



ISPRA

Istituto Superiore per la Protezione
e la Ricerca Ambientale

National Greenhouse Gas Inventory System in Italy. Year 2013



RAPPORTI



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e la Ricerca Ambientale

National Greenhouse Gas Inventory System in Italy. Year 2013

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**ISPRA – Istituto Superiore per la Protezione e la Ricerca Ambientale
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1. THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE AND THE KYOTO PROTOCOL

The United Nations Framework Convention on Climate Change (UNFCCC), adopted on 09/05/1992 and entered into force on 21/03/1994, was ratified by Italy in the year 1994 through law n.65 of 15/01/1994. On 11/12/1997, Parties to the Convention adopted the Kyoto Protocol, which establishes legally binding greenhouse gas emission limitation commitments in the period from 2008 to 2012, with reference to 1990 emission levels. Italy ratified the Kyoto Protocol on 31st May 2002 through law n.120 of 01/06/2002. The Kyoto Protocol finally entered into force on 16th February 2005.

The Kyoto Protocol has established emission limitation for Annex B Parties (i.e. industrialised countries and countries with economy in transition): in particular, the European Union as a whole is committed to an 8% reduction within the period 2008-2012, in comparison with base year levels. For Italy, the EU burden sharing agreement, set out in Annex II to Decision 2002/358/EC and in accordance with Article 4 of the Kyoto Protocol, has established a reduction objective by 6.5% in the commitment period, in comparison with 1990 levels.

As a Party to the Convention and the Kyoto Protocol, Italy is committed to develop, publish and regularly update national emission inventories of greenhouse gases as well as formulate and implement programmes to reduce these emissions.

In addition, Article 5.1 of the Kyoto Protocol requires that the Parties included in Annex I to the Convention have in place a National System by the end of 2006 at the latest for estimating anthropogenic greenhouse gas emissions by sources and removals by sinks and for reporting and archiving the results.

In the Decision of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions (280/2004/EC) it is required that Member Countries establish a national greenhouse gas inventory system by the end of 2005 at the latest and that the Commission adopts the EC's inventory system by 30 June 2006.

2. DEFINITION OF NATIONAL SYSTEM

In the first Conference of the Parties serving as the Meeting of the Parties to the Protocol, held in 2000, the "Guidelines for national systems under article 5, paragraph 1, of the Kyoto Protocol" contained in the document FCCC/KP/CMP/2005/8/Add.3 were adopted by Decision 19/CMP1. A national system, as defined in the guidelines, includes all institutional, legal and procedural arrangements established within a Party included in Annex I for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and for reporting and archiving inventory information as reported (UNFCCC, 2005).

National Systems are set up to enable Parties included in Annex I to estimate anthropogenic greenhouse gas (GHG) emissions by sources and removals by sinks and to report these emissions by sources and removals by sinks in accordance with the Kyoto Protocol and the relevant decisions of the Conference of the Parties (COP) and/or the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (COP/MOP). In addition, they are arranged to facilitate the review of the information submitted and to ensure and improve the quality of the inventories.

The overall goal of national systems is to ensure the quality of the annual national inventory through planning, preparation and management of inventory activities. Inventory activities include collecting activity data, selecting methods and emission factors appropriately, estimating anthropogenic GHG emissions by sources and removals by sinks, implementing uncertainty assessment and quality assurance/quality control (QA/QC) activities, and carrying out procedures for the verification of the inventory data at the national level, as described in the guidelines (UNFCCC, 2005). To this end, a national system should guarantee that a Party compiles the national inventory fulfilling the quality principles of:

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- transparency in methodologies, assumptions and references used;
 - consistency in the methodologies throughout the time series;
 - comparability among inventories following the methodologies and the form of presentation agreed on in the Conference of the Parties to the UNFCCC;
 - accuracy in the calculation which should not result either in systematic over- nor under- estimations and should ensure that uncertainties are as small as possible;
 - completeness in the sources or sinks and gases as specified in the relevant guideline;
 - timeliness to the agreed annual schedule.

The national system guarantees that the data not only conform to the quality requirements, but they are also officially approved by governments.

3. GENERAL FUNCTIONS

In the implementation of its national system, each Party included in Annex I shall establish and maintain the institutional, legal and procedural arrangements between the government agencies and other entities responsible for the planning, preparation and management of the inventory. Parties shall ensure sufficient capacity for timely performance of the specific functions defined in the guidelines for national systems, including data collection for estimating anthropogenic GHG emissions by sources and removals by sinks and arrangements for technical competence of the staff involved in the inventory development process. A single national entity shall be designated with overall responsibility for the national inventory (UNFCCC, 2005). Parties shall prepare national annual inventories and supplementary information in a timely manner and provide information necessary to meet the reporting requirements in accordance with the Kyoto Protocol and the relevant decisions of the COP and/or COP/MOP. In particular, the description of the national system and supplementary information under Article 7.1, including information on units of lands subject of activities under Article 3.3 and activities elected under Article 3.4, is illustrated in the Annex. In fact, the 'National Registry for Carbon sinks' has been instituted by a Ministerial Decree on 1st April 2008 and is part of the National Greenhouse Gas Inventory System in Italy.

The National System for the Italian Greenhouse Gas Inventory was established by the Legislative Decree 51 of March 7th 2008.

As indicated by art. 14 bis of the Decree, the Institute for Environmental Protection and Research (ISPRA), former Agency for Environmental Protection and Technical Services (APAT), is the single entity in charge of the development and compilation of the national greenhouse gas emission inventory. As single entity, ISPRA is responsible for all aspects of national inventory administration: collection and processing of activity data; selection of appropriate emission factors and estimating methodologies; reporting and quality management activities; archiving of the inventory results. In addition, ISPRA has to draw up annually a national system plan to be communicated to the Ministry for the Environment, Land and Sea.

As for the official approval, the Ministry for the Environment, Land and Sea is responsible for the endorsement of the inventory and for its communication to the Secretariat of the Framework Convention on Climate Change and the Kyoto Protocol. The Ministry is also responsible for the approval of the annual National System plan. The inventory is also submitted to the European Commission in the framework of the Greenhouse Gas Monitoring Mechanism.

The Italian Atmospheric Emission Inventory and the Italian Greenhouse Gas Inventory are compiled and maintained by the Institute for Environmental Protection and Research. A specific unit of the Institute is responsible for the planning, preparation and management of the inventory in the framework of both the United Nations Convention on Climate Change and the Convention on Long Range Transboundary Air Pollution. The whole inventory is compiled by the institute; scientific and technical institutions and consultants may help in improving information both on activity data and emission factors of some specific activities. All measures to guarantee and improve the transparency, consistency, comparability, accuracy and

completeness of the inventory are undertaken. To this end, a QA/QC report is prepared annually by the inventory expert team including improvements in response to review processes and those planned for the next submissions.

The submission of the national GHG emission inventory is carried out through compilation of the Common Reporting Format (CRF) and the preparation of the National Inventory Report (NIR), according to the guidelines provided by the United Nations Framework Convention on Climate Change and the European Union's Greenhouse Gas Monitoring Mechanism.

Detailed information on emission figures and estimation procedures, including all the basic data needed to carry out the final estimates, is provided in the NIR in order to improve the transparency, consistency, comparability, accuracy and completeness of the inventory.

The national inventory is updated annually in order to reflect revisions and improvements in the methodology and use of the best information available. Adjustments are applied retrospectively to earlier years, which accounts for any difference in previously published data.

Emission estimates comprise the six direct greenhouse gases under the Kyoto Protocol (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride) which contribute directly to climate change owing to their positive radiative forcing effect and four indirect greenhouse gases (nitrogen oxides, carbon monoxide, non-methane volatile organic compounds, sulphur dioxide).

The CRF files, the NIR and other related documents can be found at the address <http://www.sinanet.isprambiente.it/it/sia-ispra/serie-storiche-emissioni>.

As single National Authority, ISPRA bears the responsibility for the general administration of the inventory, co-ordinates participation in reviews, and publishes and archives the inventory results. Furthermore, the Institute participates in work under the auspices of the UNFCCC, where guidelines for reporting are discussed and decided upon, as well as in the EU monitoring mechanism for inventories of greenhouse gases, where guidelines for reporting to the EU are regulated.

In order to complete the institutional framework, the national registry for carbon sinks and the national registry need to be outlined.

The 'National Registry for Carbon sinks' was instituted by a Ministerial Decree on 1st April 2008 and it is part of the Italian National System. The registry includes information on units of lands subject of activities under Article 3.3 and activities elected under Article 3.4 and related carbon stock changes. The National Registry for Carbon sinks is the instrument to estimate, in accordance with the COP/MOP decisions, the IPCC Good Practice Guidance on LULUCF and every relevant IPCC guidelines, the greenhouse gas emissions by sources and removals by sinks in forest land and related land-use changes and to account for the net removals in order to allow the Italian Registry to issue the relevant amount of RMUs.

In 2009, a technical group, formed by experts from different institutions (ISPRA, Ministry of the Environment, Land and Sea, Ministry of Agriculture, Food and Forest Policies and University of Tuscia), set up a methodological plan of the activities necessary to implement the registry and define the relative funding. Some of these activities (in particular, IUTI, inventory of land use) have been completed, resulting in land use classification for all national territory for the years 1990, 2000 and 2008. A process of validation and verification of IUTI data is currently on going and will supply data useful to update and improve the estimations. For this year submission, emissions and removals from 3.3 and 3.4 activities have been estimated on the basis of data and methodologies used for the inventory under the Convention.

A detailed description on the registry and additional information on activities under Article 3.3 and Article 3.4 are reported in Annex 1 of this document.

