheet in the 2006 Guidelines or to one of the spreadsheets in the 2006 Guidelines.

2.1.5 Software - freely distributable

The system should be freely distributable and should avoid any financial burden on users. This is important given the limited resources of some of the target users.

The system should be a standalone system. It should not depend on web access as this may be unreliable in some users' locations.

The proposal should indicate the software platform they intend to use.

2.1.6 Help

A help system should be available in each module. The proposal is expected to be a user-friendly system that has information both on the operation of the software and technical help on the methodologies based on text of the 2006 Guidelines. If the text from the guidelines is not available from the TSU the developer should leave space for this text, indicating it is under development. Once the design is finalised the TSU, in conjunction with a group of authors of the 2006 Guidelines will develop the required text. It should also be possible to link to the appropriate section of the 2006 guidelines.

2.1.7 Languages

Previous 1996 IPCC Inventory software has not run on many non-English versions of MS Windows®. This system should be capable on running independently of the language version of the operating system.

While it would be desirable for the interface to work in the various UN Languages this is not mandatory. However the system should be language-enabled so that in the future it could be easily modified to operate in different languages. User manuals will ultimately need to be in all UN languages though not as part of phase 1.

2.1.8 Workflow

It is expected that users will follow a similar pattern in using the software. This is not mandatory but the software should be developed considering this workflow

1. Enter data in all input modules. This may be done by one user sequentially or by multiple users in parallel. The data modules will then need to be brought together and reconciled with the central data management module.
2. QA/QC Checks. These will be mechanical checks such as completeness performed by the software. Users may also wish to review inputs and consistency as part of their own QA/QC process.
3. Uncertainty Analysis is performed.
4. KCA. This will result in a set of Key Categories. The software will flag any source or sink category which uses Tier 1 if it is a Key Category.
5. Users may repeat from item 1 (e.g. where Key Categories indicate that a method be upgraded to Tier 2 or where other errors or omissions are detected or where additional data or information could improve the estimates).
6. Output data.
7. Archive final inventory.

Most of the input modules deal with all the data for one year rather than a time series of one data item, however some sectors will require users to input time series. Data import facilities would allow users to import complete time series of particular data-sets (emission factors, activity rates etc.).

2.2 Functionality

This section describes the detailed operation of the software.

2.2.1 Data Input by user

Users will enter the following items into input modules.

Numerical Data:

- Activity Data and its uncertainties.
- Emission Factors and other parameters as described in the printed worksheets in the 2006 Guidelines and the uncertainty of each.

Additional Information

- Choice of Tier
- Data Reference (source of data)
- Comments

Numerical input data can be:

- A number
- A notation key (limit input to those specified in the 2006GL (see below))
- Uncertainties are expressed as +/- 95 percentiles. Typically users write this as +/- x, +x and - y. Data may be expressed in absolute terms or as percentages and users should have flexibility on how to express inputs.

The system should have a data version control. This will record the user name of who made changes to the database and the date of the change.

It is expected that, in phase 1, users will input data in standard units (see printed worksheets in 2006 Guidelines). At a later stage this may be adapted to allow alternative units to be used with software unit conversions, proposals should allow for this in their design.

Some input modules will have text references to external databases but no direct hyperlinks.

2.2.1.i Global Warming Potentials

Global Warming Potentials (GWP) are weighting factors that, multiplied by the mass of a gas, convert it to an equivalent mass of CO₂ with the same climate impact. The IPCC does not specify which GWP to use. GWP are only needed by users in two places: to perform KCA and to total some of the fluorinated gases.

There should be a data entry form where users can either enter their own values for these parameters or chose between several sets of defaults. The TSU will advise the successful proposal on these values.

2.2.1.ii Notation Keys

These are specified in the 2006 Guidelines, Volume1, Chapter 8, page 8.7 (see Table 4, below).

In reporting tables, where sectors are aggregated to national totals, entries with these notation keys are treated as zero.

Where the notation key "IE" or "C" is entered the user should be prompted to specify the sector where the emission is included.

Table 4 Notation Keys

Notation Key	Definition	Explanation
NE	Not estimated	Emissions and/or removals occur but have not been estimated or reported.
IE	Included elsewhere	Emissions and/or removals for this activity or category are estimated and included in the inventory but not presented separately for this category. The category where these emissions and removals are included should be indicated (for example in the documentation box in the correspondent table).
C	Confidential information	Emissions and/or removals are aggregated and included elsewhere in the inventory because reporting at a disaggregated level could lead to the disclosure of confidential information.
NA	Not applicable	The activity or category exists but relevant emissions and removals are considered never to occur. Such cells are normally shaded in the reporting tables.
NO	Not occurring	An activity or process does not exist within a country.

