QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR THE ITALIAN EMISSION INVENTORY
YEAR 2014

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Contact: Riccardo De Lauretis
                telephone +39 0650072543
                fax   +39 0650072657
                e-mail   riccardo.delauretis@isprambiente.it

ISPRA- Institute for Environmental Protection and Research
Environment Department
Monitoring and Prevention of Atmospheric Impacts
Air Emission Inventory Unit
Via V. Brancati, 48 00144 Rome ITALY

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Prepared by: Daniela Romano, Riccardo De Lauretis

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NATIONAL AIR EMISSION INVENTORY: GENERAL OVERVIEW

I.   Objective

This document summarizes the specific Quality Assurance (QA) Quality Control (QC) activities and different verification procedures which are applied thoroughly the current inventory compilation as part of the estimation process.

In addition to a description of the current activities applied and the documentation, archiving and reporting processes, a specific section illustrates the main findings of the latest review process together with the actions undertaken by the inventory team.

Further improvements and planned QA activities identified during the preparation of the National Inventory and National Inventory Report 2014 are also presented.

A summary of previous QA/QC procedures which helped to understand the improvement of the inventory over the years concludes the general part of the report.

Sector specific QA/QC and verification documentation are explained in the relevant chapters.

II.   Review process recommendations

In 2013, the Italian inventory was submitted to an in-country UNFCCC review; the main critical points raised during the review process were addressed in the current inventory compilation and different improvements have been carried out.

In the same year the air emission inventory was also subjected to the in-depth UNECE review, an independent review by Aether Ltd, and a bilateral Italy - Spain review.

Specific issues are described in the relevant sectoral chapters and there were no important problems concerning the general and cross cutting activities. Nevertheless, some steps towards a streamlining of this document, the National System paper and the NIR have been performed on account of suggestions received during the independent review by Aether ltd[1].

III. QA/QC activities and verification

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.

Specific QA/QC procedures are described in the manual 'Quality Assurance/Quality Control Plan for the Italian Inventory'[2]. Verification activities are also part of the overall QA/QC program. These activities have the ultimate objective of increasing the confidence and reliability of the inventory estimates.

Feedbacks for the Italian inventory derive from communication of data to different institutions and/or at local level. For instance, the communication of the inventory to the European Community result in a pre-check of the GHG values before the submission to the UNFCCC and relevant inconsistencies may be highlighted.

Results and suggestions from expert peer reviews of the national inventory within the UNFCCC process can provide valuable feedback on areas where the inventories can be improved.

In addition to these annual reviews, an official independent review of the entire Italian greenhouse gas inventory was undertaken by the Aether consultants in 2013. Main findings and recommendations are reported in a final document, and regard mostly the transparency in the NIR, the improvement of QA/QC

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[1] Aether ltd, 2013. *Findings and Recommendations of the Independent Review of the Italian Greenhouse Gas Inventory*
[2] ISPRA, 2013.*Quality Assurance/Quality Control plan for the Italian Emission Inventor: Procedures Manual*

documentation and some pending issues in the LULUCF sector. These suggestions have been considered to improve the 2014 submission.

Also a bilateral independent review between Italy and Spain, with a focus on the revision of the GHG and air pollutant inventories of both the Parties was established in 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 reported in a technical report[3]. 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), and use of plant specific information.

Moreover feedbacks occur once the inventory, the inventory related publications and the national inventory reports are posted on the website, specifically http://www.isprambiente.gov.it. Additional comments derive from the communication of data to different institutions and/or at local level.

The inventory is presented every year to a Technical Committee on Emissions (CTE), coordinated by the Ministry for the Environment, Land and Sea, where all the relevant Ministries and local authorities are represented. Emission figures and results are shared and discussed among experts.

Expert peer reviews of the national inventory also occur annually within the UNFCCC process; results and suggestions can provide valuable feedback on areas where the inventory should be improved. Specifically, the last in-country review of the Italian GHG inventory by the UNFCC Secretariat occurred in October 2013. Results and recommendations of the reviews are available on the UNFCCC website at http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/6947.php. Responses and actions to the review processes are described in details in section IV.

With regard emissions projections and policies and measures, an official review was performed by Ecofys, in 2000, in order to verify of the effectiveness of policies and measures undertaken by Italy to reduce greenhouse gas emissions to the levels established by the Kyoto Protocol. In this framework, an independent review and checks on emission levels were carried out as well as controls on the transparency and consistency of methodological approaches[4]. In 2008, VITO, Öko-Institut and the Institute for European Environmental Policy, for DG Environment, undertook a review on the methodologies and EU Member States best practices used for GHG projections to identify possible ways to improve GHG projections and ensure consistency across the EU. The results were presented at the Workshop 'Assessing and improving methodologies for GHG projections'. Further analyses were presented in the Workshop on 'Quantification of the effects on greenhouse gas emissions of policies and measures'. More recently, in the framework of the bilateral independent review between Italy and Spain, an independent review of the projection system and emission estimates has been completed and the final report is under finalisation.

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 verification for emission trends. At national level, for instance, emission time series are reported in the Environmental Data Yearbook published by the Institute[5]. Emission data are also published by the Ministry of Environment in the Reports on the State of the Environment[6], the National Communications[7] as well as in the Demonstrable Progress

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[3] AED, 2013. *Italy-Spain bilateral QA*

[4] Ecofys, 2001. *Evaluation of national climate change policies in EU member states. Country report on Italy*

[5] ISPRA, several years. *Environmental Data Yearbook*. ISPRA. http://www.isprambiente.gov.it/it/pubblicazioni/stato-dellambiente/annuario-in-cifre-annuario-dei-dati-ambientali-2013

[6] MATT, several years. *RSA-Report on the State of the Environment*. Ministero dell'Ambiente. http://www.minambiente.it/biblioteca/relazione-sullo-stato-dellambiente-2009-sintesi

[7] MATT, several years. *National Communication under the UN Framework Convention on Climate Change*. Ministero dell'Ambiente. http://unfccc.int/files/national_reports/annex_i_natcom

report[8]. Moreover, figures are communicated to the National Institute of Statistics to be published in the relevant Environmental Statistics Yearbooks[9] as well as used in the framework of the EUROSTAT NAMEA accounting[10].

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[11]. Emission intensity indicators among countries (e.g. emissions per capita, industrial emissions per unit of added value, transport emissions per car, emissions from power generation per kWh of electricity produced, emissions from dairy ruminants 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 in the relevant 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. In 2008 and in 2014, workshops were held, on the implications of the implementation of the 2006 IPCC Guidelines for national GHG inventories. Other workshops addressed: the use of European emissions trading scheme data in the national greenhouse gas inventories, management of uncertainty in national inventories, 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 at the address: http://air-climate.eionet.europa.eu/meetings/past_html.

A national conference on the Italian emission inventory was organized by APAT 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.

In 2007, in the framework of the National Conference on Climate Change, an event previous to the Conference presented the National GHG emission Inventory and specifically the time series of emission estimates from 1990 to 2005; besides a specific session of the Conference was dedicated to the National and local Inventories focusing on methodological issues and policies and measures to be adopted to reduce GHG emissions. In 2010, the time series 1990-2008 was presented in a specific national Kyoto Protocol event. In 2014, emission time series and figure for the compliance with the Kyoto Protocol have been presented to the stakeholders and the press.

A specific procedure undertaken for improving the inventory regards the establishment of national expert panels (specifically, in the sectors of road transport, land use change and forestry and energy) 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, constituted by the relevant national

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[8] MATT, 2006. *Italian report on demonstrable progress under article 3.2 of the Kyoto Protocol*. Ministero dell'Ambiente. http://unfccc.int/resource/docs/dpr/ita1.pdf
[9] ISTAT, several years. *Annuario Statistico Italiano* . Istituto Nazionale di Statistica, Roma ,Italia
[10] ISTAT, 2006. *La NAMEA: conti economici nazionali integrati con i conti ambientali*. Istituto Nazionale di Statistica. http://www.istat.it/dati/dataset/20060301_00/.
[11] ENEA/MAP/APAT, 2004. *Energy data harmonization for CO$_2$ emission calculations: the Italian case*. Rome 23/02/04. EUROSTAT file n. 200245501004

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 (Sistan). 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 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.

The assumptions, which uncertainty estimations are based on, 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[12] and IPCC Guidelines[13].

Quantitative estimates of the uncertainties for the Italian GHG inventory are calculated using Approach 1 as defined in the IPCC 2006 Guidelines, 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 specific categories of the inventory but the results show that, with the information available at present, applying methods higher than Approach 1 does not make a significant difference in figures. The results of the study, 'Evaluating uncertainty in the Italian GHG inventory', were presented at an EU workshop on Uncertainties in Greenhouse Gas Inventories, held in Finland in September 2005, and they are also available on website at the address:

 http://air-climate.eionet.europa.eu/docs/meetings/050905_EU_GHG_Uncert_WS/meeting050905.html.

A further research on uncertainty, specifically on the comparison of different methodologies to evaluate emissions uncertainty, was also carried out[14].

In the last years, Monte Carlo analysis has been applied to some key categories of the Italian inventory and it is planned to extend progressively the study to other inventory categories.

In point of fact, the annual QA/QC plan includes 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.

All the material and documents used for the inventory preparation are stored at the Institute.

Information relating to the planning, preparation, and management of inventory activities are documented and archived. The archive is organised so that any skilled analyst could obtain relevant data sources and

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[12] IPCC, 2000. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. IPCC National Greenhouse Gas Inventories Programme, Technical Support Unit, Hayama, Kanagawa, Japan

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

[14] Romano D., Bernetti A., De Lauretis R., 2004. *Different methodologies to quantify uncertainties of air emissions*. Environment International vol 30 pp 1099-1107

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 electronically available documents and the place where they are stored as well as internal documentation on QA/QC procedures.

IV. Major QA/QC activities over the past years

Energy Balance Verification. A task force made up 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"[15].

Carbon Emission Factors Review. A sampling and measurement campaign was carried out jointly with the Stazione Sperimentale Combustibili in order to check the CO_2 emission factors used for emission estimation in the energy sector, specifically the road transport and residential and commercial sector. Representative samples of Italian fuels, specifically gasoline, diesel oil and LPG, were collected and analysed from September 2000 - August 2001. Measurements were compared with default CO_2 emission factors proposed by the IPCC in the 1996 Revised Guidelines and those proposed by the EEA and used in COPERT III methodology. Values of national emission factors resulted higher than the default ones for gasoline and LPG, while those of diesel were lower. Emission factors have been substituted for the years 2000 onwards. The study and the results are described in detail in the APAT report[16]. The analysis was repeated in 2013 with the same methodology by Innovhub (former Stazione Sperimentale Combustibili) and carbon content and main characteristic of coal and natural gas have been added. The methodology, data sources and main results are reported in a final technical paper[17].

Road Transport Emissions Review. The Italian Expert Panel on Transport, which comprises experts from Research Institutes, Universities, Industrial Associations, Local Authorities, Ministries and Public Authorities, continues 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, both in terms of availability and timeliness. Studies of the expert panel group as well as

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[15] ENEA/MAP/APAT, 2004. *Energy data harmonization for CO₂ emission calculations: the Italian case*. Rome 23/02/04. EUROSTAT file n°200245501004

[16] APAT 2003. *Analisi dei fattori di emissione di CO₂ dal settore dei trasporti*. Ilacqua M., Contaldi M., Rapporti n°28/2003

[17] Innovhub, 2013. *Caratterizzazione chimico-fisica dei combustibili utilizzati in Italia*. Rapporto finale dicembre 2013.Innovhub-Stazione Sperimentale per i combustibili.

presentations held in different meetings can be found on the website http://groupware.sinanet.isprambiente.it/expert_panel.

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. In 2014 submission, a verification of activity data from different sources was undertaken.

Energy – Industrial processes Review. A specific activity relating to improvements of the inventory and QA/QC practices in the last year regarded the progress on the building of a database where information collected in the framework of different European legislation, Large Combustion Plant, INES/PRTR and Emissions Trading, are gathered together thus highlighting the main discrepancies in information and detecting potential errors. The actual figures are considered in an overall approach and used in the compilation of the inventory and resulted in verification and updated of the emission factors for many categories and gases.

F-gases Review. A review with industrial associations and the electrical company ENEL was undertaken in order to improve the quality of estimates by implementing the use of the Tier2 methodology. SF_6 estimates improved with the cooperation of the national electrical company ENEL and the main electrical associations. Specifically, for PFC emissions from aluminium production, the estimates were carried out jointly with the only national producer. A revision has also concerned HFC emissions on account of major information on the leakages made available by the European Association of Responsible Use of HFCs in Fire Fighting. In 2013, in response to the UNFCCC review process, the industrial associations have been contacted to verify f-gases emission factors from refrigeration and air conditioning in the different phases of the process from the production to the end of life of gases and appliances.

Agriculture Review. Since 2006 submission, the main improvements regard the results from the MeditAIRaneo project which have been included in the preparation of the Agriculture emission inventory (GHG/CLRTAP) with effect especially on CH_4, N_2O and NH_3 emissions. Besides, studies on NH_3 and PM10 emissions from swine and poultry within the convention signed between APAT and the Ministry for the Environment, Land and Sea, were carried out by CRPA[18] and University of Milan[19]. At the end of 2009 another research study related to land spreading estimations and scenario was completed[20].

LULUCF Review. The ongoing work of the established expert group and the analysis of data from the new

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[18] CRPA, 2006[b]. *Predisposizione di scenari di emissione finalizzati alla progettazione di interventi per la riduzione delle emissioni nazionali di ammoniaca ed alla valutazione di misure e di progetti per la tutela della qualità dell'aria a livello regionale*. Final report. Reggio Emilia - Italy

[19] University of Milan, 2008. *Valutazione dei fattori di emissione di particolato e dei gas serra (protossido d'azoto, anidride carbonica, metano) ed ammoniaca, in relazione alle tecniche di abbattimento di inquinanti atmosferici*. Rapporto finale gennaio 2008. L'Università degli Studi di Milano - Dipartimento di Scienze e tecnologie Veterinarie per la Sicurezza Alimentare di Milano

[20] CRPA. 2009. *Valutazione dell'entità delle emissioni ammoniacali derivanti dall'applicazione al suolo dei fertilizzanti, delle loro possibilità di riduzione e individuazione degli elementi per un monitoraggio statistico delle tecniche di applicazione utilizzate*. Rapporto finale. Reggio Emilia – Italia.

national inventory forest allowed continuous improvements of LULUCF emission and removal estimates. In particular the land use assessment has been carried out on the basis of new set of data (i.e. outcomes of Inventory of Land Use (IUTI) and areas assessment resulting from the ongoing National Forest Inventory (NFI). The coefficients used in the estimation process for the litter pool in the relevant categories were updated following the inclusion of latest NFI's outcomes. Activity data related to organic soils, in cropland category, has been updated and plantations have been excluded from cropland and have been allocated in forest land category. Recalculations also occurred in fires estimates, due to the implementation of the new methodology and to the use of updated activity data.