The Italian National Registry is administrated by ISPRA under the supervision of the national Competent Authority for the implementation of Directive 2003/87/CE, jointly established by the Ministry for Environment, Land and Sea and the Ministry for Economic Development. The Italian Government modified the Legislative Decree 216/2006 which enforced European Directive 87/2003/CE, by the new Legislative Decree 51 of March 7th 2008. ISPRA, as Registry Administrator, is responsible for developing, operating and maintaining the national registry, including Kyoto Protocol obligations; the Decree 51/2008 also establishes that the economic resources for the technical and administrative support of the Registry will be supplied to

ISPRA by operators paying a fee for the use of the Registry. The amount of such a fee still has to be regulated by a future Decree. Detailed description of the national registry is presented in Annex 2.

4. SPECIFIC FUNCTIONS

4.1 Inventory planning

As part of its inventory planning, each Party included in Annex I shall designate a single national entity with overall responsibility for the national inventory, make available the postal and electronic addresses of the national entity responsible for the inventory, define and allocate specific responsibilities in the inventory development process, including those relating to choice of methods, data collection, particularly activity data and emission factors from statistical services and other entities, processing and archiving, and QC and QA. This last definition shall specify the roles of, and cooperation between, government agencies and other entities involved in the preparation of the inventory, as well as the institutional, legal and procedural arrangements made to prepare the inventory (UNFCCC, 2005).

The Party should elaborate an inventory QA/QC plan which describes specific QC procedures to be implemented during the inventory development process, facilitate the overall QA procedures to be conducted, to the extent possible, on the entire inventory and establish quality objectives. Besides, Party should establish processes for the official consideration and approval of the inventory, including any recalculations, prior to its submission and to respond to any issues asked by the inventory review process under Article 8 (UNFCCC, 2005).

As part of its inventory planning, each Party included in Annex I should consider ways to improve the quality of activity data, emission factors, methods and other relevant technical elements of inventories. Information obtained from the implementation of the QA/QC programme, the review process under Article 8 and other reviews should be considered in the development and/or revision of the QA/QC plan and the quality objectives (UNFCCC, 2005).

The Legislative Decree 51 of March 7th 2008 designated ISPRA, former APAT, as single national entity with overall responsibility for the national emission inventory. The Italian greenhouse gas inventory and the national inventory report are compiled annually by the Institute. According to the same decree, the Ministry for the Environment, Land and Sea is responsible for the official consideration and endorsement of the inventory and for the communication to the Secretariat of the Framework Convention on Climate Change and the Kyoto Protocol. The inventory is also submitted to the European Commission in the framework of the Greenhouse Gas Monitoring Mechanism. The submission of the inventory to the European Commission is by the due date of 15th January which can be extended up to 15th March; 15th April is the deadline for the national submission to the UNFCCC.

ISPRA is responsible for all aspects of national inventory preparation, reporting and quality management. Activities include the collection and processing of data from different data sources, the selection of appropriate emissions factors and estimation methods consistent with the IPCC Guidelines (IPCC, 1997; IPCC, 2006), the IPCC Good Practice Guidance and Uncertainty management (IPCC, 2000) and the IPCC Good Practice Guidance for land use, land-use change and forestry (IPCC, 2003), the compilation of the inventory following the QA/QC procedures, the assessment of uncertainty, the preparation of the National Inventory Report and the reporting through the Common Reporting Format, the response to the review processes, the updating and data storage. The web electronic address where all the information related to the inventory can be found is: <http://www.sinanet.isprambiente.it/it/sia-ispra/serie-storiche-emissioni>.

Different institutions are responsible for statistical basic data and data publication, which are essential for ISPRA in order to carry out emission estimates. These institutions are part of a National Statistical System (Sistan), which provides national official statistics, and therefore are asked periodically to update statistics; moreover, the National Statistical System ensures the homogeneity of the methods used for official statistics data through a coordination plan, involving the entire public administration at central, regional and local levels. The National Statistical System is coordinated by the Italian National Institute of Statistics (ISTAT)

whereas other bodies, joining the National Statistical System, are the statistical offices of ministries, national agencies, regions and autonomous provinces, provinces, municipalities, research institutes, chambers of commerce, local governmental offices, some private agencies and private subjects who have specific characteristics determined by law.

The Italian statistical system was instituted on 6th September 1989 by the Legislative Decree n. 322/89, which established guiding principles and criteria for reforming public statistics. This decree addresses to all public statistical bodies and agencies which provide official statistics both at local, national and international level in order to assure homogeneity of the methods and comparability of the results. To this end, a national statistical plan which defines surveys, data elaborations and project studies for a three-year period shall be drawn up and updated annually, as established in the Decree n. 322/89. The procedures to be followed with relation to the annual fulfilment as well as the forms to be filled in for census, data elaborations and projects, and how to deal with sensitive information are also defined.

The plan is deliberated by the Committee for addressing and coordinating statistical information (Comstat) and forwarded to the Commission for the assurance of statistical information; the Commission adopts the plan after endorsement of the Guarantor of the privacy of personal data. Finally, the plan is approved by a Prime Ministerial Decree after consideration of the Interministerial Committee for economic planning (Cipe). The latest Prime Ministerial Decree, which approved the three-year plan for 2011-2013, updated for 2012-2013, was issued on 20th April 2012. Statistical information and results deriving from the completion of the plan are of public domain and the system is responsible for wide circulation.

Ministries, public agencies and other bodies are obliged to provide the data and information specified in the annual statistical plan; the same obligations regard the private entities. All the data are protected by the principles of statistical disclosure control and can be distributed and communicated only at aggregate level even though microdata can circulate among the subjects of the Statistical System.

The main Sistan products, which are primarily necessary for the inventory compilation, are:

- National Statistical Yearbooks, Monthly Statistical Bulletins, by ISTAT (National Institute of Statistics) (ISTAT, several years [a]; ISTAT, several years [b]);
- Annual Report on the Energy and Environment, by ENEA (Agency for New Technologies, Energy and the Environment) (ENEA, several years);
- National Energy Balance (annual), Petrochemical Bulletin (quarterly publication), by MSE (Ministry of Economic Development) (MSE, several years [a]; MSE, several years [b]);
- Transport Statistics Yearbooks, by MIT (Ministry of Transportation) (MIT, several years);
- Annual Statistics on Electrical Energy in Italy, by TERN (National Independent System Operator) (TERN, several years);
- Annual Report on Waste, by ISPRA (ISPRA, several years[a]).

The national emission inventory itself is a Sistan product.

Other information and data sources are used to carry out emission estimates, which are generally referred to in Table 1.1 in the following section.

ISPRA has elaborated an inventory QA/QC procedures manual (APAT, 2006) which describes QC/QC procedures and verification activities to be followed during the inventory compilation process which facilitate the inventory improvement. Specific QA/QC procedures and different verification activities which are implemented thoroughly the current inventory compilation, as part of the estimation process, are figured out in the annual QA/QC plans (ISPRA, several years [b]).

Quality control checks and quality assurance procedures together with some verification activities are applied both to the national inventory as a whole and at sectoral level. Future planned improvements are prepared for each sector, by the relevant inventory compiler; each expert identifies areas for sectoral improvement based on his own knowledge and in response to inventory UNFCCC reviews and other kind of processes.

The quality of the inventory has improved over the years and further investigations are planned for all

those sectors relevant in terms of contribution to total CO₂ equivalent emissions and with a high uncertainty.

Feedbacks derive, in particular, from the communication of data to different institutions and/or at local level. The preparation of environmental reports where data are needed at different aggregation levels or refer to different contexts, such as environmental and economic accountings, is also a check for emission trends. At national level, for instance, emission time series are reported in the Environmental Data Yearbooks published by the Institute (ISPRA, several years [c]). Emission data are also published by the Ministry for the Environment, Land and Sea in the Reports on the State of the Environment (MATT, several years) and in the National Communications (MATT, 2002; MATTM, 2007; MATTM, 2009) as well as in the Demonstrable Progress report (MATT, 2006). Moreover, figures are communicated to the National Institute of Statistics to be published in the relevant Environmental Statistics Yearbooks (ISTAT, several years [c]) as well as used in the framework of the EUROSTAT NAMEA Project (ISTAT, 2006).

Comparisons between national activity data and data from international databases are usually carried out in order to find out the main differences and an explanation to them (ENEA/MAP/APAT, 2004). Emission intensity indicators among countries (e.g. emissions per capita, industrial emissions per unit of value added, road transport emissions per passenger car, emissions from power generation per kWh of electricity produced, emissions from dairy cows per tonne of milk produced) can also be useful to provide a preliminary check and verification of the order of magnitude of the emissions. This is carried out at European and international level by considering the annual reports compiled by the EC and the UNFCCC as well as related documentation available from international databases and outcome of relevant workshops.

Additional comparisons between emission estimates from industrial sectors and those published by the industry itself in their Environmental reports are carried out annually in order to assess the quality and the uncertainty of the estimates.

The quality of the inventory has also improved by the organization and participation in sector specific workshops. Follow-up processes are also set up in the framework of the WGI under the EC Monitoring Mechanism, which addresses to the improvement of different inventory sectors. Specifically in the last years, two workshops were held, one related to the management of uncertainty in national inventories and problems on the application of higher methodologies to calculate uncertainty figures, the other on how to use data from the European emissions trading scheme in the national greenhouse gas inventories. Previous workshops addressed methodologies to estimate emissions from the agriculture and LULUCF sectors, involving the Joint Research Centre, from the waste sector, involving the European Topic Center on Resource and Waste Management, as well as from international bunkers, involving the International Energy Agency and EUROCONTROL. Presentations and documentation of the workshops are available on the website at the address: <http://air-climate.eionet.europa.eu/meetings/past.html>.

