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Istituto superiore per la protezione
e la ricerca ambientale

QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR THE ITALIAN EMISSION INVENTORY YEAR 2015

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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 2015 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 2014, the Italian inventory was submitted to a centralised 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.
Specific issues are described in the relevant sectoral chapters and there were no important problems concerning the general and cross cutting activities.

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'[1]. 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 documentation and some pending issues in the LULUCF sector. In the same year, also an in depth UNECE review was undertaken in the context of the CLTRAP convention
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

[1] ISPRA, 2013.*Quality Assurance/Quality Control plan for the Italian Emission Inventor: Procedures Manual*

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[2]. 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.

Moreover, from 2011, a report concerning the state of implementation of commitments to reduce greenhouse gases emissions, and describing emission trend and projections, is prepared by the Ministry of the Environment in consultation with other relevant Ministers. The report is annexed to the economy and financial document (DEF) to be annually approved by the Government.

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 centralised review of the Italian GHG inventory by the UNFCC Secretariat occurred in September 2014. Results and recommendations of the reviews are available on the UNFCCC website at http://unfccc.int/documentation/documents/advanced_search/items/6911.php?priref=600008421#beg.
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[3]. 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[4]. Emission data are also published by the Ministry of Environment in the Reports on the State of the Environment[5], the National Communications[6] as well as in the Demonstrable Progress

[2] AED, 2013. *Italy-Spain bilateral QA*
[3] Ecofys, 2001. *Evaluation of national climate change policies in EU member states. Country report on Italy*
[4] ISPRA, several years. *Environmental Data Yearbook.* ISPRA. http://www.isprambiente.gov.it/it/pubblicazioni/stato-dellambiente.
[5] 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
[6] 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[7]. Moreover, figures are communicated to the National Institute of Statistics to be published in the relevant Environmental Statistics Yearbooks[8] as well as used in the framework of the EUROSTAT NAMEA accounting[9].
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[10]. 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

[7] 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
[8] ISTAT, several years. *Annuario Statistico Italiano* . Istituto Nazionale di Statistica, Roma ,Italia
[9] ISTAT, 2006. *La NAMEA: conti economici nazionali integrati con i conti ambientali*. Istituto Nazionale di Statistica. http://www.istat.it/dati/dataset/20060301_00/.
[10] 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[11] and IPCC Guidelines[12].
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[13].
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

[11] 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
[12] 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
[13] 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"[14].

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[15]. 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[16].

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

[14] ENEA/MAP/APAT, 2004. *Energy data harmonization for CO_2 emission calculations: the Italian case*. Rome 23/02/04. EUROSTAT file n°200245501004

[15] APAT 2003. *Analisi dei fattori di emissione di CO_2 dal settore dei trasporti*. Ilacqua M., Contaldi M., Rapporti n°28/2003

[16] 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[17] and University of Milan[18]. At the end of 2009 another research study related to land spreading estimations and scenario was completed[19].

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

[17] 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

[18] 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

[19] 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[20]. 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

[20] 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[21].

V. Planned improvements

The main institutional and legal arrangements required under the Kyoto Protocol have been finalized. 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. 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 2013 Agricultural Survey, 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.
Additional studies will regard the comparison between local inventories and national inventory and exchange of information with the 'local inventories' national expert group.
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.

[21] 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
2014 ACTIVITIES AND FUTURE IMPROVEMENTS

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NATIONAL AIR EMISSION INVENTORY: ENERGY

I. Objective

The improvements carried out during the preparation of the 2015 national inventory submission for the energy sector and those expected for the next future are summarised in the following.

II. Review process recommendations

During the review of the 2014 annual submission of Italy, coordinated by the UNFCCC secretariat in 2015[22], the following issues were raised.

Since 2013 submission an increase in transparency has been registered by the ERT, due to the inclusion of additional information in the NIR, in particular: more detailed information on the allocation of emissions from iron and steel between and within the energy and industrial processes sectors; the inclusion of EFs for all subcategories in the NIR and of additional information on trends in emissions and implied emission factors (IEFs).

No problems were identified in the review of reference and sectoral approaches, as well as for the comparison with international statistics, for international bunker fuels and for feedstocks and non-energy use of fuels.

Additional information has been provided during the review about the trend of IEF for CH_4 emissions from liquid fuels in public electricity and heat production, slightly decreasing since 2006 and showing in 2011 a sudden drop, explained by the fact that the IEF is the weighted average of the EFs for gasoil and residual oil and by the minor use of fuel oil (residual oil) for energy production, with a minimum in 2011, while the amount of gasoil has a more stable trend owing to its use in the start-up of power plants.

Explanations have been included in the NIR regarding the trend in GHG emissions in other sectors. In particular while CO_2 emissions from agriculture/forestry/fisheries decreased by only a small amount between 2011 and 2012, on the other side corresponding CH_4 emissions decreased by more than half in the same period. CH_4 emissions in this category are driven by the use of biomass indeed, especially wood, in the agriculture sector for the heating of greenhouses and aquaculture plants, whose consumption, according to the national energy balance, was reduced by more than half between 2011 and 2012.

