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Istituto superiore per la protezione
e la ricerca ambientale



**QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR THE
ITALIAN EMISSION INVENTORY
YEAR 2018**

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**QA/QC GENERAL
2017 ACTIVITIES AND FUTURE IMPROVEMENTS**

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NATIONAL AIR EMISSION INVENTORY: GENERAL OVERVIEW

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 2018 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.

Review process recommendations

In 2016, the Italian inventory was submitted to a centralised UNFCCC review; there was no UNFCCC review in 2017. The European annual review of GHG emission inventories of Member States took place in 2016 and 2017, under the Effort Sharing Decision. The main critical points raised during the review processes 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 except for some improvements requested to improve consistency between the CRF tables and the National Inventory Report.

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. In the same context, in 2017, an in depth

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

review was done focusing on the main atmospheric pollutants to verify the compliance with the national emission ceiling directive (NECD).

Also a bilateral independent review between Italy and Spain, with a focus on the revision of the GHG and air pollutant inventories of both the Parties was established in 2012. The Italian team revised part of the energy sector of Spain, specifically the categories public power plants, petroleum refining plants, road transport and off-road, whereas the Spanish team revised the industrial processes and solvent and other product use, and the LULUCF sectors of Italy. Results of these analyses are reported in a technical report². 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 UNFCCC Secretariat occurred in September 2016. Results and recommendations of the reviews are available on the UNFCCC website at <https://unfccc.int/documents/9838#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 approaches³. 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

² AED, 2013. *Italy-Spain bilateral QA*

³ Ecofys, 2001. *Evaluation of national climate change policies in EU member states. Country report on Italy*

published by the Institute⁴. Emission data are also published by the Ministry of Environment in the Reports on the State of the Environment⁵, the National Communications⁶ as well as in the Demonstrable Progress report⁷. Moreover, figures are communicated to the National Institute of Statistics to be published in the relevant Environmental Statistics Yearbooks⁸ as well as used in the framework of the EUROSTAT NAMEA accounting⁹.

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 them¹⁰. 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 were 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,

⁴ ISPRA, several years. *Environmental Data Yearbook*. ISPRA. <http://www.isprambiente.gov.it/it/publicazioni/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

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 CO₂ emission calculations: the Italian case*. Rome 23/02/04. EUROSTAT file n. 200245501004

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 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 Guidance¹¹ and IPCC Guidelines¹².

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 out¹³.

In the last years, Monte Carlo analysis was 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.

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

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 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.

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 CO₂ 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 CO₂ 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 CO₂ 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 report¹⁵. 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 paper¹⁶.

Road Transport Emissions Review. The Italian Expert Panel on Transport, which comprises experts from Research Institutes, Universities, Industrial Associations, Local Authorities, Ministries and Public

¹⁴ ENEA/MAP/APAT, 2004. *Energy data harmonization for CO₂ emission calculations: the Italian case*. Rome 23/02/04. EUROSTAT file n°200245501004

¹⁵ APAT 2003. *Analisi dei fattori di emissione di CO₂ 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.

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 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. For aviation EUROCONTROL data, methodology and results for Italy have been included in the inventory from 2016 submission.

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. SF₆ 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. A detailed analysis at sectoral level was carried out in 2017 and 2018 contacting the relevant operators to study the effect on the market of the implementation of the EU F-gases regulation and in this context additional technical information including past and new emission factors has been collected.

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 CH₄, N₂O and NH₃ emissions. Besides, studies on NH₃ 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 CRPA¹⁷ and University of Milan¹⁸. At the end of 2009 another research study related to land spreading estimations and scenario was completed¹⁹.

LULUCF Review. The ongoing work of the established expert group and the analysis of data from the new 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 CO₂ 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.

¹⁷ CRPA, 2006[b]. *Predisposizione di scenari di emissione finalizzati alla progettazione di interventi per la riduzione delle emissioni nazionali di ammoniacca 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 ammoniacca, 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.

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, 2010²⁰. 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 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 reports²¹. In 2017, the provincial inventory at local scale for the years 1990, 1995, 2000, 2005, 2010 and 2015 was finalised²².

Planned improvements

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. Energy data submitted to the international organizations in the framework of the Joint Questionnaire OECD/IEA/EUROSTAT will be compared with the national energy statistics used up to now with the aim to reduce the differences with the international statistics.

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 2016 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.

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

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

²² <http://www.sinanet.isprambiente.it/it/sia-ispra/inventaria/disaggregazione-dellinventario-nazionale-2015/view>

QA/QC ENERGY
2017 ACTIVITIES AND FUTURE IMPROVEMENTS

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NATIONAL AIR EMISSION INVENTORY: ENERGY

Objective

The improvements carried out during the preparation of the 2018 national inventory submission for the energy sector and those expected for the next future are summarised in the following.

Review process recommendations

In the following table, the issue raised and responses provided to the recommendations, for the Energy sector, during the last UNFCCC review process (as described in the report of the individual review of the annual submission of Italy submitted in 2016), then implemented, are reported.

Table 1. Issue raised for the Energy sector during the UNFCCC review in 2016

CRF category / issue	Review recommendation	Review report / paragraph	MS response / status of implementation	Chapter/section in the NIR
Energy/ manufacturing industries and construction - other fossil fuels – CO ₂ , CH ₄ , N ₂ O	No issues related to inconsistencies in the time series have been identified but the ERT recommends that Italy include a discussion in the NIR on the impact of any recalculations on the trend in CO ₂ , CH ₄ and N ₂ O emissions at the category, sector and national total levels, as appropriate	E.2	Additional information has been added in the NIR	Chapter 3 paragraph 3.4
Energy/ 1.A.2.d Pulp, paper and print - biomass – CO ₂	The ERT noted that in pulp, paper and print industry, biomass fuel consumption includes black liquor and industrial sludge and biogas from industrial organic wastes. In response to the question raised by the ERT regarding a country-specific EF for biomass (112.57 t/TJ), the Party explained that the EF is derived from EU ETS data reported by the pulp and paper operators for 2008, and applied to the whole time series, where the specific CO ₂ EF results from the average mix of biomass fuel used in the year 2008. The ERT recommends that Italy further analyse the EU ETS data for the time series available, taking into consideration biomass fuel mix in the relevant year, and document the relevant information in the NIR	E.3	Additional information has been added in the NIR	Chapter 3 paragraph 3.4
Energy/ 1.A.2.e Food processing, beverages and tobacco – biomass– CH ₄	The applied emission factor for CH ₄ emissions for biogas is much higher than the default value in 2006 GLs.... The Party explained that EF takes in account the technology used to produce energy and heat which results in higher emissions of VOC, CO and PM. The ERT recommends that Italy further analyse and collect information at plant level in order to verify and, if appropriate, update the CH ₄ EF.	E.4	Additional information has been added in the NIR	Chapter 3 paragraph 3.6
Energy	Inconsistencies between NIR and CRF regarding CH ₄ and N ₂ O emission factors for other fuels. Party explained that CORINAIR EFs applied at plant level are considered for non-CO ₂ gases but for CH ₄ and N ₂ O it does not result in changes of the IEF.	Provide corrected information in the NIR	Inconsistencies have been removed	Chapter 3 paragraph 3.6

Energy/ 1.A.3 Transport — CO ₂ , CH ₄ , N ₂ O	The ERT noted that there was no clear explanation regarding the allocation of emissions from lubricant used in railways. Use of lubricants, except in 2-stroke engines and mixed with motor gasoline is to be reported under the IPPU sector. During the review, Italy explained that all lubricants used for engines had been included under road transportation (1.A.3.b) and estimated by the COPERT model.... The ERT recommends that the Party exclude the amount of non-combustible use of lubricants in railways from 1.A.3 Transport and include it in the IPPU sector, category 2.D (lubricant use)	E.5	According to the review process and to the 2006 IPCC Guidelines emission estimates from lubricants have been reported under IPPU instead of energy except those related to its use in two stroke engines in road transport	Chapter 3 paragraph 3.5.2
Energy/ 1.A.3.a Domestic aviation – liquid fuels – CH ₄ N ₂ O	During the review, the ERT requested additional explanation from Italy regarding the rationale for the applied N ₂ O and CH ₄ EFs. ... The ERT encourages the Party to include information in the NIR to describe the choice of N ₂ O and CH ₄ EFs for aviation fuels, particularly to describe the use of survey data to estimate the CH ₄ EF and how the Party ensures times series consistency	E.6	Additional information have been added in the NIR considering also that Eurocontrol methodology and data have been used to estimate emissions from 2005.	Chapter 3 paragraph 3.5.1
Energy/ 1.A.3.d Domestic navigation — CO ₂ , CH ₄ , N ₂ O	The ERT requested additional information from the Party regarding the amount of lubricant used in the country, as reported in four groups – maritime bunkers, industrial use, engines in the transport sector, and in the petrochemical industry– and of how it estimated and reported GHG emissions.... The ERT recommends that Italy estimate the amount of non-combustible use of lubricant in domestic navigation, and include its CO ₂ emission estimation in category 2.D.3 in order to improve the completeness and comparability of its reporting	E.7	Emission estimates from lubricants have been reported under IPPU instead of energy except those related to its use in two stroke engines in road transport	Chapter 3 paragraph 3.5.4
International navigation – other liquid fuels – CO ₂ , CH ₄ , N ₂ O	In CRF table 1.D, Italy did not specify what was reported under other liquid fuels. The ERT recommends that Italy specify in CRF table 1.D the specific type(s) of liquid fuel consumed to improve transparency	E.8	According to the review process and to the 2006 IPCC Guidelines emission estimates from lubricants have been reported under IPPU instead of energy except those related to its use in two stroke engines in road transport. So there are no more other liquid fuels reported in CRF table 1.D	Chapter 3 paragraph 3.7
Energy/ 1.A.4.a Commercial/ Institutional – other fossil fuels – General	The ERT noted that Italy has reported emissions due to the non-renewable part of wastes used in electricity generation and the amount of fossil waste burned in incinerators with energy recovery under the category commercial/institutional. ... Given that the share of municipal solid waste incineration connected to the grid and used for electricity production is increasing, the ERT recommends Italy revise the allocation of these emissions under category 1.A.1.a Public electricity and heat production in order to ensure comparability	E.9	Not implemented yet although additional information have been included in the NIR to explain the allocation used	Chapter 3 paragraph 3.6
Energy/ 1.B.1.b Solid fuel transformatio n – CO ₂ and CH ₄	The ERT encourages Italy to provide the information on the charcoal production process, specifically when in the time series the modern technology replaced the conventional technology or insert a cross reference in 1.B.1.b Solid fuel transformation in order to improve the overall transparency of the report	E.10	The relevant information has been also included in section 1.B.1.B of the NIR	Chapter 3 paragraph 3.9

Energy/ 1.B.2.c Venting and flaring – Gas – CH4	The ERT noted that the inter-annual change in the CH4 IEF in the category 1.B.2.C.2 flaring – gas between 2013 and 2014 has been large (5,562.0%). ... The ERT recommends that the Party revise the value of CH ₄ emissions from 1.B.2.C.2 flaring – gas for 2014 to correct the error for flaring in production and processing	E.11	The error has been corrected	Chapter 3 paragraph 3.9
Energy/ 1.B.2.c Venting and flaring – Oil – CO ₂ , CH ₄ , N ₂ O	In CRF table 1.B.2, Italy had entered 4,668.05 kt as the amount of oil produced in 1.B.2.c. flaring – oil production while the amount of oil produced in 2014 was 5,764.93 kt as reported under category 1.B.2.a.2 (oil production) in the same CRF table. ... The ERT recommends that Italy report the correct value for the AD for flaring-oil production and improve the QC by introducing a check to ensure the same AD are included for oil production in various parts of the CRF tables	E.12	Reporting of activity data in the CRFs has been corrected for the whole time series	Chapter 3 paragraph 3.9

During the EEA greenhouse gases review related to the 2016 submission of Italy other transparency issues, mainly related to the explanation of the trend or implied emission factors, have been raised and solved before the official submission.

Table 2 reports responses to the recommendations under the review of the European National Emission Ceiling Directive (NECD) conducted in 2017.