A national conference on the Italian emission inventory was organized by ISPRA in October 2006. Methodologies used to carry out national figures and results of time series from 1990 to 2004 were presented detailing explanations for each sector. More than one hundred participants from national and local authorities, Ministries, Industry, Universities and Research organizations attended the two days meeting.

In 2007, in the context of the national conference on climate change a specific session was dedicated to the national emission inventory. In addition, a specific event was held on the results of the 2005 national GHG inventory. In April 2010 the time series of emission figures 1990-2008 were presented in a specific national Kyoto Protocol event.

A specific procedure undertaken for improving the inventory regards the establishment of national expert panels (in particular, in road transport, land use change and forestry and energy sectors) which involve, on a voluntary basis, different institutions, local agencies and industrial associations cooperating for improving activity data and emission factors accuracy. Specifically, for the LULUCF sector, following the election of the 3.3 and 3.4 activities and on account of an in-depth analysis on the information needed to report LULUCF under the Kyoto Protocol, a Scientific Committee, *Comitato di Consultazione Scientifica del Registro dei Serbatoi di Carbonio Forestali*, constituted by the relevant national experts has been established by the Ministry for the Environment, Land and Sea in cooperation with the Ministry of Agriculture, Food and Forest Policies.

In addition to these expert panels, ISPRA participates in technical working groups within the National Statistical System. These groups, named *Circoli di qualità*, coordinated by the National Institute of Statistics,

are constituted by both producers and users of statistical information with the aim of improving and monitoring statistical information in specific sectors such as transport, industry, agriculture, forest and fishing. As reported in previous sections, these activities improve the quality and details of basic data, as well as enable a more organized and timely communication.

QC procedures are also undertaken on the calculations of uncertainties in order to confirm the correctness of the estimates and that there is sufficient documentation to duplicate the analysis. Figures used to draw up uncertainty analysis are checked with the relevant experts and literature references and they are proved to be consistent with the IPCC Good Practice Guidance and Guidelines (IPCC, 2000; IPCC, 2006).

A summary of all the main QA/QC activities over the past years which ensure the continuous improvement of the inventory is presented in the document ‘Quality Assurance/Quality Control plan for the Italian Emission Inventory’ of the current year (ISPRA, several years[b]).

Specific activities relating to improvements of the inventory and QA/QC activities carried out during the last years were:

- *Energy – Industrial processes Review.* A reallocation of emissions within the petroleum refining subcategory has been carried out using ETS data. An overall revision has concerned the iron and steel emissions coming both from the combustion itself and the production process. A full carbon balance has been calculated and CO₂ emissions have been properly allocated between the relevant subsectors. CO₂ emission factors for coal derived gases, fuel oil, syngas from heavy residuals, refinery gas, natural gas and coal were revised on account of additional information collected from the EU emissions trading scheme and the National Grid Administrator (TERNA). For the industrial sector, new information was available on the use of limestone and dolomite in the pulp and paper industries and from the treatment of power plants’ flue gases.
- *Agriculture Review.* N₂O emissions from sewage sludge applied to soils have been estimated separately from those in the waste sector. CH₄ and N₂O emissions have been revised taking into consideration the results from the MeditAIRaneo project.
- *Energy Balance Verification.* The task force of energy and inventory experts (Ministry of Production Activities, ENEA and APAT) established to examine differences in basic data between the CRF and the joint EUROSTAT/IEA/UNECE questionnaire submissions and to improve the details of the National Energy Balance finalised its study and reported the results in the document “Energy data harmonization for CO₂ emission calculations: the Italian case” (ENEA/MAP/APAT, 2004).
- *Road Transport Emissions Review.* The Italian expert panel on Transport, which includes experts from Research Institutes, Universities, Industrial Associations, Local Authorities, Ministries and Public Authorities, has continued its work on the improvement and assessment of emission estimations from road transport. There has been a considerable improvement on the details of basic data to be used within the COPERT model, in terms of both availability and timeliness. Studies of the expert panel group as well as presentations held in different meetings can be found on the website http://groupware.sinanet.isprambiente.it/expert_panel. Specifically, last year, the whole time series of road transport emissions has been recalculated using the updated version of the model, COPERT 4, affecting CH₄ and N₂O emissions.
- *Other Off road Emissions Review.* The whole time series of aviation emissions was recalculated as a consequence of a specific sectoral study which considered most recent trends in civil aviation both in terms of modelling between domestic and international flights and technological progress of the fleet. The methodology was applied at national and airport level and the results shared with national experts in the framework of an ad hoc working group instituted by the National Aviation Authority (ENAC). There was also a revision of the methodology to estimate emissions from the maritime sector from 2004, on account of a national study which considered most recent trends in terms of modelling between domestic and international consumptions and improvements in operational activities in harbour. Also in this case, results were presented to a working group on local air emission inventories, formed by local authorities, sectoral experts, the Ministry of Environment, Land and Sea, and air quality model experts.

- *LULUCF Review*. The coefficients used in the estimation process for the dead organic matter pool in the relevant categories and for the change in method used to estimate carbon stock changes in perennial crops were updated. Recalculations also occurred on account of availability of new information on fires areas in cropland and grassland which have been estimated and included in the inventory.
- *Waste Review*. A rearrangement of incinerators database has been made which resulted in deviations from previous sectoral estimates. Other recalculations in N₂O and CH₄ emissions occurred because of a reallocation of from biomass pruning have been moved from the waste to the energy.
- *MeditAIRaneo Project*. A three years project involving the Inventory Reference Centres of the European Mediterranean Countries (Italy, Spain, France, Greece, and Portugal) started at the end of the year 2000. The aim was to examine in details emissions that are specific and/or typical of the Mediterranean Countries. Four different studies on air emissions from vegetation, agriculture, solvent use and urban road transport in Mediterranean areas were funded by APAT. Common objectives are analysis of methodologies and emission factors used by Mediterranean countries for estimating emissions, individuation of Mediterranean peculiarities, in comparison with other European countries, such as climate, technologies, industrial management, identification of methodological points which need in-depth examination and uncertainty assessment. An Italian case study has been developed for each of the four projects. In 2006 all the projects concluded and the results have been used in the national inventory to improve country-specific emission factors.
- *Emissions Trading Scheme*. The analysis of sectoral industrial data from the Italian Emission Trading Scheme database has been used to develop country-specific emission factors and check activity data levels.
- *European Pollutant Release and Transfer Register*. Data from the Italian Pollutant Release and Transfer Register (EPER-EPRT) from different industrial sectors were used in the estimation and/or as a check and comparison with the estimates carried out at national level. In particular, this regards the production of non-ferrous metals, chemical productions such as nitric and sulphuric acid, and the production of iron and steel.
- *Local inventories*. A study on the top-down approach to the preparation of local inventories was conducted and Italian emissions for different local areas were derived. In 2013, ISPRA finalised the provincial inventory at local scale for the years 1990, 1995, 2000, 2005 and 2010. The results were checked out by regional and local environmental agencies and governments in order to find out the main weak points and contribute with information available to characterise the local environment. Final estimates and the detailed methodologies followed for each SNAP sector to carry out emission figures are available at ISPRA web address <http://www.sinanet.isprambiente.it/it/sia-ispra/inventaria> and published in technical reports (Liburdi et al., 2004; APAT/ARPA, 2006; ISPRA 2009).

4.2 Inventory preparation

As part of its inventory preparation, each Party included in Annex I shall prepare estimates, make a quantitative estimate of the uncertainty for each source category and for the inventory in total, identify key source categories, and ensure that appropriate methods are used to estimate emissions from key source categories in accordance with the IPCC guidelines and good practice guidance. Each Party shall also ensure that the inventory and any recalculations of previously submitted estimates of anthropogenic GHG emissions by sources and removals by sinks are prepared in accordance with the IPCC good practice guidance and relevant decisions of the COP and/or COP/MOP and that general inventory QC procedures (tier 1) are implemented in accordance with its QA/QC plan (following the IPCC good practice guidance) (UNFCCC, 2005).

In addition, each Party should apply source-category-specific QC procedures (Tier 2) for key source categories and for those individual source categories in which significant methodological and/or data revisions have occurred, in accordance with the IPCC good practice guidance. A basic review of the

inventory should be provided by personnel that have not been involved in the inventory development, preferably an independent third party, before the submission of the inventory, in accordance with the planned QA procedures; a more extensive review of the inventory for key source categories, as well as source categories where significant changes in methods or data have been made, should be provided (UNFCCC, 2005).

Based on the reviews and periodic internal evaluations of the inventory preparation process, the inventory planning process should be re-evaluated in order to meet the established quality objectives (UNFCCC, 2005).

The Italian emission inventory is based on methodologies which are consistent with the IPCC guidelines, the IPCC Good Practice Guidance and the European EMEP/EEA guidebooks (IPCC, 1997; IPCC, 2006; IPCC, 2000; IPCC, 2003; EMEP/CORINAIR, 2007; EMEP/EEA, 2009); national emission factors are used as well as default emission factors from international guidebooks, when national data are not available. Development of national methodologies is supported by background reference materials. Quantitative estimates of uncertainty are calculated for source category at a detailed level and for the inventory in total following the IPCC Good Practice Guidance. The assessment of key categories is particularly important, as they should receive special consideration in terms of methodological aspects and quality assurance and quality control verification. The process of the inventory preparation takes over annually; in the year t final emissions are calculated for the year $t-2$: in case of methodological changes or additional information, emissions are recalculated from 1990 onwards. Detailed information on emission figures and estimation methodologies, including all the basic data and emission factors needed to carry out the final estimates, are provided in the National Inventory Report (NIR) which completes the stage of inventory preparation.

ISPRA has established fruitful cooperation with a number of governmental and research institutions as well as industrial associations, which helps improving some key categories of the inventory. Specifically, these activities aim at the improvement of provision and collection of basic data and emission factors, through plant-specific data, and exchange of information on scientific researches and new sources. Moreover, when in depth investigation is needed and a high uncertainty in the estimates is present, specific sector analyses are committed to ad hoc research teams or consultants.