2.2.2 Emission calculations

The modules will calculate emissions and removals for:

- all sectors and gases;
- all reporting tables, printed worksheets in the 2006GL and any spreadsheets in the 2006 GL;

Each module shall display transparently all the calculations, including emission factors, activity data and other parameters used, following the layout of the printed worksheets in the 2006 Guidelines. The system should have comprehensive time series management for consistency checking. Each module shall have export/import capabilities. Features with a lower priority (and therefore potentially may not be part of phase 1) include:

- unit conversion;
- charts of input data, results and outputs.

2.2.3 Creating a new Inventory

An inventory is typically compiled in a particular year and provides emission or removal estimates for a range of pollutants (here GHG), for all source/sink categories in the region considered, for a number of previous years¹¹. When a new inventory is started it would normally be based on earlier years (see Figure 4). This gives rise to some issues:

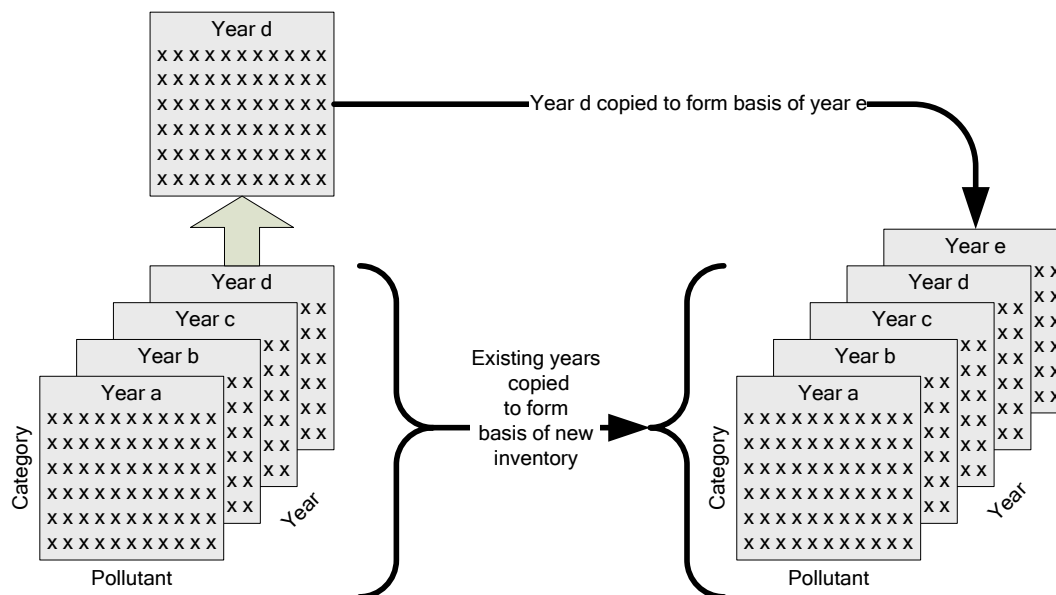
- The software will start a new inventory by copying all the data from the previous inventory into the new inventory. However, for the latest year there will be no data in the system. Here the system will need to copy data from the latest earlier year with data to the latest year. The user will then need to check this and change the activity rates. Thus the software should check that data has been changed or confirmed.
- Data in earlier years may need to be updated (this is sometimes called "recalculation"). This may be due to revisions of activity data, improvements of emission factors or other parameters or the adoption of a new methodology for a specific sector. The details are given

¹¹ While many inventories are compiled annually so there is an estimate for every year this need not be the case so the software should be able to cope with time series that do not have an estimate every year.

in the 2006 Guidelines. The software merely needs to be able to allow these data to be changed.

- When an inventory is completed it will need to be archived. This could be done by copying the system. Here the system would be to export all the information as an XML file which could be re- imported at a later stage. This option is preferred as it would enable the exchange of data and would allow import/export of the data to different systems or software.

Figure 4 Initialisation of a new inventory from an old one.



An inventory is a set of estimates of emissions or removals for all categories occurring in a country for a number (≥ 1) of years for a range of pollutants (here GHG). This example is for a set of pollutants for four years, a,b,c and d.