As regards GHG emissions from transport, explanations have been provided during the review regarding the sharp decrease in 2012. The trend in the transport sector is driven by road transport and, according to the national energy balance, a reduction of gasoline fuel consumption and diesel for road transport has been observed between 2011 and 2012, explained mainly by the economic crisis and, to a minor extent, by the increasing share of low-consumption vehicles.

As regards non-key categories, in the NIR explanations have been included about CH_4 emissions from solid fuel transformation regarding the production of coke in the iron and steel industry. In particular, charcoal production was carried out in traditional systems until the 1960s, but more recently charcoal is mainly produced in modern furnaces, where exhaust gases are recycled to produce the energy for the furnace itself and therefore it is assumed that there are no CH_4 emissions from the production of charcoal.

[22] UNFCCC, 2015. *Report of the individual review of the annual submission of Italy submitted in 2014*. FCCC/ARR/2014/ITA. UNFCCC, 3 March 2015. http://unfccc.int/resource/docs/2015/arr/ita.pdf

In Table 1 the final recommendation identified for the Energy sector by the UNFCCC expert review team has been reported.

Table 1. *Recommendations identified for the Energy sector by the UNFCCC expert review team for 2014 submission*

CRF Category	Recommendation	Reiteration of previous recommendation?	Paragraph cross references
1.A.1.c - Solid fuel transformation – CH4	Provide information on the charcoal production process, including information on when in the time series the modern technology replaced conventional technology	No	28

In Table 2 the issues raised and responses provided for the Energy sector during the EEA greenhouse gases review of the 2014 submission are reported.

Table 2. *Issues and responses provided for the Energy sector during the EEA greenhouse gases review for 2014 submission*

CRF Category	Issue	Response
1.AA.2.E Food Processing, Beverages and Tobacco	Between 2011 and 2012 CO2 emissions drop by 83% (855 Gg to 145 Gg) while for previous years the trend did not show strong fluctuations. Please validate the trend.	For 2012, on the basis of fuel consumption data supplied by the plants in the framework of the ETS, fuel oil consumption figures reported in the National Energy Balance have been reassessed in the different industrial sector resulting in a better allocation of the fuel consumption at sectoral level.
1.AA.3.A Civil Aviation	Please indicate if the method used is Tier 1, Tier 2 or Tier 3. For example, if a Tier 2 method is used for estimating CO2 emissions, please indicate T2, CS in the method used.	As indicated in the NIR 2013 the methodology used is a mix of Tier 1 and Tier 2
1.AA.3.B Road Transportation	Please indicate if the method used is Tier 1, Tier 2 or Tier 3. For example, if a Tier 2 method is used for estimating CO2 emissions, please indicate T2, CS in the method used.	As reported in the NIR we use the model COPERT4 v10 to estimate emissions and we insert the method applied accordingly. The model is clearly a Tier 3.
1.AA.3.B Road Transportation	Please indicate if the method used is Tier 1, Tier 2 or Tier 3. For example, if a Tier 2 method is used for estimating CH4 emissions, please indicate T2, CS in the method used.	As reported in the NIR we use the model COPERT4 v10 to estimate emissions and we insert the method applied accordingly. The model is clearly a Tier 3.
1.AA.3.B Road Transportation	Please indicate if the method used is Tier 1, Tier 2 or Tier 3. For example, if a Tier 2 method is used for estimating N2O emissions, please indicate T2, CS in the method used.	As reported in the NIR we use the model COPERT4 v10 to estimate emissions and we insert the method applied accordingly. The model is clearly a Tier 3.
1.AA.3.C Railways	Please indicate if the method used is Tier 1, Tier 2 or Tier 3. For example, if a Tier 2 method is used for estimating CO2 emissions, please indicate T2, CS in the method used.	We use the default method(D, according to the IPCC guidelines, that could be considered a Tier 1.
AA.3.D Navigation	Please indicate if the method used is Tier 1 or Tier 2. For example, if a Tier 2 method is used for estimating CO2 emissions, please indicate T2, CS in the method used.	As indicated in the NIR 2013 the methodology used is a mix of Tier 1 and Tier 2

NIR and IIR report additional information about the last UNECE review process[23], addressing the ERT's recommendation and with regard to the official independent review of the entire Italian greenhouse gas inventory undertaken by the Aether consultants in 2013[24].

[23] 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 30/11/2015)

[24] Aether ltd, 2013. *Report of the Independent Review of the Italian Greenhouse Gas Inventory* - September, 2013

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 the submission of national emission figures of other pollutants which have to be 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 2015 National Inventory, National Inventory Report and Informative Inventory Report 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.

As regards 1.A.1.a Public Electricity and Heat Production category, PM10 emissions are updated every year on the basis of data submitted by the plants in the framework of the EPRTR registry, Large Combustion Plants Directive and Environmental Reports; otherwise heavy metals 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 heavy metals emissions measurements by fuel and technology (with or without PM10 abatement technologies) of relevant national plants. From 2001 these Emission factors have not been updated. Heavy metals emission data in the EPRTR registry refer only to few not representative plants and are not sufficient to calculate average emission factors. Further work is planned to update/change emission factors for those pollutants, as zinc, where figures reported in the EPRTR lead to average values significantly different from those actually used.