ISPRA also coordinates with different national and regional authorities and private institutions for the cross-checking of parameters and estimates as well as with ad hoc expert panels in order to improve the completeness and transparency of the inventory.

Basic data, emission factors and methodologies used in the estimation process are consistent with the IPCC Guidelines and supported by national experiences and circumstances. Final decisions are up to inventory experts, taking into account all the information available.

All the reference material, estimates and calculation sheets, as well as the documentation on scientific papers and the basic data needed for the inventory compilation, are stored and archived at the Agency. After each reporting cycle, all database files, spreadsheets and electronic documents are archived as 'read-only-files' so that the documentation and estimates could be traced back during the review process or the new year inventory compilation.

Activity data used in emission calculations and their sources are briefly described here below.

In general, for the energy and industrial sectors, emission data collected in the framework of the European Emissions Trading Scheme, the National Pollutant Release and Transfer Register (EPER/E-PRTR) and the Large Combustion Plant (LCP) Directive have yielded considerable developments in the inventory of the relative sectors. In fact, these data are always used either directly in the estimation process or as a verification of emission estimates, improving national emissions factors as well as activity data figures.

In particular, for the energy sector, basic statistics for estimating emissions are fuel consumption published in the Energy Balance and provided by the Ministry of Economic Development. Additional information for electricity production is provided by the major national electricity producers and by the major national industry corporation. On the other hand, basic information for road transport, maritime and aviation, such as the number of vehicles, harbour statistics and aircraft landing and take-off cycles are provided in statistical yearbooks published both by the National Institute of Statistics and the Ministry of Transportation. Other data are communicated by different category associations. The analysis of data from the Italian Emission Trading Scheme database is used to develop country-specific emission factors and check

activity data levels.

For the industrial sector, the annual production data are provided by national and international statistical yearbooks. Emission data collected through the National Pollutant Release and Transfer Register (EPER/E-PRTR) are taken into account as a verification of emission inventory estimates for some specific categories. According to the Italian Decree of 23 November 2001, data from the Italian EPER/E-PRTR are validated and communicated by ISPRA to the Ministry for the Environment, Land and Sea and to the European Commission within October of the current year for data referring to the previous year.

In addition, final emissions are checked and verified also taking into account figures reported by industries in their annual environmental reports.

Both for energy and industrial processes, emissions of large industrial point sources are registered individually, communicated also in the framework of the European Directive on Large Combustion Plants, based upon detailed information such as fuel consumption. Other small plants communicate their emissions which are also considered individually.

For the other sectors, i.e. for solvents, the amount of solvent use is provided by environmental publications of sector industries and specific associations as well as international statistics.

For agriculture, annual production data and number of animals are provided by the National Institute of Statistics and other sectoral associations.

For land use, land use change and forestry, forest and soil surfaces are provided by the National Institute of Statistics while statistics on forest fires are supplied by the State Forestry Corps.

For waste, the main activity data are provided by the Institute for Environmental Protection and research and the Waste Observatory.

In Table 1.1 a summary of the activity data and sources used in the inventory compilation is reported.

In case basic data are not available, proxy variables are considered; unpublished data are used only if supported by personal communication and confidentiality of data is respected.

Table 1.1 *Main activity data and sources for the Italian Emission Inventory*

SECTOR	ACTIVITY DATA	SOURCE
1 Energy		
1A1 Energy Industries	Fuel use	Energy Balance - Ministry of Economic Development Major national electricity producers European Emissions Trading Scheme
1A2 Manufacturing Industries and Construction	Fuel use	Energy Balance - Ministry of Economic Development Major National Industry Corporation European Emissions Trading Scheme
1A3 Transport	Fuel use Number of vehicles Aircraft landing and take-off cycles and maritime activities	Energy Balance - Ministry of Economic Development Statistical Yearbooks - National Statistical System Statistical Yearbooks - Ministry of Transportation Statistical Yearbooks - Italian Civil Aviation Authority (ENAC) Maritime and Airport local authorities
1A4 Residential-public-commercial sector	Fuel use	Energy Balance - Ministry of Economic Development
1B Fugitive Emissions from Fuel	Amount of fuel treated, stored, distributed	Energy Balance - Ministry of Economic Development Statistical Yearbooks - Ministry of Transportation Major National Industry Corporation
2 Industrial Processes	Production data	National Statistical Yearbooks- National Institute of Statistics International Statistical Yearbooks-UN European Emissions Trading Scheme European Pollutant Release and Transfer Register Sectoral Industrial Associations
3 Solvent and Other Product Use	Amount of solvent use	National Environmental Publications - Sectoral Industrial Associations International Statistical Yearbooks - UN
4 Agriculture	Agricultural surfaces Production data Number of animals Fertiliser consumption	Agriculture Statistical Yearbooks - National Institute of Statistics Sectoral Agriculture Associations
5 Land Use, Land Use Change and Forestry	Forest area, biomass increment and stock Biomass burnt	National Forestry Service (CFS) - National and Regional Forestry Inventory Statistical Yearbooks - National Institute of Statistics Universities and Research Institutes
6 Waste	Amount of waste	National Waste Cadastre - Institute for Environmental Protection and Research , National Waste Observatory

In Table 1.2 a summary of the methods and emission factors used in the compilation of the Italian inventory is reported. A more detailed table describing methods and emission factors for the key categories of the national inventory for the year 2011 is reported in the National Inventory Report as an annex (ISPRA, 2013).

Table 1.2 Methods and emission factors used in the inventory preparation

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED												
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
1. Energy	D,M,T1,T2,T3	CS,D,OTH	D,M,T1,T2,T3	CR,CS,D	D,M,T1,T2,T3	CR,CS,D						
A. Fuel Combustion	D,M,T1,T2,T3	CS	D,M,T1,T2,T3	CR,CS,D	D,M,T1,T2,T3	CR,CS,D						
1. Energy Industries	T3	CS	T3	CR,D	T3	CR,D						
2. Manufacturing Industries and Construction	T2	CS	T2	CR,D	T2	CR,D						
3. Transport	D,M,T1,T2	CS	D,M,T1,T2	CR,CS	D,M,T1,T2	CR,CS						
4. Other Sectors	T2	CS	T2	CR	T2	CR						
5. Other	T2	CS	T2	CR	T2	CR						
B. Fugitive Emissions from Fuels	T1,T2	CS,D,OTH	T1,T2	CR,CS,D	T1	D						
1. Solid Fuels	T1	OTH	T1	CR,CS,D	NA	NA						
2. Oil and Natural Gas	T1,T2	CS,D	T1,T2	CS,D	T1	D						
2. Industrial Processes	D,T2	CR,CS,D,PS	D,T2	CR,CS,PS	T2	D,PS	CS,D,T2	CS,D,PS	CS,T2	PS	CS,T3	CS,PS
A. Mineral Products	T2	CS,D,PS	NA	NA	NA	NA						
B. Chemical Industry	D,T2	PS	D,T2	CR,CS,PS	T2	D,PS	NA	NA	NA	NA	NA	NA
C. Metal Production	D,T2	CR,CS,PS	D	CR,CS,PS	NA	NA	NA	NA	T2	PS	NA	NA
D. Other Production	NA	NA										
E. Production of Halocarbons and SF ₆							NA	NA	CS	PS	NA	NA
F. Consumption of Halocarbons and SF ₆							CS,T2	CS,D,PS	CS	PS	CS,T3	CS,PS
G. Other	NA	NA	NA	NA	NA	NA	D	PS	NA	NA	NA	NA
3. Solvent and Other Product Use	CR,CS	CR,CS				CS						
4. Agriculture			CS,T1,T2	CS,D	CS,T1,T2	CS,D						
A. Enteric Fermentation			T1,T2	CS,D								
B. Manure Management			T1,T2	CS,D	T2	CS,D						
C. Rice Cultivation			T2	CS								
D. Agricultural Soils			NA	NA	CS,T1	CS,D						
E. Prescribed Burning of Savannas			NA	NA	NA	NA						
F. Field Burning of Agricultural Residues			CS	CS,D	CS	CS,D						
G. Other			NA	NA	NA	NA						
5. Land Use, Land-Use Change and Forestry	T1,T2,T3	CS,D	T1	CS,D	T1	CS,D						
A. Forest Land	T1,T2,T3	CS,D	T1	D	T1	D						
B. Cropland	T1,T2,T3	CS,D	T1	D	T1	D						
C. Grassland	T1,T2,T3	CS,D	T1	CS	T1	CS						
D. Wetlands	NA	NA	NA	NA	NA	NA						
E. Settlements	T1	CS,D	NA	NA	NA	NA						
F. Other Land	NA	NA	NA	NA	NA	NA						
G. Other	NA	NA	NA	NA	NA	NA						
6. Waste	D	CS	CS,D,T2	CR,CS,D	CS,D	CR,CS,D						
A. Solid Waste Disposal on Land	NA	NA	T2	CS								
B. Waste-water Handling			D	D	D	CR,D						
C. Waste Incineration	D	CS	CS,D	CR,CS,D	CS,D	CS,D						
D. Other	NA	NA	CS	CS	NA	NA						
7. Other (as specified in Summary 1.A)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Use the following notation keys to specify the method applied:
D (IPCC default) **T1a, T1b, T1c** (IPCC Tier 1a, Tier 1b and Tier 1c, respectively) **CR** (CORINAIR)
RA (Reference Approach) **T2** (IPCC Tier 2) **CS** (Country Specific)
T1 (IPCC Tier 1) **T3** (IPCC Tier 3) **OTH** (Other)

If using more than one method within one source category, list all the relevant methods. Explanations regarding country-specific methods, other methods or any modifications to the default IPCC methods, as well as information regarding the use of different methods per source category where more than one method is indicated, should be provided in the documentation box. Also use the documentation box to explain the use of notation OTH.