When a new inventory is formed estimates will be needed for an additional year. This should be initialised by copying the previous inventory and using the latest year as the basis of the new year. If several new years are needed repeated application of this process will initialise the new years. The user will then need to revise all the data in the new year and may need to revise some earlier data as well.

2.2.4 Summary functions

These are modules that work on the complete database.

2.2.4.i Key Category Analysis (KCA)

Key Category Analysis (level and trend) is a requirement of good practice inventories according to the 2006 Guidelines. They are discussed in Volume 1 Ch 4 of the 2006 Guidelines. Essentially, key categories identify the largest contributors to the total inventory and/or trend, and additional effort should be used to estimate these categories – for example, they should use Tier 2 as the simplest methodology.

The guidelines give a list of aggregated categories for which this should be done and users need to be able to divide some of them into sub-categories. This analysis is not done at the highest level of desegregation of the inventory.

After the Key categories have been identified the software should produce a list of key categories for which Tier 1 has been used as a QA/QC check for consideration by the user.

Users should be able to add manually key categories by qualitative analysis to the list mentioned above (again see Volume 1 Ch 4 of the 2006 Guidelines).

2.2.4.ii Uncertainty

Uncertainty analysis should be performed on the inventory using an error propagation method (Volume 1 Ch 3 of the 2006 Guidelines). The Monte-Carlo method is not needed at this stage. It may be considered as part of a later phase, in which case additional data would be needed (e.g. the shape of the PDF).

2.2.4.iii Completeness

Mechanical checks that each source and sink has been addressed should be included. This can identify which sectors have not been dealt with for consideration by the user. Categories for which there is no data should be completed with the appropriate notation keys to indicate they have been considered.

In the first phase, the completeness check is simply a check that each sector has either an estimated emission or a notation key entered. A list of sectors that have not been address should be provided to the user.

Where a new year is added to an inventory based on an earlier year (see section 2.2.3) the user should be prompted to check each calculation page and the software will only regard a sheet as complete when the user has checked it. In this case, sectors that have not been checked as completed should be regarded as unaddressed and added to the list of sectors that have not been addressed for the completeness check.

2.2.4.iv Check Referencing

Each data item, when entered, has the ability for the entry of a reference to the source of the data. The software should be capable of identifying those data items that do not contain a reference and providing a list of these to the user.

2.2.4.v Outputs

The system should produce the following outputs:

- All the reporting tables in the 2006 Guidelines. To form these reporting tables data are aggregated from the individual calculation sheets. The structure of the reporting table is hierarchical with each sector being the sum of all of its sub-sectors (see 2006 Guidelines, Volume 1 Chapter 8 for details). CO₂ emissions from biomass used for energy or from biomass in waste should not be included in the national total but reported separately¹². The same applies to all emissions from international aviation and navigation¹³.
- Time series of individual data items (activity data or Emission factors).

The outputs should be:

- Printable
- For import into MS Excel©
- As XML files in the CRF Data XML Format¹⁴.

¹² This is because, in principle, the net CO₂ from biomass is included in the AFOLU sector estimates. However the data is presented primarily for QA/QC purposes,

¹³ Emissions from international aviation and shipping (sometimes called "bunker fuels") are outside the national total but are reported separately for completeness.

¹⁴ The CRF reporter (v3.1) is software produced by the UNFCCC for parties to report their emissions. Details can be found at http://unfccc.int/national_reports/annex_i_ghg_inventories/reporting_requirements/items/2759.php

The system should output data according to the reporting requirements of the 2006 Guidelines. A facility to report using the Revised 1996 Guidelines Reporting Tables should be included. The TSU will provide information on the mapping between the two systems.

In later phases more output options and formats may be required. Future phases may also ask for graphs of outputs.

2.2.5 QA/QC functions

At the data input level there should be some checks. For numerical input these will limit numbers to reasonable values or a notation key. For emission factors and other parameters, if the input data is outside the range defined by the default value and its uncertainty this should be flagged to the user. Such values should be allowed by the software.

Sector level checks are specified in Table 3.

2.2.6 Flexibility

Within each sub-category the user should have the flexibility to both to:

- Duplicate the calculation page to stratify inputs (e.g. so the same calculations can be made for regions of the country with different parameters used in the estimate).
- Add additional sub-categories.

In these cases the data management part of the software should ensure that these changes are applied consistently to all years in the same time series.