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

Table 3. *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 Industries and Construction	EFs	NOx HC CO PM	Emission reduction factor reported in the 2004/26/EC Directive have not yet been applied and introduced in the emission estimates.	2016
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
1.A.4, 1.A.5	Civil sector: small combustion and off-road vehicles	AD, EFs		The reconstruction of the wood and pellet fuel consumption time series is on-going to ensure consistency. The updated figures will be used for the next submission. On the basis of the surveys on wood consumption and combustion technologies carried out by ISPRA (SCENARI/ISPRA, 2013) and by ISTAT (ISTAT, 2014), the updating of average emission factors is planned for the next submission. An in depth analysis of emission factors resulting	2016-2017

Category	Subcategory	Parameter	Gas	Description	Timing
				from the experimental study carried out by SSC (SSC, 2012) and their comparison with the values suggested by the Guidebook will be carried out and emission factors will be updated if needed.	

QA/QC INDUSTRIAL PROCESSES
2014 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Andrea Gagna, Barbara Gonella, Ernesto Taurino

November, 2015

NATIONAL AIR EMISSION INVENTORY: INDUSTRIAL PROCESSES

I. Objective

The improvements carried out during the preparation of the 2015 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	Recommendation	Response
31	2 - IPPU	Significant parts of the emission inventory for the industrial processes sector are based on companies reporting under different reporting instruments. The NIR frequently refers to reporting under the EU ETS and the national European Pollutant Emission Register (EPER/PRTR). While the requirements for monitoring, reporting and verification are well established under the EU ETS and publically available, it is not clear what requirements are in place for reporting to EPER/PRTR, specifically for companies reporting under the EPER/PRTR, especially concerning reporting of AD, the methodologies used for estimating AD and emissions and associated uncertainties. In response to a question raised by the ERT during the review, Italy provided information on the legal framework and the data types and their availability to the inventory team. The ERT recommends that Italy includes this information in the NIR.	Implemented Additional information has been included in the NIR, addressing the ERT's recommendation.
32	2.B.3 - Adipic acid production - N_2O	Correct the error identified and include the additional justification for the abatement efficiency of the sole production facility in Italy in the NIR	Implemented The error has been corrected, addressing the ERT's recommendation.
33	2.F. - Consumption of HFCs and SF_6	Based on the description in the NIR, it is not clear to the ERT whether emissions from imported products are considered and, if so, how. In response to a question raised by the ERT during the review, Italy indicated that the estimates are based on the consumption of fluorinated gases (F-gases) in the different categories and the data include the fluid contained in imported products. As an example, the details of information concerning air-conditioning devices mounted on vehicles and metered dose inhalers were provided to the ERT, clarifying that the estimation of emissions takes into account not only the information related to national manufacturing but also to imported products. The ERT recommends that Italy include this information in the NIR.	Implemented Italy has considered this recommendation in the estimations and consequently in the NIR (§ 4.7.2)

Review report para	Subject	Recommendation	Response
34	2.G. - Consumption of HFCs and SF_6	The NIR states that emissions from disposal are included in the emissions from use, with the exception of SF6 from electrical equipment, and the same is indicated in the CRF tables by using the notation key "IE" (included elsewhere). However, it is not clear how FCCC/ARR/2014/ITA15 this works in practice (i.e. how it is assured that F-gases remaining in the products at decommissioning are accounted for,as emissions or completely recovered). In response to a question raised by the ERT during the review, Italy informed the ERT that legislative decree n°. 151/05 has implemented the European Union (EU) directive on waste from electric and electronic equipment in Italy. According to this decree, when equipment is disposed of, it is a legal requirement to recover the remaining F-gases and either reuse or destroy them. The ERT considers that the product life factors used by Italy are reasonable and, as such, the amount of fluid remaining can be calculated based on the emissions during the product's lifetime. Based on information provided by the Party to the ERT during the review, the ERT also considers that the use of the notation key "IE" is inappropriate as there are no emissions from disposal. The ERT recommends that Italy expand the description in the NIR regarding disposal and change the notation key used in the CRF tables to "NA". Furthermore, the ERT recommends that Italy make contact with the treatment centres to verify that the recovery rate can be assumed to be 100 per cent (i.e. that no fugitive losses occur).	A survey is in progress to verify the recovery rates and the decommissioning operations
35	2.F. - Consumption of HFCs and SF_6	The NIR presents two distinct time series for leakage rates. There is a very steep decrease in some of the leakage rates from 1999 to 2000 (e.g. manufacturing leakage rates decrease from 3 per cent to 0.5 per cent for chillers, large commercial refrigeration and domestic refrigeration, as well as there being lower use leakage rates for chillers and large commercial refrigeration). Based on the information in the NIR, it is not clear what developments prompted this big decrease between the two years. In response to a question raised by the ERT during the review, Italy explained that for the years 1990–1999 leakage rates were supplied by industrial associations of manufacturers as the best available country-specific information for the years concerned and that the industrial associations have revised the leakage rates for the years 2000–2012 to take into consideration the changes in technology that have occurred in the manufacturing of the equipment concerned. The ERT considers it reasonable that there has been a decrease in emissions from manufacturing, but finds it unlikely that	Implemented Additional information has been included in the NIR, addressing the ERT's recommendation.