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

Observation	Key Category	NFR, Pollutant(s), Year(s)	Recommendation	RE or TC	Implementation
IT-1A1-2017-0001	No	1A1 Energy industries, NH ₃ , 2000-2015	For categories 1A1b Petroleum Refining and 1A1c Manufacture of Solid Fuels and Other Energy Industries and NH ₃ , the TERT noted that the NFR tables indicate the notation key 'NA' whereas the 2016 EMEP/EEA Guidebook mentions 'NE'...	no	Notation key has been changed
IT-1A1-2017-0002	Yes	1A1 Energy Industries, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 2000-2015	For all stationary energy sectors (1A1, 1A2, 1A4) and NECD pollutants, the TERT noted that it is stated in the IIR that a detailed description of the methods of the energy sector is documented in the national inventory report of the Italian greenhouse gas inventory. In the in-depth LRTAP review in 2013 Italy was recommended to improve the transparency of the IIR: "the ERT is of the opinion that some parts of the IIR (sectoral chapters in particular) include only short descriptions of the methodologies used, with no EFs included, and no consideration of AD trends"...	no	Not implemented although additional information has been added in the paragraph 3.2
IT-1A1-2017-0003	No	1A1 Energy industries, PM _{2.5} , 2000-2015	For the stationary energy sector and pollutants PM _{2.5} for the entire time series the TERT noted that the IIR refers to an ISPRA website to collect EF (EF combustion.xlsx) which doesn't provide EFs for PM _{2.5} . In response to a question raised during the review, Italy explained that PM _{2.5} emission factors have been calculated starting from PM ₁₀ emission factors and applying the speciation reported in the Tier 2 tables of the 2016 EMEP/EEA Guidebook at fuel level calculated as PM _{2.5} divided by PM ₁₀ EF and Italy will update the file EF combustion.xlsx. ...	no	PM2.5 emission factors have been added in the relevant Tables.
IT-1A1-2017-0004	Yes	1A Combustion, SO ₂ , 2000-2015	For the energy sector and pollutant SO ₂ for the entire time series, the TERT noted that the SO ₂ EF for LPG is equal to 0. In response to a question raised during the review, Italy explained that according to the LPG distributors SO ₂ emission factor should	no	SO _x emission factors for LPG, natural gas and refinery gas have been revised for the relevant sectors according with the

			<p>be close to 0. The TERT acknowledges the explanation provided by Italy. The TERT notes that this issue is below the threshold of significance for a technical correction. ...For the category 1A4 and pollutant SO₂ for the entire time series, the TERT noted that the SO₂ EF for natural gas is equal to 0 for NFR code 1A4. In response to a question raised during the review, Italy explained that Italy will update SO₂ EF for natural gas used in 1A4 in the next submission. Italy provided an estimate for year 2015. The TERT noted that the issue is below the threshold of significance for a technical correction. ... For the category 1A1b Petroleum Refining and SO₂, the SO₂ EF for refinery gas is 6 g/GJ, but the range in the 2016 EMEP/EEA Guidebook for Tier 1 method is between 0.169 and 0.393 g/GJ. In response to a question raised during the review, Italy explained that for category 1A1b, a Tier 3 method is used and SO₂ emissions are estimated on the basis of emission and consumption data provided by the refineries in the framework of LCP (Large Combustion Plant) and ETS (Emissions Trading System) European Directives and E-PRTR (European Pollutant Release and Transfer Register) Regulation. ...</p>		recommendations.
IT-1A1-2017-0006	Yes	1A1 Energy Industries, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 2000-2015	<p>For the energy sector and for waste incineration with energy recovery, the TERT noted that these sectors are estimating NECD emissions using annual emissions reported by operators on the basis of stack measurements. When continuous measurements are used to estimate annual emissions, there is a risk that operators have misinterpreted the IED (Industrial Emissions Directive) and have used validated average values (after having subtracted the value of the confidence interval) although this subtraction must not be applied in the context of reporting annual emissions. In response to a question raised during the review, Italy explained that the IED directive entered in force in Italy on 14th March 2014. National large combustion plants should measure SO_x, NO_x and PM with continuous monitoring systems from the nineties ... The TERT recommends Italy to organise a survey among operators to identify which one are reporting emissions on the basis of the validated average values and try to derive a methodology to adjust the national emissions over the time series in order to compensate the fact that national emissions are estimated on the basis of data reported by operators using validated average values.</p>	no	The survey among operators is in progress.
IT-1A1a-2017-0001	Yes	1A1 Energy industries, SO ₂ , NO _x , 2000-2015	<p>For category 1A1 Energy Industries and pollutants SO₂ and NO_x, the TERT noted a lack of transparency about the versions of the Guidebook used. In response to a question raised during the review, Italy explained that for 1A1, a Tier 3 method is used and SO_x and NO_x emissions are estimated on the basis of emission and consumption data provided by the relevant plants in the framework of the Large Combustion Plant Directive, the EU Emission Trading Scheme and the E-PRTR Regulation. ...The TERT recommends Italy to add a specific section in the IIR for category 1A1 and specify that for the category 1A1 and for SO₂ and NO_x pollutants, the methodology used is a Tier 3 method.</p>	no	Not implemented although additional information has been added in the paragraph 3.2

IT-1A2-2017-0001	Yes	1A2 Stationary combustion in manufacturing industries and construction, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 2000-2015	For category 1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-metallic Minerals and NECD pollutants for the entire time series, the TERT noted that all emissions are counted in the category 1A2f and not disaggregated by NFR categories (1A2a to 1A2g) whereas consumption data are available by NFR categories. In response to a question raised during the review, Italy explained that some emissions included in this category are estimated on the basis of the production data and not on fuel consumption. Italy also indicated that the 2018 reporting would be disaggregated. The TERT notes that this issue does not relate to an over- or underestimate because all emissions are taken into account in Italy's inventory. The TERT recommends that Italy carries out estimates for category 1A2 Stationary Combustion in Manufacturing Industries and Construction at sub category level as already done for greenhouse gases and report these in the next submission.	no	The recommendation has been implemented.
IT-1A3ai(i)-2017-0001	No	1A3a Aviation LTO (civil), NH ₃ , 1990-2015	For ammonia from categories 1A3ai(i) International Aviation LTO (Civil) and 1A3aii(i) Domestic Aviation LTO (Civil) the TERT noted that within the NFR tables, the notation key 'not applicable' ('NA') is provided, further acknowledging that this might be correct for jet kerosene with the 2016 EMEP/EEA Guidebook not providing sufficient explanatory information... the TERT recommends checking the applicability of this emission factor.	no	Notation key has been changed
IT-1A3aii(i)-2017-0001	No	1A3aii(i) Domestic aviation LTO (civil), SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 1990-2015	For category 1A3aii(i) Domestic Aviation LTO (Civil), the TERT noted that no activity data were provided in the NFR tables. In response to a question raised during the review, Italy confirmed this erroneous reporting, further providing the requested data to the TERT. The TERT acknowledged the data supplied, recommending Italy to report the activity data in the next submission and to implement suitable QC procedures to ensure the completeness of the NFR tables.	no	The error has been corrected
IT-1A3b-2017-0001	Yes	1A3b Road Transport, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 2005, 2010, 2015	For category 1A3b Road Transport for all years, the TERT noted with reference to the NFR tables and IIR page 71 that there is a lack of transparency regarding the lubricant consumptions calculation (2 and 4 stroke engines) and the associated reporting. ... The TERT agreed with the explanation provided by Italy. The TERT recommends that Italy includes the explanations in its next submission.	no	Additional information has been included in paragraph 3.8.2
IT-1A3bi-2017-0001	Yes	1A3bi Road transport: Passenger cars, NO _x , 2005,2006	For category 1A3bi Road Transport: Passenger Cars and NO _x for years 2005-2006, the TERT noted that there is a lack of transparency regarding the emissions and activity data trends. In response to a question raised during the review, Italy explained that ... The TERT agreed with the explanation provided by Italy. The TERT recommends that Italy includes such explanations in its next submission.	no	Additional information has been included in paragraph 3.8.4
IT-1A3bii-2017-0001	Yes	1A3bii Road transport: Light duty vehicles, NO _x , NH ₃ , NMVOC, PM _{2.5} , 2001, 2006, 2012, 2013, 2015	For category 1A3bii Road Transport: Light Duty Vehicles and pollutants NO _x , NH ₃ , NMVOC and PM _{2.5} for years 2001, 2006, 2012, 2013, 2015, the TERT noted that there is a lack of transparency regarding the emissions and activity data trends. In response to a question raised during the review ... The TERT agreed with the explanation provided by Italy. The TERT	no	Additional information has been included in paragraph 3.8.4

			recommends that Italy includes such explanations in its next submission.		
IT-1A3biii-2017-0002	Yes	1A3biii Road transport: Heavy duty vehicles and buses, NO _x , NH ₃ , 2006	For category 1A3biii Road Transport: Heavy Duty Vehicles and Buses and pollutants NO _x and NH ₃ for year 2006, the TERT noted that there is a lack of transparency regarding the emissions and activity data trends. In response to a question raised during the review, Italy explained The TERT agreed with the explanation provided by Italy. The TERT recommends that Italy includes such explanation in its next submission.	no	Additional information has been included in paragraph 3.8.4
IT-1A3biv-2017-0001	Yes	1A3biv Road transport: Mopeds & motorcycles, NO _x , NMVOC, PM _{2.5} , 2000-2015	For category 1A3biv Road Transport: Mopeds & Motorcycles and pollutants NO _x , NMVOC and PM _{2.5} for years 2000-2010, the TERT noted that there is a lack of transparency regarding the emissions and activity data trends. In response to a question raised during the review, Italy explained that The TERT agreed with the explanation provided by Italy. The TERT recommends that Italy includes these explanations in its next submission.	no	Additional information has been included in paragraph 3.8.4
IT-1A3bv-2017-0001	Yes	1A3bv Road transport: Gasoline evaporation, NMVOC, 2000-2015	For category 1A3bv Road Transport: Gasoline Evaporation and pollutant NMVOC for all years, the TERT noted that there is a lack of transparency regarding the emissions and activity data trends. For NMVOC, the emissions jump by 7% between 2002 and 2003 and dip by 28% between 2003 and 2004. The IEF is not in the trend of all member states IEF. In response to a question raised during the review, Italy explained ...The TERT agreed with the explanations about fluctuations, but was not totally convinced about the high IEF compared to all other member states. The TERT asked for input data of the COPERT model (population, vapour pressure, etc.) in order to detect a potential error. The TERT detected an error in summer vapour pressure (RVP) with a too high value and asked Italy to provide revised estimations with appropriate RVP. Italy provided revised estimates for years 2005, 2010 and 2015. ... The TERT recommends that Italy includes the revised estimate and explain in the IIR that the mean age of the fleet give high evaporation emissions and hence a high IEF in its next submission.	RE	Emission estimates have been revised accordingly with the review
IT-1A3bvii-2017-0001	No	1A3bvii Road Transport: Automobile Road Abrasion, PM _{2.5} , 2005, 2010, 2015	For category 1A3bvii Road Transport: Automobile Road Abrasion and pollutants PM _{2.5} for all years, the TERT noted with reference to the NFR tables and IIR pages 69 that there may be an under-estimate of PM emissions as the emissions are not estimated. In response to a question raised during the review, Italy explained that although emission factors are available in the 2016 EMEP/EEA Guidebook, they are not included in the COPERT model, by the developers and not Italy, because the emission factors are not considered sufficiently reliable. The TERT disagreed with the explanation provided by Italy. The TERT decided to calculate emissions with activity data provided by Italy and emission factors from the EMEP/EEA Guidebook, following this calculation, the TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends that Italy estimates and reports emissions from road abrasion in its next submission.	no	PM emissions from road abrasion have been estimated and included in the inventory
IT-1A3c-	No	1A3c Railways, SO ₂ ,	For category 1A3c Railways and solid fuels,	no	Additional information

