ISPRA
Institute for Environmental Protection and Research

National Greenhouse Gas Inventory System in Italy. Year 2009

April 2009

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ISPRA is the Institute for Environmental Protection and Research established by the Italian Law 133/2008, as published in the Official Journal n. 195, August 21 2008. The Institute performs the functions of three former institutions: APAT (Agency for Environmental Protection and Technical Services), ICRAM (Central Institute for Applied Marine Research), INFS (National Institute for Wildlife).

This publication refers to activities carried out prior to the unification of the three institutions and, therefore, individual reference is still made to them.

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ISBN 978-88-448-0398-8

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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:

- 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; at the moment, there isn't a fund for the activities related to art. 3.3 and 3.4 of Kyoto, considering that the fund of 2 million euros per year for each of the years 2008, 2009 and 2010 established in the Budget Law 2008 (subparagraph 335) was zeroed by the actual Government. The National Registry for Carbon sinks should have been in place from January 2008, to supply data for the first Kyoto submission in January 2010. Up to now, National Registry for Carbon Sinks is not operational even though, in the last months, a technical group, formed by experts from different istitutions (ISPRA, Ministry for the Environment, Land and Sea, Ministry of Agriculture, Food and Forest Policies and University of Tuscia), is working to set up the methodological plan of the activities and define the relative funding.

The National System for the Italian Greenhouse Gas Inventory has been 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 the 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 website http://www.sinanet.apat.it/it/sinanet/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.

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

ISPRA is also responsible for developing, operating and maintaining the national registry under Directive 2003/87/CE as instituted by the Legislative Decree 51 of March 7th 2008; the Institute performs this tasks 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. ISPRA, as Registry Administrator, is responsible for the management and functioning of the 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 will be regulated by a future Decree. Detailed information on the national registry is reported 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 raised 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.apat.it/it/sinanet/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 draw 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 2008-2010, was issued on 6th August 2008. 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 MINT (Ministry of Transportation) (MINT, several years);
- Annual Statistics on Electrical Energy in Italy, by TERNA (National Independent System Operator) (TERNA, several years);
- Annual Report on Waste, by ISPRA (APAT-ONR, several years).

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 (APAT, 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 CO_2 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 (APAT, several years [a]). 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) 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. 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. International reviews also contribute to improve the inventory and identify areas where further studies are needed.
Additional comparisons between emission estimates from industrial sectors and those published by the industry itself in the 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 address to the improvement of different inventory sectors.
A specific procedure undertaken for improving the inventory regards the establishment of national expert panels (specifically, 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 and Forestry. The information included in Annex 1 of this document is the result of discussion and has also been shared within this expert panel.
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. These activities should 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 (IPCC, 2000).

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

- *Energy – Industrial processes Sectors Review*. 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 CO_2 emissions have been properly allocated between the relevant subsectors.
- *Agriculture sector*. CH_4 and N_2O 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 CO_2 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 www.inventaria.sinanet.apat.it/ept. Specifically, this year the whole time series of road transport emissions has been recalculated using the updated version of the model, COPERT 4.
- *Other Off road Emissions Review*. The whole time series of aviation emissions has been 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 has been 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 has also been 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.
- *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 Emission Registry.* Data from the Italian Pollutant Emission Register (EPER) from some industrial sectors were used 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 2008, ISPRA finalised the provincial inventory at local scale for the years 1990, 1995, 2000 and 2005. 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.apat.it/it/inventaria and published in technical reports (Liburdi et al., 2004; APAT/ARPA, 2006; ISPRA 2009 [a]).

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-CORINAIR Emission Inventory Guidebook (IPCC, 1997; IPCC, 2006; IPCC, 2000; IPCC, 2003; EMEP/CORINAIR, 2007); 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 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 Emission Register (EPER, now EPRTR) 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/EPRTR 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.

These data are not always directly used for the compilation of the inventory because industries communicate figures only if they exceed specific thresholds; furthermore, basic data such as fuel consumption are not supplied and production data are not split by product but given as an overall value. Anyway, EPER/EPRTR is a good basis for data checks and a way to facilitate contacts with industries which, in many cases, supply additional information as necessary for carrying out sectoral emission estimates.
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.