Waste Review. In 2013 a database of incinerators has been built with data collected from different sources resulting in update of previous sectoral estimates. The analysis regarding incineration plants has been conducted through verifications and comparisons with data reported in E-PRTR registry, Emissions Trading Scheme and data collected directly from the operators updating data of waste amount and pollutants emissions at plant level.

MeditAIRaneo Project. A three years project involving the Inventory Reference Centres of the European Mediterranean Countries (Italy, Spain, France, Greece, 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 were concluded and the results have been used in the national inventory to improve country-specific emission factors.

Emissions Trading Scheme. Analyses of sectoral industrial data from the Italian Emission Trading Scheme database are used to develop country-specific emission factors and check activity data levels. ETS data have been used together with additional information collected by the industrial association to assess CO_2 emissions abatement resulting from the implementation of the II phase EU ETS in Italy as well as for the definition of the benchmark in the III phase of EU ETS and the final communication to the EU for benchmark and carbon leakage for the years 2009 and 2013. In this context, additional information has been elaborated data provided by the industry to assess the sectors subjected to potential carbon leakage and relevant benchmarks.

European Pollutant Release and Transfer Register (E-PRTR). Data from the Italian Pollutant Emission Register from some industrial sectors are used in the inventory compilation or as a check with the estimates carried out at national level. In particular, this regards the production of non-ferrous metals, chemical productions, cement and lime productions 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[21]. The results were checked out by regional and local environmental agencies and authorities in order to find out the main weak points and contribute with information available to characterise the local environment, this contributing as well as a

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[21] ISPRA, 2013. *Database della disaggregazione a livello provinciale dell'Inventario nazionale delle emissioni:1990-1995-2000-2005-2010.* Istituto Superiore per la Protezione e la Ricerca Ambientale, ISPRA

feedback to the improvement of the national inventory. Final estimates and the detailed methodologies followed for each SNAP sector to carry out emission figures are published in technical reports[22].

V. Planned improvements

The main institutional and legal arrangements required under the Kyoto Protocol have been finalized. 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. Main improvements are related to the finalization of activities defined in the framework of national registry for forest carbon sinks, specifically related to the land and land-use changes identification in accordance with paragraph 20 of the annex to decision 16/CMP.1. Time series related to the different IPCC categories areas have been assembled using IUTI data, and the data assessed by the national forest inventories (1985, 2005, 2012).

Other sector specific improvements are identified in the relevant chapters; they can be summarized in the following.

For the energy and industrial sectors, the database where information collected in the framework of different EU legislation, Large Combustion Plant, E-PRTR and Emissions Trading, is annually updated and improved. The database has helped highlighting the main discrepancies in information and detecting potential errors leading to a better use of these data in the national inventory.

For the agriculture and waste sectors, improvements will be related to the availability of new information on emission factors, activity data as well as parameters necessary to carry out the estimates; specifically, for agriculture, improvements are expected for the grazing, housing, storage systems and land spreading information collected by 2010 Agricultural Census, while for waste sector the availability of additional information on waste composition.

For the LULUCF, the third NFI field surveys will allow using of IPCC carbon stock change method to estimate emissions and removals for forest land remaining forest land category. In addition a comparison between the two IPCC methods (carbon stock change vs gains-losses) could be undertaken; the comparison is a valuable verification exercise and is able to highlight any potential outlier which detaches the two estimates. Further work is planned with regard the cropland and grassland emissions and removals estimates.

Additional studies will regard the comparison between local inventories and national inventory and exchange of information with the 'local inventories' national expert group. In fact, ISPRA has also finalised the provincial inventory at local scale for the year 2010 in the context of the Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) under the Convention on Long-range Transboundary Air Pollution (CLTRAP). Results are checked out by regional and local environmental agencies and authorities; data are available at ISPRA web address http://www.sinanet.isprambiente.it/it/inventaria.

Further analyses will concern the collection of statistical data and information to estimate uncertainty in specific sectors by implementing Approach 2 of the IPCC guidelines as well as a quantitative uncertainty analysis for air pollutants.

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[22] Liburdi R., De Lauretis R., Corrado C., Di Cristofaro E., Gonella B., Romano D., Napolitani G., Fossati G., Angelino E., Peroni E., 2004. *La disaggregazione a livello provinciale dell'inventario nazionale delle emissioni*. Rapporto APAT CTN-ACE 2004
APAT/ARPA, 2006. *Confronto tra l'Inventario Nazionale e gli Inventari Locali*. Realizzato nell'ambito del tavolo interagenziale "Inventari delle emissioni e piani di risanamento della qualità dell'aria"
ISPRA, 2009. *La disaggregazione a livello provinciale dell'inventario nazionale delle emissioni*. Anni 1990-1995-2000-2005. ISPRA, 92/2009

QA/QC ENERGY
2013 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Antonella Bernetti, Riccardo De Lauretis

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NATIONAL AIR EMISSION INVENTORY: ENERGY

I. Objective

The improvements carried out during the preparation of the 2014 national inventory submission for the energy sector and those expected for the next future are summarised in the following.

II. Review process recommendations

Italy 2013 inventory submission has been subjected to four reviews: UNFCCC review, UNECE review, Aether independent review, Italy - Spain bilateral review (being the last one related only to: industrial combustion, solvents and other products use and LULUCF).

In the following tables, the list of improvements implemented during the compilation of the inventory according to the exchange of information related to the energy sector with the expert review team of the above mentioned review processes is presented. Separately for UNFCCC, UNECE and Aether independent reviews, a prospectus is presented in which the subject, the recommendation and the implemented improvement are specified.

As regards UNFCCC review, in table 1 the synthesis of the review process is illustrated.

Table 1. *Response to the UNFCCC review process recommendations*

Review report para	Subject	Recommendation	Response
22	Energy - Feedstocks and non-energy use of fuels	Include in the NIR information on the specific calculation of the fractions of carbon oxidized	Additional information has been provided in the NIR (§ 3.8.2)
25	Energy - Stationary combustion: solid fuels - CH_4	Include more detailed information in the NIR on how emissions from iron and steel are allocated between and within the energy and industrial processes sectors	Additional information has been provided in the NIR (§ 3.4.2)
26	Energy - Stationary combustion: gaseous fuels, biomass – CO_2, CH_4, N_2O	Include in the NIR the explanation for the trends of the different gases for the category	Additional information has been provided in the NIR (§ 3.3.1)
27	Energy - Stationary combustion: other fuels – CH_4	Include in the NIR the EFs used in all subcategories	Additional information has been provided in the NIR (§ 3.4.3)
28	Energy - Fugitive emissions: oil and natural gas – CO_2, CH_4, N_2O	Review and correct the comments in the CRF tables	The inappropriate note in the CRF cells has been deleted

The UNECE review process is summarized in table 2, in which general recommendations on energy cross cutting issues are specified too.

Table 2. *Response to the UNECE review process recommendations*

Subject	Recommendation	Response
1.A.1.a Public electricity and heat production	The ERT noted that PM_{10} emissions show a strong decrease, while heavy metals do not show a similar reduction. Italy explained that heavy metal emission factors for 1990 to 2001 have been derived from a	PM_{10} emissions are updated every year on the basis of data submitted by the plants in the framework of the EPRTR registry, Large Combustion Plants

Subject	Recommendation	Response
	country specific study and that from 2001 onwards constant emission factors have been applied. However, Italy also noted updating these EFs is planned, especially for zinc (par. 35). The ERT appreciates the work already carried out to estimate heavy metals emissions from power plants and encourages Italy to refine this approach as outlined (par. 36).	Directive and Environmental Reports while HMs emission factors time series have been reconstructed from 1990 to 2001 on the basis of a study conducted by ENEL (major company in Italy) which reports HM emissions measurements by fuel and technology (with or without PM_{10} abatement technologies) of relevant national plants. From 2001 HM EFs have not been updated. HM emission data in the EPRTR registry refer only to few not representative plants and are not sufficient to calculate average EFs. Further work is planned to update/change emission factors for those pollutants, as zinc, where figures reported in the EPRTR lead to average EFs significantly different from those actually used.
1 A 2 f i Stationary Combustion in Manufacturing Industries and Construction: Other	As regards transparency, the ERT identified that emissions from combustion of manufacturing industry (NFR 1 A 2 a, b, c, d) are not reported in the detail of the NFR tables but are aggregated and included in 1 A 2 f i Stationary Combustion in Manufacturing Industries and Construction: Other. During the review week, Italy provided detailed activity data and emission factors of category 1 A 2 f i for the year 2011. The ERT encourages Italy to report these sources separately (par. 25).	We plan to report emissions in the detail of the NFR tables in the next submissions. Many of the estimation methods are based on a product specific rather than a fuel specific approach.
1.A.2.f.ii Mobile Combustion in Manufacturing Industries and Construction	As regards transparency, a specification of description of mobile combustion in manufacturing industries and construction activities is solicited in the IIR	Emission reduction factor reported in the 2004/26/EC Directive have not yet been applied and introduced in the emission estimates.
1.A.3.a.ii.(ii) Civil aviation (domestic, cruise)	As regards transparency, the ERT stated that nearly no information is provided regarding all other off-road mobile sources such as civil aviation, railways and navigation and encourages Italy to include this in the next IIR in order to improve the inventory's transparency and comparability (par. 40).	The NFR subsector 1.A.3.a has been included in the paragraph 3.7 of the IIR. As regards comparability in general, in the paragraph 3.7, activity data regarding aircraft movement data (LTO cycles), aviation jet fuel consumptions for domestic and international flights have been reported.
1.A.3.b Road transportation	In the 2010 review, the ERT noted that, according to the NFR tables, there was no biodiesel sold in 1997. The ERT also observed a jump in consumption after 2007. With no information provided during the review week, the ERT asked Italy to explain these circumstances in coming IIRs. In the current review, the ERT noted that information on these national circumstances is still missing in the IIR. Italy explained that biodiesel fuel has been tested from 1994 to 1996	Additional information has been provided in the IIR (§ 3.8.3). As regards comparability in general, in the paragraph 3.8.3 activity data regarding annual fuel consumptions and circulating fleet technological evolution have been reported.

Subject	Recommendation	Response
	before entering production from 1998, resulting in no deliveries in 1997. In addition, the strong increase in consumption after 2007 is a result of the targets set in the framework of the European directive 20-20-20. The ERT thanks Italy for the answer and the consumption data provided. However, the ERT recommends that Italy include a descriptive time series and/or AD graphs as well as information in the IIR, especially on trends, in order to improve the transparency of the inventory and to avoid further reiteration of this issue in future reviews (par. 58).	
1.A.3.b.vii Road transport, automobile road abrasion	The ERT noted some estimates missing within the inventory such as particulate matter from road surface abrasion (NFR 1.A.3.b vii) (par. 49).	As regards road surface wear, missing values are explained by the choice to not consider currently this subsector in the estimation model (as stated in par. 1.9 of the IIR about completeness) because of the high uncertainty still associated to emission factors (EMEP/EEA emission inventory guidebook 2013)
1.A.3.c Railways	During the review week the ERT noted that liquid fuels used in railways show a declining trend over the entire time series 1990-2011 with an additional sharp drop in 2008 (2007: 4.5 Mio GJ, 2008: 3 Mio GJ). Given the lack of specific information in the IIR regarding NFR 1.A.3.c, the ERT asked Italy to provide some information on the overall trend as well as the sharp decline after 2007 (par. 59). Italy stated that emissions arising from power generation for railways are reported under NFR 1.A.1.a, and pointed out that most of the Italian railway system is electrified with diesel engines only used in the limited areas without electrification. The declining trend reflects the decrease in the use of these railways (par. 60). The ERT encourages Italy to include information, especially on trends, in the IIR. (par. 61)	The NFR subsector 1.A.3.c has been included in the paragraph 3.9 of the IIR. As regards comparability in general, in the paragraph 3.9 activity data regarding annual fuel consumptions have been reported.
1 A 3 d i (i) International maritime navigation	As regards transparency, the ERT stated that nearly no information is provided regarding all other off-road mobile sources such as civil aviation, railways and navigation and encourages Italy to include this in the next IIR in order to improve the inventory's transparency and comparability (par. 40).	The NFR subsector 1.A.3.d has been included in the paragraph 3.10 of the IIR. As regards comparability in general, in the paragraph 3.10 activity data regarding annual marine fuel consumptions have been reported.
1.A.3.d.i (ii) international inland navigation	During the review the ERT noted that within NFR table 1 the notation key "NA" is being reported for the entire sector, suggesting that "The source exists but relevant emissions are considered never to occur." with no further explanation provided. The ERT asked Italy whether consumption data were available to allow the calculation of emissions from this sector and to provide further details on this issue. Italy replied that "International inland waterways do not occur in Italy", and therefore the ERT recommends the use of notation	Within NFR table 1 the notation key "NO" has been inserted, international inland waterways do not occurring in Italy.