2017-0001		NO _x , NH ₃ , NMVOC, PM _{2.5} , 1990-2015	the TERT noted that activity data and, hence, resulting emissions are reported as 'not occurring' ('NO'), with information on a least one steam engine still operating in Italy available online. In response to a question raised during the review, Italy explained that this historic train is used only for few days per year and is probably fuelled with biomass nowadays instead of coal. The TERT acknowledges the answer provided by Italy. The TERT further agrees, that this activity is of very minor importance. Furthermore, the TERT recommends that Italy includes a brief statement in the IIR on the likely insignificance of this source.		has been included in paragraph 3.9
IT-1A3ei-2017-0001	No	1A3ei Pipeline transport, NH ₃ , 1990-2015	For category 1A3ei Pipeline Transport and NH ₃ , the TERT noted that emissions are reported as 'not applicable' ('NA') with the 2016 EMEP/EEA Guidebook not providing separate information for this category but referring to the "Small Combustion" chapter, where the notation key 'NE' is provided for several related combustion activities using natural gas. In response to a question raised during the review, Italy proposed to revise the notation key in the next annual submission. The TERT agrees and recommends Italy to implement this change in the next submission.	no	Notation key has been revised
IT-1A4ai-2017-0001	Yes	1A4ai Commercial/institutional: Stationary, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 2000-2015	For category 1A4ai Commercial/Institutional: Stationary and NECD pollutants, the TERT noted that emissions from waste incineration facilities with energy recovery are reported under category 1A4ai Commercial/Institutional: Stationary. In response to a question raised during the review, Italy explained that waste management with incinerators is a commercial activity with recovery of the energy auto-produced and emissions from these plants are allocated to the commercial /institutional category because of the final use of heat and electricity production. Referring to the 2016 EMEP/EEA Guidebook, chapter 1A1 Energy industries - part Overview (page 4) states that "if there is heat recovery or power generation in the incineration process, the emission should be reported under the appropriate 1.A.1 activity" and not in the category 1A4. The TERT notes that this issue does not relate to an over- or under-estimate but the TERT recommends that emissions from waste incineration facilities with energy recovery are reported under category 1A1a Public Electricity and Heat Production.	no	Not implemented
IT-1A4ai-2017-0002	Yes	1A4ai Commercial/institutional Combustion, NMVOC, 2000-2015	For category 1A4a Commercial/institutional Combustion and pollutants NMVOC and PM _{2.5} , the TERT noted a lack of transparency about the versions of the EMEP/EEA Guidebook used. In response to a question raised during the review, Italy explained that wood and waste account for more than 80 per cent of the emission. The TERT recommends that Italy states more precisely in the IIR the reference of the Guidebook version used for the category 1A4a. The TERT also recommends that Italy updates this methodology in line with 2016 EMEP/EEA Guidebook in the next submission.	no	Additional information has been included in paragraph 3.12.3
IT-1A4ai-2017-0003	No	1A4a Commercial/institutional Combustion, SO ₂ , NO _x , PM _{2.5} , 2000-2015	For the energy sector and NECD pollutants for the entire time series the TERT noted that the IIR doesn't describe the methodology for waste incineration with energy recovery (chapter 1A4 in the IIR). In	no	Additional information has been included in paragraph 3.12.3

			response to a question raised during the review, Italy explained that the methodology used to estimate emissions for this category is reported in the waste sector in the relevant paragraph on waste incineration of the IIR and it suggests to report in the next submission the relevant information also in the energy sector. In order to improve the transparency of the IIR, the TERT recommends that Italy adds in the energy sector (rather in category 1A1 than in category 1A4 as it is described in the recommendation IT-1A4ai-2017-0001) a sentence which refers to the methodological description of waste incineration with energy recovery in the waste of the IIR.		
IT-1A4aii-2017-0001	No	1A4aii Commercial/institutional: Mobile, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 1990-2015	For category 1A4aii Commercial/Institutional: Mobile, the TERT noted that activity data and emissions are reported as 'not occurring' ('NO'). In response to a question raised during the review, Italy proposed to revise the notation key 'included elsewhere' ('IE') with the next annual submission. The TERT agreed with the planned revision, nonetheless recommending putting additional effort into making data available that allows for a separate reporting of this NFR category. For the time being, the TERT further recommends including sufficient explanatory information on the allocation of fuels consumed in this category in the national energy statistics and the emission inventory.	no	Notation key has been revised
IT-1A4bi-2017-0001	Yes	1A4bi Residential: Stationary, NO _x , NMVOC, PM _{2.5} , 2000-2015	For category 1A4bi Residential: Stationary and NECD pollutants, the TERT noted a lack of transparency about the versions of the Guidebook used. In response to a question raised during the review, Italy explained that in the case of NO _x for example, country specific EFs are used and updated for natural gas and wood, while for liquid fuels (gasoil, kerosene and LPG), a default equal to 50 g/GJ is used versus the 2016 EMEP/EEA Guidebook Tier 1 default for liquid fuel equal to 51 g/GJ. The TERT notes that this issue is below the threshold for a technical correction. The TERT recommends that Italy states more precisely in the IIR in the chapter relative to category 1A4b the methodology used: for example, explain that country specific EFs are used for wood and natural gas for SO ₂ and NO _x and for other fuels and other pollutants default emission factors are applied. The TERT also recommends that Italy updates the methodology, where relevant, in line with the 2016 EMEP/EEA Guidebook in the next submission.	no	Additional information has been included in paragraph 3.12.3
IT-1A4ci-2017-0002	No	1A4ci Agriculture/Forestry/Fishing: Stationary, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 2000-2015	For category 1A4ci Agriculture/Forestry/Fishing: Stationary for the entire time series the TERT noted that no biomass consumption is provided in the NFR tables. .. The TERT recommends that Italy corrects in the NFR tables the fuel biomass consumption for category 1A4ci in its next submission.	no	The error has been correct
IT-1B1b-2017-0001	No	1B1b Fugitive Emission from Solid Fuels: Solid Fuel Transformation, SO ₂ , NO _x , NH ₃ , 1990-2015	For category 1B1b Fugitive Emission from Solid Fuels: Solid Fuel Transformation and pollutants NO _x , SO ₂ and NH ₃ , the TERT noted that emissions had been reported as not applicable (NA), whilst the 2016 EMEP/EEA Guidebook identifies potential emissions of these pollutants. In response to a question raised during the review, Italy explained that emissions from coke production were estimated on the basis of the	no	Notation key has been corrected for the relevant pollutants

			<p>data reported by the plants under E-PRTR and these had been allocated within the category 1A1c Manufacture of Solid Fuels and Other Energy Industries. Italy had not estimated NH₃ emissions for this sector, however Italy noted that these emissions were considered below the threshold of significance because on the basis of data collected, they were estimated to be below 1 ton per year. The TERT noted that the issue for NH₃ is below the threshold of significance for a technical correction. The TERT recommends that Italy include an estimate of NH₃ emissions from coke production in the next submission, and document the methodology used in the IIR.</p> <p>...</p>		
IT-1B2aiv-2017-0001	Yes	1B2aiv Fugitive emissions oil: Refining / storage, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 1990-2015	<p>For category 1B2aiv Fugitive Emissions Oil: Refining/Storage the TERT noted a lack of transparency regarding the methodology to estimate emissions from refining, the sources included, and the split between combustion (category 1A1b Petroleum Refining) and process (category 1B2aiv). In response to a question raised during the review, Italy explained the procedure for estimating the combustion and process emissions based on the data reported by plants under E-PRTR (European Pollutant Release and Transfer Register), ETS (Emissions Trading System) and LCP (Large Combustion Plant). Italy acknowledged that NH₃ emissions from refineries were not estimated, which is quantified at an amount below 50 tonnes per year. The TERT notes that the impact of this under-estimate is lower than the threshold of significance for a technical correction, but recommends that Italy includes the estimation of NH₃ emissions from refineries in the next submission.</p>	no	Notation key for NH ₃ has been revised. Emission estimates will be included in the next submission
IT-1B2aiv-2017-0002	No	1B2aiv Fugitive emissions oil: Refining / storage, PM _{2.5} , 2015	<p>For category 1B2aiv Fugitive Emissions Oil: Refining/Storage and pollutant PM_{2.5} for year 2015 the TERT noted a potential error of reporting or estimation as activity data changes did not explain the peak in PM_{2.5} emissions and the equal value in that year for the PM₁₀ emissions and the PM_{2.5} emissions. In response to a question raised during the review, Italy explained that there was a reporting error and that emissions for 2015 were lower than reported. The TERT notes that this is below the threshold for a technical correction. The TERT recommends that Italy corrects the error and includes an updated estimate in its next submission.</p>	no	The error has been corrected
IT-1B2av-2017-0001	No	1B2aiv Fugitive Emissions Oil: Refining / Storage, NH ₃ , 1990-2015	<p>For category NFR 1B2aiv Fugitive Emissions Oil: Refining/Storage and NH₃, the TERT noted that emissions had been reported as not applicable ('NA'), whilst the 2016 EMEP/EEA Guidebook identifies potential emissions of this pollutant from catalytic cracking unit regenerators (partial burn without CO boiler). In response to a question raised during the review, Italy provided a rough estimation of 50 tonnes per year based on the data collected and stated that these emissions will be included in the next submission. The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends that Italy estimates and reports emissions in the next submission.</p>	no	Notation key for NH ₃ has been revised. Emission estimates will be included in the next submission
IT-1B2b-2017-0001	No	1B2b Fugitive emissions from natural gas (exploration, production,	<p>For category 1B2b Fugitive Emissions from Natural Gas and 1B2c Venting and Flaring as well, the TERT noted a certain lack of transparency about some potential emitting</p>	no	Additional information has been included in paragraph 3.13.1 and 3.13.2

		processing, transmission, storage, distribution and other), NMVOC, 1990-2015	sources. In response to a question raised during the review, Italy explained that all emitting sources had been estimated in this category (i.e production, transport, distribution and storage and distribution, including housing). Italy also explained the methodology applied based on estimates of methane emissions and volume of gas flared as activity data and country-specific emission factors. Emissions from flaring in refineries was reported in that category and its estimation was based on country-specific emission factors from the relevant industrial association and on the amount of gas flared reported by plants under the EU ETS (from 2005 onwards). The TERT notes that this issue does not relate to an over- or underestimate of emissions and recommends that Italy includes a section in the IIR with the methodology applied for categories 1B2b and 1B2c for the next submission.		
IT-1B2d-2017-0001	No	1B2d Other fugitive emissions from energy production, NH ₃ , 1990-2015	For category 1B2d and pollutant NH ₃ the TERT noted that the no occurrence of the emission source had been reported even though electricity is being generated from geothermal energy in the country. Based on the exchange of information during the review, Italy provided a revised estimate. The TERT agreed with the revised estimate provided by Italy and attached to the annex of the review report. The TERT recommends that Italy include the revised estimate in its next submission.	RE	Emission estimates have been included in the inventory

NIR and IIR report additional information about the last review processes (e.g UNFCCC²³ and UNECE²⁴), addressing the recommendations of the review teams.

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 1°×1° degree 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. In the framework of CLRTAP, every five years emissions are disaggregated at regional and provincial level; for 2015 and previous years data collected from point sources have been analysed and elaborated allowing the distribution of emissions at local level. Results are compared with those obtained by regional bottom up inventories. Emissions disaggregated at local level are also used as input for air quality modelling. Final results are useful to highlight the most critical areas in the Italian Regions.

As regards the improvements carried out since last submission, in the stationary fuel combustion categories, the main update regarded the 1A1 and 1A2 where solid fuel combustion data from EUROSTAT/IEA/OECD questionnaire have been used for the whole time series. Concerning 1.A.3 mobile fuel combustion, the upgraded version of COPERT 5, v.5.1 has been used for road transport sector resulting in a general revision

²³ UNFCCC, 2017. Report on the individual review of the annual submission of Italy submitted in 2016. Note by the expert review team. <http://unfccc.int/resource/docs/2017/arr/ita.pdf>.

²⁴ 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

of emission estimates for the whole time series. For aviation, data from EURCONTROL have been integrated in the national inventory resulting in variations of the number of flights, consumption and emission factors.

Planned improvements

In this paragraph further improvements identified during the preparation of the National Inventory, National Inventory Report 2018 and of the Informative Inventory Report 2018 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. A first improvement of the aviation sector occurred in consideration of the information made available by EUROCONTROL to the each European Member State; detailed checks were carried out on some gases and pollutant and some revisions already took place. 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 data checks are on-going especially concerning vehicle fleet and technological information.

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 is regarding 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. Furthermore an analysis about the differences between Eurostat and National energy variables is being carried out by Ispra and Ministry of Economic Development. This year, specifically, ISPRA went through a detailed examination of the Eurostat Energy balance in order to integrate the reported information in the inventory compilation.