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 Emission Registry 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 and soil surfaces Amount of biomass Biomass burnt Biomass growth	Statistical Yearbooks - National Institute of Statistics State Forestry Corps National and Regional Forestry Inventory Universities and Research Institutes
6 Waste	Amount of waste	National Waste Cadastre - Institute for Environmental Protection and Research , National Waste Observatory

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

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 as communicated to the European Commission in the framework of the monitoring mechanism of GHG emission inventory for the purpose of Article 4(1)(b) under the Implementing Provisions (EC, 2005) is reported in the National Inventory Report as an Annex (ISPRA, 2009 [b]).

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)
1. Energy	**D,M,T1,T2,T3**	**CS,D**	**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	T1,T2	CR,CS,D	T1	D						
1. Solid Fuels	NA	NA	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**	**CR,CS,PS**	**D**	**D,PS**	**CS,D,T2**	**CS,D,PS**	**CS,T2**	**D,PS**	**CS,D,T3**	**CS,PS**
A. Mineral Products	D,T2	CS,D,PS	NA	NA	NA	NA						
B. Chemical Industry	D	CR,PS	D	CR,CS,PS	D	D,PS	NA	NA	NA	NA	NA	NA
C. Metal Production	D	CR,CS,PS	D	CR,CS,PS	NA	NA	D	PS	T2	D,PS	D	PS
D. Other Production	NA	NA										
E. Production of Halocarbons and SF_6							CS	PS	NA	NA	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	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	**CR,CS**	**CR,CS**			**CS**	**CS**						
4. Agriculture			**D,T1,T2**	**CS,D**	**D,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	D	CS,D						
E. Prescribed Burning of Savannas			NA	NA	NA	NA						
F. Field Burning of Agricultural Residues			D	CS,D	D	CS,D						
G. Other			NA	NA	NA	NA						
5. Land Use, Land-Use Change and Forestry	**T1,T2**	**CS,D**	**T1**	**D**	**T1**	**D**						
A. Forest Land	T1,T2	CS,D	T1	D	T1	D						
B. Cropland	T1	CS,D	NA	NA	NA	NA						
C. Grassland	T1	CS,D	NA	NA	NA	NA						
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**	**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	D	CR	D	CS						
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

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.

Table 1.2 Methods and emission factors used in the inventory preparation

According to the IPCC Good Practice Guidance, 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 a Tier 1 approach as defined in the IPCC Good Practice Guidance (IPCC, 2000), which provides a calculation based on the error propagation equations. In addition, a Tier 2 approach, corresponding to the

application of Monte Carlo analysis, has been applied to specific categories of the inventory but the results show that, with the information available at present, applying methods higher than the Tier 1 does not make a significant difference in figures.
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 (IPCC, 2000).

The IPCC Good Practice Guidance recommends as good practice the identification of *key source categories* in national GHG inventories (IPCC, 2000; IPCC, 2003). A *key source category* is defined as an emission source 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 Good Practice according to whether or not a country has performed an uncertainty analysis of the inventory: the Tier 1 and Tier 2.
When using the Tier 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, the Tier 2 can be used to identify key categories. The Tier 2 approach is a more detailed analysis that builds on the Tier 1; in this case, the results of the Tier 1 are multiplied by the relative uncertainty of each source/sink category. Key categories are those that represent 95% 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 the Tier 1 and Tier 2 methods. National emissions are disaggregated, as far as possible, into the categories proposed in the Good Practice; 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 Good Practice Guidance (IPCC, 2000).
Tier 2 QC procedures for key sources, 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 (APAT, 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 sources 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.

Regarding a basic review of the inventory provided by preferably an independent third party, before the submission of the inventory, as requested by the UNFCCC guidelines, different proposals for an independent basic review of the greenhouse gas emission inventory are under examination. Difficulties are encountered not only in funding but in finding inventory experts, at national level, who are not involved in the preparation of the emission estimation process.