Use the following notation keys to specify the emission factor used:
D (IPCC default) **CS** (Country Specific) **OTH** (Other)
CR (CORINAIR) **PS** (Plant Specific)

Where a mix of emission factors has been used, list all the methods in the relevant cells and give further explanations in the documentation box. Also use the documentation box to explain the use of notation OTH.

According to the IPCC Good Practice Guidance and Guidelines, an uncertainty assessment is carried out on the Italian greenhouse gas inventory to establish the uncertainties related to different emission sources and the uncertainty of total emissions for the base year 1990 and the latest inventory year and the so-called trend uncertainty. The uncertainty assessment helps to identify the key categories whose effect on the total uncertainty of the inventory is highest; furthermore, by means of such assessment the improvement measures can be directed so that the total uncertainty of the inventory can be lowered as effectively as possible with the available resources. Uncertainty assessments have been calculated on the Italian greenhouse gas inventory from the inventory of 2001 onwards, recalculations only apply to the base year.

Quantitative estimates of uncertainty for the Italian GHG inventory are calculated using Approach 1 as defined in the IPCC Guidelines (IPCC, 2006), which provides a calculation based on the error propagation equations. In addition, Approach 2, corresponding to the application of Monte Carlo analysis, has been applied to some of the key categories of the inventory in different sectors but the results show that, with the information available at present, applying higher method produces comparable results.

The assumptions on which uncertainty estimations are based are documented for each category. Figures to draw up uncertainty analysis are checked with the relevant analyst experts and literature references and

they are consistent with the IPCC Good Practice Guidance and Guidelines (IPCC, 2000; IPCC, 2006).

The IPCC Good Practice Guidance and Guidelines recommends as good practice the identification of *key categories* in national GHG inventories (IPCC, 2000; IPCC, 2003; IPCC, 2006). A *key category* is defined as an emission source or removal that has a significant influence on a country's GHG inventory in terms either of the absolute relative level of emissions or the trend in emissions, or both. Key categories therefore are those found in the accumulative 95% of the total annual emissions in the last reported year or belonging to the total trend, when ranked in descending order of magnitude.

The assessment of national key categories is important because key categories should receive special consideration in terms of methodological aspects and quality assurance and quality control verification.

Two different approaches are reported in the IPCC 2006 guidelines according to whether or not a country has performed an uncertainty analysis of the inventory: Approach 1 and Approach 2.

When using Approach 1, key categories are identified by means of a pre-determined cumulative emissions threshold, usually fixed at 95% of the total.

If an uncertainty analysis is carried out at category level for the inventory, Approach 2 can be used to identify key categories. Approach 2 is a more detailed analysis that builds on Approach 1; in this case, the results of Approach 1 are multiplied by the relative uncertainty of each source/sink category. Key categories are those that represent 90% of the uncertainty contribution.

So the factors which make a source or a sink a key category are a high contribution to the total, a high contribution to the trend and a high uncertainty.

For the Italian inventory, a key category analysis is carried out according to both Approach 1 and Approach 2. National emissions are disaggregated, as far as possible, into the categories proposed in the IPCC guidelines; other categories are added to reflect specific national circumstances. Both level and trend analysis are applied.

It should be noted that higher tiers are mostly used for calculating emissions from the key categories as requested by the IPCC guidelines (IPCC, 2006).

Tier 2 QC procedures for key categories, as reported in the QA/QC manual procedures (APAT, 2006), are applied. QC procedures are also undertaken on the calculations of uncertainties in order to confirm the correctness of the estimates and that there is sufficient documentation to duplicate the analysis.

The process of the inventory preparation takes over annually. To meet the requirements of transparency, consistency, comparability, completeness and accuracy of the inventory, the entire time series from 1990 onwards is checked and revised every year during the annual compilation of the inventory. Measures to guarantee and improve these qualifications are undertaken and recalculations should be considered as a contribution to the overall improvement of the inventory.

In addition to a new year, the inventory is updated annually by a revision of the existing activity data and emission factors in order to include new information available.

Recalculations are elaborated on account of changes in the methodologies used to carry out emission estimates, changes due to different allocation of emissions as compared to previous submissions and changes due to error corrections. The inventory may also be expanded by including categories not previously estimated if sufficient information on activity data and suitable emission factors have been identified and collected. Revisions always apply to the entire time series.

Information on the major recalculations is provided every year in the sectoral and general chapters of the national inventory reports; detailed explanations of recalculations are given compiling the relevant CRF tables. Descriptions and justifications of the current together with the planned improvements of the inventory are also supplied in the annual QA/QC plan (ISPRA, several years [b]).

In point of fact, the annual QA/QC plan, include all the improvements planned to the inventory and references to the relevant documentation and information supporting the modifications at sectoral and general level. Changes are based on the observations of the different inventory review stages (internal and external evaluations by third parties involved in inventory issues), the review feedbacks received from the

UNFCCC Secretariat on the previous inventory or from the European internal review, and other collected information.

Whenever relevant changes in methodologies and emission estimates for key categories are planned, new methodologies and emission factors are chosen after consultation with the national experts also in the framework of the national sectoral expert panels. Internal reviews are also undertaken, comparing different methodologies, before changes are included in the inventory.

The QA/QC plan is updated every year to re-evaluate the quality objectives of the inventory.

With regard to a review provided by preferably an independent third party, before the submission of the inventory, as requested by the UNFCCC guidelines, an agreement to conduct a bilateral independent review between Italy and Spain was established last year, with a focus on the revision of the GHG inventories of both the Parties. Two in-country visits were already held, in September and October 2012; the Italian team revised part of the energy sector of Spain, specifically the categories public power plants, petroleum refining plants, road transport and off-road, whereas the Spanish team revised the Industrial processes and solvent and other product use, and the LULUCF sectors of Italy. Results of these analyses are not finalized yet but a report will be published as soon as possible. Aim of the review was to carry out a general quality assurance analysis of the inventories in terms of the methodologies, the EFs and the references used, as well as analysing critical cross cutting issues such as the details of the national energy balances and comparison with international data (Eurostat and IEA), use of plant specific information. Revisions of the other inventory sectors are planned during the year 2013.

In addition, a call for tender to carry out an official independent technical review of the entire Italian national greenhouse gas inventory has been launched this year and will be finalized in the next few months.

4.3 Inventory management

As part of its inventory management, each Party included in Annex I shall archive inventory information for each year in accordance with relevant decisions of the COP and/or COP/MOP. This information shall include all disaggregated emission factors, activity data, and documentation about how these factors and data have been generated and aggregated for the preparation of the inventory as well as internal documentation on QA/QC procedures, external and internal reviews, documentation on annual key sources and key source identification and planned inventory improvements (UNFCCC, 2005).

Party shall provide review teams under Article 8 with access to all archived information used by the Party to prepare the inventory, in accordance with relevant decisions of the COP and/or COP/MOP and respond to requests for clarifying inventory information resulting from the different stages of the review process of the inventory information, and information on the national system, in a timely manner in accordance with Article 8 (UNFCCC, 2005).

As part of its inventory management, each Party included in Annex I should make the archived information accessible by collecting and gathering it at a single location (UNFCCC, 2005).

A proper archiving and reporting of the documentation related to the inventory compilation process is also part of the national QA/QC programme. All information relating to the planning, preparation, and management of inventory activities are documented and archived. The material and documents are stored at the Institute for Environmental Protection and Research and can be consulted whenever needed. All information used for the inventory compilation is traceable back to its source. The inventory is composed by spreadsheets to calculate emission estimates; activity data and emission factors as well as methodologies are referenced to their data sources. Particular attention is paid to the archiving and storing of all inventory data, supporting information, inventory records as well as all the reference documents. The archive is organised so that any skilled analyst could obtain relevant data sources and spreadsheets, reproduce the inventory and review all decisions about assumptions and methodologies undertaken.

A master documentation catalogue is generated for each inventory year and it is possible to track changes

in data and methodologies over time. Specifically, the documentation includes:

- electronic copies of each of the draft and final inventory report, electronic copies of the draft and final CRF tables;
- electronic copies of all the final, linked source category spreadsheets for the inventory estimates (including all spreadsheets that feed the emission spreadsheets);
- results of the reviews and, in general, all documentation related to the corresponding inventory year submission.

After each reporting cycle, all database files, spreadsheets and electronic documents are archived as 'read-only' mode.

A 'reference' database is also compiled every year to increase the transparency of the inventory. This database consists of a number of records that references all documentation used during the inventory compilation, for each sector and submission year, the link to the electronically available documents and the place where they are stored as well as internal documentation on QA/QC procedures.

The archive and the 'reference' database are completely accessible to the review team and ISPRA makes this information available, in the framework of the official UNFCCC review process under the Convention and the Kyoto Protocol, to the requests for clarifying inventory information in the different stages of the review, in a timely and complete manner.