Review report para	Subject	Recommendation	Response
		the change occurred in a specific year and finds that the time series could be inconsistent. In response to the draft review report, Italy stated that the year 2000 is considered to be a turning point for the industry. However, no supporting information, for example on regulations implemented, changes in prices of F-gases or technological improvements, was provided either in the NIR or in the response to the draft review report on what technical improvements or other incentives occurred precisely in the year 2000 that resulted in a decrease in the leakage rate of more than 80 per cent. The ERT recommends that Italy provide information in the NIR to prove that this significant reduction occurred between 1999 and 2000.	
36	2.F.3 - Consumption of HFCs and SF_6	During the review, the ERT noted that there was no information in the NIR on the source of AD for fire extinguishers and that the AD for new charges have been constant since 2005 (150 t). In response to a question raised by the ERT during the review, Italy provided information on the current data sources and indicated plans for collecting and updating AD for this category. The ERT welcomes the plans and recommends that Italy report on their implementation.	Further investigation is still needed. We are gathering data from the annual communication established by article 16 of DPR 43/2012.
37	2.F. - Consumption of HFCs and SF_6	Based on the description in the NIR, the emission estimation for metered dose inhalers does not follow the IPCC good practice guidance. The IPCC emission estimation methodology is to calculate emissions as half of the charge in year t plus half of the charge in t–1, while Italy calculates emissions equal to the charge in any given year. In response to a question raised by the ERT during the review, Italy explained that the trend is stable and that implementing the IPCC good practice guidance would mean slightly lower emissions for the period 2008–2012. The ERT agrees that emissions are not underestimated but recommends that Italy follow good practice methods to estimate emissions.	Implemented The methodology has been updated, addressing the ERT's recommendation.
39	2.A.2 - Lime production - CO_2	Include in the NIR an explanation of the minor fluctuations in the IEF for lime production	Implemented The methodology has been updated and additional information has been included in the NIR, addressing the ERT's recommendation.
40	2.A.2 - Lime production - CO_2	...Considering that the data for 2000–2003 do not take into account the specific raw materials used at individual facilities, the ERT considers that the estimates for 2005 onwards are more accurate. Furthermore, since the IEF drops significantly from 2004 to 2005, it is probable that the lack of other information and not taking into account the specific raw materials used	Implemented The methodology has been updated and additional information has been included in the NIR, addressing the ERT's recommendation.

Review report para	Subject	Recommendation	Response
		from 2000 to 2003 have led to an overestimation of emissions for these years. The ERT recommends that Italy further investigate the impact of the assumptions made in relation to the data collected for 2000–2003 and provide information in the NIR showing that those assumptions have not led to an overestimation of emissions for 2000–2003 and hence also for 1990–1999.	
41	2.A.4. - Limestone and dolomite use - CO_2	...In response to the question raised by the ERT during the review, Italy confirmed that dolomite is used in cement and lime production and accordingly emissions have been allocated to these categories. Italy also clarified that it would not be possible to construct a top-down approach since import/export data are not available in sufficient detail. The ERT recommends that Italy clarify the text in the NIR regarding the use of dolomite.	Implemented Additional information has been included in the NIR, addressing the ERT's recommendation.
42	2.A.4. - Limestone and dolomite use - CO_2	Since Italy is using a bottom-up approach to estimate emissions relating to limestone and dolomite use, there is a risk that possible emission sources are not included. According to the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, all other uses of limestone and dolomite that produce CO2 emissions are to be reported. The ERT therefore enquired during the review whether mineral wool production occurs in Italy and whether these emissions are included in the total for this category. In response to a question raised by the ERT, Italy acknowledged that one mineral wool production facility had been operating from 1993 to 2009 and was not included in the inventory. Further, Italy provided preliminary data showing that the CO2 emissions were in the range of 1–4 Gg. The ERT strongly recommends that Italy include this category in the emission inventory. Furthermore, the ERT recommends that Italy investigate other potential emissive uses of carbonates and provide information on the steps taken to ensure completeness in the NIR.	Although the category has been included in the emission inventory and estimates of some pollutants have been calculated further investigation is needed to evaluate the amount of carbonates used for mineral wool production in Italy as well as the other use of carbonates in different sectors.

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 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[25] were considered and the description of the fluctuation of the CO_2 implied emission factor was already improved in the previous NIR accordingly. Specifically, further investigations about the amount of limestone&dolomite used has led to an update of the activity data and CO_2 estimates along the whole time series.
Also emissions from the metal sector are checked with the relevant process operators. In this framework, primary aluminium production supplied by national statistics and the only national producer ALCOA, in addition with data reported in a site-specific study, have been checked. Moreover, emissions from magnesium foundries are annually compared with those reported in the national EPER/E-PRTR registry while for the iron and steel sector emissions reported in the national EPER/E-PRTR registry and for the Emissions Trading Scheme are compared and checked. Emissions from primary aluminium production have been also checked with data reported under EU-ETS.