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 APAT 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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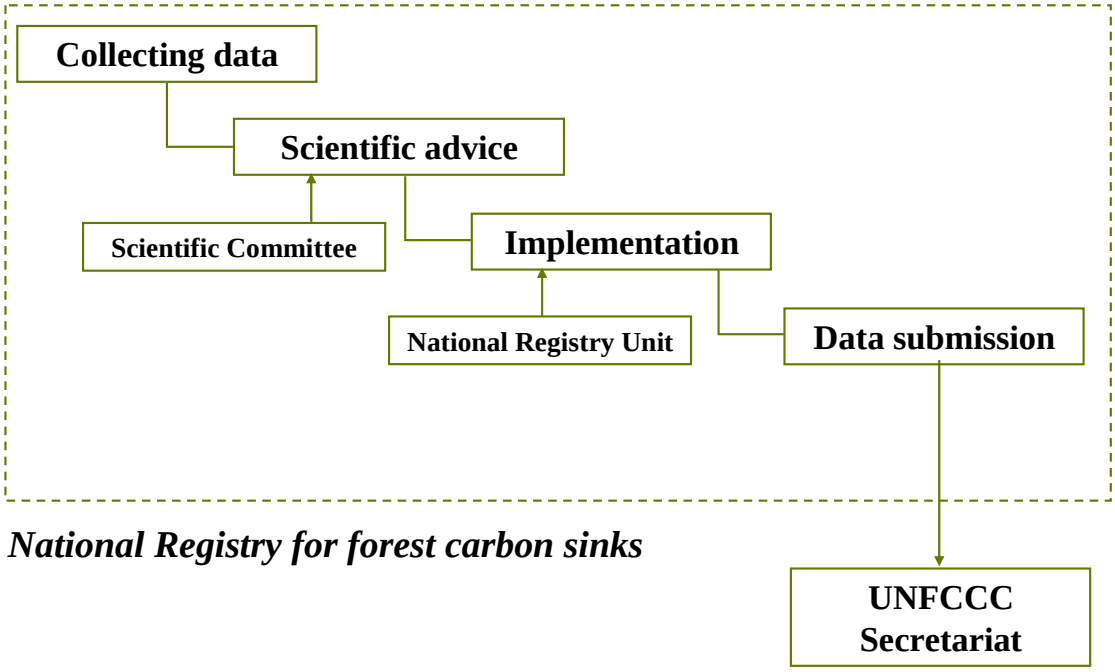
Annex1: The National Registry for forest carbon sinks

The so-called "National Registry for forest carbon sinks" is part of the Italian National System; it is the instrument used 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*).

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 are applied:

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.

Under SBSTA conclusion FCCC/SBSTA/2006/L.6 and related draft COP/MOP2 decision (FCCC/SBSTA/2006/L.6/Add.1), credits from *forest management* are capped, in the first commitment period, to 2,78 Mt C per year, times fives.

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, Kyoto Protocol reporting has to account for carbon stocks changes (and the related non-CO_2 emissions) on the national forest area, and on deforested areas, occurring in the first Commitments Period.

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-CO_2 emissions from forest fires (IEIF)

aimed at quantifying:

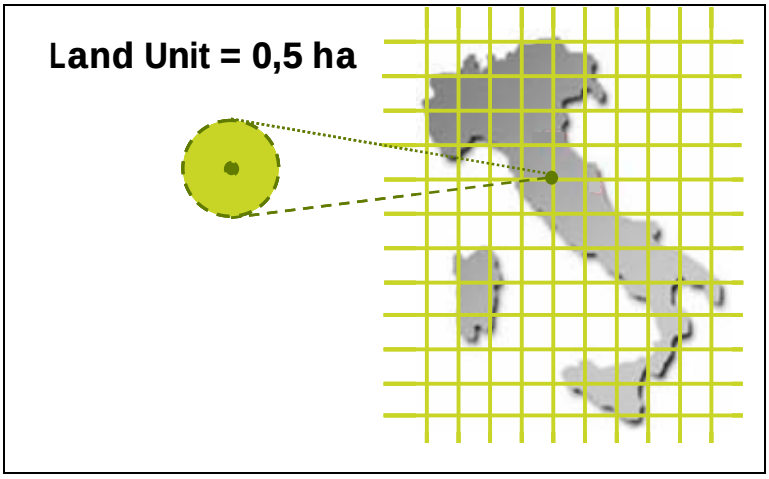
- non-CO_2 emissions from *forest land* areas affected by fires.