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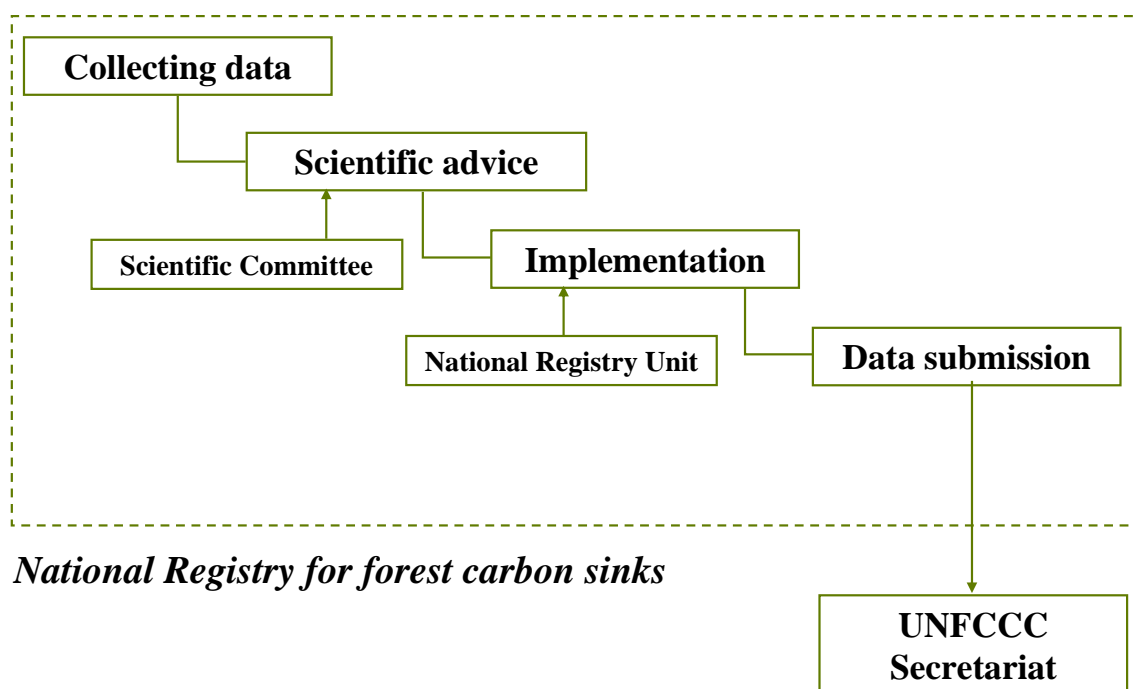
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ANNEX1: THE NATIONAL REGISTRY FOR FOREST CARBON SINKS

The “National Registry for forest carbon sinks” is part of the Italian National System; it is the instrument to estimate, in accordance with the COP/MOP decisions, the IPCC Good Practice Guidance on LULUCF and every relevant IPCC guidelines, the greenhouse gases emissions by sources and removals by sinks in *forest land* and related land-use changes and to account for the net removals in order to allow the Italian Registry to issue the relevant amount of RMUs.



Italy has approved the National Plan for greenhouse gases reduction (PNR_{GHG}) with the CIPE (*Interministerial Economic Planning Committee*) decision n. 123, of 19 December 2002. The PNR_{GHG} sets policies and measures to act in order to achieve the national target of the Kyoto Protocol; Italy has committed to 6.5% reduction below 1990 greenhouse gases emission levels. The article 7.4 of CIPE decision (123/2002) states that Ministry for the Environment, Land and Sea (MATTM), in agreement with Ministry of Agriculture, Food and Forest Policies (MIPAAF) has to constitute, the National Registry for the forest carbon sinks to account for the net removals in the period 2008 – 2012, from *afforestation*, *reforestation* and *deforestation* activities (art. 3.3 KP) and from elected activities under article 3.4 of Kyoto Protocol (*forest management*). The National Registry for Carbon sinks, instituted by a Ministerial Decree on 1st April 2008, is part of National Greenhouse Gas Inventory System in Italy and includes information on units of lands subject of activities under Article 3.3 and activities elected under Article 3.4 and related carbon stock changes.

The National Registry for Carbon sinks is the instrument to estimate, in accordance with the COP/MOP decisions, the IPCC Good Practice Guidance on LULUCF and every relevant IPCC guidelines, the greenhouse gases emissions by sources and removals by sinks in forest land and related land-use changes and to account for the net removals in order to allow the Italian Registry to issue the relevant amount of RMUs. In 2009, a technical group, formed by experts from different institutions (ISPRA; Ministry of the Environment, Land and Sea; Ministry of Agriculture, Food and Forest Policies and University of Tuscia), set up the methodological plan of the activities necessary to implement the registry and defined the relative funding. Some of these activities (in particular IUTI, inventory of land use) have been completed, resulting in land use classification, for all national territory, for the years 1990, 2000 and 2008. A process of validation and verification of IUTI data is ongoing and will supply data useful to update and improve the estimations.

Italy, in the “*Report on the determination of Italy’s assigned amount under Article 7, paragraph 4, of the*

Kyoto Protocol (Decision 13/CMP.1), has reported:

- the election of *forest management* as an activity under Article 3.4 of Kyoto Protocol and has adopted the forest definition in agreement with Food and Agriculture Organization of the United Nations definitions, with the following threshold values for tree crown cover, land area and tree height:
 - a. a minimum area of land of 0.5 hectares;
 - b. tree crown cover of 10 per cent;
 - c. minimum tree height of 5 meters.

Italy's forest area eligible under *forest management* activity is the total forest area, since the entire Italian forest area has to be considered managed.

Following the Decision 8/CMP.2, credits from *forest management* are capped, in the first commitment period, to 2.78 Mt C (10.19 MtCO₂) per year, or 13.9 Mt C (50.97 MtCO₂) the whole commitment period per year.

Italy intends to account for Article 3.3 and 3.4 activities at the end of the commitment period.

Considering that the entire Italian forest area is subject to the *forest management* activity, under Kyoto Protocol, accounting for carbon stocks changes (and the related non-CO₂ emissions) on the national forest area, and on deforested areas, occurring in the first Commitments Period, is required.

The key elements of the accounting system in the National Registry for forest carbon sinks are:

National Land-Use Inventory (IUTI)

aimed at identifying and quantifying:

- *forest land* areas;
- land in conversion from *forest land* category since 31 December 1989;
- land in conversion to *forest land* category since 31 December 1989.

National Inventory of Carbon Stocks (ISCI)

aimed at quantifying:

- carbon stocks and carbon stock changes in any land-use category in the first Commitments Period.

National Census of Forest Fires (CIFI)

aimed at identifying and quantifying:

- *forest land* areas affected by fires.

National Inventory of non-CO₂ emissions from forest fires (IEIF)

aimed at quantifying:

- non-CO₂ emissions from *forest land* areas affected by fires.

National Land-Use Inventory (IUTI)

The National Land-Use Inventory (IUTI) is aimed at identifying the land uses and land-use changes over the national territory. IUTI will supply data concerning areas under *forest land* category (art. 3.4 of KP) and of land in conversion to and from *forest land* categories (art. 3.3 of KP). IUTI is based on a survey of sample

points throughout Italian national territory considered as a population of points, and on the classification of the land use coupled with the sampling points. By using on-screen interpretation of digital orthophotos, land use is classified with a high degree of accuracy and precision, as required by IPCC standards. The following set of multi-temporal orthophotos was used as basis of photo-interpretation process:

- 1990, the black and white high resolution full national coverage aerial photography database of TerraItaly¹ was used to produce orthophotos in scale 1:75.000, spatial resolution of 1 m (the aerial photos, taken on 1988/89, have the same image acquisition standard adopted by USGS-National High Altitude Program at that time: panchromatic film, 400 lines per millimeter);
- 2000, TerraItaly² 2000 dataset, digital color aerial orthophotos with spatial resolution of 1 m;
- 2008, TerraItaly³ 2008 dataset, digital color aerial orthophotos with spatial resolution of 0.5 m.

Furthermore, visual interpretation was supported by ancillary information from available thematic forest and land use maps at regional and sub-regional scales.

Time:

IUTI adopts statistical sampling procedures to estimate the area covered by IPCC land use categories in Italy at three points in time (1990, 2008 and 2012). Annual estimates of land uses and land use changes are deduced to provide time-series of the areas devoted to any land-use category and any land-use change subcategory to and from *forest land* use, in the KP reporting. For the first Commitment Period accounting, the time series needed is related to the period 31/12/1989 - 1/1/2013; in particular the 31/12/1989 data are needed for identifying existing forest lands (*Forest Management*, art. 3.4) and setting land reference scenario for *Afforestation*, *Reforestation* and *Deforestation* (art. 3.3).

Space:

The sampling grid and the relative sample plots (1,206,000 sampling points) is uniformly distributed throughout the entire Italian national territory, using a non-aligned systematic sampling. The set of sample points was extracted using a 0.5 km square grid, for a total of about 1,206,000 geo-referenced points randomly located in each square cell and fully covering the Italian territory. A subset of the IUTI sample is represented by the 301,300 first phase sample points of the the national forest inventory (INFC).

Categories and subcategories:

Land use categories (Table A10.1) are defined according to IPCC Good Practice Guidance for LULUCF:

¹ http://www.cgrit.it/prodotti/voli_italia.html

² <http://www.terraitaly.it/>

³ <http://www.terraitaly.it/>

Table A10.1: IUTI classification system

IPCC Category Level I	IUTI Category Level II	IUTI Subcategory Level III	Code
1. Forest land	<i>Woodland</i>		1.1
	<i>Wooded land temporarily unstocked</i>		1.2
2. Cropland	<i>Arable land and other herbaceous cultivations</i>		2.1
		<i>Fruit orchards and plant nurseries</i>	2.2.1
	<i>Arboreal cultivations</i>	<i>Wood product plantations</i>	2.2.2
3. Grassland	<i>Grassland, pastures and uncultivated herbaceous areas</i>		3.1
	<i>Other wooded land</i>		3.2
4. Wetlands	<i>Marshlands and open waters</i>		4
5. Settlements	<i>Urban development</i>		5
6. Other land	<i>Non-productive areas or areas with scarce or absent vegetation</i>		6

Each sample point is photo-interpreted in order to classify the sample into IUTI land use classes at different points in time (1990, 2008 and 2012). For sample points where a land use change in the forest category is detected between 1990 and 2008, as a result of afforestation/reforestation/deforestation activities, the land use classification is performed also in an intermediate point in time (2000), in order to estimate by interpolation the annual gain/loss of forest area in different time periods (1990-2000 and 2000-2008)

Quality assurance/Quality control:

Data supplied by IUTI will be collected in the “*National Registry for the forest carbon sinks*” of Kyoto Protocol, and have to fulfil quality requirements as stated by the IPCC and UNFCCC guidelines. The photointerpreters have been trained through specific courses, in order to ensure a standard photointerpretation approach. In this phase, a particular attention was paid to the presence and distribution of forest formations. In cases of uncertain land use classification of the sample point, an internal expert panel classified the point.