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 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 are 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.

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

Table 2. *Planned improvements*

Category	Subcategory	Parameter	Gas	Description	Timing
General	-	-	-	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.	2016
	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
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	2016
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 CO_2 from electric arc furnaces have been checked with ETS data and the Tier 2 or Tier 3 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 article 16 of the Decree of the President of the Republic 27 January 2012, n. 43 which receipts the article 3(6) of the EC Fluorinated Gas Regulation. In the framework of the F-gases Regulations (EC n. 842/2006 and EU n. 517/2014), 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 collected included 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 is 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
2014 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Daniela Romano

November, 2015

NATIONAL AIR EMISSION INVENTORY: SOLVENT AND OTHER PRODUCT USE

I. Objective

The improvements carried out during the preparation of the 2015 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 in 2013, 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*"[26] 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[27]. The results are reported in "*Fattori di emissione per l'utilizzo di solventi*"[28]) 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

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

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

[28] 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.
In the actual submission, the new 2006 IPCC Guidelines have been implemented and the sector is now integrated in the IP. Only minor modifications occurred, due to the update of some emission factors, specifically, in paint application for construction and building and in leather tanning, the use of N_2O for anaesthesia in term of the 2012 activity data. Also, a new source has been added, emissions from Mineral wool enduction from 1993; this activity stopped in 2010.

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	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	2016
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
2014 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Eleonora Di Cristofaro

November, 2015

NATIONAL EMISSION INVENTORY: AGRICULTURE

I. Objective

This report describes activities and improvements carried out during the preparation of the 2015 national inventory submission for the agriculture sector.

II. Review process recommendations

During the last UNFCCC review process (UNFCCC, 2015)[29] the following recommendations were raised.

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

Review report para	Subject	Recommendation	Response
50	3.B.1 – Manure management - CH_4	Italy has estimated CH_4 emissions from manure management for cattle and buffalo using a tier 2 method and country-specific values of 15.32 g CH_4/kg volatile solids (VS) for slurry and 4.80 g CH_4/kg VS for solid manure. However, Italy has not provided in its NIR a detailed description of the methodology. In response to a question raised by the ERT during the review, Italy provided such a description and a reference to the method used and explained how the country-specific parameters were derived. The ERT recommends that Italy include this information in its annual submission.	Implemented. Additional detailed information has been reported in the NIR (§5.3.2 - Methodological issues Methane emissions (cattle and buffalo)), addressing the ERT's recommendation.
51	3.B.3 - Manure management - CH_4	...In response to a question raised by the ERT during the review, Italy explained that the shares of covered/uncovered storage systems are equal to 4 per cent and 96 per cent, respectively, and that the CH_4 emission rates used were: 41 normal litre CH_4/100 kg live weight/day for fattening swine and 47 normal litre CH_4/100 kg live weight/day for sows, including piglets, for covered storage systems; and 37.6 normal litre CH_4/100 kg live weight/day for fattening swine and 43.1 normal litre CH_4/100 kg live weight/day for sows, including piglets, for uncovered storage systems. The ERT recommends that Italy include this information in its annual submission.	Implemented. Additional detailed information has been reported in the NIR §5.3.2 - Methodological issues Methane emissions (swine)), addressing the ERT's recommendation.

[29] UNFCCC, 2015. *Report of the individual review of the annual submission of Italy submitted in 2014*. FCCC/ARR/2014/ITA. UNFCCC, 3 March 2015. http://unfccc.int/resource/docs/2015/arr/ita.pdf

Additional detailed information has been reported in the NIR in response to an official independent review of the entire Italian greenhouse gas inventory undertaken by the Aether consultants in 2013[30] and in response to last UNECE review process[31], addressing the ERT's recommendation.

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 UNFCCC/UNECE-CLRTAP national emission inventory of the agriculture sector has been updated. This report contains information on the procedures undertaken for preparing the national inventory *2013 submission*[32].

Since 2006 submission, results from the MeditAIRaneo project have been included in the preparation of the agriculture emission inventory (UNFCCC/UNECE-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[33].

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.

ISPRA together with CRPA participated to the preparation of the instructions for specific queries (grazing, housing, storage and land spreading) of the 2010 Agricultural Census and 2013 Farm Structure Survey (FSS). 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.

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). In 2015, emission estimates have been updated on the basis of the 2006 IPCC Guidelines.

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-

[30] Aether ltd, 2013. *Report of the Independent Review of the Italian Greenhouse Gas Inventory* - September, 2013

[31] 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 12/11/2015)

[32] Cóndor R.D., Di Cristofaro E., 2015. *Procedura per la preparazione, caricamento e reporting dell'inventario nazionale delle emissioni 1990-2013, settore agricoltura. Rapporto interno AMB-MPA/ISPRA.* Roma – Italia.

[33] 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.