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 of *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 will also supply estimates of the coverage percentage of the most important land-cover elements (that are considered as land-use indicators).

Time:
IUTI will annually provide, from 01/01/2010 in operational phase, 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 Kyoto Protocol first Commitment Period (I CP) accounting, the needed time series 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 will homogenously cover the national territory and will supply data, at NUT2 level, of the investigated variables (i.e. *forest land* category and each subcategory in conversion to and from *forest land*). The sampling grid will be dimensioned on the basis of the first phase results of the National Forest Inventory (NFI). The analysis of sample plots will be carried out using remote sensed data and ground truth for present and future dates while for setting the 1990 only remote sensed data (satellite and aerial photographs) will be used since no ground truth is available for that date.



Land-use indicators:
Land-use indicators are the different elements covering the investigated area (e.g. trees, buildings, roads, rivers, grasses, etc.) and that indicated the potential land use. The land-use indicators are used to drive the land-use classification of the area under examination and contribute to quantify the carbon stock related to the same area. For instance, the presence of trees potentially higher more than 5 meter can point out the potential forest land use, while the tree-coverage percentage is an important driver for

estimating carbon stocks.

Categories and subcategories:
Land use categories are defined according to IPCC Good Practice Guidance for LULUCF:

Settlements:
prevalent urban use. Land-use indicators: building, infrastructures insisting on an area of 0.5 ha, with a density at least equal to X%.

Cropland
prevalent agricultural use. Land-use indicators: herbaceous cultures, woody crops insisting on an area of 0.5 ha, with a density at least equal to X%.

Forest land
prevalent forest use. Land-use indicators: trees potentially higher more than 5 meter, crops insisting on an area of 0.5 ha, with a density at least equal to 10%.

Wetlands
prevalent wetland use. Land-use indicators: land covered or saturated by water for all or part of the year (e.g. peatland), insisting on an area of 0.5 ha, with a density at least equal to 10%.

Grassland:
prevalent grazing use. Land-use indicators: herbaceous cultures, shrubs crops insisting on an area of 0.5 ha, with a density at least equal to 10%.

Other Lands:
no prevalent use. It corresponds to unproductive category.

Relation between activities under articles 3.3 and 3.4 of the Kyoto Protocol and the land-use categories

		Initial					
		Settlements	*Cropland*	*Forest Land*	*Wetlands*	*Grassland*	*Other lands*
Final	*Settlements*	------		**D**			
	Cropland		------	**D**			
	Forest Land	**AR**	**AR**	------	**AR**	**AR**	**AR**
	Wetlands			**D**	------		
	Grassland			**D**		------	
	Other Lands			**D**			------

Quality assurance:
Data supplied by IUTI 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.

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 hierarchical order of prevalence of the land uses to assess the predominant land-use. The hierarchical order takes into account the socio-economic value of use, following the FAO-FRA2000 forest definition.

Hierarchical order	Land-use category	**Land-cover indicators**
1	Settlements	building, infrastructures
2	Cropland	herbaceous and woody cultures
3	Forest	trees
4	Wetland	land covered or saturated by water
5	Grassland	grasses, shrubs
6	Other land	none