2.2.7 Software documentation

There should be a user manual this will include the following:

1. Installation
2. Getting started
3. Workflow
4. Use
 - Input data
 - Adding new categories
 - Viewing data
 - Import/export
 - Modification of input forms

In addition there should be an on-line help system. This should describe the functions and should also link to text from the 2006 Guidelines (see 2.1.6).

2.2.8 Maintenance

The successful contractor shall produce a report about the maintenance requirements of the software, to be submitted in January 2008.

2.3 Data

The system should contain the default data from the 2006 Guidelines for emission factors and other parameters and their uncertainties. These are being extracted from the guidelines by the TSU for input into the Emission Factor Database (EFDB) and will be provided to the software developer.

2.4 Updatability in future

As indicated above the system should be designed so that it can be updated and extended in the future. Some of the features that may be needed are described so that developers can, in phase 1, allow for such development.

Future versions should be able to completely exchange data with this current phase 1 software.

3 Other Items

3.1 Project Proposals

To submit a proposal for this work the interested parties should include:

1. A project appreciation outlining their understanding of the proposed project.
2. A proposed solution, including software platform, demonstrating how they will meet the requirements.
3. A discussion of the required testing and future maintenance programmes.
4. A summary of their relevant experience.
5. Details and examples of previous work.
6. Separate quotations for Phases 1a and 1b. The quotations should cover all costs required throughout the contract period. The proposals are requested to provide sufficient detailed costs and explanation to enable each task and its quotation to be judged. Costs for travel, software and programming effort should be specified.
7. The timing of the completed Phase 1a and other milestones.
8. Indicative costs for completing Phase 2 and for the additional requirements indicated here.

3.1.1 Questions from parties – responses

Before submitting a proposal, interested parties can address questions to the TSU to be received by 7 May 2007. Responses from the TSU to any such inquiries will be compiled into a single document that will be made available on the NGGIP web site within 2 weeks of this date.

3.1.2 Submission of Proposals

Proposals should be received by the TSU in Japan by 17:00 (JAPANESE TIME) on 22 May 2007.

They should be printed with an attached electronic version. Following receipt of the proposals they will be assessed by a Selection Committee including the TFI TSU and IGES. The successful proposal will be selected according to, inter alia:

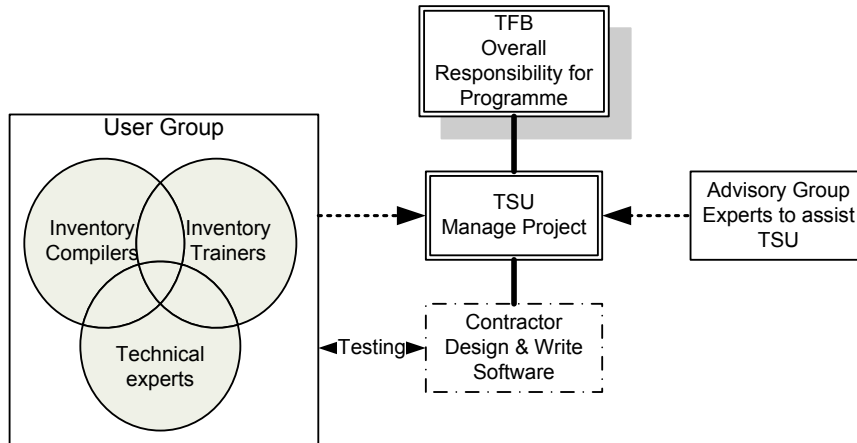
- The price
- The technical solution offered
- The understanding of the TFI's needs as demonstrated in their proposal
- The relevant experience

The TSU will contact the successful individual/company/entity to discuss the contract.

3.2 Project Management

The overall structure is shown in Figure 5. The contractor will have a contract with the Institute for Global Environmental Strategies where the TSU is hosted. The TSU will manage the project. Any queries or request for changes should be submitted to the TSU. The TSU is responsible to the TFB who manage the whole TFI work-programme. The TSU may be assisted by an advisory group of experts. This group's sole role is to provide additional expertise to the TSU. A user group will also be set up to assist in testing the software.