Subject	Recommendation	Response
	key "NO" ("*An source or process does not exist within a country.*") as appropriate. (par. 52)	
1.A.3.d.ii national navigation	The ERT noted that the IEF for SO_2 emissions from national navigation does not decline sharply before 2002 whereas IEFs for other Diesel-dominated mobile sources decrease around 1995 and 1997 (1.A.3.b iii, 1.A.3.c), and asked Italy to explain the differences between these trends (par. 54). Italy explained that for maritime transportation the regulation of the sulphur content of fuels started much later. Italy also provided detailed information on the legislatory background and the development of the sulphur content boundary values. The ERT welcomes the explanation and data provided, and encourages Italy to include this information in future IIRs, and to further explain the national circumstances regarding navigation e.g. does navigation also take place on the Po river? If so, is the associated legislation different from coastal navigation? (par. 55). In addition to the issue discussed above, as NFR 1.A.3.d ii – National Navigation is a key source for emissions of SO_2, NH3, PM, CO in Italy, the ERT noted that no information on the tier approach applied is given in the IIR (see Transparency above). The ERT asked Italy to clarify the tier and the methodology being used to estimate emissions for this key source. Italy provided a description of the detailed methodology used to estimate emissions from National navigation, and the ERT was satisfied that this met the requirements to use a higher tier (par. 56). However, the ERT encourages Italy to report the tier in the IIR, as well as a separate sectoral chapter describing the estimation methodology with all necessary background information (par. 57).	The NFR subsector 1.A.3.d has been included in the paragraph 3.10 of the IIR. As regards comparability in general, in the paragraph 3.10 activity data regarding annual marine fuel consumptions have been reported.
1.A.4.a.ii commercial / institutional: mobile	The ERT noted that within NFR table 1 notation key "NA" is being reported for the entire sector with no further explanation provided in the IIR. It is expected that mobile sources will be operated in the Italian commercial/intuitional sector, and therefore the ERT considered the use of "NA" to be inappropriate, asking Italy to provide further details on this issue. Italy explained that separate activity data is available for sub-sectors 1.A.4c ii and b ii only, from the national Energy Balance (BEN). The ERT therefore recommends that Italy use the notation key "IE", and encourages Italy to further explain these national circumstances in both the NFR "Additional info" table and the IIR. (par. 53)	Within NFR table 1 the notation key "IE" has been inserted and in the additional info table the explanation is given (inclusion in the NFR code 1.A.3.b).
1 B 2 a iv Refining / Storage - SO_X ; 1 A 3 e Pipeline compressors	As regards transparency, the ERT identified a lack of methodological description and trend analysis for the key source 1 B 2 a iv Refining /Storage - SO_X and for the source 1 A 3 e Pipeline compressors. The ERT recommends that Italy completes the IIR regarding	The NFR subsector 1.A.3.e has been included in the paragraph 3.11 of the IIR.

Subject	Recommendation	Response
	methodological description for these and other sources, and in particular for key sources (par. 26).	

The results of Aether independent review are summarized in table 3.

Table 3. *Response to the Aether independent review outcomes*

Subject	Recommendation	Response
Energy balance	We propose that Italy assess the differences between the Eurostat and IEA/OECD and that provided by the Ministry for the GHG inventory and decide which energy balance is the more appropriate for emission estimates.	A study carried out jointly by the Ministry of Economic Development and Enea (National Agency for New Technologies, Energy and Sustainable Economic Development) is currently in progress with the aim of analyzing the correspondence between Eurostat format energy statistics and the National Energy Balance statistics. In addition a working group of Ispra and Ministry of Economic Development is investigating about the differences between Eurostat and National energy variables.
Reference and Sector approaches	We suggest that Italy review its Reference Approach and develop an approach to estimate carbon in the "supply balance" for the country using data from the fossil fuels supply balance statistics only. Italy should then highlight the quantities of fossil fuel used as feedstocks and/or stored carbon and carbon contained in waste in the Sector Approach so it can be removed from the Reference Approach comparison.	Some suggestion has been used in the 2014 submission improving the stored carbon estimate while further improvements are expected from the study indicated in the previous response especially with regard waste fuel production.
Reference and Sector approaches	Italy should consider using the Eurostat format data rather than pre-processed data to estimate CO_2 emissions for the Reference Approach and to compare with its Sector Approach energy balance estimates.	A study carried out jointly by the Ministry of Economic Development and Enea is currently in progress with the aim of analyzing the correspondence between Eurostat format energy statistics and the National Energy Balance statistics. In addition a working group of Ispra and Ministry of Economic Development is investigating about the differences between Eurostat and National energy variables.
Fuel combustion	We propose that Italy continue investing the resources it has to maintain its high quality GHG inventory data for the energy sector including its access to plant specific data and company information for deriving emission factors.	Ispra is continuing to invest resources it has to maintain its high quality GHG inventory data for the energy sector including the management of plant specific data and company information for deriving emission factors.
Energy balance	We suggest that Italy review its energy balance data to ensure it has a transparent dataset fully consistent with other national energy balance	A study carried out jointly by the Ministry of Economic Development and Enea is currently in progress with the aim of

Subject	Recommendation	Response
	data submissions and consider using the data submitted to the Eurostat Joint Questionnaire as the primary source for the emission estimations in the energy sector.	analyzing the correspondence between Eurostat format energy statistics and the National Energy Balance statistics. In addition a working group of Ispra and Ministry of Economic Development is investigating about the differences between Eurostat and National energy variables.
Iron and steel	We suggest that Italy undertake further analysis and discussion between the energy statisticians and the inventory team to ensure that the Iron and Steel estimates data are indeed fully consistent.	A working group of Ispra and Ministry of Economic Development is investigating about the differences between Eurostat and National energy figures also at sectoral level.
Iron and steel	To increase transparency and to enable a split of energy and process emissions in the Iron and Steel industry, we suggest that the Italian Inventory team starts the estimation procedure from activity data directly obtained from the EUROSTAT format energy statistics, similarly to the review team's approach above.	The carbon balance for 2012 calculated with Eurostat data has been compared with that reported in the NIR resulting in satisfactory differences. Improvements will come from the increase of consistency of the national energy balance with that submitted to the international organizations.

Some additional findings have been individuated by the Spanish inventory team in the bilateral review of the emission inventory.

In particular an increase of transparency of the reporting in the IIR has been requested with a focus on those category emission estimates included in 1.A.2 subsector with both combustion and processes emissions, especially for that concern the description of the allocation and the relevant chooses in attributing that emission to the combustion or production process sector.

III. Inventory improvements and QA activities

Documentation collected in the framework of the different European Directives, and Regulations (E-PRTR, Large Combustion plants and the Emissions Trading scheme) has been completely integrated in a unique informative system, with the aim to verify emissions and activity data reported for the same year under different reporting obligations and identify possible improvements in emission estimations. A further use of this database has regarded the calculation at plant level of emission estimates of other pollutants than greenhouse gases. This activity has been implemented also in view of this year submission of national emission figures of other pollutants which have been communicated in the framework of the EMEP-CLRTAP Convention at 50*50 grid scale. Emissions at point source level have been therefore derived for the energy and industrial sectors, refining figures previously attributed at local level by a top-down approach.

IV. Planned improvements

In this paragraph further improvements identified during the preparation of the National Inventory and National Inventory Report 2014 are presented.

Agreements have been established with ISTAT for aviation and maritime data provision which should allow a yearly availability of basic data and the application of more advanced Tiers for the estimation of these sectors. Specifically, for aviation, data by aircraft type and origin destination matrix are under investigation

and relevant emission factors will be updated consequently. For the maritime sector, a verification of activity data on ship movements and emission estimates is in progress together with regional environmental agencies. Generally, off-road basic activity data are planned to be checked and updated especially concerning technological information.

Other improvements will consider the verification of figures reported in the energy balance for some sector. In particular, data on energy consumption communicated to ISPRA by the relevant industries in the framework of the ETS are provided to the Ministry of Economic Development Activities for a comparison and verification with the final consumption reported in the BEN for the Industry sector; the aim is to make full use of the ETS data in the compilation of the final fuel consumption of the energy balance. An additional verification will regard the comparison of ETS data with figures of energy consumption for electricity production reported by the Italian Independent System Operator (TERNA) to the Ministry of Economic Development Activities for publication in the BEN. As previously mentioned, activities aimed at analyzing the correspondence between Eurostat format energy statistics and the National Energy Balance statistics were initiated jointly by the Ministry of Economic Development and Enea (National Agency for New Technologies, Energy and Sustainable Economic Development). Furthermore an analysis about the differences between Eurostat and National energy variables is being carried out by Ispra and Ministry of Economic Development.

The previous activities will improve the robustness and accuracy of data reported in the national balance thus of the emission inventory estimates.

Table 4. *Planned improvements*

Category	Subcategory	Parameter	Gas	Description	Timing
Cross-cutting	Energy balance	AD		A study carried out jointly by the Ministry of Economic Development and Enea is currently in progress with the aim of analyzing the correspondence between Eurostat format energy statistics and the National Energy Balance (BEN). In addition a working group of Ispra and Ministry of Economic Development is investigating about the differences between Eurostat and BEN	2015-2017
1.A.1.a	Public electricity and heat production	EFs	HMs	Further work is planned to update/change emission factors for those pollutants, as zinc, where figures reported in the EPRTR lead to average EFs significantly different from those actually used.	2015-2016
1.A.1.a	Public electricity and heat production	AD		Comparison of ETS data with figures of energy consumption for electricity production reported by the Italian Independent System Operator (TERNA) to the Ministry of Economic Development Activities for publication in the BEN	2015-2017
1 A 2	Stationary Combustion in Manufacturing Industries and Construction	-	-	We plan to report emissions in the detail of the NFR tables in the next submissions. Many of the estimation methods are based on a product specific rather than a fuel specific approach	2016
1.A.2.f.ii	Mobile Combustion in Manufacturing	EFs	NOx HC CO	Emission reduction factor reported in the 2004/26/EC Directive have not yet been applied and introduced in the emission estimates.	2016

Category	Subcategory	Parameter	Gas	Description	Timing
	Industries and Construction		PM		
1.A.3.a	Civil aviation	EFs	NOx HC CO PM	Agreements have been established with ISTAT for aviation data provision which should allow a yearly availability of basic data and the application of more advanced Tiers for the estimation of this sector	2016-2017
1.A.3.d	Maritime Navigation	EFs	NOx HC CO PM	Agreements have been established with ISTAT for maritime data provision which should allow a yearly availability of basic data and the application of more advanced Tiers for the estimation of this sector	2016-2017

QA/QC INDUSTRIAL PROCESSES
2013 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Andrea Gagna, Barbara Gonella, Ernesto Taurino

April, 2014

NATIONAL AIR EMISSION INVENTORY: INDUSTRIAL PROCESSES

I. Objective

The improvements carried out during the preparation of the 2014 national inventory submission for the industrial processes sector and those expected for the next future are summarised in the following.

II. Review process recommendations

In the following table, issues raised during the review process and related to the industrial processes sector are reported; improvements implemented for each subject are also included.

Table 1. *Response to the UNFCCC review process recommendations*

Review report para	Subject	Description	Response
32	**Industrial processes** - Cement production – CO_2 - Transparency	In response to a recommendation made in the previous review report, Italy provided a statistical analysis of the clinker facility level IEFs for the years 2003 and 2005–2011. Italy stated in the NIR that the IEFs based on national ETS data from 2003 are in line with the value of 540 kg CO2/t clinker used for the period 1990–2003 as 88.0 per cent of the facilities had an IEF in the range of 535.00–549.99 kg CO2/t clinker and 75.0 per cent were in the range of 540.00–544.99 kg CO2/t clinker. The ERT recommends that Italy in its next submission provide more information on the underlying drivers for the change in IEFs since 2003 and on how time-series consistency has been maintained. As an example, it could be clarified whether the lower IEFs are due to a change in the composition of the raw material, changes in the process or changes in estimation methods. The ERT also recommends that Italy provide more information about the method used to determine process emissions from cement production under the EU ETS and indicate whether this method is kiln input based or clinker output based.	Additional information has been added in the NIR (§ 4.2.1, 4.2.2)
33	**Industrial processes** – Iron and steel production – CO_2	The previous review report encouraged Italy to disaggregate the process emissions due to the use of coke in iron and steel production from total emissions reported in fuel combustion and report them under the industrial processes sector. During the review, Italy reported on the preliminary results of an industry survey which found that there is no accurate information by which to disaggregate the emissions. As any arbitrary disaggregation would not reflect the real situation, the ERT agreed that leaving the total emissions from the use of coke in the iron and steel industry in the energy sector is appropriate. The ERT recommends that Italy report the details of the survey in the NIR in its next annual submission.	Additional information has been added in the NIR (§ 4.4.2; Annex 3). See also Annex 6 and § 3.4.3
34	**Industrial**	HFC emissions from domestic refrigeration, small and	Italy has considered this

Review report para	Subject	Description	Response
	processes - Consumption of HFCs and SF6 – HFCs	large commercial units and chillers have all been reported under domestic refrigeration in the NIR and the CRF table 2(II). As a consequence, it is not clear which product life factors and product manufacturing factors have been used for the different subcategories. This reduces transparency and prevents the assessment of comparability of these factors. During the review, Italy provided the ERT with the underlying calculations used to estimate emissions from refrigeration. These calculations show that Italy could report emissions from certain of the subcategories separately as the consumption of blends and gases are attributed to these different subcategories (data provided by the HFC manufacturer) and different country-specific product life and product manufacturing factors are used for each subcategory. The ERT strongly recommends that Italy report separately the AD, product life factors, product manufacturing factors and emissions for domestic and commercial refrigeration in CRF table 2(II) and document the factors used in the NIR of the next annual submission.	recommendation in the estimations and consequently in the NIR (§ 4.7.2)
35	**Industrial processes** - Consumption of HFCs and SF6 – HFCs	As outlined in paragraph 34 above, Italy uses a bottom-up method to estimate emissions from refrigeration. In addition, Italy stated in the NIR and CRF tables that the emissions from equipment disposal have been included in the emissions during the product's life for the whole time series. In order to improve the transparency of the estimation methodology, the ERT recommends that Italy improve the description of the inventory and use a top-down approach to cross-check the final emission estimate.	The description has been improved (§ 4.7.2) while the cross check with the top-down approach is planned for the next submission
37	**Industrial processes** - Consumption of HFCs and SF6 – HFCs	In response to the list of potential problems and further questions raised by the ERT, Italy provided additional information, based on consultations with relevant industry associations, which confirmed that the product life factor for large commercial refrigeration is too low and should be 12.0 per cent. However, during these consultations it was also identified that the product life factor for chillers and the product manufacturing factors for both refrigeration and chillers were too high. The net result of implementing all the corrected factors would be a reduction in the 2011 emissions of 502.7 Gg CO2 eq. The ERT strongly recommends that Italy use the revised factors in the estimation of emissions in its next annual submission and that it document the methods appropriately in the NIR by specifying the manufacturing and product life factors used for each application.	Italy has considered this recommendation in the estimations and consequently in the NIR (§ 4.7.2)
38	**Industrial processes** - Lime production – CO_2	The NIR states that for the period 2005–2008 the emissions from lime production have been estimated using production data from the Italian National Institute of Statistics (ISTAT) and detailed information from the EU ETS, while from 2009 on the EU ETS has provided	Additional information has been added in the NIR (§ 4.2.1, 4.2.2)