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 2. *Planned improvements*

Category	Subcategory	Parameter	Gas	Description	Timing
Cross-cutting	Energy balance	AD		A working group of Ispra and Ministry of Economic Development is investigating about the differences between Eurostat and BEN	2017-2019

Category	Subcategory	Parameter	Gas	Description	Timing
1.A.1a	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.	2017-2019
1.A.2.g	Off-road Industry	EFs	All	Survey on activity data and technological parameters of off-road vehicles	2018-2019
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	2017-2019
1.A.4	Civil sector: small combustion	EFs	All	New surveys on wood consumption and combustion technologies	2018-2019

**QA/QC INDUSTRIAL PROCESSES
2017 ACTIVITIES AND FUTURE IMPROVEMENTS**

Prepared by: Andrea Gagna, Barbara Gonella, Ernesto Taurino

April, 2018

NATIONAL AIR EMISSION INVENTORY: INDUSTRIAL PROCESSES

Objective

The improvements carried out during the preparation of the 2018 national inventory submission for the industrial processes sector and those expected for the next future are summarised in the following.

Review process recommendations

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

Table 1 describes the responses to the recommendations under the UNFCCC review process.

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

CRF category / issue	Review recommendation	Review report / paragraph	MS response / status of implementation	Chapter/section in the NIR
IPPU/ 2.A Mineral industry – CO ₂	The NIR (p.121) states that CO ₂ emissions from road paving and asphalt roofing are included in mineral products. ... The ERT recommends Italy to correct the error in the NIR in the next annual submission.	I.13	The relevant paragraph has been moved under 2D category description of the NIR	Chapter 4 paragraph 4.5
IPPU/ 2.B.6 Titanium dioxide production – CO ₂	In the NIR, Italy states that the AD and CO ₂ emission estimates for titanium dioxide production have been provided by the only operator in the country for the entire time series. However, it is not clear from the NIR what methodology was used to provide these estimates. Italy explained this facility is in the scope of the EPER/EPRTTR legislation; The ERT recommends that Italy include a detailed description used to estimate emissions from titanium dioxide in the annual submission. The ERT also recommends that Italy include a description of how EPER/EPRTTR and EU ETS methodologies correlate with the 2006 IPCC guidelines for GHG emission estimation	I.14	Additional information has been added in the NIR	Chapter 4 paragraph 4.3
IPPU/ 2.D.2 Paraffin wax use – CO ₂	The ERT noted that there was no information in the NIR on the source of AD for paraffin wax use and no rationale for calculating the fraction of entire paraffin consumption ... During the review, Italy provided information on the current data sources and a rationale for extracting 65% of the total paraffin consumption under the assumption that it is used for candle production as the sole known example of paraffin waxes combustion during use. ... The ERT recommends that the Party include a description of the AD source for this category in the NIR	I.15	Additional information has been added in the NIR	Chapter 4 paragraph 4.5
IPPU/ 2.E.1 Integrated circuit or semiconductor - HFCs, PFCs, SF ₆	Italy estimates the F-gas emissions from semiconductor manufacturing in accordance with the tier2a methodology on the basis of an equation accepted by the World Semiconductor Council. ... The ERT noted that this equation is different from the proposed equation in the 2006 IPCC guidelines and it is not clear from the NIR how the different methods correlate. ... Italy provided the explanation that the formula reported in the NIR combines the equations 6.2, 6.3, 6.4, 6.5 and 6.6 of the 2006 IPCC Guidelines. The ERT ... agrees on the appropriateness of the approach... The ERT recommends that Italy provide information to	I.16	Additional information has been added in the NIR	Chapter 4 paragraph 4.6

	present the correlation of the formula that is used to calculate the F-gas emissions from semiconductor manufacturing and the proposed Tier 2a method in the 2006 IPCC guidelines			
IPPU/ 2.E.1 Integrated circuit or semiconductor - HFCs, SF ₆	The ERT noted that the inter-annual change between 1998 and 1999 in the HFC-23 IEF and SF ₆ IEF has been identified as large in the time series.... In the NIR Italy explains that the first three years of the time series (1998-2000) are calculated on the basis of consumption data and the following years are calculated on the basis of plant specific parameters, which might imply time-series consistency issues ... Italy explained that for this period, owing to confidentiality problems and consequent lack of specific information, it was impossibleThe ERT recommends that Italy conduct an extrapolation of the estimates after 2001 in order to obtain the emissions for the period 1998-2000 and to include these estimates in the next inventory submission	I.17	Emission estimates have been updated according to additional data collected from industry	Chapter 4 paragraph 4.6
IPPU/ 2.F. Product uses as substitutes for ozone depleting substances – HFCs (35, 2014)	Provide information in the NIR to prove that a significant reduction in the leakage rates for F-gases occurred between 1999 and 2000. In the NIR it is explained that the appropriate leakage rates have been suggested by a pool of experts from several relevant national associations of refrigeration and air conditioning, and these showed a decrease in the leakage rates after 2000. However, Italy Italy did not provide a detailed explanation about the scientific reasons and assumptions behind this significant change (e.g. by providing supporting information on regulations implemented, changes in prices of F-gases or technological improvements, as identified by the previous ERT)	I.8	Additional information has been included in the NIR	Chapter 4 paragraph 4.7
IPPU/ 2.F.1 Refrigeration and air conditioning – HFCs	In NIR table 4.17, p. 160, Italy reported emissions from 2.F.1.a twice. ... Italy confirmed that there was an error ... The ERT recommends that Italy correct the error in table 4.17...	I.18	The table has been corrected	Chapter 4 paragraph 4.7
IPPU/ 2.F.1 Refrigeration and air conditioning – HFCs	The ERT in the review of the 2013 annual submission of Italy advised Italy to perform a cross-check of the GHG estimations from the top-down and the bottom-up approach.... . In response to a question raised by the ERT Italy explained that it is working in order to collect these data in a better way... The ERT welcomes the efforts that Italy undertakes to improve the accuracy and the transparency of the inventory and encourages the Party report on the future improvements related to the use of these two data sets in the next annual submission	I.19	Some comparisons and verification activities have been included in the NIR	Chapter 4 paragraph 4.7

IPPU/ 2.F.3 Fire protection – HFCs	... After 2010 there are no detailed consumption data for fire extinguishers, but Italy states in the NIR that according to projections the amount of gas was expected to decrease.... During the review, Italy explained that owing to lack of additional data ... for the years 2010-2014, it was assumed that emissions are constant at 2010 levels although a reduction in the trend was expected. The ERT noted that there is a discrepancy between the NIR description and the actual manner of emission estimation... The ERT recommends that Italy correct the description in the expected trend ... for the years 2010-2014 and explain that for these years the emissions are assumed to be constant and not decreasing	I.20	The relevant text in the NIR has been corrected	Chapter 4 paragraph 4.7
IPPU/ 2.F.4 Aerosols – HFCs	... The ERT noted that Italy changed the methodology and the revised estimates are included in the inventory submission. However, the Party did not provide an explanation of the emission estimation approach in the NIR. The ERT recommends that the Party include a description in the NIR of the methodology used to calculate the emission estimates for this category	I.21	According to the review and the 2006 IPCC Guidelines emission estimates have been updated and the relevant information has been included in the NIR	Chapter 4 paragraph 4.7

Table 2 reports responses to the recommendations under the review of the European National Emission Ceiling Directive (NECD) conducted in 2017.

Table 2. Response to the NECD review process recommendations

CRF category / issue	Review recommendation	Review report / paragraph	MS response / status of implementation	Chapter/section in the IIR
2A5a Quarrying and mining of minerals other than coal, PM2.5, 1990-2015	...The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends that Italy estimates emissions from this category for the next submission. ...	IT-2A5a-2017-0001	Emission estimates not implemented	Additional information added in paragraph 4.2.
2A5b Construction and demolition, PM2.5, 1990-2015	...The TERT strongly recommends that Italy collects the base information for estimating the emissions for this category and include the estimate in its next submission.	IT-2A5b-2017-0001	Emission estimates not implemented	Additional information added in paragraph 4.2.
2A5c Storage, handling and transport of mineral products, PM2.5, 1990-2015	...The TERT recommends that Italy improves the transparency of the IIR by including information on allocation of emissions and potential emissions that are not estimated for this category in the next submission.	IT-2A5c-2017-0001	Notation key has been changed	Additional information added in paragraph 4.2.
2C Metal Industry, NOX, PM2.5, 2005-2015	...The TERT recommends that Italy includes the process emissions of lead, zinc and copper production under category 2C5 Lead Production, 2C6 Zinc Production and 2C7a Copper Production in its next submission and provides information on the estimate and split in its next IIR.	IT-2C-2017-0001	Not implemented	Additional information added in paragraph 4.2 to explain the reasons of emissions allocation
2H1 Pulp and paper industry, SO2, NOX, NMVOC, PM2.5, 2005, 2010, 2015	The TERT recommends that Italy provides information on the processes, methodologies, activity data and emission factors including the references used, in the next submission.	IT-2H1-2017-0001	Implemented	Additional information added in paragraph 4.2

Inventory improvements and QA activities

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

CO₂ emissions have been checked with the relevant industrial associations. Activity data and emissions reported under EU-ETS and EPER/EPRTTR are compared with the information provided by the industrial associations. In particular, comparisons have been carried out for iron and steel, 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 CO₂ emissions from the decarbonation process in the national cement industry: resulting suggestions to focus on raw materials fed to clinker kilns²⁵ were considered and the description of the fluctuation of the CO₂ 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 CO₂ estimates along the whole time series.

Also emissions from the metal sector are checked with the relevant process operators. 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. Concerning the electric arc furnaces, since 2004, the same estimation scheme as the previous period has been followed but using data becoming from ETS (only process emissions) and related to the amounts of pig iron, metallurgical coke, graphite, anthracite, dolomite, limestone and electrodes for 35 plants on 35 in 2016. The availability of data for each plant has allowed also the application, for a first attempt, of the Tier 3 methodology (IPCC, 2006) that demonstrated the soundness of estimates.

Planned improvements

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

Periodically, further improvements can result from the analysis of the different databases. The inventory team integrates the documentation collected in the framework of the different pieces of European legislation (EPER-E PRTR, Large Combustion Plants and Emission Trading Scheme) with the aim to verify emissions and activity data reported for the same year under different reporting obligations and identify possible improvements in emission estimations. In the framework of EU-ETS, CO₂ 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 CO₂ 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/EPRTTR 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 CO₂ emissions sources

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

from the activities of this sector are planned, as well as additional checks will be carried out on account of information from new entrance installations included in the ETS from 2013.

In Table 3, the planned improvements are synthesized; for each topic, the reference to the UNFCCC category, which the improvement is focussed, is reported.

Table 3. Planned improvements

Category	Subcategory	Parameter	Gas	Description	Timing
General	-	-	-	Implementation of a quantitative uncertainty analysis for air pollutants	2018-2019
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.	2018-2019
	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"	2018
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.	2017-2019
Metal production	Lead and zinc production	Allocation	All	Combustion vs process	2017 - 2018
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 studies carried out in the framework of the agreements signed with the Ministry of the Environment, Land and Sea and the new national database of F-gases and implementation of bottom-up approach to cross-check the final emission estimates with a focus on stationary refrigeration and air conditioning.	2017-2018

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. Further investigations concerning the use of carbonates other than limestone in the source category "other processes uses of carbonates are planned.

Chemical products

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.

Metal production

CO₂ emissions from lead and zinc production have been subdivided in combustion (reported in 1.A.2) and processes (reported in 2.C.6) on the basis of ETS data. The whole time series has been reconstructed but only for CO₂ emissions, the disaggregation for other gasses is planned.

Consumption of halocarbons and SF₆

In 2016 and 2017, ISPRA signed two agreements with the Ministry of the Environment, Land and Sea for a survey, at a national level, about HFCs alternative substances with low GWP, natural refrigerants and alternative technologies made in Italy. In this framework ISPRA is in contact with air conditioning and refrigeration national associations, major import/export F-gas companies, and the major experts of the sector, as well as companies, in order to better understand the market evolution in terms of HFCs substitutes. Data are collecting, both regarding HFCs and substitutes, and a bottom-up approach is scheduled for the 2019 submission for the air conditioning sub-category.

Improvements in the refrigeration, air conditioning and fire protection sub-category are also expected from the collection of emission data as requested by the article 16 of the Decree of the President of the Republic 27 January 2012, n. 43 which receipt the article 3(6) of the EC Fluorinated Gas Regulation. In the framework of the 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 end of May every year; as for 2013 the information to be collected includes type and numbers of stationary appliances containing 3 kg or more of fluorinated greenhouse gases; from 2014 also information about leakages from those stationary appliances have been collected thus contributing to an improvement of the inventory of F-gas emissions.