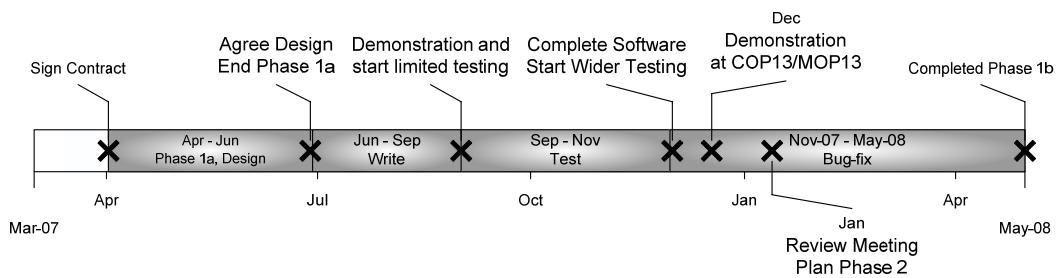
Figure 5 Management of this project



3.3 Timing

The proposed time line is shown in Figure 6 though this may be adjusted by proposals if necessary.

Figure 6 Contract timeline



Following award of the contract there will be a series of stages. These allow for an initial extensive design phase followed by development and extensive testing. The proposal should indicate in their proposal if they feel they need to adjust these timings. These stages are as follows:

1. **Phase 1a: (Design).** The developer will design the software. This will be done in close cooperation with the TSU. The TSU will appoint additional experts to cover specific areas of expertise. The developer should indicate how they will interact with the TSU. Contact with experts outside of the TSU will be by email or teleconference. The design will have to be approved by the TSU and TFB before software can be written. This stage should assist the developer in fully understanding the requirements of the TSU in developing this software. At the end of this stage the developer will present the design to the TSU at its premises.

2. **Start Phase 1b:** The initial development stage will aim at producing a demonstration version showing at least the Energy Module, the Data Management Core and the Output modules, Key Category Analysis, Uncertainty and QA/QC modules and their functionality (see **Error! Reference source not found.**).
3. An initial version of the software, demonstrating its operation, should be made available to a small group of tester, nominated by the TSU, to review the software and check its operation and usability.
4. A second version will be developed in association with testing by users. The aim is to produce a complete working version of the software in time for demonstration by the TSU at COP 13/MOP3 in December 2007.
5. **End Phase 1b:** Following COP13/MOP3 there should be further testing and bug fixing before release of version 1 of the software before SBSTA in May 2008

3.3.1 Interaction between contractor, TSU, Testers etc.

The work will be undertaken under a contract between the contractor and the Institute for Global Environmental Strategies, Hayama, Japan, acting for the IPCC. The work will be managed by the TSU at IGES.

For contractual matters the contractor should contact the Head of the TSU, Dr Simon Eggleston.

During the execution of the contract the contractor will need extensive contact with greenhouse gas inventory experts. This will be need during the design phase, while writing the software and while testing the software. This will be arranged thorough contact between the contractor and Head of the TSU or whoever he designates.

3.3.2 Milestones

These milestones will be used to check the progress of the project. In addition the developer should provide monthly reports on progress. The milestones are:

1. Sign contract
2. Agree detailed specification (end Phase 1a)
3. Demonstration of core and modules. Start limited review and testing
4. Revised complete Phase 1b software. Start wider testing
5. COP13/MOP13 (December 2007)
6. Proposed maintenance programme report (January 2008)
7. Completion of Phase 1b in time for release at SB28.

The contractor shall submit monthly progress reports.

3.3.3 Need for contractor to visit TSU

The successful contractor can visit the TSU as required. The proposal should indicate where such a need is foreseen.

3.4 Options for future development

There are a number of features that could be included in future versions of the software. These need to be accommodated in the system design at this stage. They include:

- Further QA/QC checks
- Reasonability checks that need a certain inventory knowledge.
- Unit conversions

- Multi-lingual interface
- Graphics - plots of inputs and outputs
- Presentation of activity and emission factors in time series, by sector gas pool etc
- Detection of unusual step changes in time series

3.5 Contractual Conditions

3.5.1 Term

This Agreement shall be valid 12 months. Delivery of material shall be made in a timely manner. This Agreement can only be modified by consultation and agreement between IGES and the successful contractor.

3.5.2 Payment

The agreed amount of funds for this task will be paid as follows.

On signing contract	30%
On conclusion of phase 1a and agreement of design	20%
On successful demonstration of software at COP13	30%
On conclusion of Phase 1	20%

Each payment will be made after IGES agrees the work has been completed successfully in accordance with the agreed terms.