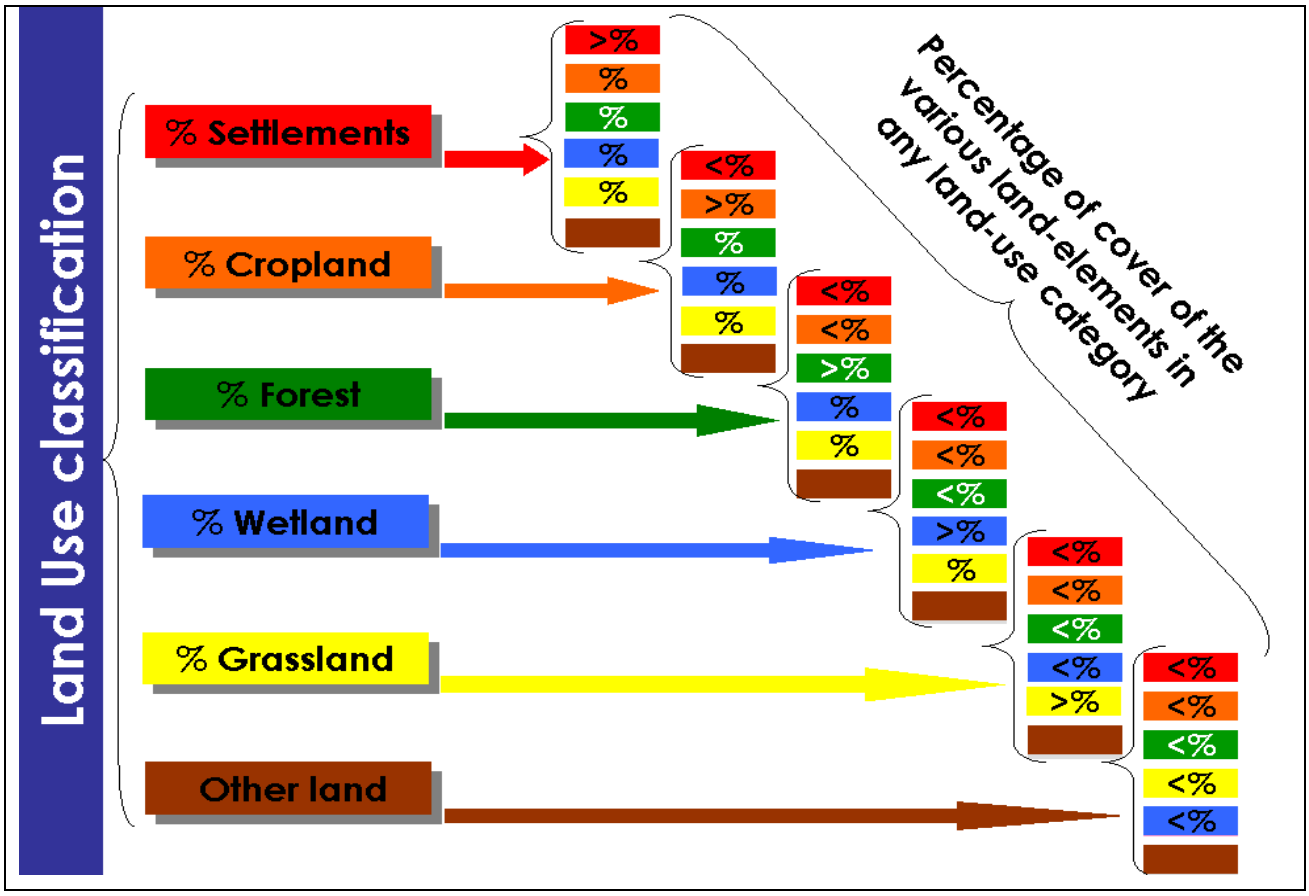
To achieve land use classification, a 0.5 ha circular neighbourhood of the sample plot is investigated. In the first phase, this area is processed, by the way of a contour mapping software: any sub-area covered by any land-use indicator is contoured. In a second phase, a video-operator codes each contoured sub-area, identifying the different land-use indicators. Then, the processed area is archived and automatically classified under a land use and, at the same time, the surface of each sub-area is measured. The assignment of any unit of land to a land-use category is done with a routine that test the prevalence of a land-use category, following the hierarchical order and checking the exceeding of the cover thresholds set for the land indicators.

For instance, an area, where different land-use indicators, e.g. *farm, herbaceous cultures, coppices,* are present, will be classified, testing:

- if the land-use indicator "*farm*" reaches or exceeds *settlements* threshold, then the sample point is classified as *settlements* land use and the coverage percentage of the land-use indicators is recorded;
- then if the land-use indicator "*herbaceous culture* " reaches or exceeds *cropland* threshold, then the sample point is classified as *cropland* land use and the coverage percentage of the land-use indicators is recorded;

– lastly, if the land-use indicator "*coppices*" reaches or exceeds *forest land* threshold, then the sample point is classified as *forest land* land use and the coverage percentage of the land-cover indicators is recorded.

Once set the land-use classification of the national land, the comparison of subsequent land-use classifications produces land-use change matrices which permit to figure out the activities under which every unit of land shall be accounted for, if any.