The procedure of quality control has been carried out by an internal expert panel which led a new photointerpretation on a sub-sample of classified points (5%). The control activities have produced the same classification as carried out by the photointerpreters in more than of 95% of the cases.

Classification methodology

The adopted classification methodology ensures that any unit of land could be classified univocally (exclusion of multiple classification of the same unit of land) under a category (exclusion of the null case), by means of:

- a systematic sampling design to select classification points;
- a list of land-use definitions as reported in the IPCC GPG land-use classification;
- a list of land-use indicators able to indicate the presence of a certain use on the land;

-
- a classification hierarchy to facilitate land use classification (Table A10.2)

Concerning land use classification, the first step is related to a land classification, following artificial land level; the aim is to discriminate between land areas significantly modified by human activity, with an evolution strongly conditioned by prevalently residential and productive activities, and land areas characterized by a high degree of naturalness, in which natural evolution, although conditioned by human action, still exercises a predominant effect in the determination of the prevalent characteristics of the land.

Distinctions are therefore made between urbanized and agricultural territories, and natural and semi-natural territories (forest, pre-forest and herbaceous formations, open water, rocky areas).

At the subsequent levels, the classification process follows the prevalent use of land in the category of artificial territories, while the discriminating element for natural and semi-natural territories is essentially given by the vegetative cover degree, considering canopy, shrub and herbaceous cover.

Table A10.2: Classification hierarchy

A. Land with its original characteristics of physiognomy and vegetation significantly modified by human action, cultivated, cleared or subject to urbanization work, and dominated by anthropic artefacts due to residential, industrial, socio-cultural and agricultural activities.

AI. Land occupied by other agricultural cultivations

AI1. Herbaceous cultivations in open fields, subject to regular rotation, for the production of cereals, pulses, other food products or forage.

ARABLE

AI2. Arboreal cultivations not subject to regular rotation, destined permanently to the production of fruit or wood products.

AI2a. Arboreal cultivations destined prevalently to the production of fruit for nutritional purposes (apple orchards, vineyards, olive groves, etc) or for the production of arboreal or shrub species for ornamental purposes

ORCHARDS and NURSERIES

AI2b. Arboreal cultivations destined prevalently to the production of wood products or of woody biomass for energy generation purposes

ARBOREAL CULTIVATIONS FOR WOOD PRODUCTS

II. Areas with residential and industrial buildings and services, transport routes, infrastructures and urban green areas (parks and gardens)

SETTLEMENTS

B. Natural or semi-natural land not significantly modified by human action or in phase of renaturalization.

BI. Formations constituted by trees able to reach the height on maturity *in situ* of 5 m, but temporarily lacking in canopy cover following accidental events or anthropic action.

wooded land temporarily without above-ground cover

BII. Formations constituted by trees able to reach the height on maturity *in situ* of 5 m and procuring a degree of canopy cover on the terrain of $\geq 5\%$.

BIII1. Formation with a degree of cover $< 10\%$

OTHER WOODED AREAS

BII2. Formation with a degree of cover $\geq 10\%$

WOODLAND

BIII. Formations never as above

BIII1. Formations constituted by shrubs or trees not able to reach a height on maturity *in situ* of 5 m, and procuring a degree of canopy cover on the terrain of $\geq 10\%$

OTHER WOODED LAND

BIII2. Formations constituted by shrubs or trees not able to reach a height on maturity *in situ* of 5 m and procuring a degree of canopy cover on the terrain of $< 10\%$, and silvi-pastoral formations with canopy cover from trees able to reach a height on maturity *in situ* of 5 m but with cover $< 5\%$

BIII2a. *Natural herbaceous formations of ground species with a degree of herbaceous cover of $\geq 40\%$.*

PASTURES, MEADOWS and UNCULTIVATED HERBACEOUS AREAS

BIII2b. *Natural herbaceous formations with a degree of herbaceous cover of $< 40\%$ or land completely lacking herbaceous cover*

BIII2b1. *Land without vegetation or with sporadic herbaceous vegetation. Rocky outcrops and beaches.*

OTHER LANDS

C. Areas without vegetation and covered by still or flowing water or areas occupied by particular ecosystems other than terrestrial ecosystems (floating vegetation, wet vegetation, saltwater vegetation, etc).

MARSHLANDS AND OPEN WATERS

To achieve land use classification, a 0.5 ha neighbourhood of the sample plot is investigated. The operative procedure consists in digital orthophotos processing, considering sampling points: for each point identified on the territory by coordinates in a known reference system, the land use category, defined according to the classification system, must be established.

A grid, composed of 9 squares (3 x 3) of 2500 m² each, for an overall surface area of 22,500 m² is used. This graphic object, at the centre of which the sampling point must be situated, allows to assess whether area intercepted by the sampling point has an extension equal to or greater than the established threshold (equivalent to the surface area of 2 of the 9 cells displayed).

If the surface area value is very close to the threshold and the use of the cells still leaves doubts, a graphic tool for surface area measurement is used for the classification process. The contour of the polygon containing the sampling point is mapped, computing the extent of the area.

In Figures A10.1, A10.2 and A10.3, examples from land use classification system are reported. In particular, in figure 1 the sampling point is classified as 3.1 Grassland, given that trees covering the sampling point have a surface area between 500 and 5000 m². In Figure A10.2, the sampling point is classified as 1.1 Woodland, while in Figure A10.3, the sampling point is classified as 3.1 Grassland.

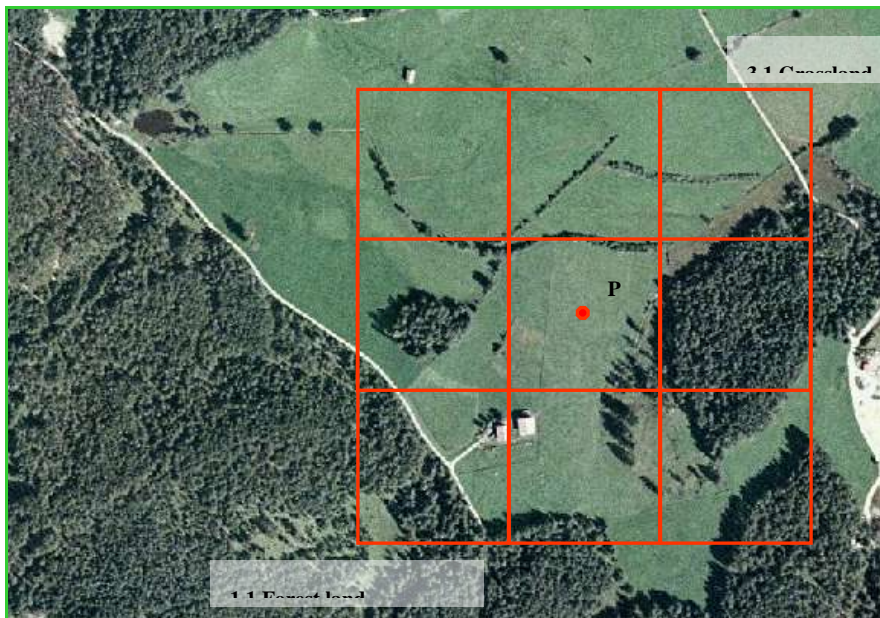


Figure A10.1: Land use classification system - grassland



Figure A10.2: Land use classification system - Woodland

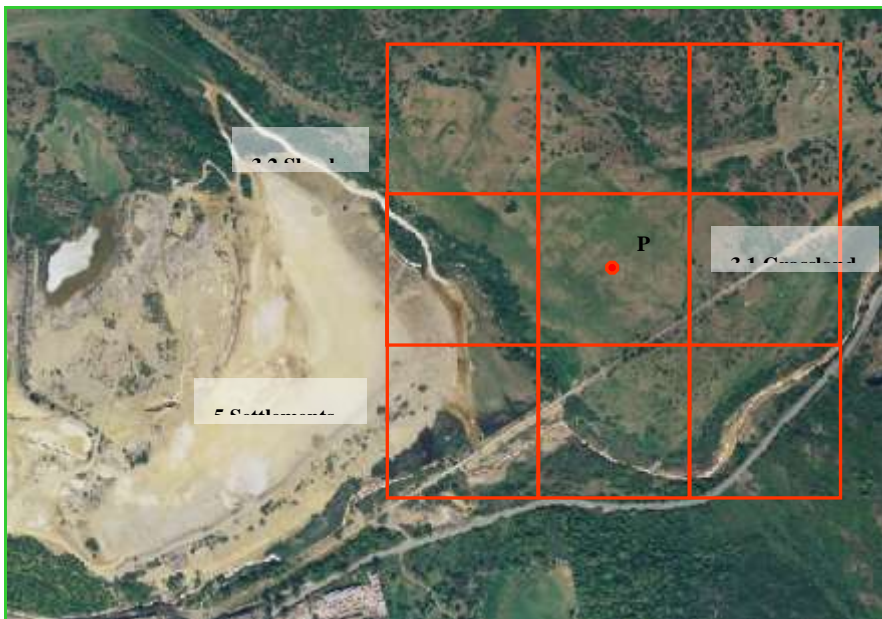


Figure A10.3: Land use classification system – grassland

National Inventory of Carbon Stocks (ISCI)

The National Inventory of the Carbon Stocks is a sampling of carbon stocks related to the different land-use categories.