3.5.3 Copyright and ownership

All intellectual property rights resulting from any work to be performed under any contract related to the IPCC 2006 GHG Inventory Software shall be vested in the IPCC, including, without limitations, the right to use, publish, translate, sell or distribute privately or publicly any item or part thereof. Neither IGES nor the successful contractor nor their personnel shall communicate to any other person or entity any confidential information made known to it by the IPCC in the course of the performance of its obligations under the terms of the successful contractor nor shall it use this information to private or company advantage. This provision shall survive the expiration or termination of any Agreement. The ownership of the products shall reside in the IPCC and the IGES.

3.5.4 Primary contacts

The primary contact for IGES is Mr Hiroyuki Ishitobi.

3.5.5 Application of Law

This agreement shall be construed in accordance with the laws of Japan.

3.5.6 Termination

In the event that IGES judges the successful contractor unable to execute the duties described in above, IGES may terminate this contract with successful contractor. In this case, IGES reserves the right to request reimbursement of all or part of the remuneration already paid to contractor by IGES.

3.5.7 Special Terms

During the course of this agreement both parties may be privy to confidential information and/or trade secrets of the other party, or information that could be applied directly for commercial or

other purposes. Both IGES and the successful contractor will warrant not to disclose any such information gained directly or indirectly as a result of this agreement to any other party at any time.

**Annex C. Report of Software Review Meeting 15-17
April 2008**

**IPCC NGGIP TASK FORCE BUREAU
NINETEENTH SESSION
Helsinki, Finland
16th May 2008**

TFB 19/Doc.5

Report of Software Review Meeting

1 Background

The Task Force Bureau (TFB) at its last meeting agreed that the software for the 2006 IPCC Guidelines should be developed in stages or phases. The first phase was to develop a demonstration version of the software covering the Energy Sector. Following the TFB decision the TSU held an open tender and, following a review of the bids received by a committee including representatives of the TFB Co-Chairs, Institute for Global Environmental Strategies (IGES) and the TSU, awarded the contract to SPIRIT a.s.¹.

This software is now being developed and two review versions have been circulated to experts including CLAs and Energy Volume authors of 2006 Guidelines, participants of Qatar Meeting (January 2007) Editorial Board Members of the Emission Factor Database as well as the TFB members to invite their comments. A third version, including responses to comments, was made available just before this review meeting.

The review meeting was held in Geneva, 15-17 April. (The list of participants is annexed to this report.) The aim was to decide if the second phase should go ahead and to provide some feedback on the demonstration software and guidance on the implementation of the remaining sectors. The discussions were based on the demonstration version of the software and comments received, the latest version of the demonstration software by SPIRIT a.s. and the agreed specification.

2 Results

The meeting:

- Agreed that, generally, the design and appearance of the software is fit for purpose;
- Agreed that, the second phase of development of complete software covering all sources should commence;
- Noted a number of corrections and refinements should be implemented. These are detailed below;
- Discussed and agreed how the remaining sectors should be implemented;
- Also discussed features that could be implemented in a third phase.

It was clear that all the participants at the meeting agreed that the existing demonstration software was suitable as a basis for further developments. The third version of the software, which was introduced in detail to the meeting participants during the meeting, answered most of the comments about the operation of the software, backups, and linkage of simultaneous users of the software in a single country. While a number of issues were discussed at the meeting and some points had to be clarified there were no major problems.

Phase 1 still needs to be finished and a further phase 1 version of the software is anticipated in June.

Following a successful demonstration of the phase 1 requirements the TSU can issue a tender for phase 2 which will cover all the remaining sectors at Tier 1, and where relevant, at Tier 2 as well.

The detailed comments from the meeting are given below for, firstly for the energy sector demonstration software and then, in section 4, for phase 2 implementation.

¹ SPIRIT a.s., Kubaniho 12, 811 04 Bratislava, Slovak Republic (<http://www.spirit.sk>)