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[34,35]. Still further efforts on theoretical assessment of nitrogen excretion data will be done base on N balance methodology[36]. 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 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 2015*.
In the 2014 submission, revised CH_4 and N_2O emission estimates from manure management have been calculated using a country-specific methodology and MCF, that separate the manure used in anaerobic digesters from the manure treated as slurry/solid.
Also in 2014, as regards CH_4 emissions from rice cultivation, the cultivation period (days) for some rice varieties have been updated. Despite the upload of the vegetation period of some varieties, the estimate of the average value for water regime does not change the previous values.

As a part of QA activities, 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 and archived in the reference database. The data flow chart describes the link to the working files used for the estimates.
In November 2014, the CH_4 emission factors used for the rice cultivation category in the Italian emissions inventory were presented at the 9th Expert Meeting on Data for the IPCC Emission Factor Database (EFDB) and the values were entered into the database. On the basis of the feedback received during the meeting, the daily emission factor for continuously flooded fields without organic amendments for multiple aeration regime have been updated.
As regards N_2O emissions from agriculture soils, in 2015, data on crop residues and, in particular, on the relationship between crop residues and product were compared with studies and research provided by the

[34] *De Roest and Speroni, 2005. Il bilancio dell'azoto negli allevamenti di latte. Agricoltura. Marzo 2005. pag 112-114*
[35] 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.
[36] 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

Agricultural Research Council (CRA). However, these studies were conducted in different countries from Italy, so despite the differences, the values used in the inventory, based on national studies, have not been changed.

By comparison with the experts of the CRA, however, it was shown that in the estimation of N_2O emissions from crop residues the total amount of residues has been considered, without deducting the fraction removed for purposes such as feed, bedding and construction. Therefore, the data were corrected using the fixed residues/removable residues ratio for each crop considered, which is the same information used to estimate the emissions from category emission 3F.

IV. Planned improvements

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

Table 4. *Planned improvements*

Category	Subcategory	Parameter	Gas	Description	Timing
Manure management	Dairy cattle	N excretion	N_2O	Further efforts on theoretical assessment of N excretion data will be done based on N balance methodology (Gruber and Poesch, 2006).	2017
	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.	2016
	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 and Farm and structure survey 2013.	2016
	Livestock categories	Average temperature	GHG	The average annual temperatures used in the assessment of the manure management CH_4 emission factors will be verified on the basis of the available information (i.e. updated data from SCIA[37]).	2017
Agricultural soils	Activity data	Land spreading	NH_3/GHG	Figures on land spreading collected in the framework of the 2010 Agricultural Census and Farm and structure survey 2013 will be considered for the next annual submission.	2016

[37] SCIA is the national system for the collection, elaboration and dissemination of climatological data, by ISPRA, in the framework of the national environmental information system, in collaboration with the relevant institutions: http://www.scia.isprambiente.it/scia_eng.asp

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 (UNFCCC/UNECE-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 FSS from 2005 and 2007. We expect to validate results obtained with FSS 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. In 2015, the request of the 2013 FSS data has been submitted to ISTAT.

IV.2 Estimation improvements

Further efforts on theoretical assessment of nitrogen excretion data will be done base on N balance methodology[38]. 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.

[38] 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

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November, 2015

NATIONAL AIR EMISSION INVENTORY: LULUCF

I. Objective

The report summarizes the improvements and remarks, which have been identified during the preparation of the 2015 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 2015, are described.

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

Review report para	Subject	Description	Response
54	**LULUCF** - General	… The ERT considers that some of the documentation describing the derivation of AD, methodologies and models used to estimate emissions and removals from LULUCF lacks clarity and transparency. In particular, methods and data sources used to update the IUTI are not transparently communicated in the NIR. During the review, the ERT raised a question regarding how data from phase one of the national forest inventory (NFI) were used to construct the land-use matrices. For example, there is no documentation in the NIR regarding the use of historical ratios of forest and other wooded land (reported under grassland) to distinguish between forest land and shrubland, reported under grassland. Moreover, the methods that the FOR-EST model used to estimate biomass losses are not transparently described in the NIR. During the review, Italy provided additional information and referred to text in the NIR that outlined the nature of the AD and methods used. However, the ERT recommends that Italy include this additional information in its next submission.	Implemented Additional detailed information has been reported in the NIR, addressing the ERT's recommendation (§6.2.2)
55	**LULUCF** - Sector overview	...The ERT recommends that the Party use the notation key "NA" when a tier 1 zero stock change method is used. The ERT recommends that Italy review the use of notation keys so that it is clearer what methods are used and whether some pools are not estimated.	Implemented Notation key NA instead of NE has been used addressing the ERT's recommendation. (§6).
56	4.A. - LULUCF - Forest land - CO_2	The FOR-EST model uses input data, such as forest mesuration variables, from the 1985 NFI to estimate biomass and DOM stock changes, which may now be outdated because a subsequent inventory was completed in 2005. During the review, in response to a question raised by the ERT, the Party explained that there is good agreement between the 2005 NFI data and the FOR-EST model estimated biomass variables for 2005, based on a validation exercise. The Party also indicated that the quality assurance/quality control (QA/QC)	Implemented (for the model validations) To be implemented (for the NFI2015) as soon as data will be available (§6.2.6).