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 NFI 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, from 01/01/2008 in experimental phase and from 01/01/2010 in operational phase, 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 needed time series 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 at detecting, locating and classifying the *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 needed time series 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 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 Inventory of non-CO_2 emissions from forest fires (IEIF)

The Forest fires GHG emissions National Inventory is aimed at estimating non-CO_2 emissions from forest fires (CO_2 emissions aren't 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, from 01/01/2008 in experimental phase and from 01/01/2010 in operational phase, time series of non-CO_2 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 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.

ANNEX 2: THE NATIONAL REGISTRY

Introduction

In this annex it is reported a description of the Italian national Registry, in accordance with the guidelines set down in UNFCCC's Decision 22/CP.8 (Additional sections to be incorporated in the guidelines for the preparation of the information required under Article 7, and in the guidelines for the review of information under Article 8, of the Kyoto Protocol).

The national registry under Article 7 of the Kyoto Protocol is not fully operational to date. However, Italy carried out all required steps of the initialization process with the UNFCCC: in particular, Italy successfully performed and passed:

- SSL connectivity testing (Oct. 26th 2007);
- VPN connectivity testing (Oct. 15th 2007);
- Interoperability test according to Annex H of the UN DES (Nov. 9th 2007),

and submitted all required information through a complete Readiness questionnaire.

This implies that the Italian registry fulfilled all of its obligations regarding conformity with the UN DES. These obligations include having adequate transaction procedures, adequate security measures to prevent and resolve unauthorized manipulations and adequate measures for data storage and registry recovery. The registry was therefore deemed fully compliant with the registry requirements defined in decisions 13/CMP.1 and 5/CMP.1.

As a result, Italy could participate to the "ETS go-live" event that took place in October 2008.
After successful completion of the go-live process on 16th October 2008, the Italian registry commenced live operations with the ITL and it's been operational ever since.

At present, Italy is also operating its registry under Article 19 of Directive 2003/87/CE establishing the EU Emission Trading Scheme and according to Regulation No. 2216/2004 of the European Commission, which require national registries to be compliant with the UN DES document.
The Italian registry is based on the GRETA registry software developed by the UK Department for Environment, Food and Rural Affairs (DEFRA) and used by many other Member States. Currently, the development of this software adheres to the standards specified in Draft #7 of the UN DES document. Italy had the registry systems tested successfully with the EU Commission on February the 6th 2006; the connection between the registry's production environment and the CITL has been established on March the 13th 2006 and the Registry has since gone live, starting on 28 March 2006.

Registry administrator

The Italian Government modified the previous Legislative Decree 216/2006 which enforced the Directive 87/2003/ CE, by the new Legislative Decree 51 of March 7th 2008. Due to this new Decree, Italy's Agency for the Protection of the Environment and for Technical Services (APAT) is responsible for developing, operating and maintaining the national registry under Directive 2003/87/CE. In August

2008 APAT was merged into ISPRA (Institute for Environmental Protection and Research) and therefore ISPRA, as Registry Administrator, becomes responsible for the management and functioning of the Registry, including Kyoto protocol obligations. The reference person is Mr Mario Contaldi.
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 will be regulated by a future Decree.
Besides the one person designated as Registry administrator, ISPRA set up an operational unit ("Settore del Registro nazionale dei crediti di emissione") where five persons are working in order to manage, develop and maintain the Italian National Registry and, additionally, relays on the structure of the Institute for information, secretary and administrative services:

- one IT expert who is taking care of hardware and software with the support of an external IT supplier giving remote consultancy;
- two persons are responsible for the registry application management, the resolution of problems with operators, the manual intervention in the database and they interface with the "Competent Authority";
- one person is dedicated to the helpdesk for operators;
- one person is dedicated to archiving the documentation.

Cooperation with other Parties
Italy's National Registry is currently linked to the other EU member states' National Registries and to the European Commission CITL (Community Independent Transaction Log) by way of the UNFCCC ITL (International Transaction Log), in a consolidated system forming the European Emissions trading scheme (EU ETS).