The National Inventory of the Carbon Stocks includes:

- carbon stock changes in the land-use category forest land, the dataset is derived by the IFN data;
- carbon stock changes in the subcategories of the conversion to or from forest land to other predominant uses, the land in conversion to and from *forest land* to other uses require data integration with studies and additional surveys in order to estimate, at regional level, the C stock levels related to non-forest land uses (i.e. *settlements, cropland, grassland, wetlands*).

Time:

ISCI will annually provide time series of carbon stock levels and carbon stock changes for the category *forest land* and for the sub-categories land in conversion to and from *forest land* to other uses. For the Kyoto Protocol first Commitment Period accounting, the time series needed is related to the period 31/12/2007 - 1/1/2013.

Space:

Concerning the category *forest land* and any other category in conversion to and from *forest land*, the NFIs will assure the spatial coverage, providing carbon stocks data, at NUT2 level.

Quality assurance:

Data supplied by ISCI will be collected in the so-called “*National Registry for the forest carbon sinks*” of Kyoto Protocol, and have to fulfil quality requirements as stated by the IPCC and UNFCCC guidelines.

National Census of Forest Fires (CIFI)

The National Census of Forest Fires is a system aimed to detect, locate and classify *forest land* areas affected by fires; it will provide data on:

- forest areas affected by fires;
- forest typology and stand features;
- proxy parameters in order to estimate the initial C stock and losses by fire (e.g. vegetation height, altitude, slope, exposure).

Time:

CIFI will annually provide, from 01/01/2008, time series of forest areas affected by fires. For the Kyoto Protocol first Commitment Period accounting, the time series needed is related to the period 01/01/2008 - 31/12/2012 (because of the strong variability of the forest fires occurrence no interpolation of data is allowed).

Space:

CIFI will cover all the national territory and will provide geographically referenced data on burned *forest land remaining forest land* areas (art. 3.4) and on *land converted to forest land* burned areas (art. 3.3).

Key elements:

The key elements are:

- ground surveys that have to detect fires and record boundaries of burned areas. Additional data will concern collection of attributes as damage evaluation (percentage of oxidised biomass), forest typology (following NFI classification);
- remote sensed data will integrate data from ground surveys, in order to cross-check detected burned areas, at 0.5 ha spatial definition;
- digital terrain model;
- forest-non forest Boolean mask.

Quality assurance:

Data supplied by CIFI will be collected in the so-called “*National Registry for the forest carbon sinks*” of Kyoto Protocol, and have to fulfil quality requirements as stated by the IPCC and UNFCCC guidelines.

National Inventory of non-CO₂ emissions from forest fires (IEIF)

The Forest fires GHG emissions National Inventory is aimed at estimating non-CO₂ emissions from forest fires (CO₂ emissions are not taken into account, being already computed by National Inventory Carbon Stocks as decreases in carbon stocks). It will provide:

- emission figures of the land-use category *forest land*;
- emission figures of the land-use categories in conversion to or from *forest land* to other predominant uses.

Time:

The Forest fires GHG emissions National Inventory will annually provide time series of non-CO₂ emissions from forest fires. For the Kyoto Protocol first Commitment Period (CP) accounting, the needed time series is related to the period 01/01/2008 - 31/12/2012.

Space: IEIF will supply estimates of emissions released by fires detected by National Census of Forest Fires.

Key elements:

For any fire, once identified the prevalent forest typology and the damage of the stand (i.e. percentage of burned biomass) affected by fire, through the National Forest Service surveys, related carbon stocks are estimated by National Inventory Carbon Stocks. Emissions are calculated applying the damage coefficients and the emissions factors referenced or elaborated by research projects to the estimated carbon stocks.

Quality assurance:

Data supplied by IEIF will be collected in the “*National Registry for the forest carbon sinks*” of Kyoto Protocol, and have to fulfil quality requirements as stated by the IPCC and UNFCCC guidelines.

ANNEX 2: THE NATIONAL REGISTRY

According to Article 7 of the Kyoto Protocol each Party included in Annex I shall incorporate in its annual greenhouse gas inventory the necessary supplementary information for the purposes of ensuring compliance with Article 3 of the Kyoto Protocol.

Supplementary information under article 7, paragraph 1, with regards to units holdings and transactions during the year 2012, is reported in the annual SEF submission.

This annex reports supplementary information under article 7, paragraph 2, with regards to the national registry and in accordance with the guidelines set down in Annex I.II of UNFCCC's Decision 22/CP.8.

More detailed information can be found in the relevant annexes that have been submitted to the UNFCCC along with the National Inventory Report 2013.

(a) The name and contact information of the registry administrator designated by the Party to maintain the national registry

The Italian Registry is administrated by ISPRA (former APAT) under the supervision of the national Competent Authority for the implementation of the European directive 2003/87/CE, jointly established by the Ministry for Environment, Land and Sea and the Ministry for Economic Development. ISPRA, as Registry Administrator, is responsible for the management and functioning of the Registry, including Kyoto protocol obligations.

The contact person is: Mr Riccardo Liburdi
address: Via Vitaliano Brancati 48 – 00144 Rome – Italy
telephone: +390650072544
fax: +390650072657
e-mail: riccardo.liburdi@isprambiente.it

(b) The names of the other Parties with which the Party cooperates by maintaining their national registries in a consolidated system

The EU Member States, which are also Parties to the Kyoto Protocol (25) plus Iceland, Liechtenstein and Norway, decided to operate their registries in a consolidated manner in accordance with all relevant decisions applicable to the establishment of Party registries - in particular Decision 13/CMP.1 and decision 24/CP.8. The consolidated platform which implements the national registries in a consolidated manner (including the registry of EU) is called Consolidated System of EU registries (CSEUR).

(c) A description of the database structure and capacity of the national registry

In 2012, the EU registry has undergone a major redevelopment with a view to comply with the new requirements of Commission Regulation 920/2010 and Commission Regulation 1193/2011 in addition to implementing the Consolidated System of EU registries (CSEUR).

The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries. The documentation is annexed to the current submission to UNFCCC.

During certification, the consolidated registry was notably subject to connectivity testing, connectivity reliability testing, distinctness testing and interoperability testing to demonstrate capacity and conformance to the Data Exchange Standard (DES). All tests were executed successfully and lead to successful certification on 1st June 2012.

(d) A description of how the national registry conforms to the technical standards for data exchange between registry systems for the purpose of ensuring the accurate, transparent and efficient exchange of data between national registries, the clean development mechanism registry and the transaction log (decision 19/CP.7, paragraph 1)

The overall change to a Consolidated System of EU Registries triggered changes to the registry software and required new conformance testing. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries. The documentation is annexed to the current submission to UNFCCC.

During certification, the consolidated registry was notably subject to connectivity testing, connectivity reliability testing, distinctness testing and interoperability testing to demonstrate capacity and conformance to the Data Exchange Standard (DES). All tests were executed successfully and lead to successful certification on 1st June 2012.

(e) A description of the procedures employed in the national registry to minimize discrepancies in the issuance, transfer, acquisition, cancellation and retirement of ERUs, CERs, tCERs, lCERs, AAUs and/or RMUs, and replacement of tCERs and lCERs, and of the steps taken to terminate transactions where a discrepancy is notified and to correct problems in the event of a failure to terminate the transactions

The overall change to a Consolidated System of EU Registries also triggered changes to discrepancies procedures, as reflected in the updated manual intervention document and the operational plan. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries. The documentation is annexed to the current submission to UNFCCC.

(f) An overview of security measures employed in the national registry to prevent unauthorized manipulations and to prevent operator error and of how these measures are kept up to date

The overall change to a Consolidated System of EU Registries also triggered changes to security, as reflected in the updated security plan. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries. The documentation is annexed to the current submission to UNFCCC.

(g) A list of the information publicly accessible by means of the user interface to the national registry

Non-confidential information required by Decision 13/CMP.1 annex II.E paragraphs 44-48, is publicly accessible through the public website <http://www.info-ets.isprambiente.it>.

All required information is provided with the following exceptions:

- paragraph 45(e): representative name and contact information is deemed as confidential according to Annex XVI of the EU Registry Regulation No 916/2007/EC;
- paragraph 46: no Article 6 (Joint Implementation) project is reported as conversion to an ERU under an Article 6 project did not occur in the specified period;
- paragraph 47(a)(d)(f): holding and transaction information is provided on an account type level, due to more detailed information being declared confidential by article 75 of EC Regulation 920/2010 as emended by EC Regulation 1193/2011.

(h) The Internet address of the interface to its national registry

The Italian registry can be accessed at the following URL:

<https://ets-registry.webgate.ec.europa.eu/euregistry/IT/index.xhtml>

A support portal, with news, procedures, documentation, is also available for the public at:

<http://www.info-ets.isprambiente.it>

(i) A description of measures taken to safeguard, maintain and recover data in order to ensure the integrity of data storage and the recovery of registry services in the event of a disaster

The overall change to a Consolidated System of EU Registries also triggered changes to data integrity measures, as reflected in the updated disaster recovery plan. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries. The documentation is annexed to this submission.

(j) The results of any test procedures that might be available or developed with the aim of testing the performance, procedures and security measures of the national registry undertaken pursuant to the provisions of decision 19/CP.7 relating to the technical standards for data exchange between registry systems.

On 2 October 2012 a new software release (called V4) including functionalities enabling the auctioning of phase 3 and aviation allowances, a new EU ETS account type (trading account) and a trusted account list went into Production. The trusted account list adds to the set of security measures available in the CSEUR. This measure prevents any transfer from a holding account to an account that is not trusted.