Review report para	Subject	Description	Response
		plan has made provisions to update modelled estimates of biomass stock changes when phases two and three of the 2015 NFI have been completed. The ERT welcomes these planned improvements, but recommends that the Party document model validations in the NIR and that the Party use NFI 2005 data to initiate model estimates until the new inventory data become available.	
57	**LULUCF** - Forest land remaining forest land - CO_2	Short rotation forest crop areas have been included under the forest land category following recommendations made in the 2013 review report. The ERT welcomes this improvement by Italy. However, in order to improve transparency, the ERT recommends that the Party provide in the NIR documentation, as submitted during the review, summarizing harvest removals from short rotation crops, coppices and high forest categories so that the drivers influencing trends in biomass stock changes can be made more evident.	Implemented Additional detailed information has been reported in the NIR, addressing the ERT's recommendation. (§6.2.4).
58	4.A. - LULUCF - Forest land - CO_2	Italy transparently describes the allocation of carbon between the above-ground and below-ground biomass, litter and deadwood pools. However, during the review, the ERT raised a question regarding the definition of the pools and thresholds applied to different pools. For example, the ERT noted that no information is provided on the diameter threshold for deadwood and how this pool is differentiated from litter. Similarly, it is not clear which soil horizons are included in the soil pool or which pool contains the humus layer. Consequently it was difficult for the ERT to determine whether double counting of emissions by sources or removals by sinks for different carbon pools had occurred because there is a lack of clear information that defines each carbon pool. Italy provided additional information (definitions and thresholds) to the ERT that resolved the concerns of the ERT. The ERT recommends that Italy provide these definitions and thresholds in a new table in the NIR in the annual submission.	Implemented Addition detailed information has been reported in the NIR, addressing the ERT's recommendation. (§6.2.4)
59	4.E. - LULUCF - Land converted to settlements – CO_2	Italy reports an increase in the area of grassland converted to settlements of 26.7 kha per year from 1991 to 1995, but reports “NO” for biomass carbon stock changes and “NE” for DOM stock changes. In the NIR, it is reported that emissions from DOM pools are not estimated as there is insufficient information to enable this. However, the Party documents detailed methods to estimate biomass and DOM stocks and carbon stock changes in shrubland areas under the grassland category. The methods used to report emissions and removals from shrublands are similar to those applied to forest land. Moreover, Italy does report emissions from biomass and DOM due to forest land converted to settlements using a conservative approach. In order to apply a complete and balanced reporting approach across all land-use categories, the ERT recommends that Italy develop methods to distinguish between shrubland and other grassland conversions	Implemented Estimates for grassland converted to settlements have been provided in the CRF tables; detailed information has been reported in the NIR, addressing the ERT's recommendation (§6.6.4)

Review report para	Subject	Description	Response
		to settlements and report the associated emissions from biomass. If country-specific biomass carbon stocks for grassland (i.e. referred to as grazing land in the NIR) immediately before conversion to settlements are not available, the IPCC default value should be used. In addition, the ERT recommends that the Party report biomass and DOM stock changes for the conversion of shrublands to settlements, if these do occur, using the same approaches as those used for forest land converted to settlements.	
60	4.D. - LULUCF - Land converted to wetlands – CO_2	Italy describes land-use transitions from grassland and cropland to wetlands in the NIR but does not report the associated biomass stock changes. In response to a question raised by the ERT during the review, the Party confirmed that these are land conversions to flooded land. The ERT recommends that Italy estimate biomass stock changes associated with the flooding of grassland and cropland.	Implemented Estimates for grassland converted to settlements have been provided in the CRF tables; detailed information has been reported in the NIR, addressing the ERT's recommendation (§6.5.4)
61	LULUCF - CO_2 emissions from agricultural lime application (now in 3.G. Agriculture)	The ERT noted that CO_2 emissions from agricultural lime application were only provided for 1998–2012. In response to a question raised by the ERT requesting clarification, the Party indicated that the QA/QC plan has made provisions to acquire the relevant data for the lime applied over the period 1990–1997 and to explore the possibility of disaggregating data from statistics on limestone and dolomite used for agricultural applications. The ERT welcomes this planned improvement and recommends that the Party report emissions from lime application consistently over the complete time series.	Implemented The complete time series have been estimated addressing the ERT's recommendation. (§5.7.2).
62	4.A. LULUCF - Direct N_2O emissions from nitrogen fertilization of forest land	Italy reports in the CRF tables that fertilization of forest land does not occur. In response to a question raised by the ERT during the review, the Party confirmed that nitrogen (N) fertilization of short rotation forest crops does occur, but direct emissions are reported under the agriculture sector. The ERT recommends that Italy report direct N_2O emissions from N fertilization as "IE" in CRF table 5(II) and transparently explain that these emissions are reported under the agriculture sector (with a cross reference to the relevant section of the NIR) in the annual submission.	Implemented Addition detailed information has been reported in the NIR, addressing the ERT's recommendation. (§6.8)

III. Inventory improvements and QA activities

III.1 Forest land (4A)

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; following a key finding in the 2013 review process, the plantations, previously classified in the cropland category, have now 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 (4B)

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 1990–2013 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.