Database structure and capacity of the national registry
The GRETA registry system is implemented using a Microsoft SQL Server 2000 Enterprise Edition relational database management system with a dedicated data model for supporting registry operations. The SQL license adopted has no access limitations of simultaneous transactions.
The actual **production environment** consists in: 1 Firewall server + 1 webserver + 2 DB server in cluster configuration with two controllers fibre channel towards storage unit; the data directory is on the data storage device + 1 Tape Autoloader.
The actual **test environment** is protected by 1 Firewall server. The test environment webserver has the same hardware and software configuration of the production web server. In this case the DB server is on the same unit. It will be reinstalled on another server.
The **disaster recovery environment** is physically separated from the production environment (in a different building in a different part of the city of Rome) and has been implemented in the following way:

- a firewall Cisco ASA is installed and configured and then connected through VPN with the firewall Cisco ASA of the production environment;
- 2 servers S.O. Windows 2003 are installed and configured;
- Microsoft SQL Server 2000 Enterprise Edition is installed, synchronized with the production SQL through VPN;

- Microsoft Internet Information Server 6 and the GRETA software are installed.

This synchronization system between the production environment and the disaster recovery environment is carried out every 15 minutes. In case the primary system falls, the synchronization platform will be served by a different connection to the internet with the immediate recovery of all functionalities; the time estimated is just the time needed to update the public DNS caches that will have to "memorize" the new path towards a different IP address. The ITL is requested to send the last 15 minutes transaction logs files in order to upgrade the disaster recovery DB and start it again. In the meantime, the dedicated personnel will try to resolve as soon as possible the problem on the production platform.
Once a week, the correct functioning of the disaster recovery platform is checked.

Conformity with data exchange standards (DES)
The GRETA registry system has been developed for the EU Emissions Trading Scheme. This scheme requires its Member States' registries to be compliant with the UN Data Exchange Standards specified for the Kyoto Protocol. Currently, the development adheres to the standards specified in Draft #7 of the UN DES document.
In addition, 24 Hour Clean-up, Transaction Status enquiry, Time Synchronisation, Data Logging requirements (including Transaction Log, Reconciliation Log, Internal Audit Log and Message Archive) and the different identifier formats as specified in the UN DES document have been implemented. From February the 7th 2008, however, on both production and test sites a new NTP software has been installed. This software is provided by "http://www.meinberg.de/english/sw/ntp.htm" and was obtained by compiling version 4.2.4p4 sources of the software supplied by ntp.org.

Formats for account numbers, serial numbers for ERUs, CERs, AAUs, and RMUs, including project identifiers and transaction numbers are as specified in the UN DES #7 Annex F – Definition of Identifiers.
The display format is controlled via the registries web configuration file.
Electronical information when transferring ERUs, CERs, AAUs, and/or RMUs to other registries will be transmitted to other registries in the format of the messages specified in the UN DES #7 via the ITL.
Acknowledgement information when acquiring ERUs, CERs, AAUs, and/or RMUs from other national registries or the CDM registry will be transmitted to other registries in the format of the messages specified in the UN DES #7 via the ITL.
Electronical Information when issuing, transferring, acquiring, canceling and retiring ERUs, CERs, AAUs, and/or RMUs will be transmitted from the national registry to the ITL in the format of the messages specified in the UN DES #7.

Procedures for minimizing and handling of discrepancies
Communications between the National Registry and the ITL is via web-services using XML messages – as specified in the UN DES document. These web-services, XML message format and the processing sequence are as per that specified in the UN DES document.
In the EU ETS, to prevent discrepancies between the Registry and the Transaction Log, internal checks (as specified in the UN DES document) are implemented as far as possible. The same approach has

been adopted for the development of the GRETA software for the remaining Kyoto functionalities.
Whenever a possible discrepancy is detected by the internal checks no transaction will be started. Moreover, unit blocks involved in a pending transaction are locked for use in any other transaction and there will be an automatic termination of the transaction that has caused the discrepancy.

In the event of a failure to terminate the transaction, an inconsistency with the ITL or STL will be detected during the subsequent reconciliation process. The ITL or STL will then block any transaction involving the related blocks. The status of the blocks will afterwards be corrected manually by the registry administrator with the help of a manual intervention function. This intervention will be logged automatically in the registry. If no inconsistencies are detected during the next reconciliation process with the ITL or STL, the related unit blocks will be unblocked so that further transactions with these blocks will be possible.