**QA/QC SOLVENT AND OTHER PRODUCT USE
2017 ACTIVITIES AND FUTURE IMPROVEMENTS**

Prepared by: Daniela Romano

April, 2018

NATIONAL AIR EMISSION INVENTORY: SOLVENT AND OTHER PRODUCT USE

Objective

The improvements carried out during the preparation of the 2018 national inventory submission for the solvent sector and those expected for the next future are summarised in the following.

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, where 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 pentane, which resulted in a strong reduction of 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.

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 guidebook²⁷. 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 composition of the total amount of paints and varnishes (water and solvent contents) in different

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

subcategories for interior and exterior use and the total amount of products used for vehicle refinishing and they are available from the year 2007.

With the application of the 2006 IPCC Guidelines, the sector is integrated in the IP. In the actual submission, CO₂ emissions from lubricants use, were recalculated along the whole time series due to the update of the data resulting from COPERT model. Also, significant recalculations for CO₂ emissions occurred from the use of urea in engines due to the update of the data resulting from COPERT model. Minor recalculations occurred for paint application subcategories mainly due to the update of emission factors in paint application for domestic and other use (car repairing, construction and buildings) and the update of some activity data in 'Other' (glass wool enduction and fat edible and non edible oil extraction).

Table 1 reports responses to the recommendations under the review of the European National Emission Ceiling Directive (NECD) conducted in 2017.

Table 1. Response to the NECD review process recommendations

CRF category / issue	Review recommendation	Review report / paragraph	MS response / status of implementation	Chapter/section in the IIR
2D3d Coating applications, NMVOC, 2005, 2010, 2015	...The TERT recommends that Italy includes this explanation and in general provides more information on the trends in its next submission.	IT-2D3d-2017-0001	Implemented	Additional information added in paragraph 5.2
2D3e Degreasing, NMVOC, 2005, 2010, 2015	...The TERT recommends that Italy includes information on the methodology, including the activity data and emission factors including references in its next submission. ...	IT-2D3e-2017-0001	Implemented	Additional information added in paragraph 5.2
2G Other product use, PM2.5, 2005, 2010, 2015	he TERT recommends that Italy, estimates and reports emissions from use of tobacco and fireworks using either the 2016 EMEP/EEA Guidebook or national data, if available, in its next submission.	IT-2G-2017-0001	Not implemented. Notation key NE has been included	Additional information added in paragraph 4.2

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 2. Planned improvements

Category	Sub-category	NMVOC Emission	Description	Timing
<i>Cross cutting</i>	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	2018-2019
<i>Paint application</i>	Other industrial paint application	8%	Assess the possibility to split non industrial application according to the Guidebook EMEP/EEA	2018-2019

<i>Degreasing, dry cleaning and electronics</i>	Metal degreasing	4%	Update information, from the national chemical industrial association (Federchimica), on activity data and emission factor	2018-2019
<i>Chemical products manufacturing and processing</i>	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	2018-2019
<i>Other use of solvents</i>	Printing industry	4%	Update emission factor for the last years on the basis of the information collected by the industrial association	2018-2019
<i>Other use of solvents</i>	Application of glues and adhesives	5%	Update emission factor for the last years on the basis of the information collected by the industrial association	2018-2019

**QA/QC AGRICULTURE
2017 ACTIVITIES AND FUTURE IMPROVEMENTS**

Prepared by: Eleonora Di Cristofaro

April, 2018

NATIONAL EMISSION INVENTORY: AGRICULTURE

Objective

This report describes activities and improvements carried out during the preparation of the 2018 national inventory submission for the agriculture sector.

Review process recommendations

During the last UNFCCC Greenhouse gases review process in 2016 the following issues were raised.

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

Subject	Review issues	MS response
3.A.1 Cattle – CH4	Italy uses CH4 conversion factor (Ym) of 4- 6% for non-dairy cattle ... which is one of the lowest compared with other European countries. During the review, Italy explained that the data are based on the Nitrogen Balance Inter-regional Project ... The Ym values were calculated as a function of food digestibilityThe ERT recommends Italy to provide more information on Nitrogen Balance Inter-regional Project research results (including breeding performance, food consumption, composition of rations and digestibility) in the NIR to confirm country- specific Ym values for non-dairy cattle.	Additional information has been included in the NIR (Chapter 5 paragraph 5.2).
3.B Manure management – CH4	... Italy reported that losses from digesters are equal to 1% of biogas produced. ... CH4 flared has been assumed to be equal to 0. In response to a request by the ERT ..., the Party informed that The amount of biogas produced was estimated on the basis of the biogas used and information on the average losses of biogas ... reported to be about 1% of the total biogas produced. The Party also explained that it is still investigating the biogas flared together with CRPA, which is completing a new survey on the digesters. The ERT ... and recommends that the Party include the results of the survey in its submission.	Additional information on the amount of biogas flared has been collected and included in the emission estimates (Chapter 5 paragraph 5.3).
3.B Manure management – CH4	For 1990, N2O Emissions from Manure Management from Digesters have been reported as NO/NA (CRF table Table3.B(b)). However, in table Table3.B(a)s2 Italy has reported the percentage allocated by digesters for dairy cattle, non -dairy cattle and swine as 0 but the MCF is 1.14. During the review, Italy explained that there is an error in Table3.B(a)s2 and that it will be corrected. The ERT recommends that Italy correct the error in the reporting of a MCF in Table3.B(a)s2 for 1990 and fill the cells with the correct notation keys.	The error has been corrected (Chapter 5 paragraph 5.3).
3.B.5 Indirect N2O emissions – N2O	In CRF table 3(b) Italy reported indirect N2O emissions from nitrogen leaching/runoff using the notation key IE, indicating that in the cell comment that indirect N2O emissions ... are included ... under agricultural soils. During the review, Italy explained that it reports ... under agricultural soils because it has a country-specific factor only for nitrogen losses from livestock, due to runoff and leaching which confirms the use of the 2006	Separate estimates have been provided and additional information has been included in the NIR (Chapter 5 paragraph 5.3).

Subject	Review issues	MS response
	<p>IPCC guidelines default factor of 0.30 kg N/kg N of manure and the country-specific factor refers to the phase of the spreading of manure. Additionally, the Party explained that FracLEACH-(H) is comparable with the IPCC default, and therefore it has been decided to apply the IPCC default factor in the overall estimation process, The Party explained that a focus on the N losses from leaching and run-off in the storage of manure is currently on going, involving the main national experts. Italy noted that it plans to provide separate estimates and improve the methodological description in the NIR in the next submission. The ERT recommends that Italy make efforts to obtain information on the nitrogen losses due to leaching and run-off during manure storage and improve the accuracy of reporting indirect N₂O emissions from manure management ... and improve the methodological description in the NIR.</p>	
<p>3.D.a.2 Organic N fertilizers – N₂O</p>	<p>Estimates of emissions from animal manure applied to soils in Italy use a default Nbedding from the 2006 IPCC; however, the country specific N amounts in straw for calculating emissions from crop residues are used During the review, Italy was asked whether the verification of crop residues information with the calculations of animal manure applied to soils had been completed. ... The Party ... is still conducting further research to determine whether the 2006 IPCC defaults are appropriate for Italy. The ERT ... encourages that Italy continue investigation on the nitrogen amount in bedding materials.</p>	<p>Additional relevant information has been collected and emission estimates have been revised (Chapter 5 paragraph 5.5).</p>
<p>3.D.b Indirect N₂O emissions from managed soils - N₂O</p>	<p>Italy uses the 2006 IPCC default EF for FracLEACH-(H) of 0.30. During the review, Italy confirmed that the soils meet the criteria indicated in Table 11.3 of the 2006 IPCC Guidelines to use this default value as it has a country-specific factor of nitrogen losses from livestock due to runoff and leaching. Additionally, the Party noted that it is investigating the fulfilment of the criteria set out in the guidelines. The ERT recommends that Italy include information on the value used for Frac LEACH-(H) and encourages the Party to continue to investigate the FracLEACH-(H) fulfilment of the criteria set out in the IPCC 2006 guidelines.</p>	<p>Additional information has been included in the NIR (Chapter 5 paragraph 5.5).</p>
<p>3.G Liming – CO₂</p>	<p>In CRF table 3.G-I, Italy reported CO₂ emissions from dolomite using the notation key “IE”, indicating in the NIR that there are no national statistics to disaggregate statistics of liming material. ... During the review, Italy explained that ... the disaggregation between limestone and dolomite used in agriculture showing a share of 55% for limestone and 45% for dolomite; these data will be used in the next submission. ... The ERT recommends that Italy estimate emissions from limestone and dolomite application separately to improve the accuracy of reporting liming emissions ... and confirm the amount of lime and dolomite for liming.</p>	<p>Additional information has been collected from the industry on the amount of dolomite and limestone applied and the weighted average emission factor has been used to estimate emissions (Chapter 5 paragraph 5.7).</p>

During the last ESD Greenhouse gases review process in 2017 no recommendations were raised.

During the last NECD review process²⁹ in 2017 the following issues were raised. The 2017 comprehensive review of NECD air pollutant inventories of EU Member States focused on the years 2005, 2010 and 2015 and the pollutants SO_x, NO_x, NMVOC, NH₃ and PM_{2.5} with a national ceiling for 2030.

Table 2. Recommendations from the TERT of the NECD comprehensive review air pollutant inventories

Observation	Key category	NFR, Pollutant(s), Year(s)	Recommendation	Implementation
IT-3B1a-2017-0001	Yes	3B1a Manure management - Dairy cattle, NH ₃ , 2003-2015	For category 3B1a Manure Management - Dairy Cattle and pollutant NH ₃ for year 1990-2015 the TERT noted that the IEF is amongst the highest in the EU. In response to a question raised during the review, Italy sent information on AWMS (animal waste management system) distribution and grazing time that explains this high IEF. The TERT recommends that Italy enhances the transparency of its next submission by including the most relevant parameters/factors that affect the estimates: such as livestock numbers, N excretion rates, use of MMS (manure management system) and a detailed justification of any reduction in emissions (EFs) caused by mitigation measures/national policies. All country specific EFs should also be included with references and any assumptions made accompanied by a clear justification.	Additional information has been included in paragraph 6.2.
IT-3B-2017-0003	No	3B Manure management, NMVOC, 1990-2015	For category 3B4gi, 3B4gii, 3B4giii, 3B4giv, 3B4h and pollutant NMVOC for years 1990-2015 the TERT noted that emissions are reported as 'NA'. In response to a question raised during the review, Italy explained that on the basis of the emission factors provided by the 2016 EMEP/EEA Guidebook Tier 1, the weight of emission estimates for these categories on the total NMVOC emission would be on average equal to 1.8% in 1990 and 4.6% in 2015. The TERT recommends Italy to apply the 2016 EMEP/EEA Guidebook methodology to estimate these emissions in the next submission, and use the Tier 2 approach if this proves to be a key category.	NMVOC emissions have been estimated or updated.
IT-3B-2017-0006	No	3B Manure management, NH ₃ , 1990-2015	For category 3B4gi Manure Management - Laying Hens and pollutant NH ₃ for years 1990-2015 the TERT noted that IEF is amongst the lowest of EU and lower than the Tier 1 EF in the 2016 EMEP/EEA Guidebook. In response to a question raised during the review, Italy provided information and references on the N excretion rates, AWMS distribution and reduction factors for the abatement techniques. The TERT agreed with the explanation provided by Italy. However, the TERT noted a lack of transparency in the IIR and recommends that for category 3B Manure Management and categories related (3Da2a Animal Manure Applied to Soils and 3Da3 Urine and Dung Deposited by Grazing Animals) Italy enhances the transparency of its next submission by including the	Additional information has been included in paragraph 6.2.

²⁹ The review of the air pollution emission data submitted by Member States under the European Union's Directive on the Reduction of National Emissions of Certain Atmospheric Pollutants (Directive (EU) 2016/2284) (NECD) defined in Article 10(3).