Review report para	Subject	Description	Response
		plant-specific lime production and CO2 emissions data. However, the NIR provides no information on how the EFs for years prior to 2005 are estimated. During the review, Italy provided the ERT with the information that the EFs for the period 2000–2003 are based on detailed information from the national allocation plan and that the EFs for 1990–1999 are based on the average of the 2000–2003 EFs. To improve transparency and information about consistency, the ERT recommends that Italy provide more information about the methods used to estimate emissions from lime production for the entire time series. Italy should also clearly document whether the method is based on the amount of calcium and magnesium carbonate from the raw material, or on the amount of calcium and magnesium oxides in the lime produced for each of the periods.	
39	**Industrial processes** - Lime production – CO_2	For the period 1990–2004, the IEF for lime production is 0.8 t CO2/t lime, then from 2005 on, following the introduction of the EU ETS, the IEF changes to 0.7 t CO2/t lime. Since more detailed information about raw kiln input and the process became available with the introduction of the EU ETS, the IEF can be specified more accurately. The ERT recommends that Italy in its next annual submission provide more information about the underlying drivers for the change in the IEF since 2005 and on how time-series consistency has been maintained. As an example, it is not clear whether the lower IEFs are due to a change in the composition of the raw material, changes in the process or changes in the estimation methods.	Additional information has been added in the NIR (§ 4.2.1, 4.2.2)

III. Inventory improvements and QA activities

Other improvements not identified during the review process have been carried out.

CO_2 emissions have been checked with the relevant industrial associations. Activity data and emissions reported under EU-ETS and EPER/EPRTR are compared with the information provided by the industrial associations. In particular, comparisons have been carried out for cement, lime, limestone and dolomite, and glass sectors. The outcome of further investigations concerning the production of soda ash and chlorine at facility level has been accounted for in this submission. Activity data and emissions reported under EU-ETS and EPER/EPRTR are compared to the information provided by the industrial associations. In particular, comparisons have been carried out for cement, lime, limestone and dolomite, and glass sectors. The general outcome of this verification step shows consistency among the information collected under different legislative framework and the information provided by the relevant industrial associations. Additional QA/QC was performed on the inventory of CO_2 emissions from the decarbonation process in the national cement industry: resulting suggestions to focus on raw materials fed to clinker kilns[23] were considered and

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[23] Aether ltd, 2013. *Findings and Recommendations of the Independent Review of the Italian Greenhouse Gas Inventory*

the description of the fluctuation of the CO_2 implied emission factor has been improved in the present NIR accordingly.

IV. Planned improvements

In the following, specific improvements and remarks to be taken into account in the next submission of the national air inventory for IP sector are reported. Planned improvements include also the findings identified in the independent review of the Italian inventory undertaken by Aether in 2013 and those identified in the CLRTAP/UNECE review process.

Periodically, further improvements can result from the analysis of the different databases The inventory team integrates the documentation collected in the framework of the different pieces of European legislation (EPER-E PRTR, Large Combustion Plants and Emission Trading Scheme) with the aim to verify emissions and activity data reported for the same year under different reporting obligations and identify possible improvements in emission estimations. In the framework of EU-ETS, CO_2 emissions are checked with the relevant industrial associations at national level.

Both activity data and average emission factors are also compared every year with data reported in the national EPER/E-PRTR registry and in the European emissions trading scheme. Under the EU-ETS, operators are requested to report activity data and CO_2 emissions as information verified and certified by auditors who check for consistency to the reporting criteria.

Activity data and emissions reported under EU-ETS and EPER/EPRTR are compared to the information provided by the industrial associations. The general outcome of this verification step shows consistency among the information collected under different pieces of legislations and the information provided by the relevant industrial associations. Further investigations regarding completeness of CO_2 emissions sources from the activities of this sector are planned. as well as additional checks regarding emissions for 2005-2009 will be carried out on account of information from new entrance installations that will be included in the ETS from 2013.

In Table 2, the planned improvements are synthesized; for each topic, the reference to the UNFCCC category, which the improvement is focussed, is reported.

Table 2. *Planned improvements*

Category	Subcategory	Parameter	Gas	Description	Timing
General	-	-	-	Implementation of 2006 Guidelines	2015
	-	-	-	Implementation of a quantitative uncertainty analysis for air pollutants	2016
Mineral products	Cement and lime production	Activity data	CO_2	Further investigations concerning the replacement of natural raw material in clinker manufacture and in lime production are planned.	2015
	Building industry	Emission estimates	PM10	Estimate and report emissions from categories 2A7a, "Quarrying and mining of minerals other than coal" and 2A7b, "Construction and demolition"	2016-2017

Category	Subcategory	Parameter	Gas	Description	Timing
Chemical industry	Other chemical industry	Activity data	CO_2	A detailed balance of the natural gas reported in the Energy Balance, as no energy fuel consumption, and the fuel used for the production processes in the petrochemical sector is planned.	2015-2016
Metal production	Iron and steel production	Emission factor	CO_2	Update of electric arc furnaces emissions estimates	2015
Consumption of halocarbons and SF_6	Consumption of halocarbons and SF_6	Activity data	F-gases	Investigations on activity data on the basis of the new national database of F-gases and implementation of top-down approach to cross-check the final emission estimates with a focus on stationary refrigeration and air conditioning. Mobile air conditioning will be also investigate drawing attention on the quality of the information collected and how import/export is managed, and on the methodology used especially with regard the recharging and the end of life of f-gases.	2015-2016

IV.1 *Mineral products*

Further investigations concerning the replacement of natural raw material in clinker manufacture and in lime production are planned to improve the knowledge on the process and the accuracy of the estimations.

IV.2 *Metal production*

Reductants used in EAF and the average emission factor of CO2 from electric arc furnaces have been checked with ETS data and the T2 methodology will be applied in the next submission.

IV.3 *Consumption of halocarbons and SF_6*

Improvements in the refrigeration and air conditioning sub-category are expected from the collection of emission data as requested by the article 16 of the Decree of the President of the Republic 27 January 2012, n. 43 which receipt the article 3(6) of the EC Fluorinated Gas Regulation. In the framework of the Regulation (EC) n. 842/2006 of the European Parliament and of the Council on certain fluorinated greenhouse gases, Italy has established a reporting system in order to collect emission data. For this purpose, ISPRA, and in particular the inventory team, is responsible for the collection of reports by the operators of stationary application for refrigeration and air conditioning heat pumps as well as fire protection systems containing 3 kg or more of fluorinated greenhouse gases. Operators must report within 31 May every year; as for 2013 the information to be collected includes type and numbers of stationary appliances containing 3 kg or more of fluorinated greenhouse gases; from 2014 also information about leakages from those stationary appliances will be collected thus contributing to an improvement of the inventory of F-gas emissions.

Further investigation is planned to evaluate disposal emissions, also checking data reported in the National Database. A top down approach to cross check emission estimates is also in program.

QA/QC SOLVENT AND OTHER PRODUCT USE
2013 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Daniela Romano

April, 2014

NATIONAL AIR EMISSION INVENTORY: SOLVENT AND OTHER PRODUCT USE

I. Objective

The improvements carried out during the preparation of the 2014 national inventory submission for the solvent sector and those expected for the next future are summarised in the following.

II. Review process recommendations

The UNFCCC as well as UNECE review processes did not result in specific recommendations for this sector.

Additional verifications of the emissions from the sector occurred the last year, on account of the bilateral independent review between Italy and Spain and the revision of national estimates and projections. In the case of the bilateral review, national emissions from the solvent sector were revised by the Spanish team. The analysis by category has not highlighted the need of major methodological revisions of the sector although some general issues on the appropriateness of the activity data used are highlighted as well as the update for some categories of the emission factors for the last years of the time series on the basis of the recent available scientific documentation.

Hence, a revision involved the chemical products subsector with respect to NMVOC emissions, due to the update of emission factors for polyurethane processing; on the basis of the industrial association communication, the phase out of CFC gases occurred in the second half of nineties and the blowing agent currently used is penthane, which resulted in a strong reduction of emissions. An additional source of emissions has been added, asphalt blowing, affecting only NMVOC emissions. NMVOC emission factors for paint application in construction and building, domestic use, wood and other industrial have been checked and when relevant updated in consideration of the latest available source of information.

III. Inventory improvements and QA activities

In this paragraph, specific improvements of the national air inventory for the solvent and other product use sector are reported.

In the framework of the MeditAIRaneo project, ISPRA commissioned to Techne Consulting S.r.l. a survey to collect national information on emission factors in the solvent sector. The results, published in the report "*Rassegna dei fattori di emissione nazionali ed internazionali relativamente al settore solventi*"[24] have been used to verify and validate the emission estimates. ISPRA commissioned to Techne Consulting S.r.l. another survey to compare emission factors with the last update published in the EMEP/EEA guidebook[25]. The results are reported in "*Fattori di emissione per l'utilizzo di solventi*"[26]) and have been used to update emission factors for polyurethane and polystyrene foam processing activities.

In addition, for paint application, data communicated from the industries in the framework of the EU Directive 2004/42, implemented by the Italian Legislative Decree 161/2006, on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products have been used as a verification of emission estimates. These data refer to the

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[24] TECHNE, 2004. *Progetto MeditAiraneo. Rassegna dei fattori di emissione nazionali ed internazionali relativamente al settore solventi*. Rapporto Finale, novembre 2004

[25] EMEP/EEA, 2009. *Air Pollutant Emission Inventory Guidebook*. EEA. Technical report No 9/2009

[26] TECHNE, 2008. *Fattori di emissione per l'utilizzo di solventi*. Rapporto Finale, marzo 2008

composition of the total amount of paints and varnishes (water and solvent contents) in different subcategories for interior and exterior use and the total amount of products used for vehicle refinishing and they are available from the year 2007.

No major improvements occurred in the 2014 submission. In the actual submission, minor modifications are observed, due to the update of some activity data, specifically, in other use of solvents, for the updating of ink consumption in printing industry, fat, edible and non edible oil extraction and the import and export of cosmetics. Minor changes also occurred in chemical products considering a variation in import-export data of paints.

IV. Planned improvements

In the following table, the specific planned improvements and remarks to be taken into account in future submissions of the national air inventory for the solvent and other product use sector are reported with the information on the weight of the category on total NMVOC emissions of the sector.

Table 1. *Planned improvements*

Category	Sub-category	NMVOC Emission	Description	Timing
Cross cutting	-	-	Implementation and verification of 2006 Guidelines and EMEP/EEA 2013 Guidebook	2015
Cross cutting	Paint application for construction and building; Polyester processing; Polyurethane processing	-	Assess the possibility to obtaining information to derive the apparent consumption to be used instead of production data as activity data	2016
Paint application	Other industrial paint application	8%	Assess the possibility to split non industrial application according to the Guidebook EMEP/EEA	2015
Degreasing, dry cleaning and electronics	Metal degreasing	4%	Update information, from the national chemical industrial association (Federchimica), on activity data and emission factor	2016
Chemical products manufacturing and processing	Leather production	5%	Update emission factor for the last years on the basis of the information collected by the industrial association and EPRTR registry and local emission inventories	2016

Other use of solvents	Printing industry	4%	Update emission factor for the last years on the basis of the information collected by the industrial association	2016
Other use of solvents	Application of glues and adhesives	5%	Update emission factor for the last years on the basis of the information collected by the industrial association	2016

QA/QC AGRICULTURE
2013 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Eleonora Di Cristofaro

May, 2014

NATIONAL EMISSION INVENTORY: AGRICULTURE

I. Objective

This report describes activities and improvements carried out during the preparation of the 2014 national inventory submission for the agriculture sector.

II. Review process recommendations

During the last UNFCCC review process (UNFCCC, 2014)[27] the following recommendations were raised.

Table 1. *Response to the UNFCCC review process recommendations*

Review report para	Subject	Recommendation	Response
43	Manure management 4.B.8. Swine - CH_4	Document the methods used to adjust the uncovered storage EF, including information on the share of covered/uncovered storage and the emissions rate for covered storage systems. Review and revise the uncovered storage EF adjustment, as appropriate, to take into consideration changes in waste management through the time series.	Additional information has been supplied in the NIR 2014 (§6.3.2 *Methane emissions (swine)*). The collection of additional information on the share of covered/uncovered storage, the emissions rate for covered storage systems and the review of the percentage emission reduction are in progress, in collaboration with the CRPA and the ISTAT (National Institute of Statistics).
44	Agricultural soils - N_2O	Provide crop production type and appropriate parameters for all relevant crop production categories.	Additional information has been supplied in the NIR (§6.5.2 *Methodological issues (see Crop residues (FCR))* and in the Annex 7, *§A7.3 Agricultural soils*).
45	Field burning of agricultural residues - CH_4, N_2O	Correct the identification of the methodology type in the NIR and in CRF table summary 3.	The identification of the methodology has been corrected in the NIR and in CRF.

An official independent review of the entire Italian greenhouse gas inventory was undertaken by the Aether consultants in 2013[28] . Main findings and recommendations are reported in the following table.

Table 2. *Response to the Aether independent review outcomes*

Subject	Comment	Response
Livestock numbers	The Aether Team (AT) suggests that Italy make livestock recalculation files more accessible to improve transparency within the National System. [paragraph 45 of the report]	Data on livestock numbers are given in the excel file 'Parco Animali'. Whenever data is updated, comments are inserted in the file with an indication of the dates of data update. In addition, the sheet 'changes' in the file contains all the data changes made over the years.