Prevention of unauthorized manipulations and operator error

The Institute emphasizes physical security of server premises in addition to normal logical access control methods. All servers and backup media are located in secure premises with electronic access control, allowed only to the system administrators.
Personnel have duty of identification when entering the building and a security channel allows monitoring inside the building. When moving servers or backup media between controlled premises, they are never left unattended.
Computers are accessible through username and password and they are automatically locked after 15 minutes of idle time. Employees are required to lock the computers manually whenever leaving the desk.
Servers are protected by firewalls (Cisco ASA appliances).

To log-in, every user of the registry software is obliged to use username and password. Passwords are of 8 to 15 digits including minimum 1 numbers and minimum 1 alphabet and to change their password every 60 days. The registry administrator disables unused user ids and passwords on a regular basis.
Session security is ensured by using encryption both in management traffic and production network traffic (SSL).
All servers are protected with Anti-Virus product (eTrust Inoculate) updated daily. Regular virus scans are run on all nodes, workstations and servers within their network.
Significant attention is placed on verifying the identity of the operator's or organization's legal representative who is signing the nomination of the account primary and secondary authorized representatives.

For the operators' accounts, such verification requires a "visura camerale", a document produced by the Italian Chamber of Commerce identifying the legal representatives of a specific commercial company. Non Italian Companies are requested to provide an equivalent document, identifying the Company's representatives and their roles and responsibilities.
The same document, "visura camerale" or an equivalent (e.g. statute), is requested for organizations applying for an account.
For individual accounts, only a signed copy of an identity document is required (identity card or passport for non Italian persons).

All persons involved those who delegate and the authorized representatives, need to send a signed copy of an identity document (identity card or passport for non Italians).

User interface of the national registry

The GRETA software makes available on the registry site publicly accessible information. These reports are described below in the following.

1. Open Internet Explorer (or similar) and browse to the following URL:
http://www.greta.sinanet.apat.it
2. Click on the link to the national registry
3. Select the public reports link at the bottom of the page. The user can choose from:
    a. User details – unchanged, updated, created
    b. Account details – unchanged, updated, created
    c. Operator holding account – unchanged, updated, created

Integrity of data storage and recovery

In addition to disaster recovery in real time (see paragraph A10.4), a backup policy is implemented for the production environment, according to the following schedule:

- full backup of the database is taken everyday in the storage unit;
- differential backups of new logs are taken every hour in the storage unit;
- every week all daily backups are recorded on a tape that is retained for 2 weeks in a separate location.

We are using the internal backup scheduling system of SQL Server 2000 Enterprise Edition. Full database backup taken everyday. Differential backups of new logs taken every hour.
Both storage (HP StorageWorks MSA20) and tapes (HP StorageWorks 1/8 Tape Autoloader Ultrium 230) are kept in secure location with controlled access.
Currently ISPRA uses three backup tapes. After being in use for one week, the tape is stored for two weeks. After two weeks it is erased and used again.
This means that daily backups are available in 14 generations (two weeks).
Backup software's log is checked every weekday. Abnormalities are checked and necessary corrections made.
Reliability of the whole system is guaranteed by the following stability features:

- power supply from the public power supply network through two separate feeding points;
- uninterruptible power supply on battery basis;
- guarantee of the supply through diesel emergency power aggregate in the event of prolonged failure of the public power supply network;
- all essential hardware components of the server are implemented with redundancy (power supply, multiprocessor, hard-disks RAID);
- the database servers are operated as a cluster (switchover).

Test results

The performance and security measures of the national registry have been successfully tested through

the implementation of secure connection (digital certificates and VPN tunnel).
As reported in paragraph A10.1, Italy carried out all required steps of the initialization process with the UNFCCC. In particular, Italy successfully performed and passed SSL connectivity testing, VPN connectivity testing, interoperability test according to Annex H of the UN DES and submitted all required information through a complete Readiness questionnaire.
Currently, the GRETA registry system for the EU Emissions Trading Scheme uses the security mechanism as specified within the EU Regulation Annex XV; that is, it uses basic authentication and SSL.