Observation	Key category	NFR, Pollutant(s), Year(s)	Recommendation	Implementation
IT-3B3-2017-0002	Yes	3B3 Manure management - Swine, NO _x , NH ₃ , 1990-2015	<p>most relevant parameters/factors that affect the estimates: such as consistent livestock numbers, N excretion rates and use of MMS, and a detailed justification of any reduction in emissions (EFs) caused by mitigation measures/national policies. All country specific EFs should also be documented including references and all assumptions should be accompanied by a clear justification of the applicability.</p>	NO _x emissions have been updated with the Tier 2 according to the review recommendation.
IT-3B3-2017-0004	No	3B3 Manure management - Swine, PM _{2.5} , 2004-2010	<p>For category 3B3 Manure Management - Swine and pollutant PM_{2.5} for years 1990-2004 the TERT noted that there has been a significant decrease in IEF from 2004 to 2010 (0.08 vs 0.008 kg/head). In response to a question raised during the review, Italy explained that from 2010 PM_{2.5} emission estimates are based on emission factors provided by the 2016 EMEP/EEA Guidebook. These emission factors are based on studies conducted between 2006 and 2016 which include scientific works conducted in Italy. These studies have suggested that Takai's emission factors suggested in the 2006 EMEP/CORINAIR Guidebook are too high and do not represent current particulate emission levels. A gradual transition to the new factors has been assumed for the intermediate years (2004-2010) taking in account the gradual penetration of the abatement technologies. The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT disagree with the explanation of Italy and recommends that the EFs in 2016 EMEP/EEA Guidebook are used in its next submissions, unless more appropriate country specific EF are available. In this case the TERT recommends that Italy includes information on the gradual penetration of the abatement technologies, all</p>	Additional information has been included in paragraph 6.2.

Observation	Key category	NFR, Pollutant(s), Year(s)	Recommendation	Implementation
			country specific EFs are documented (including references) and all assumptions are accompanied by a clear justification of the applicability.	
IT-3Da1-2017-0001	Yes	3Da1 Inorganic N-fertilizers (includes also urea application), NH ₃ , 1990-2015	For category 3D1a Inorganic N-fertilizers (includes also urea application) and pollutant NH ₃ , years 1990-2015 EFs presented in 2002 EMEP/CORINAIR were used. In response to a question raised during the review, Italy explained the methodology used and provided revised estimates for the years. The TERT agreed with the revised estimates provided by Italy and it is attached to the annex of the review report. The TERT recommends that Italy revises NH ₃ estimates according to the availability of country specific data of soil pH in the next submission.	NH ₃ emissions have been updated according to the review recommendation.
IT-3Da1-2017-0002	No	3Da1 Inorganic N-fertilizers (includes also urea application), NO _x , 1990-2015	For category 3Da1 Inorganic N-fertilizers (includes also urea application) and pollutant NO _x for years 1990-2015 the TERT noted that emissions are not reported using the methodology from the 2016 EMEP/EEA Guidebook, but instead using the methodology from the 2007 EMEP/Corinair Guidebook. In response to a question raised during the review, Italy indicated that the methodology and EF of the 2016 EMEP/EEA Guidebook for the estimates of NO _x emissions of 3Da1 Inorganic N-fertilizers will be provided in the next submission. The TERT recommends that the 2016 EMEP/EEA Guidebook is used to estimate and report emissions in the next submission.	NO _x emissions have been updated according to the review recommendation.
IT-3Da2b-2017-0001	No	3Da2b Sewage Sludge Applied to Soils, NH ₃ , 1990-2015	For categories 3Da2b Sewage Sludge Applied to Soils and 3Da2c Other Organic Fertilisers Applied to Soils (Including Compost) and pollutants NH ₃ and NO _x for years 1990-2015, the TERT noted that Italy uses the volatilization factor included in the 2006 IPCC Guidelines for NH ₃ -N and NO _x -N losses. In response to a question raised during the review, Italy indicated that it will use the methodology and EF of the 2016 EMEP/EEA Guidebook for these estimates in the next submission and results will be compared with the current estimates. The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends Italy to implement the 2016 EMEP/EEA Guidebook methodology in the next submission.	NH ₃ and NO _x emissions have been updated according to the review recommendation.
IT-3Dc-2017-0001	No	3Dc Farm-Level Agricultural Operations Including Storage, Handling and Transport of Agricultural Products, PM _{2.5} ,	For category 3Dc Farm-level Agricultural Operations Including Storage, Handling and Transport of Agricultural Products and pollutant PM _{2.5} for years 1990-2015, the TERT noted that emissions are reported as 'NA'. In response to a question raised during the review, Italy explained that "The required estimate was already planned for the next submission. On the basis of the emission factors provided by the Guidebook for the Tier 1 and the cultivated arable area the weight of emissions estimates for	PM emissions have been estimated.

Observation	Key category	NFR, Pollutant(s), Year(s)	Recommendation	Implementation
		1990-2015	these categories on the total PM _{2.5} is on average equal to 0.2% for the period 1990-2015. Current information for applying the Tier 2 method is unavailable". The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends that PM _{2.5} emissions for 3Dc are estimated and reported in the next submission.	
IT-3De-2017-0001	No	3De Cultivated crops, NMVOC, 1990-2015	For category 3De Cultivated Crops and NMVOC for years 1990-2015 the TERT noted that emissions are reported as 'NA'. In response to a question raised during the review, Italy explained that using Tier 1, the weight of emission estimates for these categories on the total NMVOC would be on average equal to 0.6% for the period 1990-2015 and that this estimate has been already planned for inclusion in future submissions. The TERT recommends that Italy applies the 2016 EMEP/EEA Guidebook methodology for estimating NMVOC emissions from cultivated crops in the next submission.	NMVOC emissions have been estimated.
IT-3F-2017-0001	No	3F Field burning of agricultural residues, SO ₂ , NH ₃ , 1990-2015	For category 3F Field Burning of Agricultural Residues and pollutants SO _x and NH ₃ for years 1990-2015, the TERT noted that emissions are reported as 'NA'. In response to a question raised during the review, Italy explained that on the basis of the emission factors provided by the Guidebook for the Tier 1 the weight of emissions estimates for this category on the total is on average equal to 0.12% for the period 1990-2015 for NH ₃ and 0.004% in 1990 and 0.067% in 2015 for SO _x . The TERT noted that this issue is below the threshold of significance for a technical correction. The TERT recommends that Italy applies the 2016 EMEP/EEA Guidebook methodology to estimate and report emissions of 3F in the next submission.	SO _x and NH ₃ emissions have been estimated.

Improvements and QA activities

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

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 *2018 submission*³⁰.

Results from the MeditAIRaneo project³¹ 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.

³⁰ Córdor R.D., Di Cristofaro E., 2018. *Procedura per la preparazione, caricamento e reporting dell'inventario nazionale delle emissioni 1990-2016, settore agricoltura. Rapporto interno VAL-ATM/ISPRA*. Roma – Italia.

At the end of 2009 another research study related to land spreading estimations and scenario was completed³².

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, 2013 and 2016 Farm Structure Survey (FSS), and 2020 Agricultural Census. This exercise will allow obtaining information useful as required by the EC regulation and the improvement of the emission inventory, which will include peculiarities of agricultural production in Italy.

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-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^{33,34}. Still further efforts on theoretical assessment of nitrogen excretion data will be done base on N balance methodology³⁵. 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.

Regarding uncertainty analysis applied to GHG estimates, Monte Carlo analysis has been extended to other key categories of the sector, the estimation of uncertainties are shown in the *NIR submission 2014*.

³¹ CRPA, 2006. Progetto MeditAIRaneo: settore Agricoltura. Relazione finale. Technical report on the framework of the MeditAIRaneo project for the Agriculture sector, Reggio Emilia – Italia.

³² 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.

³³ De Roest and Speroni, 2005. *Il bilancio dell'azoto negli allevamenti di latte*. Agricoltura. Marzo 2005. pag 112-114

³⁴ 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.

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

In November 2014 submission, revised CH₄ and N₂O 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.

In 2014, as regards CH₄ 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.

In 2016, some updates have been done: as regards CH₄ emissions from enteric fermentation, Tier 2 methodology has been applied for sheep category; data on biogas from digesters used for energy production provided by TERNA have been updated and biogas flared has been estimated in response to the 2016 UNFCCC review process; N₂O emissions from nitrogen leaching and run-off during manure management activities have been estimated; for liming category, additional information has been collected from the industry on the amount of dolomite and limestone applied and the weighted average emission factor has been used to estimate CO₂ emissions.

As a part of QC activities and data verifications, 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.

Data on cow's milk collection from farms for dairy industry provided by the AGEA³⁶ were compared to official statistics provided by ISTAT, for the years 2004-2015. Data from AGEA are on average higher by 6% in the years 2004-2007 and 3% in the years 2011-2013. In other years, the differences are negligible, in particular for the years 2014 and 2015.

Differences on sheep's milk collection data are found between FAOSTAT and national statistics. For the years 1990-1995, FAO data are higher on average more than 40%, then the difference decreases. After 2003, FAO data becomes lower than official ISTAT statistics. In the period 2005-2008, FAO data is equal to the total of the milk collected at the farms including the amount used on farms. The milk directly suckled by calves is not considered. In the period 2009-2013, FAO data is only equal to the total of milk collected at the farms. Further investigation will be carried out.

Data on national sales of synthetic nitrogen fertilizers (by type of fertilizers) as provided by *Assofertilizzanti – Federchimica* (personal communication) for the period 2012-2015 have been compared to official statistics provided by ISTAT and used to estimate the FSN amount. Differences were mainly found for the amount of simple mineral nitrogen fertilizers, where data from *Assofertilizzanti* are higher by 20%, on average, for the years 2013-2015. This could be due to a possible double counting of some product which could be considered as a single product and as a compound with other fertilizers. Further investigations will be conducted.

Concerning compost data, from waste sector only data on compost production are available. Official statistics provided by ISTAT on compost used in agriculture sector (that is the green and mixed amendments) are compared to data on compost from waste sector. For the year 2015, the amount of compost used is 58.1% of the compost production only from plants that treat a selected waste.

³⁶ AGEA is the Agency for Agricultural Payments. The Agency has the task of performing the functions of coordination, monitoring and disbursement of European funds for agriculture - <http://www.agea.gov.it/portal/page/portal/AGEAPageGroup/HomeAGEA/home>. Data are available online at the link <http://www.sian.it/downloadpub/jsp/zfadlx001.jsp> (the filename is *Riepilogo per regione di produzione delle consegne mensili non rettificata registrate*).

In 2017 submission, in response to the UNFCCC review process, the cross check of crop residues with the calculations of the amount of organic bedding materials added to animal manure available for application to soils has been done. The estimated amount of nitrogen in bedding materials is equal to 66% of the nitrogen contained in straw removed from wheat and barley crops, for the year 2015.

In 2018 submission, some updates have been done: on the basis of the 2010 General Agricultural Census data on housing distribution for dairy cattle category, the production of manure both liquid/slurry and solid has been updated, involving a change in the methane emission factors. Based on the 2010 General Agricultural Census and the 2013 Farm Structure Survey data on manure management systems, NH₃ emission factors for cattle, buffalo, swine and poultry categories and CH₄ emission factors on manure storage for swine category have been updated. NO_x emissions from storage have been updated according to the Tier 2 methodology reported in the last version of the EMEP/EEA Guidebook (EMEP/EEA, 2016). NH₃ emissions from digesters biogas facilities have been estimated and subtracted from manure management category (cattle and swine) and allocated in the anaerobic digestion at biogas facilities (5B2 of the waste sector in the NFR classification under UNECE/LRTAP Convention). N₂O emissions have been recalculated according to the update of the average value of Frac_{LEACH-(H)} for the entire national territory based on a country specific methodology.

As a part of QC activities and data verifications, the verification of statistics was carried out: the comparison between Istat and *Assofertilizzanti* data on 2016 national sales of synthetic nitrogen fertilizers was also made. 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 CH₄ 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 N₂O 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 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. Following the suggestion of the CRA experts, in the estimation of N₂O 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.

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
Enteric fermentation	Sheep	Emission factor	CH ₄	Additional data and information will be collected to improve the estimation of methane emissions from sheep.	2018

Category	Subcategory	Parameter	Gas	Description	Timing
Manure management	Dairy cattle	N excretion	N ₂ O	Further efforts on theoretical assessment of N excretion data will be done based on N balance methodology (Gruber and Poesch, 2006) ³⁷ .	2019
	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 ³⁸).	2019
Agricultural soils	Agriculture soils	Land spreading	NH ₃ /GHG	Figures on land spreading collected in the framework of the 2016 Farm structure survey will be considered for the next annual submission.	2018

National statistics

The implementation of an *ad hoc* survey on “Agricultural Production Methods”, namely Farm and structure survey (FSS), 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. Data from 2010 Agricultural Census and FSS 2013 were analyzed and the emission factors of ammonia, the values of nitrogen excreted between liquid and solid manure of some categories of livestock and methane emission factors of dairy cattle and swine categories were updated based on the results of the calculations. FSS 2016 data on manure spread data are not yet available. A survey on the digesters was conducted by the CRPA in 2016. The outcomes of the survey, which should be available in the course of 2018, will be used to verify the accuracy of the estimates.