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[27] UNFCCC, 2014. *Report of the individual review of the annual submission of Italy submitted in 2013*. FCCC/ARR/2013/ITA. UNFCCC, 2 April 2014. http://unfccc.int/resource/docs/2014/arr/ita.pdf (last access 14/05/14)
[28] Aether ltd, 2013. *Report of the Independent Review of the Italian Greenhouse Gas Inventory* - September, 2013

Subject	Comment	Response
Livestock numbers	AT proposes that Italy improves the transparency of the NIR by including text that explains more thoroughly the precise definition of the livestock data, and how calculations account for animals that live for less than a complete year. [paragraph 46]	Additional information has been supplied in the NIR 2014 (§*6.1.4 Agricultural statistics*).
Livestock numbers	AT suggests that Italy review possible data sources of the average weights for dairy cattle to see if it is possible to source and use year-specific data, as this will impact on emission estimates from manure management. [paragraph 47]	We have verified that currently year-specific data related to the average weights for dairy cattle are not available. A further verification of potential data sources, as the registry of dairy cattle, is in course.
Enteric fermentation	AT suggests that Italy include some text (and possibly even an extra column in the table) that compared these country-specific parameters with the default IPCC values, and explains the main reasons for any arising differences in the NIR. This would provide useful contextual information, and would allow the largest differences between the CS and default values to be clearly identified and explained. [paragraph 48]	Additional information has been supplied in the NIR 2014 (§*6.2.2 Methodological issues – Dairy cattle*). An extra column in the table has been added with the default IPCC values.
Manure management	AT suggests that Italy improve the transparency of the NIR by including details of inventory development projects and the improvements that these deliver (e.g. developing year-specific Nex values for dairy cattle), and including these in Italy's Improvement Plan. [paragraph 49]	We will evaluate whether to include additional information in the NIR 2015.
Manure management: N_2O	AT suggests that Italy provide a clearer explanation in the NIR to explain that the methodology for determining the use of different AWMS is very detailed, and considers a number of different handling systems with country specific data. We also encourage Italy to improve the notes in the compilation sheets, so that everything is transparent for all members of the inventory team. [paragraph 50]	Additional information will be included in the NIR 2015.
Manure management: N_2O	AT proposes that Italy clearly present this analysis (*relative to an overall N balance*) as a QA check in the compilation spreadsheets and document it in the QA/QC system. [paragraph 51]	A flowchart of the flow of nitrogen in the manure management was prepared and inserted in documents of the QA/QC system, saved in the reference database.
Manure management: CH_4	AT proposes that Italy include a description on what this value represents (*the density of solid manure*), and the corresponding units in the calculation sheets. [paragraph 52]	The value is referenced in the document CRPA, 2006[a] (p. 50-51), to which reference is made in the NIR 2014 (§*6.3.2 Methodological issues – Methane emissions (cattle and buffalo)*).

Subject	Comment	Response
Manure management: CH_4	AT suggests that Italy includes a description in the NIR to explain the underlying reasons for the difference that is observed between the error propagation and Monte Carlo approaches in the uncertainty analysis. [paragraph 53]	Additional information has been included in the internal files.
Rice production	AT suggests that Italy make improvements to the estimates of rice production emissions but recognize that as this is not a key category it may be sensible to include it in the improvement plan and allocate resources to improving other source sectors. [paragraph 54]	Improvements for the rice cultivation category are reported in the NIR 2014 (§*6.4.6 Source-specific planned improvements*).
Direct emissions from soil: N_2O	AT suggests that Italy make improvements to this input data (*cultivation of histosols*). The inventory team has indicated that there is on-going work to update the national soil map, and this will be used once it is available. [paragraph 55]	Data were updated, as reported in the NIR 2014 (§*6.5.2 Methodological issues – Cultivation of histosols (F_{os})*).
Indirect emissions from soil: N_2O	AT proposes that Italy review the availability of agricultural data in Italy to assess whether it is possible to improve the emission estimates from indirect sources. However, it is thought likely that the resources required to achieve any significant improvement would be prohibitive. [paragraph 56]	Currently data to improve the emission estimates from indirect sources are not available.
Burning of residues	No improvements are currently planned for this sector, but given that the review mentioned above was undertaken in response to comments raised in 2007, AT suggests that Italy investigate whether it is now possible to improve the assumptions about the percentages of crop burned on-field. [paragraph 57]	Currently data to improve the assumptions about the percentages of crop burned on-field are not available. Only for rice cultivation the percentage is supplied by the national association.

During the last UNECE review process (UNECE, 2014)[29] the following recommendations were raised.

Table 3. *Response to the UNECE review process recommendations*

Subject	Recommendation	Response
Transparency	The ERT encourages Italy to provide more detailed information on the methodologies adopted by Italy regarding emission estimates of NH3 from all sources in 4.B (livestock emissions) particularly for emissions of NH3 from 4B 8 swine and 4B 9a (laying hens). [paragraph 76 and 77]	Additional information has been supplied in the IIR 2014 (§*6.2 Methodological issues – Manure management (4B)*).

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[29] UNECE, 2013. *Report for the Stage 3 in-depth review of emission inventories submitted under the UNECE LRTAP* Convention and EU National Emissions Ceilings Directive for: STAGE 3 REVIEW REPORT ITALY. CEIP/S3.RR/2011/ITALY 01/08/2013. http://www.ceip.at/fileadmin/inhalte/emep/pdf/2013_s3/ITALY-Stage3ReviewReport-2013.pdf (last access 15/05/14)

Transparency	The ERT noted that the Party indicated in the IIR that for 4F Field burning emissions of NH3 and SOx were not estimated and the notation key 'not applicable ("NA")' was used in NFR templates for these pollutants. The ERT recommends that the Party uses appropriate notation keys, "NE" instead of not applicable "NA" in order to enhance the transparency of the inventory. [paragraph 78]	The notation keys in the NFR templates have been corrected.
Accuracy and uncertainties	Italy did not undertake a QA/QC procedure for the air pollutants inventory but plans to estimate uncertainties for some pollutants such as NH_3 and PM. The ERT recommends that Italy undertake a consistent uncertainty analysis for the agriculture sector and provide an indication of the reliability of the inventory data in its next submissions. [paragraph 82]	Uncertainty assessment will be implemented.
Manure management: Swine	The ERT noted that activity data concerning swine population (4B 8) reported in the IIR/NFR is not consistent with the activity data included in NIR/CRF and that the difference is significant (about 18% lower in IIR/NFR). The ERT recommends that Italy provide detailed information in the IIR regarding this methodology in order to enhance the transparency of the agricultural inventory in its next submission. [paragraph 87]	Additional information has been supplied in the IIR 2014 (§6.2 *Methodological issues – Manure management (4B)*).
Manure management: Laying hens	The ERT requested Italy to clarify why 4B 9a (laying hens) and 4B 9b (Broilers) exhibit very different NH3 emission trends, although their populations have followed a similar trend since 1990. The ERT recommends that the Party includes this explanation and other relevant information in the IIR of its next submission in order to enhance the transparency of the agricultural inventory. [paragraph 88]	Additional information has been supplied in the IIR 2014 (§6.2 *Methodological issues – Manure management (4B)*).

As a part of QA procedures, the verification of statistics was carried out: the livestock number was compared between conjunctural (short-term) statistics used in the estimates and Agricultural census for the year 2010. Moreover, an assessment of the methane conversion factors (MCF) has been carried out on the basis of the data coming from the Farm Structure Survey 2007 (carried out by ISTAT) and the 2010 Agriculture Census (ISTAT), resulting in very slight differences comparing to the used average methane conversion factors. The percentage of animals in temperate zone based on data from the 2010 Agriculture Census and the average temperature at provincial level are shown in the NIR. This information has been included to support the details on the estimation of the methane emission factors from manure management.

Finally, a detailed checklist of procedures for compiling the agriculture sector that is used as part of the QC system was included in the QA/QC Manual. A data flow chart for the agriculture sector was compiled and included in the file that already describe the inventory compilation procedures for the agriculture sector (see next paragraph) and archived in the reference database. The data flow chart describes the link to the working files used for the estimates.

III. Improvements and QA activities

Improvements for the Agriculture sector developed in the last years are described in the following.

III.1 General aspects

An internal report of the "**National Agriculture UNFCCC/CLRTAP emission inventory"** has been updated. This report contains information on the procedures undertaken for preparing the national inventory *2012 submission*[30].

Since 2006 submission, results from the MeditAIRaneo project have been included in the preparation of the Agriculture emission inventory (GHG/CLRTAP). Besides, results from the convention signed between APAT and the Ministry for the Environment, Land and Sea have been incorporated.

At the end of 2009 another research study related to land spreading estimations and scenario was completed[31].

III.2 National statistics

The Italian National Statistical System (SISTAN) revises every year the National Statistical Plan that covers a three years period. In this framework, the Agriculture, Forestry and Fishing Quality Panel (*Circolo Qualità Agricoltura, Foreste e Pesca*) has been established under the coordination of the Agriculture service of ISTAT. In the last years, through this process different improvements, at activity data level, have been reached. Moreover, ISPRA has established a direct contact with a network of sectoral experts useful for the verification of the time series.

III.3 Estimation improvements

In 2010 data collection and verification of emission factors presented in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 4 – Agriculture, Forestry and other land uses, *AFOLU*) was implemented. In particular, emission factors related to nitrous oxide emissions from agricultural soils were compared. Different local and European scientific publications were used for this verification. Different research groups that are working on soil emission measurements were contacted (University of Naples, University of Turin, University of Udine).

N excretion in Italy has been evaluated through a N balance inter-regional project "Nitrogen balance in animal farms", funded by the Regional Governments of the most livestock-intensive Italian Regions. The N-balance methodology has been applied in real case farms, monitoring their normal feeding practice, without specific diet adaptation. In the project the most relevant dairy cattle production systems in Italy has been considered. In contrast with what normally found in European milk production systems, poor correlation between the N excretion and milk production has been found. Probably there are two reasons for explaining the non correlation: a) extreme heterogeneity in the protein content of the forage and in the use of the feed; b) the non optimisation of the protein diet of less productive cattle[32,33]. Still further efforts on theoretical assessment of nitrogen excretion data will be done base on N balance methodology[34]. An ad-hoc agro-environmental indicator group coordinated by the Ministry of Agriculture is working to determine gross nitrogen balances; therefore, N coefficients will be revised.

For the agricultural emission inventory, a new source has been estimated: the use of sewage sludge applied to soils for agriculture (direct and indirect N_2O emissions). Activity data, amount of sewage sludge and % N content, was provided by the Ministry for the Environment, Land and Sea, which is in charge of collecting

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[30] Cóndor R.D., Di Cristofaro E., 2014. *Procedura per la preparazione, caricamento e reporting dell'inventario nazionale delle emissioni 1990-2012, settore agricoltura. Rapporto interno AMB-MPA/ISPRA.* Roma – Italia.

[31] CRPA. 2009. *Valutazione dell'entità delle emissioni ammoniacali derivanti dall'applicazione al suolo dei fertilizzanti, delle loro possibilità di riduzione e individuazione degli elementi per un monitoraggio statistico delle tecniche di applicazione utilizzate.* Rapporto finale. Reggio Emilia – Italia.

[32] *De Roest and Speroni, 2005. Il bilancio dell'azoto negli allevamenti di latte. Agricoltura. Marzo 2005. pag 112-114*

[33] CRPA, 2010. *Personal communication - experts Laura Valli and Maria Teresa Pacchioli from Centro Ricerche Produzioni Animali (expert consultation on N excretion and natinal production systems).* Reggio Emilia, Italy.

[34] Gruber, L. & Pötsch, E. M., 2006. *Calculation of nitrogen excretion of dairy cows in Austria.* Die Bodenkultur, 2006, Vol. 57, Heft 1- 4, Vienna. http://www.boku.ac.at/diebodenkultur/volltexte/band-57/heft-2/gruber.pdf

and reporting data under the EU Sewage Sludge Directive 86/278/EEC. Regarding uncertainty analysis applied to GHG estimates, Monte Carlo analysis has been extended to other key categories of the sector, the estimation of uncertainties are shown in the *NIR submission 2014.*

IV. Planned improvements

In the following table, improvements for the Agriculture emission inventory (GHG/CLRTAP) are reported.

Table 4. *Planned improvements*

Category	Subcategory	Parameter	Gas	Description	Timing
Manure management	Dairy cattle	N excretion	N$_2$O	Further efforts on theoretical assessment of N excretion data will be done based on N balance methodology (Gruber and Poesch, 2006).	2016
	Livestock categories	Housing systems	NH$_3$/GHG	A query on the housing systems of different livestock categories has been introduced in the Farm and structure survey 2005. Validation of the results has been carried out, in collaboration with the CRPA experts, taking into account also information collected from the 2010 Agricultural Census. An evaluation of the possible update to be introduced in the estimation process is currently ongoing.	2015
	Livestock categories	Slurry and solid manure storage facilities	NH$_3$/GHG	A query related to storage facilities for slurry and solid manure of different livestock categories has been introduced in the Farm and structure survey 2007. Validation of the results has to be carried out, taking into account also information collected from the 2010 Agricultural Census. Moreover, for swine, the collection of additional information on the share of covered/uncovered storage, the emissions rate for covered storage systems and the review of the percentage emission reduction are in progress, in collaboration with the CRPA and the ISTAT (National Institute of Statistics).	2015
	Livestock categories	Production methods	NH$_3$/GHG	Different queries have been incorporated in a specific section of the 2010 Agricultural Census. Detailed information on grazing, housing, storage systems and land spreading information has been collected and will be considered in the next submission.	2015
	Livestock categories	Average temperature	CH$_4$	The average annual temperatures used in the assessment of the manure management CH4 emission factors will be verified on the basis of the available information (i.e. updated data from SCIA).	2016
Rice cultivation	-	Days of cultivation by cultivars	CH$_4$	Information on days of cultivation for new varieties will be collected.	2015

Category	Subcategory	Parameter	Gas	Description	Timing
	Rice cultivation	Emission factor	CH_4	The Joint Research Centre Institute for Environment and Sustainability - Climate Change Unit, in charge of measuring rice paddy fields in Italy, has been contacted to obtain data related to measurements carried out in the latest years. The use of updated information on EFs is under evaluation.	2015
Agricultural soils	Activity data	Land spreading	NH_3/GHG	Figures on land spreading collected in the framework of the 2010 Agricultural Census will be considered for the next annual submission.	2015

IV.1 National statistics

The implementation of an *ad hoc* survey on "Agricultural Production Methods", regulated by the European Commission (EC), will be crucial for improving the preparation of the national agriculture emission inventory (GHG/CLRTAP). This survey was carried out during the 2010 General Agricultural Census in Italy. Detailed data such as animal grazing information, animal housing and storage systems characteristics, and use of manure/slurry for land application information were collected. Already, initial efforts had been oriented to collect these data at provincial level through the incorporation of specific queries in the Farm Structure Survey (FSS) from 2005 and 2007. ISPRA together with CRPA participated to the preparation of the instructions for specific queries (grazing, housing, storage and land spreading) of the Agricultural Census. This exercise will allow obtaining information useful as required by the EC regulation and the improvement of the emission inventory, which will include peculiarities of agricultural production in Italy. We expect to validate results obtained with FSS 2005 with information coming from the Agricultural census; final data from the census have been published by ISTAT at the end of 2012 and data analysis is currently ongoing.