Detailed Comments and Conclusions on the Demonstration Software

Topic	Status	Decision taken
Inventory start year and final year	Currently the start year is 1990 and latest year is current year	Inventory start year and final year should be user-defined in the preferences box.
Documentation	“Documentation” in worksheets and “documentation box” in reports are suitable for our needs	‘Documentation’ for each record in the worksheets should be renamed ‘Remarks’.
GWPs	GWPs not yet implemented in Energy sector (they are needed for KCA and Uncertainty analysis). They will be user-defined.	Do not use term “GWP” use “CO2 equivalent factors”. Factors will be enterable by the “super-user”, IPCC factors from SAR, TAR and AR4 will be available for selection or new factors can be entered.
Number of significant digits	Numbers are not rounded in display or reports	No rounding should be performed during the calculations. For presentation of the reports, users should be able to specify the number of digits to be displayed.
Fuel types and fuels	Currently different fuel types (SOLID, LIQUID etc.) are displayed separately and selected from a drop down menu.	Add “All Fuels” to drop down menu which will then display all fuels for an aid to inventory compilers.
Addition of new units for fuel consumption	Currently only TJ and Gg are allowed	It should be possible to add new units of fuel consumption (such as m3 as in the guidelines) but USERS will have to input a conversion factors (TJ/unit) for these new units, the system should also understand Mg, Tg, MJ, PJ etc. If m3 selected then warning to users that they need to enter their own factor.
Notation Keys	Not yet Implemented	Implementation as shown in Table 1 of this report. Two codes from the Guidelines are treated differently NA (Not Applicable) is not needed for the software. Confidentiality (C): data will be flagged as confidential and entered into worksheet. Second Phase: the software may need to only display the confidential data to the data enterer or super-user.
Colour scheme of the interface	The colour scheme is fixed and not liked by all. Calculated values are coloured differently – this is good.	If it is feasible, there should be an option to chose other colours or TSU and SPIRIT to find a better colour scheme.
QA/QC	Name in software	Rename “Quality Control”

Topic	Status	Decision taken
Uncertainty	Not yet implemented	To be implemented.
Information/Memo Items	Software does not indicate how these are dealt with	Leave it as it is
Key Category Analysis (KCA)	Not yet Implemented	To be implemented following the Guidelines. User will have the option to modify the categories/gas combinations for the KCA. SPIRIT will check whether this flexibility is feasible within the present state of development of the software. This could be in next phase(s).
Quality Control	Currently: Completeness check (list categories without data) and existing range checks.	This is OK for phase 1. Ideas for Phase 2 and 3 are given below.
Time Series Display	Not yet Implemented	To be implemented (display of Emission x Year, tables and graphs).
1.B.1.b	No worksheet in guidelines	Use worksheet for stationary combustion. Emission factors only for coal for CO ₂ , (Anthracite; Coking Coal; Other Bituminous Coal; Sub-Bituminous Coal; Lignite; Oil Shale and Tar Sands)
1.B.1.c	No worksheet in guidelines	There is no 1.B.1.c category in volume 2 this is a fugitive emission from solid fuel conversion. (see 1.A.1.c for combustion emissions for this category.) A worksheet with simply 3 cells to enter emissions of CO ₂ , CH ₄ and N ₂ O calculated elsewhere or measured is needed.
CCS	No worksheet in guidelines	Use the 2 reporting tables as data entry table. Should be accessible for worksheet menu and under reporting menu table is displayed as at present.
Data Entry	Currently data is typed in (or cut and paste) cell by cell	This is as specified for Phase 1. Needed.
Grand totals of activity data should be displayed in each worksheet		It will be addressed in the next version.
NCV or GCV	Currently not displayed	Must be indicated
Multiple rows with the same fuel	Currently these can only be distinguished by the remarks field.	It was agreed this is OK.

Topic	Status	Decision taken
Creating New Year	Can be based on previous year only. Currently can save any previous year into XML and import into a new year.	Must be able to base new year on any other year.
Backup	Manual system implemented	Automatic back-up system will be implemented, if possible.
Road Transport	Now follows Tier2. (Detailed aggregation is Tier 2, Tier 1 is at level of total fuel use...)	Needs to be able to enter data at tier 1 level (aggregated level) as well as Tier 2 more detailed sub-categories.

Table 1 Use of Notation Keys and How they Used

Code	Meaning	Applicability	Comment
NO	Not occurring	Activity data only	All these notation keys will be treated as zero in any summation of calculations based on records where they are used.
NE	Not estimated	Activity data or emission factor	
IE	Included elsewhere	Activity data only	

3 Sectoral Issues

3.1 IPPU

IPPU Sector module can be developed in a similar way to that for Energy Sector module. It should be noted there are three spreadsheet calculation sheets for F-gases (Category 2.F.) that were developed by the 2006 GLs authors. These models should become part of the software.