Estimation improvements

Information and administrative data related to number of heads, average weight by livestock category, food rations of livestock for cattle and swine, milk production data will be collected by the Ministry of Economic Development as part of the Decree of Ministry for the Environment, Land and Sea 9 december 2016 *Attuazione della legge 3 maggio n. 79 in materia di ratifica ed esecuzione dell’Emendamento di Doha al Protocollo di Kyoto* (GU, 2016) and comparisons and verifications with the data used to estimate emissions will be carried out.

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, a study on the best available used in agriculture practices to reduce emissions are under investigation.

³⁷ 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>

³⁸ 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

**QA/QC LULUCF
2017 ACTIVITIES AND FUTURE IMPROVEMENTS**

Prepared by: Marina Vitullo

April, 2018

NATIONAL AIR EMISSION INVENTORY: LULUCF

Objective

The report summarizes the improvements and remarks, which have been identified during the preparation of the 2018 inventory submission for the LULUCF sector.

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 2016, are described. No review has taken place in 2017.

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

CRF category / issue	Review recommendation	Review report / paragraph	MS response / status of implementation	Chapter/sec tion in the NIR
LULUCF General	Review of the use of the notation key so it is clearer what methods are used or if some pools are not estimated	L.3	Notation keys have been changed accordingly	Chapter 6
LULUCF/ 4.A Forest land – CO ₂	Provide in the NIR documentation summarising harvest removal from short rotation crops, coppices and high forest categories so that drivers influencing trends in biomass stock changes can be made more evident	L.6	Additional information has been included in the NIR	Chapter 6 paragraph 6.2.4
LULUCF/ 4.A Forest land – CO ₂	Provide definition and thresholds for carbon pools in a table in the NIR	L.7	Additional information has been included in the NIR	Chapter 6 paragraph 6.2.4
LULUCF/ 4.A.1 Forest land remaining forest land – CO ₂	In response to a recommendation made in the 2013 review report, Italy included plantations in the forest category instead of in the cropland category from the beginning of its 2016 submission. This inclusion can be observed in CRF table 4.A but is not clearly reported in the NIR. The ERT commends the Party for this improvement and recommends it to include information in the NIR indicating that plantations are included in the forest category instead of cropland in order to be consistent with the CRF tables	L.12	Additional information has been included in the NIR	Chapter 6 paragraph 6.2.2
LULUCF/ 4.C.1 Grassland remaining grassland – CO ₂	Italy has reported carbon stock change in mineral soils in grazing land management under the KP but has not reported the same pool in GL remaining GL under the Convention During the review, Italy explained that improved grazing land ... is a subset of the grassland area and that the Party has a planned data collection and model implementation for the soils pool for the grassland area. The ERT welcomes these planned improvements and recommends that the Party include this subset in the CFR tables and the NIR under the Convention while the new information is becoming available	L.14	Data of land subject to grazing land management has been derived from the National System on Organic Farming; quantitative information on the different subcategories, including organic grazing land, is available from the year 1999. Verification activities are currently ongoing to assess the data related to the land subject to the organic grazing land from 1990 to 1998 in order to include this subset (improved grazing land) as a subset of the grassland area, consequently reporting the relative carbon stock changes in mineral soils.	Chapter 6 paragraph 6.4; Chapter 9, paragraph 9.2
LULUCF/ 4.(I) direct	Report direct N ₂ O emissions from nitrogen fertilization as "IE" and transparently explained	L.10	Notation key has been changed and additional information has	Chapter 6 paragraph 6.8

N ₂ O emissions from nitrogen inputs to managed soils	these emissions are reported under the agriculture sector (with a cross reference to the relevant section in the NIR)		been added in the NIR	
KP-LULUCF/ Article 3.4 activities – CO ₂	Under the KP, the Party reported 'NA' for the litter pool and 'NO' for dead wood pools for cropland management and also reported 'NO' for Above-ground biomass, Below-ground biomass, Litter and Dead wood for grassland management. During the review week the Party explained that for cropland management a Tier 1 was applied assuming that the dead wood and litter stocks are not present in Cropland or are at equilibrium as in agroforestry systems and orchards and that a Tier 1 value was also applied for the pools in Lands under GM for aboveground and belowground biomass, litter and dead wood pools, assuming that they are at equilibrium. The ERT recommends that the Party include transparent and verifiable information that demonstrates that these pools are not a source, as it is stated in the Annex to Decision 2/CMP.7 and to change the notation key from 'NO' to 'NE'	KL.2	Additional information has been added in the NIR	Chapter 9 paragraph 9.5
KP-LULUCF/ Forest management – CO ₂	The ERT notes that Italy has not reported its FMRL in its CRF tables; the NIR correctly references the values presented in the appendix to the annex of decision 2/CMP.7 (–21.182 Mt CO ₂ eq assuming instantaneous oxidation and –22.166 Mt CO ₂ eq applying a first order decay function for HWP). The ERT recommends that Italy complete CRF table 4(KP-D)B.1.1 to include the FMRL as included in the appendix to the annex to decision 2/CMP.7	KL.3	CRF Tables have been corrected and completed	Chapter 9 paragraph 9.5.2
KP-LULUCF/ Forest management – CO ₂	Italy described ... the methodological elements that trigger a methodological inconsistency between the FMRL and FM reporting. It is noted in the NIR that a recommendation was made in the technical assessment of the FMRL in 2011 to make a technical adjustment. However, the Party has not presented the technical correction. ... The ERT recommends that the Party report the FMRL correction in the next submission and complete the relevant CFR tables with the current and corrected values	KL.4	The need for the application of a technical correction has been detected. The technical correction has been elaborated and included in the 2018 submission, consistently with the requirements of decision 2/CMP.7, annex, paragraph 14 and guidance of the 2013 KP Supplement (IPCC, 2014, par. 2.7.6.3).	Chapter 9 paragraph 9.5.2

Inventory improvements and QA activities

Forest land (4A)

The 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 and included in the determination of Italy's assigned amount under Article 7, paragraph 4, of the Kyoto Protocol, and the election of the art. 3.3 and 3.4 activities, by a national expert panel set up under the coordination of Ministry of Environment and in cooperation with the Ministry of Agriculture, Food and Forest Policies. The abovementioned panel involves, on a voluntary basis, the relevant national experts, including the forest inventory experts (http://www.sian.it/inventarioforestale/jsp/home_en.jsp), members of the FAO-FRA Italian panel (<http://www.fao.org/docrep/013/al537E/al537E.pdf>) and other national researchers. The national expert panel has considered the Kyoto Protocol rules and requirements, related to

reporting and accounting of art. 3.3 and 3.4 activities, and agreed the national forest definition. In the same context, national circumstances (e.g. forest composition, forestry management practices, agroforestry practices, etc.) were examined and it was decided to classify shrubland in the grassland category because they do not fulfil national forest definition; in the 2014 submission, following a key finding in the 2013 review process, the plantations, previously classified in the cropland category, have been included in forest. Several activities have been implemented and carried out; following the election of Cropland Management and Grazing land Management activities under article 3.4 of the Kyoto Protocol, the Ministry for the Environment, Land and Sea (MATTM) jointly with the Ministry of Agriculture, Food and Forest Policies (MIPAAF) has established a Committee of National experts at institutional and scientific level, aimed to deal with all issues related to reporting and coordination of activities related to LULUCF reporting, included also the needs set out by the Kyoto Protocol. A specific aim of the abovementioned Committee is to deal with land use representation issue: the current inventory submission is based on the outcomes of IUTI, the inventory of land use with a national coverage. Verification and validation activities are usually undertaken and the resulting time series are discussed with the institutions involved in the data providing (i.e. National Forest Service, Ministry of Agricultural, Food and Forestry Policies (MIPAAF), Forest Monitoring and Planning Research Unit (CRA-MPF)).

In addition, a specific Decree³⁹ was adopted by Ministry for the Environment, Land and Sea to fulfil the requirements outcoming from the ratification of the Doha amendment to the Kyoto Protocol establishing the second commitment period. The technical annex to the abovementioned Decree is including detailed list, for each reporting sector, of the needed data and timeframes; the relevant data providers have been identified and included in the same Decree. The entry into force of the Decree is expected to facilitate the data collection as well as to increase the quality and timeliness of the gathered data.

Cropland (4B)

For the land use conversion, land use change matrices have been used; as abovementioned, LUC matrices for each year of the period 1990–2016 have been assembled on the basis of the IUTI data, related to 1990, 2000 and 2008 and 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 technical annex to the abovementioned Decree related to the Doha amendment to the Kyoto Protocol includes a detailed list, for each reporting sector, of the needed data and timeframes; the relevant data providers have been identified and included in the same Decree. The entry into force of the Decree is expected to facilitate the data collection as well as to increase the quality and timeliness of the gathered data.

Grassland (4C)

Consistently with the forest definition adopted by Italy in the framework of application of elected 3.4 activities, under Kyoto Protocol, shrublands 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 1990–2016 have been assembled on the basis of the IUTI data, related to 1990, 2000 and 2008 and 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

³⁹ Decree of Ministry for the Environment, Land and Sea 9 december 2016 Attuazione della legge 3 maggio n. 79 in materia di ratifica ed esecuzione dell'Emendamento di Doha al Protocollo di Kyoto (GU, 2016).

scale (NUTS2). 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. The technical annex to the abovementioned Decree related to the Doha amendment to the Kyoto Protocol includes a detailed list, for each reporting sector, of the needed data and timeframes; the relevant data providers have been identified and included in the same Decree. The entry into force of the Decree is expected to facilitate the data collection as well as to increase the quality and timeliness of the gathered data.

Wetlands (4D)

For the land use conversion, land use change matrices have been used; as abovementioned, LUC matrices for each year of the period 1990–2016 have been assembled on the basis of the IUTI data, related to 1990, 2000, 2008 and 2012, through linear interpolations for the periods 1990-2005, 2005-2012 and linear extrapolation for 2012-2016. 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.

Concerning land converted to wetland, during the period 1990-2016, cropland and grassland categories have been converted into wetlands area.

Settlements (4E)

For the land use conversion, land use change matrices have been used; as abovementioned, LUC matrices for each year of the period 1990–2016 have been assembled on the basis of the IUTI data, related to 1990, 2000, 2008 and 2012, through linear interpolations for the periods 1990-2005, 2005-2012 and linear extrapolation for 2012-2016. 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 2016, 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.

Harvested wood products (HWP) (4G)

Annual changes in carbon stocks and associated CO₂ emissions and removals from the Harvested Wood Products (HWP) pool are estimated, following the production approach described in the Annex to Volume 4, Chapter 12, of the 2006 IPCC Guidelines (IPCC, 2006), in line with Decision 2/CMP.7 and the guidance provided by the 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (KP Supplement, IPCC 2014).

Biomass Burning (4V)

CH₄ and N₂O 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. CO₂, CH₄ and N₂O 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 1990-2016, 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 2008-2016, 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 regions⁴⁰ (the 5 autonomous regions are not included), reporting, for each fire event, the following information:

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

Data and information related to fire occurrences in the 5 remaining autonomous regions are collected at regional level, with different level of disaggregation and details (for example, in Sardinia region, the amount of biomass burned is reported instead of the scorch height). Detailed description of the methodological issues is included in the NIR (§6.12.1).

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.

Supplementary information required under Article 7.1 of the KP - art. 3.3 (Afforestation/Reforestation/Deforestation) and art. 3.4 (Forest Management, Cropland Management, Grazing land 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 par. ***Forest land (4A)***.

Verification and validation activities are usually undertaken and the resulting time series are discussed with the institutions involved in the data providing (i.e. National Forest Service, Ministry of Agricultural, Food and Forestry Policies (MIPAAF), Forest Monitoring and Planning Research Unit (CRA-MPF)).

The methodological consistency between the Forest Management Reference Level (FMRL), and reporting for *forest management* during the second commitment period has been checked, in accordance with the Decision 2/CMP.7. In particular, in the 2018 submission the methodological elements listed in paragraph 2.7.5.2 (IPCC, 2014) have been analyzed, providing a description on the detected inconsistencies (NIR, §9.5.2.3, Table 9.14).