IV.2 Estimation improvements

Further efforts on theoretical assessment of nitrogen excretion data will be done base on N balance methodology[35]. An ad-hoc agro-environmental indicator group coordinated by the Ministry of Agriculture is working to determine gross nitrogen balances; therefore, N coefficients will be revised.

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[35] Gruber, L. & Pötsch, E. M., 2006. *Calculation of nitrogen excretion of dairy cows in Austria*. Die Bodenkultur, 2006, Vol. 57, Heft 1- 4, Vienna. http://www.boku.ac.at/diebodenkultur/volltexte/band-57/heft-2/gruber.pdf

QA/QC LULUCF
2013 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Marina Vitullo

June, 2014

NATIONAL AIR EMISSION INVENTORY: LULUCF

I. Objective

The report summarizes the improvements and remarks, which have been identified during the preparation of the 2014 inventory submission for the LULUCF sector.

II. Review process recommendations

In Table 1, responses to the main questions raised during the last UNFCCC review process, related to the national inventory submitted in 2013, are described.

Table 1. *Response to the UNFCCC review process recommendations*

Review report para	Subject	Description	Response
47	**LULUCF** - Sector overview	… The ERT recommends that Italy provide detailed explanations for all recalculations in future submissions.	A detailed description related to the recalculations applied in the different categories has been provided in the NIR (§7.2.7, §7.3.7, §7.4.7, §7.6.7, §7.10.3, §7.12.6)
48	**LULUCF** - Sector overview	… The ERT recommends that Italy assess which type of cropland and grassland is converted to settlements and use appropriate notation keys	Detailed information has been reported in the NIR (§7.3.4, §7.4.4, §7.6.4).
50	**LULUCF** - Sector overview	... The ERT reiterates the recommendation made in the previous review report that Italy use the IUTI data to update the land-use matrices and recalculate the estimates for the period 1990–2011 in its next annual submission.	The ERT's recommendation has been addressed and an updated methodology to assess land uses and land use changes has been used, on the basis of the IUTI data, as detailed in the NIR (§7.1).
51	**LULUCF** - Forest land remaining forest land - CO_2	... The ERT recommends that Italy improve the explanation of how the AD are derived in its next annual submission.	Detailed information has been reported in the NIR (§7.1, §7.2.2).
55	**LULUCF** – Cropland remaining cropland - CO_2	… The ERT recommends that Italy for its next annual submission either report all areas of plantations in forest land or alternatively disaggregate the areas of plantations and report in cropland only those considered very short rotations used as energy crops.	The ERT's recommendation has been addressed and plantations, previously included into cropland category, have been allocated in forest land category as described in the NIR (§7.2.2, §7.2.3)
56	**LULUCF** – Land converted to settlements - CO_2	... The ERT recommends that Italy correct the value of the carbon content of woody crops biomass for land converted to settlements in the next annual submission.	The ERT's recommendation has been addressed and the correct value has been used to estimate carbon stock changes for cropland converted to settlements as described in the NIR (§7.6.4)
57	**LULUCF** – Land converted to settlements - CO_2	…The ERT notes that this method could, theoretically, introduce significant uncertainties if the linear relationships are not validated and reiterates the	In the NIR (§7.2.4) a detailed description of the methods and data used to estimate soils carbon stocks (and the consequent carbon stock changes) is

Review report para	Subject	Description	Response
		recommendation made in the previous review report that the Party provide further documentation on the adequacy of this method for the national circumstances of Italy.	reported. These SOCs have been used to assess the carbon stock changes for forest land converted to settlements.
63	**Supplementary information required under Article 7.1 of the KP** – Overview – Table 6	Italy reported that a new system of identifying land using the national land-use inventory (IUTI) will be implemented in the 2014 submission to address this issue. The IUTI uses statistical sampling procedures to classify lands at three points in time (1990, 2008 and 2012). Where a land-use change has been detected in 2008, the classification is also performed for 2000. The process of collection, validation and verification of the 2012 IUTI data is currently ongoing. The ERT strongly recommends that Italy complete the IUTI and implement it in the 2014 submission so as to provide the necessary additional spatial data required to meet the reporting requirements of decision 16/CMP.1	The ERT's recommendation has been addressed and an updated methodology to assess land uses and land use changes has been used, on the basis of the IUTI data, as detailed in the NIR (§7.1).
64	**Supplementary information required under Article 7.1 of the KP** – Overview	…Following a similar rationale, the ERT recommends that Italy classify these plantations as forest and report them in the appropriate Article 3, paragraphs 3 and 4, categories in the next annual submission….	The ERT's recommendation has been addressed and plantations, previously not included in area subject to art. 3.3 and 3.4 activities, have been classified as forest and reported in the appropriate Art. 3.3 and 3.4, categories as described in the NIR (§10.1.1)
66	**Supplementary information required under Article 7.1 of the KP** - Activities under Article 3.3, of the KP -Afforestation and reforestation - CO_2	…To improve transparency, the ERT recommends that Italy improve the explanation and justification for abandoned arable lands which are "naturally forested" to be reported as afforestation/reforestation consistent with decision 16/CMP.1. Specifically, Italy should elaborate how the decree 227/2001 protects all naturally regenerated forest.	A description of legislative Italian context and the consequent implications for the direct human induced afforestation and reforestation activities has been provided in the NIR (§10.4.1)
68	**Supplementary information required under Article 7.1 of the KP** - Activities under Article 3.4 of the KP – Deforestation - CO_2	…The ERT recommends that Italy provide information in the next annual submission on how deforestation of these lands is identified and reported, ensuring appropriate accounting of emission/removals.	The ERT's recommendation has been addressed and updated data related to deforestation activities have been used, as described in the NIR (§10.1.3, §10.2.2, §10.4.1)
69	**Supplementary**	…The ERT recommends that the Party	In the NIR (§10.3.1.2) a detailed

Review report para	Subject	Description	Response
	information required under Article 7.1 of the KP - Activities under Article 3.4 of the KP – Forest management - CO$_2$	provide further documentation on the adequacy of this approach to estimate changes in SOC for the national circumstances of Italy (see para 56 above).	description of the methods and data used to estimate soils carbon stocks (and the consequent carbon stock changes) is reported. These SOCs have been used to assess the carbon stock changes in AR activities.

III. Inventory improvements and QA activities

III.1 Forest land (5A)

Coherently with the previous submission, forest definition adopted by Italy in the framework of application of elected 3.4 activity, under Kyoto Protocol, has been fully implemented also in the LULUCF sector of the inventory under the Convention, in order to maintain coherence and congruity between the two forest-related reporting. The forest definition has been set up, and included in the determination of Italy's assigned amount under Article 7, paragraph 4, of the Kyoto Protocol, and the election of the art. 3.3 and 3.4 activities, by a national expert panel set up under the coordination of Ministry of Environment and in cooperation with the Ministry of Agriculture, Food and Forest Policies. The abovementioned panel involves, on a voluntary basis, the relevant national experts, including the forest inventory experts (http://www.sian.it/inventarioforestale/jsp/home_en.jsp), members of the FAO-FRA Italian panel (http://www.fao.org/docrep/013/al537E/al537E.pdf) and other national researchers. The national expert panel has considered the Kyoto Protocol rules and requirements, related to reporting and accounting of art. 3.3 and 3.4 activities, and agreed the national forest definition. In the same context, national circumstances (e.g. forest composition, forestry management practices, agroforestry practices, etc.) were examined and it was decided to classify shrubland in the grassland category because they do not fulfil national forest definition; in the 2014 submission, following a key finding in the 2013 review process, the plantations, previously classified in the cropland category, have been included in forest.

Activities planned in the framework of the 'National Registry for Carbon sinks' (in particular IUTI, inventory of land use) has been completed, resulting in land use classification, for all national territory, for the years 1990, 2000 and 2008. After a process of validation and verification, the IUTI data has been used in the current submission. An update of the for-est model has been done; the II NFI (INFC2005) data related to the litter carbon content, collected in the framework of INFC2005 surveys, have been implemented in the model and land use and land use changes assessment has been carried out through the use of IUTI results. For the LULUCF sector, following the election of 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.

III.2 Cropland (5B)

Following 2013 ERT's finding, plantations, previously included into cropland category, have been allocated in forest land category.

For the land use conversion, land use change matrices have been used; as abovementioned, LUC matrices for each year of the period 1990–2012 have been assembled on the basis of the IUTI data, related to 1990, 2000 and 2008, and the results of the NFI (related to 2012). Annual figures for areas in transition between different land uses have been derived by a hierarchy of basic assumptions (informed by expert judgement) of known patterns of land-use changes in Italy as well as the need for the total national area to remain constant. CO_2 emissions from urea application have been estimated; it has to be noticed that CRF Reporter doesn't allow inputting such a contribution to overall emissions, and therefore these emissions are not included in the 2014 submission.

III.3 Grassland (5C)

Coherently with the forest definition adopted by Italy in the framework of application of elected 3.4 activities, under Kyoto Protocol, shrubland have been reported into the grassland category, as they don't fulfil the national forest definition. For the land use conversion, land use change matrices have been used; as abovementioned, LUC matrices for each year of the period 1990–2012 have been assembled on the basis of the IUTI data, related to 1990, 2000 and 2008, and the results of the III NFI (related to 2012). Annual figures for areas in transition between different land uses have been derived by a hierarchy of basic assumptions (informed by expert judgment) of known patterns of land-use changes in Italy as well as the need for the total national area to remain constant.

The change in biomass has been estimated only for subcategory "other wooded land", since, for grazing land, the increase in biomass stocks in a single year is assumed equal to biomass losses from harvest and mortality in that same year. For the "other wooded land" subcategory, growing stock and the related carbon are assessed by the For-est model, estimating the evolution in time of the different pools and applied at regional scale (NUTS2). Therefore the update of the model, taking into account the INFC2005 data related to the litter carbon pool, affects also the grassland category. Concerning soils pool, following the ERT recommendation, Italy has decided to apply the IPCC Tier1, assuming that, the carbon stock in soil organic matter, for shrubland, does not change. Therefore carbon stock changes in soils pool, for grassland remaining grassland, have been not reported.

III.4 Wetlands (5D)

Land uses and land use changes, for each year of the period 1990–2012 have been assessed on the basis of the IUTI data, related to 1990, 2000 and 2008, and the results of the III NFI (related to 2012), resulting also in an assessment of wetlands land use and land in transition to wetlands category. Concerning land converted to wetland, during the period 1990-2012, cropland and grassland categories have been converted into wetlands area.

III.5 Settlements (5E)

For the land use conversion, land use change matrices have been used; as abovementioned, LUC matrices for each year of the period 1990–2012 have been assembled on the basis of the IUTI data, related to 1990, 2000 and 2008, and the results of the III NFI (related to 2012). Annual figures for areas in transition between different land uses have been derived by a hierarchy of basic assumptions (informed by expert judgement) of known patterns of land-use changes in Italy as well as the need for the total national area to remain constant. The average area of land undergoing a transition from non-settlements to settlements during each year, from 1990 to 2012, has been estimated with the land use change matrices that have also permitted to specify the initial and final land use. Land use changes have been derived, by the way of land use change matrices, smoothing the amount of changes over a 5 year period, harmonizing the whole time series, resulting in a constant amount of C stock change in the 5 year period, following a previous review remark.

III.6 Carbon emissions from agricultural lime application (5(IV))

In 2014 submission CO_2 emissions from application of carbonate containing lime and dolomite to agricultural soils have been estimated for the period 1998-2012, since data on agricultural lime application have been became available only for that period; moreover CO_2 emissions from agricultural dolomite application have been included in CO_2 emissions from limestone application, as national statistics on amount of lime applied don't allow to disaggregate the two components (limestone and dolomite). CO_2 emissions from agricultural lime application are reported in the Table5(IV) - CO_2 emissions from agricultural lime application.

III.7 Biomass Burning (5(V))

CH_4 and N_2O emissions from forest fires are estimated, in accordance with the IPCC method, and burned areas for forest land remaining forest land and land converting to forestland subcategories have been reported. CO_2, CH_4 and N_2O emissions have been also estimated for cropland and grassland categories. Areas affected by fires encompassed in settlements category have been reported, but no emissions are estimated, assuming the carbon losses from the settlements areas affected by fires are irrelevant.

For the period 1990-2012, national statistics on areas affected by fire per region and forestry use, high forest (resinous, broadleaves, resinous and associated broadleaves) and coppice (simple, compound and degraded), are available (ISTAT, several years [a]). In addition, for the period 2008-2012, a detailed database, provided by the Italian National Forest Service (CFS - Ministry of Agriculture, Food and Forest Policies), has been used; the database collects data related to any fire event occurred in 15 administrative Italian regions[36] (the 5 autonomous regions are not included), reporting, for each fire event, the following information:

- *burned area [ha]*
- *forest typology (27 classes in line with the NFI nomenclature)*
- *scorch height [m]*
- *fire's type (crown, surface or ground fire)*

Data and information related to fire occurrences in the 5 remaining autonomous regions are collected at regional level, with different level of disaggregation and details (for example, in Sardinia region, the amount of biomass burned is reported instead of the scorch height). Detailed description of the methodological issues is included in the NIR (§7.12.1).