3.2 AFOLU

AFOLU categories can be considered in two groups (from a software development perspective):

1. Categories that depend on a disaggregated land area classification e.g. Biomass, DOM, Soils and Biomass Burning
2. Categories that depend on nationally aggregated data, e.g. N₂O from soils; Liming; Urea Application; Livestock and manure management; and Rice

This will be reflected in the software. The software will follow the worksheets in the guidelines and implement Tier 1 methods. These could be filled directly by hand (by entering data, defaults of national factors. (This could be extended in some case in a potential phase 3 e.g. DOM in forests remaining forests where the Tier 1 default is zero.)

For stock change categories where there is no Tier 1 worksheet (as the default is zero change) we should have a “worksheet” for the entry of data calculated elsewhere, in order to extend the flexibility of the software in line with the text of the guidelines.

Entering land area data and classification is a problem. There was a broad discussion over the issues and difficulties of this. After extensive discussion it was decided that SPIRIT assisted by the TSU and authors as necessary will develop a detailed proposal on the basis of the discussions. The main features of this will be:

- Allow for Approach 1 and 2 for land area classification;
- Will try to ease data entry for users by ensuring the same data is entered only once;

- Reduce chance of errors by allowing the land classification matrices to be use for checking entered data;
- Will consider if and how links to default data can be made
- XML, or other import will enable import from other software
- Excel or text file data entry will also allow users to enter multiple data items at once.

QC checks - Links to other sectors

The software should present a similar data used in different sectors for consideration by the users. Differences may be OK or may indicate errors so this will be a valuable QC check. Examples are:

- Biomass harvested and that used for energy use
- Urea production and fertiliser use
- Sewage sludge production, application to land and amount burnt
- Peat extraction and burnt for energy or used in horticulture
- Production of manure and amounts burnt for energy

The HWP spreadsheet has an option to line to the SWDS spreadsheet in the waste sector where specific numbers have to be exchanged.

•There are some specific QC checks in the guidelines within the AFOLU sector that can be implemented in the software. These concern the consistence of land areas within and across years, and livestock numbers and manure production.

3.3 WASTE

Waste Sector module can be developed in a similar way to that for Energy Sector module. It should be noted there is a First-Order Decay (FOD) model that was developed by the 2006 GLs authors. This model should become part of the software.

3.4 OTHER

Only a data entry sheet is needed here.

4 General Issues beyond Phase 1

Topic	Status	Decision taken
Addition of guidelines as pdf files or hyperlinked HTML files	Currently little information is given of link to guidelines	Hyperlinks could be added to HTML version of Guidelines for each category. Resources will determine when this can be done.
Reference Approach	Not Yet implemented	Needs to be implemented in phase 2 Option should be under Quality Control not Worksheets.
Deleting data:	It is not clear how to delete /undo data which have been typed in. How to do it is explained in the user manual.	SPIRIT and TSU to try to improve the manual.
Size of database	Currently uses MS Access	SPIRIT: db is small and size is not a problem
Information/Memo Items	Software does not indicate how these are dealt with	Leave it as it is
Restart	Currently does not restart at same worksheet	Look at options and feasibility
Currently can only see on year at a time	Would like to see time series	Should be able to see tables of Activity data x Year and Emission factor x Year. These should be editable as it will be a way of checking and correcting numerical errors.
Export/Import	Can export a category or sector or entire inventory for one year and import it into a new inventory by REPLACING existing data	Need to optionally be able to add additional row with new data so the final inventory is the sum of the import and existing data. Identifiers on the imported records are needed.
Help comments	Currently very limited	Hyperlinks to appropriate sections of the guidelines would be desirable. Implementation, resource dependant.
Only XML import currently available	Need a facility to bulk upload data in other formats	This needs to be able to import time series as well as single year data. Export to spreadsheets and import from spreadsheets desirable. Import from text files (e.g. csv) an option.
QC (Phase 2)	Not Yet implemented	Time series analysis tools: graphs, outlier detection
QC (Phase 2/3)	Not Yet implemented	Display value of similar parameters in different sectors for QC by users. <ul style="list-style-type: none"> ➤ Biomass burnt (in Energy & AFOLU sector) ➤ Waste as energy (in Energy & waste sector) ➤ methane recovery from waste (in Energy & waste sector) ➤ Woody waste and HWP (Waste and AFOLU) ➤ Natural gas: combustion and fugitives (Energy) ➤ Non energy use of fuels, (Energy & IPPU) particularly <ul style="list-style-type: none"> ✓ Iron & Steel ✓ Ammonia

ANNEX

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IPCC Expert Meeting on Software for the 2006 IPCC Guidelines

15-17 April 2008

WMO Headquarters, Geneva, Switzerland

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