III.3 Grassland (4C)

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 1990–2013 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 (4D)

Land uses and land use changes, for each year of the period 1990–2013 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 1990-2013, cropland and grassland categories have been converted into wetlands area.

III.5 Settlements (4E)

For the land use conversion, land use change matrices have been used; as abovementioned, LUC matrices for each year of the period 1990–2013 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 2013, 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 (4(IV))

In 2015 submission CO_2 emissions from application of carbonate containing lime and dolomite to agricultural soils have been estimated for the period 1998-2013, and reported in the agriculture sector according to the new CRF format.

III.7 Biomass Burning (4(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 1990-2013, 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[39] (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]*

[39] 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).

- *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).***
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
	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
	CL-CL	Activity data	GHG	Verification activities carried out in the framework of the implementation of EU Decision n. 529/2013	2015-2016
	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 (4A)

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[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. 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

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

collected by LUCAS[41] 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[42], 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 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 (4B)

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[43], 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

[41] 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
[42] INEMAR: INventario EMissioni Aria: http://www.inemar.eu/xwiki/bin/view/Inemar/WebHome; http://www.ambiente.regione.lombardia.it/inemar/e_inemarhome.htm
[43] Eurostat is the statistical office of the European Union: http://epp.eurostat.ec.europa.eu/portal/page/portal/about_eurostat/introduction

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 (4C)

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[44], 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 *Grassland* category will be improved.

IV.4 Wetlands (4D)

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 (4E)

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[45], involves ISPRA, the Ministry of Agriculture, Food and Forest Policies, the National Forestry Service and the SIN

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

(*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 (4(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 (4(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[46].

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.

[46] European Forest Fire Information System (EFFIS): http://forest.jrc.ec.europa.eu/effis/

QA/QC WASTE
2014 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Barbara Gonella, Ernesto Taurino

November, 2015

NATIONAL AIR EMISSION INVENTORY: WASTE

I. Objective

This report summarises the improvements, which have been identified during the preparation of the 2015 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
66	5.C. - Waste incineration – CO_2	...The waste compositions vary with time, allowing the variation of the carbon content as well as the fossil carbon fraction. The ERT recommends that Italy apply the time-series carbon content as well as fossil carbon fraction in line with the variation of the waste compositions, and report thereon in its next annual submission.	A survey is in progress to check the variability of the fossil carbon content in the waste to be incinerated

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)[47] .

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[48], 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.

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

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
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
Biological treatment of solid waste	Compost production	Management methods	CO_2	An assessment of different management methods of composting is planned for the future.	2016-2017
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
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

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 Biological treatment of solid waste

Anaerobic digestion of solid waste is under investigation to collect more information about technologies and emission factors.

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.

The analysis regarding incineration plants has been conducted through verifications and comparisons with data reported in E-PRTR registry, Emissions Trading Scheme and updated data of waste amount and pollutants emissions (ENEA-federAmbiente, 2012). These investigations have led, in the previous submission, to the right allocation of some plants erroneously reported as incinerators whilst boilers and cement kiln facility already considered in the energy sector have been deleted.

IV.4 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.

IMPROVEMENT PLAN

Prepared by: Riccardo De Lauretis

November, 2015

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	2016
	-	-	-	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	2015-2017
	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
Processes and solvent	Cement /lime production	AD	CO_2	Further investigations concerning the replacement of natural raw material in clinker manufacture and in lime production	2016

	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	2016-2017
	Iron and steel production	EFs	CO_2	Update of electric arc furnaces emissions estimates	2016
	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	2015-2017
	Paint application	EFs	HC CO_2	Assess the possibility to split non industrial application according to the Guidebook EMEP/EEA	2017
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	2016
	Dairy cattle	N excretion	N2O	Further efforts on theoretical assessment of N excretion data based on N balance methodology	2016
LULUCF	-	Uncertainty	-	Re-assessment of uncertainty analysis with Montecarlo	2015-2017
	-	-	-	Implementation of the updated methodologies reported in the IPCC 2013 KP Supplement, estimation of HWP and implementation of provisions related to natural disturbances	2016
	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	2015-2017
	Biomass burning	EFs	CO_2	The fraction of CO_2 emissions, due to biomass burning, will be pointed out.	2015-2017
	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	2015-2017
	Wetland /Settlement	AD	CO_2	Improvement of data collection	2016
Waste	Disposal on landfills and incinerators	AD	CO2, CH4	Waste composition and Carbon content of waste managed in landfills or incinerated	2015-2017
	Domestic Wastewater treatment	MCF	CH_4	Methane conversion factor from domestic and commercial wastewater will be investigated in the future.	2015-2017

	Waste incineration	EFs	GHG	Assessment of the changes in GHG EFs across the time series with the aim of reflecting efficiency improvements	2015-2017