Statistics related to fires occurring in other land use categories (i.e. cropland, grassland and settlements) have been collected in the framework of *ad hoc* expert panel on fires has been set up, formed by experts from different institutions from ISPRA and Italian National Forest Service (Ministry of Agriculture, Food and Forest Policies), currently in charge for the official publication related to burned area (http://www3.corpoforestale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/6358). The expert panel on forest fires has been also aimed to obtain geographically referenced data on burned area.

III.8 Supplementary information required under Article 7.1 of the KP - art. 3.3 (Afforestation/Reforestation/Deforestation) and art. 3.4 (Forest Management)

The forest definition has been set up, and included in the determination of Italy's assigned amount under Article 7, paragraph 4, of the Kyoto Protocol, and the election of the art. 3.3 and 3.4 activities, by a national expert panel set up under the coordination of Ministry of Environment and in cooperation with the Ministry of Agriculture, Food and Forest Policies. Further details on the panel and other forestry issues are reported in the par. ***III.1 Forest land (5A).***

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[36] The Italian territory is subdivided in 20 administrative regions, 5 of which are autonomous: Valle d'Aosta, Friuli Venezia Giulia, Sardegna, Sicilia and Trentino Alto Adige, the latest subdivided in two autonomous provinces (Trento and Bolzano).

Activities planned in the framework of the 'National Registry for Carbon sinks' (in particular IUTI, inventory of land use) has been completed, resulting in land use classification, for all national territory, for the years 1990, 2000 and 2008. After a process of validation and verification, the IUTI data has been used in the current submission. An update of the for-est model has been done; the II NFI (INFC2005) data related to the litter carbon content, collected in the framework of INFC2005 surveys, have been implemented in the model and land use and land use changes assessment has been carried out through the use of IUTI results.

For the LULUCF sector, following the election of 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.

IV. Planned improvements

In the following, specific improvements and remarks to be taken into account in the next submission of the national air inventory for LULUCF sector are reported. Planned improvements include also the findings identified in the independent reviews of the Italian inventory undertaken by Aether and by AED in 2013.

The Approach 2 uncertainty analysis has been carried out for 2009 inventory year; Montecarlo has been applied to following LULUCF categories, producing, for most of the results, comparable results for both approaches (Approach 1 and 2). A re-assessment of uncertainty analysis with Montecarlo methodology is planned in order to be included in the 2015 submission.

In Table 2, the planned improvements are synthesized; for each topic, the reference to the UNFCCC category or KP activity, which the improvement is focussed, is reported.

Table 2. *Planned improvements*

Category	Subcategory	Parameter	Gas	Description	Timing
Forest land	FL-FL; L-FL	-	GHG	Implementation of the III NFI's outcomes; the final outcomes, related to the field surveys, are expected to be available in 2015	2015-2016
Biomass burning	Activity data		CO_2	The fraction of CO_2 emissions, due to biomass burning, will be pointed out.	2015-2016
Biomass burning	Activity data		GHG	Verification activities comparing EU data sources (i.e. EFFIS).	2015
Cropland	CL-CL	Woody crops	CO_2	Collection of country specific data on woody crops	2015-2016
Cropland	CL-CL	Activity data	GHG	Verification activities carried out in the framework of the implementation of EU Decision n. 529/2013	2015-2016
Cropland	CL-CL; L-CL	Soils pool	CO_2	Data collection and model implementation for soils pool, in the framework of the implementation of EU Decision n. 529/2013	2015-2016

Grassland	GL-GL	Activity data	GHG	Verification activities carried out in the framework of the implementation of EU Decision n. 529/2013	2015-2016
	GL-GL; L-GL	Soils pool	CO_2	Data collection and model implementation for soils pool, in the framework of the implementation of EU Decision n. 529/2013	2015-2016
Wetlands	WL-WL	Activity data	CO_2	Data collection	2016
Settlements	SL-SL	Activity data	CO_2	Data collection	2016
Lime Application	Lime Application	Activity data	CO_2	Data collection related to the 1990-1997 period	2016
Uncertainty	Uncertainty	-	-	Re-assessment of uncertainty analysis following Approach 2 (Montecarlo)	2015-2016
KP LULUCF	art. 3.3; art. 3.4	Activity data	CO_2	Implementation of the III NFI's outcomes; the final outcomes, related to the field surveys, are expected to be available in 2015	2015-2016
	art. 3.3; art. 3.4	Activity data; emissions/removals	GHG	Implementation of the provision related to Natural disturbances/CECF	2015
	art. 3.3; art. 3.4	Activity data; emissions/removals	CO_2	Estimation of the HWP pool	2015
KP LULUCF	FM	Activity data; emissions/removals	CO_2	Assessment for the need of Technical Correction to Forest Management Reference Level	2015
KP LULUCF	art. 3.3; art. 3.4	emissions/removals	GHG	Implementation of the updated methodologies reported in the IPCC 2013 KP Supplement	2015

KP LULUCF	Biomass burning	emissions CO_2	The fraction of CO_2 emissions, due to biomass burning, will be pointed out.	2015-2016

In the following, details related to the specific improvements are provided category by category.

IV.1 Forest land (5A)

The implementation of the III national forest inventory, which has already completed the first phase related to forest area assessment, is increasing the robustness of the data sources used in the estimation process. The third NFI, which has the same sampling design of the previous one, is a three-phase inventory. In particular the field surveys, related to the qualitative and quantitative attributes measurements, will allow using of IPCC carbon stock change method to estimate emissions and removals for forest land remaining forest land category. In addition a comparison between the two IPCC methods (carbon stock change versus gains-losses) could be undertaken; the comparison is a valuable verification exercise and is able to highlight any potential outlier which detaches the two estimates.

In 2013, the joint project "ITALI" (*Integration of Territorial And Land Information*) has started its activities; the project, coordinated by the National Institute of Statistics and promoted by EUROSTAT[37], involves ISPRA, the Ministry of Agriculture, Food and Forest Policies, the National Forestry Service and the SIN (*Sistema Informativo Nazionale per lo sviluppo dell'agricoltura*) and is aimed to supply national statistics related to land use and land cover, harmonising and improving the current informative bases already available in the country. In this framework existing data sources for land cover and land use are under examination, comparing the statistical design (classification system, coverage, statistical unit, reference area, time coverage and statistical process), in order to underline the opportunities of producing coherent and consistent statistics, concerning the whole Italian territory. Furthermore, for some experimental areas, data collected by LUCAS[38] will be compared with data collected by in-situ Italian surveys, administrative data or data collected by photo-interpretation.

An expert panel on forest fires has been set up, in order to obtain geographically referenced data on burned area; the overlapping of land use map and georeferenced data should assure the estimates of burned areas in the different land uses. The fraction of CO_2 emissions due to biomass burning, now included in the estimates of the forest land category, will be pointed out.

Furthermore ISPRA participates in technical working groups, denominated *Circoli di qualità*, within the National Statistical System (*Sistan*). Concerning the LULUCF sector, this group, coordinated by the National Institute of Statistics, includes both producers and users of statistical information with the aim of improving and monitoring statistical information for the forest sector. These activities should improve the quality and details of basic data, as well as enable a more organized and timely communication.

A specific procedure undertaken for improving the inventory regards the establishment of national expert panels which involve, on a voluntary basis, different institutions, local agencies cooperating for improving activity data and emission factors accuracy. To this aim, an interregional project, named INEMAR[39], developed to carry out atmospheric emission inventories at local scale, has added a module to estimate forest land emission and removals, following the methodology applied, at national level, to estimates removals and emissions by forest land. The module is currently applied, at local scale with local data, in seven of the 20

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[37] Eurostat is the statistical office of the European Union: http://epp.eurostat.ec.europa.eu/portal/page/portal/about_eurostat/introduction
[38] LUCAS (Land Use/Cover Area frame statistical Survey) is an European field survey program: http://www.lucas-europa.info/NewsBASE/content_eftas_lucas01/frame_deutsch.php
[39] INEMAR: INventario EMissioni Aria: http://www.inemar.eu/xwiki/bin/view/Inemar/WebHome;
http://www.ambiente.regione.lombardia.it/inemar/e_inemarhome.htm

Italian regions and the results will constitute a good validation of the used methodology. The module has been applied, at local scale with local data, for the different pools in Lombardy region, for the years 1990, 2000, 2005, 2008, in Veneto region for the year 2005 and in Friuli Venezia Giulia region for the year 2007.

IV.2 Cropland (5B)

Additional research will be carried out to collect more country-specific data on woody crops. Improvements will concern the implementation of the estimate of carbon change in cropland biomass at a higher disaggregated level, with the subdivision of the activity data in the main categories of woody cropland (orchards, citrus trees, vineyards, olive groves) and the application of different biomass accumulation rates and harvest/maturity cycles for the various categories.

In addition, in 2013, the joint project "ITALI" (*Integration of Territorial And Land Information*) has started its activities; the project, coordinated by the National Institute of Statistics and promoted by EUROSTAT[40], involves ISPRA, the Ministry of Agriculture, Food and Forest Policies, the National Forestry Service and the SIN (*Sistema Informativo Nazionale per lo sviluppo dell'agricoltura*) and is aimed to supply national statistics related to land use and land cover, harmonising and improving the current informative bases already available in the country. Further details may be found in the section III.1 Forest land (5A).

Italy has been identified, jointly with other 6 countries, as beneficiary of support action by the European Commission, through the Joint Research Centre, to improve current LULUCF reporting (in the 1st CP of the Kyoto Protocol) and to increase the level of preparedness for reporting during the 2nd CP (2013-2020).
Specifically, the following activities are included:

1) Implementation of country-specific recommendations developed by JRC, based, inter alia, on the latest 2012 UNFCCC ARRs, the JRC QA/QC process, the new LULUCF rules for the 2nd CP, and the latest IPCC guidance.

2) For Forest Management and *forest land remaining forest land* the latest GHG inventory will be compared with estimates provided for all carbon pools by the forest Carbon Budget Model (CBM), run by the JRC. In line with the IPCC guidance, this comparison could be seen as a "verification activity", whose purpose is to build confidence on the reported estimates and trends, help scientific understanding, and when relevant provide possible inputs to improve inventories.

Bilateral discussion and interactions with the JRC's experts are currently ongoing and are expected to result in refining and enhanced accuracy of the GHG estimates for the next submissions; particular focus will be, among others, applied to verification activities carried out in the framework of the implementation of EU Decision n. 529/2013. In the same framework, activity data and emission factors will be analyzed (checking availability and quality) and consequently reporting for *Cropland* category will be improved.

IV.3 Grassland (5C)

Concerning land in transition to grassland, further investigation will be made to obtain additional information about different types of management activities on grassland, and the crop types of land converting to grassland, to obtain a more accurate estimate of the carbon stocks change.

In 2013, the joint project "ITALI" (*Integration of Territorial And Land Information*) has started its activities; the project, coordinated by the National Institute of Statistics and promoted by EUROSTAT[41], involves ISPRA, the Ministry of Agriculture, Food and Forest Policies, the National Forestry Service and the SIN (*Sistema Informativo Nazionale per lo sviluppo dell'agricoltura*) and is aimed to supply national statistics related to land use and land cover, harmonising and improving the current informative bases already available in the country. Further details may be found in the section III.1 Forest land (5A).

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[40] Eurostat is the statistical office of the European Union: http://epp.eurostat.ec.europa.eu/portal/page/portal/about_eurostat/introduction
[41] Eurostat is the statistical office of the European Union: http://epp.eurostat.ec.europa.eu/portal/page/portal/about_eurostat/introduction

Italy has been identified, jointly with other 6 countries, as beneficiary of support action by the European Commission, through the Joint Research Centre, to improve current LULUCF reporting (in the 1st CP of the Kyoto Protocol) and to increase the level of preparedness for reporting during the 2nd CP (2013-2020). Specifically, the following activities are included:

1) Implementation of country-specific recommendations developed by JRC, based, inter alia, on the latest 2012 UNFCCC ARRs, the JRC QA/QC process, the new LULUCF rules for the 2nd CP, and the latest IPCC guidance.

2) For Forest Management and *forest land remaining forest land* the latest GHG inventory will be compared with estimates provided for all carbon pools by the forest Carbon Budget Model (CBM), run by the JRC. In line with the IPCC guidance, this comparison could be seen as a "verification activity", whose purpose is to build confidence on the reported estimates and trends, help scientific understanding, and when relevant provide possible inputs to improve inventories.

Bilateral discussion and interactions with the JRC's experts are currently ongoing and are expected to result in refining and enhanced accuracy of the GHG estimates for the next submissions; particular focus will be, among others, applied to verification activities carried out in the framework of the implementation of EU Decision n. 529/2013. In the same framework, activity data and emission factors will be analyzed (checking availability and quality) and consequently reporting for *Grassland* category will be improved.

IV.4 Wetlands (5D)

Improvements will concern the acquirement of data about flooded lands and the implementation of the GPG method to estimate CO_2, CH_4 and N_2O emissions from flooded lands.

IV.5 Settlements (5E)

Urban tree formations will be probed for information, in order to estimate carbon stocks. In addition, in 2013, the joint project "ITALI" (*Integration of Territorial And Land Information*) has started its activities; the project, coordinated by the National Institute of Statistics and promoted by EUROSTAT[42], involves ISPRA, the Ministry of Agriculture, Food and Forest Policies, the National Forestry Service and the SIN (*Sistema Informativo Nazionale per lo sviluppo dell'agricoltura*) and is aimed to supply national statistics related to land use and land cover, harmonising and improving the current informative bases already available in the country. Further details may be found in the section III.1 Forest land (5A).

IV.6 Carbon emissions from agricultural lime application (5(IV))

Improvements will concern the acquirement of data about annual amount of lime applied in the period 1990-1997; consideration will be focussed onto the acquisition of disaggregated data on calcic limestone and dolomite agricultural application.

IV.7 Biomass Burning (5(V))

In the framework of the supporting action by the European Commission, through the Joint Research Centre, to improve current LULUCF reporting (in the 1st CP of the Kyoto Protocol) and to increase the level of preparedness for reporting during the 2nd CP (2013-2020), verification activities will be carried out comparing burned areas reported by annual statistics against the JRC's results of comparative assessment of data reported under UNFCCC and EFFIS[43].

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[42] Eurostat is the statistical office of the European Union: http://epp.eurostat.ec.europa.eu/portal/page/portal/about_eurostat/introduction
[43] European Forest Fire Information System (EFFIS): http://forest.jrc.ec.europa.eu/effis/

IV.8 Supplementary information required under Article 7.1 of the KP - art. 3.3 (Afforestation/Reforestation/Deforestation) and art. 3.4 (Forest Management)

The full implementation of the III NFI's outcomes, which are expected to be available in 2015, is foreseen for the 2016 submission; in particular, also for the KP activities, these data will allow a comparison between the two IPCC methods (carbon stock change versus gains-losses) could be undertaken; the comparison is a valuable verification exercise and is able to highlight any potential outlier which detaches the two estimates.

The fraction of CO_2 emissions due to biomass burning, now included in the estimates of art. 3.3 and 3.4 activities, will be pointed out, with the support of the expert panel on forest fires.

A specific focus will be applied to the information and estimates related to the potential application of the new provisions outlined in the decision 2/CMP.7 (i.e. natural disturbances and carbon equivalent forest conversion (CEFC) in order to include this information in the submission of the Initial reports under Article 7, paragraph 4, of the Kyoto Protocol. The decision 2/CMP.7 allows that under certain conditions, emissions from natural disturbances that occur in forests may be excluded from accounting under the KP for the second commitment period, following the guidance provided in the 2013KP Supplement.

The estimates of the Harvest Wood Products pool, as required by the decision 2/CMP.7, have to be carried out for the next annual submission, following the guidance the 2013KP Supplement.

In the context of Forest Management Reference Level (FMRL), as required by the accounting rules for the 2nd CP for art. 3.4 Forest Management activities, an assessment of methodological consistency, during the CP, between the methodological elements used in the construction of FMRL (i.e. method used, historical data used for FMRL (e.g. forest area, harvest, increment, age structure, forest characteristics and management, net emissions and related estimation parameters, etc.) and other elements (e.g.: pools and gases, treatment of HWP, natural disturbances, climate and other parameters used by models) and those used in the reporting of FM. A change in methodological elements used in the construction of FMRL triggers a methodological inconsistency, to be addressed through a Technical Correction.

QA/QC WASTE
2013 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Barbara Gonella, Ernesto Taurino

April, 2014

NATIONAL AIR EMISSION INVENTORY: WASTE

I.   Objective

This report summarises the improvements, which have been identified during the preparation of the 2014 inventory submission for the waste sector.

II.   Review process recommendations

In the following table, issues raised during the review process and related to the waste sector are reported; responses to each subject are also included.

Table 1. *Response to the UNFCCC review process recommendations*

Review report para	Subject	Description	Response
60	**Waste** - Solid waste disposal on land - transparency	The transparency of information on CO2 emissions from recovered landfill gas has been improved in the 2013 submission with the provision of a detailed breakdown of the sources of biomass AD in the commercial/institutional subcategory in the energy sector (table 8.12 in the NIR). This table includes information relevant to other waste categories and the energy sector. To ensure transparency in all categories/subcategories, the ERT recommends that Italy appropriately reference table 8.12 in all relevant sections of the NIR in both the energy and the waste sector in its next annual submission.	Italy has considered this suggestion (§ 3.6.2; § 8.3.1 of the NIR)
62	**Waste** - Waste incineration – CO$_2$	When justifying the choice of the CO2 EF for municipal waste (289.26 kg/t) in the NIR of the 2013 submission, Italy stated that the CO2 EF for municipal waste has been calculated considering a carbon content equal to 23.0 per cent; moreover, on the basis of the Revised 1996 IPCC Guidelines and the average content analysis on a national scale reported by Federambiente (1992), a distinction was made between CO2 from fossil fuels (generally plastics) and CO2 from renewable organic sources (paper, wood, other organic materials). Only emissions from fossil fuels, which are equivalent to 35.0 per cent of the total, were included in the inventory. The ERT noted that the distribution of carbon content between fossil carbon and renewable carbon is actually presented in a report by De Stefanis (2002). In order to improve the transparency of the report, the ERT recommends that Italy replace the reference to Federambiente (1992) with De Stefanis (2002) in its next annual submission.	Italy has considered this suggestion (§8.4.2)

III. Inventory improvements and QA activities

Other improvements not identified during the UNFCCC review process have been carried out together with the implementation of some remarks identified in the CRTAP/UNECE review process.

An in depth analysis of EWC codes of waste disposed of in landfills has been done for the year 2007, thanks to the complete database of Waste Cadastre kindly supplied by ISPRA Waste Office. This accurate analysis has permitted to verify the correctness of waste typology assumptions used for the estimations.

The LCV used for biogas derives from national experts and it has been verified with energy and quantitative data about biogas production from waste supplied by TERNA (National Independent System Operator)[44].

Where information is available, wastewater flows and COD concentrations are checked with those reported yearly by the industrial sectoral reports or technical documentation developed in the framework of the Integrated Pollution and Prevention Control (IPPC) Directive of the European Union (http://eippcb.jrc.es).

A thesis on GHG emissions from wastewater handling has been carried out at Environmental, Hydraulic, Infrastructures and Surveying Engineering Department (DIIAR) of Politecnico di Milano[45], where national methodology has been compared with that reported in 2006 IPCC Guidelines and with a methodology developed in the framework of a previous thesis for the estimation of emissions from wastewater treatment plants located in Regione Lombardia.

As planned in the previous submission a rearrangement of incinerators database has been made. During this process an in depth analysis of all incineration plants has been carried out with the target to eliminate double counting and to add eventual no counted plants. Once the list of plants was updated, a new and unique database has been developed to manage activity data, emissions of greenhouse gases and other pollutants, and spatial disaggregation, supporting QA / QC processes.

Moreover, mortal remains have been added to cremation of corpses.

IV. Planned improvements

In the following, specific improvements and remarks to be taken into account in the next submission of the national air inventory for the waste sector are reported. Such improvements include also the findings identified in the independent reviews of the Italian inventory undertaken by Aether in 2013.

In Table 2, the planned improvements are synthesized; for each topic, the reference to the UNFCCC category, which the improvement is focussed, is reported.

Table 2. *Planned improvements*

Category	Subcategory	Parameter	Gas	Description	Timing
General	-	-	-	Implementation and verification of 2006 Guidelines and EMEP/EEA 2013 Guidebook	2015
Solid waste disposal on land	Managed and unmanaged Disposal	Activity data	CH_4	Currently, more recent data on the fraction of CH_4 in landfill gas and on the amount of landfill gas collected and treated are under investigation. A survey on industrial sludge disposed of into landfills for hazardous waste is ongoing and relates to 2010 activity data.	2015-2016
Wastewater treatment and discharge	Domestic and commercial	MCF; activity data	CH_4	Methane conversion factor from domestic and commercial wastewater will be investigated in the future. Moreover the served population equivalent figures supplied by the National Institute of Statistics will be verified with the results of the next national survey.	2015-2016

[44] TERNA, several years. *Dati statistici sull'energia elettrica in Italia*. Rete Elettrica Nazionale.
[45] Solini, 2010. *Emissioni di gas serra dallo scarico e trattamento di acque reflue*. PhD thesis

Category	Subcategory	Parameter	Gas	Description	Timing
Waste incineration	Municipal waste incineration	Combustion technologies	GHG	An assessment of the changes in GHG EFs across the time series with the aim of reflecting efficiency improvements or other changes with time is planned for the future.	2015-2016
Compost production	Compost production	Management methods	CO_2	An assessment of different management methods of composting is planned for the future.	2016

IV.1 Solid waste disposal on land

More recent data on the fraction of CH_4 in landfill gas and on the amount of landfill gas collected and treated are under investigation. Different sustainability report and E-PRTR declaration are and will be analysed to obtain activity data about the collected biogas.

Regarding the energy conversion efficiency of biogas engine, actually assumed equal to 0.3, as the technological evolution is probably leading to increase efficiency to around 40%; further investigations are planned.

Investigation on industrial sludge disposed into landfills is on-going, the information about the amount of sludge disposed in managed landfills has already been collected and must be processed and checked on the basis of data reported in the National Cadastre. The National Waste cadastre is managed by ISPRA and is formed by a national branch hosted by ISPRA and regional and provincial branches hosted respectively by the Regional Agencies for the Protection of the Environment. So the system requires continuous and systematic knowledge exchange and QA/QC checks in order to ensure homogeneity of information concerning waste production and management throughout the entire Italian territory.

IV.2 Wastewater handling

Possible improvements in future submissions could come from the share of information with the Office of the Ministry of the Environment, Territory and Sea who is responsible for water activities.

Some improvements could also come from the analysis of E-PRTR data.

Methane conversion factor from domestic and commercial wastewater will be investigated in the future. Moreover the served population equivalent figures supplied by the National Institute of Statistics will be verified with the results of the last national survey.

IV.3 Waste incineration

As reported for solid waste disposal on land, the waste composition is very important to improve CO_2 emission factor on the basis of carbon content, but in the case of incineration combustion technologies are equally important. In order to update the government's strategy to achieve Italy's emissions reduction target under the Kyoto Protocol, the GHG emission projections for 2020, specific to waste management, have been updated with a focus on how this could influence the waste composition. The new information on waste composition will improve also waste incineration emission estimates. On the other hand, a survey about combustion technologies is ongoing and it should be achieved 2016.

IMPROVEMENT PLAN

Prepared by: Riccardo De Lauretis

June, 2014

NATIONAL AIR EMISSION INVENTORY: IMPROVEMENT PLAN

The quality objectives of the Italian inventory are revised every year and improvements are planned on account of the results of the various review processes, the accuracy of the estimation method, the uncertainty and weight of the category analysed, and a cost effectiveness evaluation.
The following table show a list of priorities identified by the inventory team to be implemented in the next submissions.

Sector	Category	Parameter	Gas	Description	Timing
Cross- cutting	-	-	-	Implementation and verification of 2006 Guidelines and EMEP/EEA 2013 Guidebook	2015
	-	-	-	Continue to consolidate information in the NIR, annual QA/QC plan, QA/QC procedures manual and National System document	2015
	-	-	-	Improve the QA/QC annual plan report with the description of the tier2 QC checks implemented at sectoral level	2015-2017
	-	-	-	Quantitative uncertainty analysis of emission estimates of other pollutants reported in the UNECE/CLRTAP framework	2015-2017
Energy	-	AD	-	A study carried out jointly by the Ministry of Economic Development and Enea is currently in progress with the aim of analyzing the correspondence between Eurostat format energy statistics and the National Energy Balance (BEN). In addition a working group of Ispra and Ministry of Economic Development is investigating about the differences between Eurostat and BEN. The analysis of differences includes the comparison of ETS data with figures of energy consumption for electricity production reported by the Italian Independent System Operator (TERNA) to the Ministry of Economic Development Activities for publication in the BEN	2015-2017
	Public electricity and heat production	EFs	HMs	Update/change emission factors for those pollutants, as zinc, where figures reported in the EPRTR lead to average EFs significantly different from those actually used	2015-2016
	Transport-Aviation and maritime	EFs	NOx HC CO PM	Agreements have been established with ISTAT for aviation and maritime data provision which should allow a yearly availability of basic data and the application of more advanced Tiers for the estimation of these sectors	2016-2017

Industrial Processes and solvent use	Cement /lime production	AD	CO_2	Further investigations concerning the replacement of natural raw material in clinker manufacture and in lime production	2015
	Chemical industry	AD	CO_2	A detailed balance of the natural gas reported in the Energy Balance, as no energy fuel consumption, and the fuel used for the production processes in the petrochemical sector	2015-2016
	Iron and steel production	EFs	CO_2	Update of electric arc furnaces emissions estimates	2015
	Consumption of halocarbons and SF_6	AD	F-gases	Investigations on activity data on the basis of the new national database of F-gases and implementation of top-down approach to cross-check the final emission estimates of stationary refrigeration and air conditioning. Mobile air conditioning will be also investigate with a focus on the quality of the information collected and how import/export is managed, and methodologies used with regard the recharging and end of life	2015-2016
	Paint application	EFs	HC CO_2	Assess the possibility to split non industrial application according to the Guidebook EMEP/EEA	2015
Agriculture	Livestock /Agriculture soils	EFs	NH_3 GHG	Analysis of the information collected from the 2010 Agricultural Census and other statistical surveys especially with regard grazing, housing, storage systems and land spreading	2015
	Dairy cattle	N excretion	N2O	Further efforts on theoretical assessment of N excretion data based on N balance methodology	2016
	Rice cultivation	EFs	CH4	The JRC unit in charge of measuring rice paddy fields in Italy has been contacted to obtain data related to measurements carried out in the latest years. The use of updated information on EFs is under evaluation.	2015
LULUCF	-	Uncertainty	-	Re-assessment of uncertainty analysis with Montecarlo	2015-2016
	-	-	-	Implementation of the updated methodologies reported in the IPCC 2013 KP Supplement, estimation of HWP and implementation of provisions related to natural disturbances	2015
	Forest land	-	GHG	Implementation of the III NFI's outcomes; the final outcomes, related to the field surveys, are expected to be available in 2015	2015-2016
	Biomass burning	EFs	CO_2	The fraction of CO_2 emissions, due to biomass burning, will be pointed out.	2015-2016
	Cropland /Grassland	AD/EFs	GHG	Verification activities, data collection and model implementation for soils pool, in the framework of the implementation of EU Decision n. 529/2013	2015-2016
	Wetland /Settlement	AD	CO_2	Improvement of data collection	2016

	Disposal on landfills and incinerators	AD	CO2, CH4	Waste composition and Carbon content of waste managed in landfills or incinerated	2015-2016
Waste	Domestic Wastewater treatment	MCF	CH_4	Methane conversion factor from domestic and commercial wastewater will be investigated in the future.	2015-2016
	Waste incineration	EFs	GHG	Assessment of the changes in GHG EFs across the time series with the aim of reflecting efficiency improvements	2015-2016