The changes related to the methodological elements listed in abovementioned Table 9.14 of the NIR 2018 are triggering a methodological inconsistency between the FMRL and FM reporting, to be addressed through a technical correction (TC). Therefore to ensure methodological consistency between the FMRL and reporting for Forest Management during the second commitment period, the FMRL has been recalculated (FMRL_{corr}) in order to deduce the technical correction to the FRML.

The key element is the use, in the elaboration of the FMRL_{corr}, of the same model used in the FM reporting (i.e. the For-est model, as described in NIR 2018, §6.2.4 and §9.3.1.1); in addition the latest available activity data (i.e. forest areas, harvest statistics, fires occurrences) have been used and the HWP have been estimated following the 2013 KP Supplement (IPCC, 2014) methodology.

The resulting FMRL_{corr} and the related technical correction is provided in the NIR (Table 9.15).

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*

⁴⁰ 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).

Consultazione Scientifica del Registro dei Serbatoi di Carbonio, 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.

Following the election of Cropland Management and Grazing land Management activities under article 3.4 of the Kyoto Protocol, the Ministry for the Environment, Land and Sea (MATTM) jointly with the Ministry of Agriculture, Food and Forest Policies (MIPAAF) has established a Committee of National experts at institutional and scientific level, aimed to deal with all issues related to reporting and coordination of activities related to LULUCF reporting, included also the needs set out by the Kyoto Protocol.

Land subject to *grazing land management* have been assessed based on the definition included in the Annex to the decision 16/CMP.1. As preliminary step, only the area related to the 'improved grazing land' have been reported; this area corresponds to lands subject to inspections and certifications procedures, in accordance with the EU Regulations on organic production, as well as by the Rural Development Regulations⁴¹ related to the organic farming measure. Data of grazing lands managed with organic practices has been derived from the National System on Organic Farming (SINAB, <http://www.sinab.it/>) of the Ministry of Agriculture, Food and Forest Policies (MIPAAF). An update of the assessment of the country specific SOC_{ref} has been carried out using the following layers: Climatic Zone layer, Corine Land Cover 2006 (classes codes: 2.3, 3.2), Italian soil map. The country specific SOC_{ref} have been stratified into three macroareas in Italy (north, center and south).

Planned improvements

In the following, specific improvements and remarks to be considered in the next submission of the national GHG inventory for LULUCF sector are reported.

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 to be included in the next submissions.

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.

⁴¹ Regulation (EEC) n. 2078/92: http://ec.europa.eu/agriculture/envir/programs/evalrep/text_en.pdf;
Council Regulation (EC): n. 1257/1999 <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999R1257&from=en>;
Council Regulation (EC) n. 1698/2005: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32005R1698&from=en>;
Regulation (EU) n. 1305/2013: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0487:0548:EN:PDF>

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 2019	2019-2020
Biomass burning	Activity data		GHG	Verification activities comparing EU data sources (i.e. EFFIS).	2019
Cropland	CL	Activity data	GHG	Verification activities, data collection and model implementation for soils pool; data collection and reporting at regional level	2018-2019
Grassland	GL	Activity data	GHG	Verification activities, data collection and model implementation for soils pool; data collection and reporting at regional level	2018-2019
Settlements	SL-SL	Activity data	CO ₂	Data collection	2019
HWP	HWP	emission factors	CO ₂	Analysis on the end-use, the discard rates of HWP, as well as the final market use of wood in Italy. The main outcome of this investigation could be the set-up of country specific emission factors to be used in the estimation process	2020
Uncertainty	Uncertainty	-	-	Re-assessment of uncertainty analysis following Approach 2 (Montecarlo)	2019
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 2019	2019-2020
	CM	Activity data; emissions/rem ovals	CO ₂	Data collection and verification activities	2018-2019
	GM	Activity data; emissions/rem ovals	CO ₂	Data collection and verification activities	2018-2019

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

Forest land (4A)

The implementation of the III national forest inventory, which has already completed the first phase related to forest area assessment, is increased 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 the 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.

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.

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 late 2017, a LIFE project, named MEDINET⁴², has started its activities, aimed to built an compilation of existing knowledge and data with relevance for reporting croplands and grasslands emissions in Mediterranean conditions, in particular for mineral soil and aboveground biomass of perennial crops. Two main reports have been produced by the project: “Gains and Losses in Living Biomass and Deadwood” and “Gains and Losses in Soils”, collecting data, emission factor and Soil Organic Contents to be applied in the Mediterranean region for different crops and management practices. The data included in the abovementioned report will be examined and potentially used in the next annual submission.

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

Specifically, the following activities are included:

- 1) Implementation of country-specific recommendations developed by JRC, based, inter alia, on the latest 2012 UNFCCC ARRs, the JRC QA/QC process, the new LULUCF rules for the 2nd CP, and the latest IPCC guidance.
- 2) For Forest Management and *forest land remaining forest land* the latest GHG inventory will be compared with estimates provided for all carbon pools by the forest Carbon Budget Model (CBM), run by the JRC. In line with the IPCC guidance, this comparison could be seen as a "verification activity", whose purpose is to build confidence on the reported estimates and trends, help scientific understanding, and when relevant provide possible inputs to improve inventories.

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

⁴² MEDINET: Mediterranean Network for Reporting Emissions and Removals in Cropland and grassland
<http://www.lifemedinet.com/>

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 late 2017, a LIFE project, named MEDINET⁴³, has started its activities, aimed to built an compilation of existing knowledge and data with relevance for reporting croplands and grasslands emissions in Mediterranean conditions, in particular for mineral soil and aboveground biomass of perennial crops. Two main reports have been produced by the project: “Gains and Losses in Living Biomass and Deadwood” and “Gains and Losses in Soils”, collecting data, emission factor and Soil Organic Contents to be applied in the Mediterranean region for different crops and management practices. The data included in the abovementioned report will be examined and potentially used in the next annual submission.

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 ARR, 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.

Wetlands (4D)

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*) started its activities; the project, coordinated by the National Institute of Statistics and promoted by EUROSTAT, 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.

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*) started its activities; the project, coordinated by the National Institute of Statistics and promoted by EUROSTAT⁴⁴, 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

⁴³ MEDINET: Mediterranean Network for Reporting Emissions and Removals in Cropland and grassland
<http://www.lifemedinet.com/>

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

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).

Harvested wood products (HWP) (4G)

Planned improvements are related to the investigation on the end-use, the discard rates of HWP, as well as the final market use of wood in Italy. The main outcome of this investigation could be the set-up of country specific emission factors to be used in the estimation process. A review will also be undertaken aiming to better understand the interactions among the different sectors to which the HWP pool is related (i.e. LULUCF/forest land, the Energy sector and the Waste sector).

Biomass Burning (4V)

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 EFFIS⁴⁵.

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 2019, is foreseen for the 2019-2020 submissions; 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.

Supplementary information required under Article 7.1 of the KP - art. 3.4 (Grazing land Management)

In the framework of the specific section of the *national registry for carbon sinks*, an ongoing process is focused on data collection of land subject to cropland management have been assessed on the basis of the following subcategories:

subcategories	data sources	notes
land covered by arable crops and woody crops subject to inspections and certifications, in accordance with the EU Regulations on organic production ⁴⁶	National System on Organic Farming (SINAB, http://www.sinab.it/) of the Ministry of Agriculture, Food and Forest Policies (MIPAAF).	Data from SINAB are collected at national level for the total organic area starting form 1990
land covered by arable crops grown using " conservative practices ", including management practices aimed to preserve the soil ⁴⁷	Implementation Report Tables ⁴⁸ (AIRs) of the regional Rural Development Programmes (RDs).	Data have been collected at regional level (NUTS2), from 2008

⁴⁵ European Forest Fire Information System (EFFIS): <http://forest.jrc.ec.europa.eu/effis/>

⁴⁶ Council Regulation (EEC) No 2092/91: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991R2092:EN:HTML>, Commission Regulation (EC) n. 889/2008: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008R0889&from=EN>; Council Regulation (EC) n. 834/2007: <http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:f86000&from=IT>; Council Regulation (EEC) n. 2092/91: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991R2092:EN:HTML>; Rural Development Regulations – organic farming measure (Regulations (ex) 2078/1992, (ex) 1257/1999, (ex) 1698/2005 and 1305/2013)

⁴⁷ in accordance with the Regulation (EEC) n. 2078/92: http://ec.europa.eu/agriculture/envir/programs/evalrep/text_en.pdf, (ex) 1257/1999, Council Regulation (EC) n. 1698/2005: <http://eur-lex.europa.eu/legal->

land covered by arable crops and woody crops grown using “ sustainable management systems ” ⁴⁹ ,	AIRs of the regional RDPs ⁵⁰ and the Annual Report of the Operative Programmes of the fruit and vegetables in the framework of CMO ⁵¹ , being the integrated production funded under these two schemes.	Data have been collected at regional level (NUTS2), from 2000. The AIRs data have been broken down by arable crops and woody crops by applying the indicators contained in the national database ⁵² .
land set aside ⁵³	Eurostat and are available for 1990, 1993, 1995, 1997, 2000, 2003, 2005 and 2007.	Data for the missing years have been estimated by interpolation
land covered by arable crops and woody crops grown using “ ordinary agriculture ”	Data of land using “ordinary agriculture” is obtained by difference between the total area detected by national statistics (ISTAT) and the data related to the abovementioned subcategories	
land subject to greening practices , in accordance with the EU Regulation 1307/2013		

Verification activities are currently ongoing; data collection will be used in the estimation process for the 2019 inventory submission.

Supplementary information required under Article 7.1 of the KP - art. 3.4 (Grazing land Management)

An update of the data subject to the *grazing land management* is planned; in the 2018 submission only the area related to the ‘improved grazing land’ have been reported, corresponding to the lands subject to organic production. A specific work is currently ongoing to enlarge the area currently reported under GM activities, by the inclusion of additional subcategories.

[content/EN/TXT/PDF/?uri=CELEX:32005R1698&from=en](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32005R1698&from=en), and Regulation (EU) n. 1305/2013: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0487:0548:EN:PDF>

⁴⁸ http://ec.europa.eu/agriculture/cap-indicators/output/working-document-rd-monitoring-implementation-report-tables_en.pdf in the framework of the EU’s rural development policy: http://ec.europa.eu/agriculture/rural-development-2014-2020/index_en.htm; for 2007-2014 referred to action 214.6)

⁴⁹ in accordance with the national guidelines on integrated production and with the EU Regulations on the Rural Development (Regulations (ex) 2078/1992, (ex) 1257/1999, (ex) 1698/2005 and 1305/2013

⁵⁰ for 2007-2014 referred to action 214.1 – tables O.214(1) and O.AGRI.ENV

⁵¹ Common Organisation of the Markets (CMO) in agricultural products http://www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuId=FTU_5.2.4.html

⁵² “Indicatori Agricoli Territoriali”, National Rural Network: <http://indiciterritorialiagricoli.ismea.it>

⁵³ EU Regulations ((ex) 1094/88; (ex) 1765/92 e 1251/99; (ex) 1782/03 and 1307/2013) and National decree on cross compliance implementation (ex) DM 22.12.2009 and DM 23.1.2015

QA/QC WASTE
2017 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Barbara Gonella, Ernesto Taurino

April, 2018

NATIONAL AIR EMISSION INVENTORY: WASTE

Objective

This report summarises the improvements, which have been identified during the preparation of the 2018 inventory submission for the waste sector.

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
w.1	5.C.1 - Waste incineration – CO ₂ - accuracy	Apply the time-series carbon content as well as fossil carbon fraction in line with the variation of the waste compositions, and report thereon	A survey is in progress to check the variability of the fossil carbon content in the waste to be incinerated. More info will be added in next NIRs
w.2	5.A.1 Managed waste disposal sites- CH ₄	The ERT recommends that the Party develop a continuous time-series of the methane generation constant instead of using the step function variation over the relevant periods	The review of estimates is on-going and is a general process as it includes the review of waste composition, other parameters such as DOCs and also the evaluation of landfill sites in the various climatic zones of Italy.
w.3	5.A.1 Managed waste disposal sites- CH ₄	The ERT recommends that the Party make the necessary changes to the degradable organic carbon fraction in CRF table 5A to improve the consistency between the NIR and the CRF tables	Current k values are a partial result of an on-going survey which confirm that the k values probably should be lower. Consequently, for the forthcoming submission Italy plans to review several parameters (k included) taking into account the contents of this review.
w.4	5.A.2 Unmanaged waste disposal sites- CH ₄ , N ₂ O	The ERT recommends that the Party provide information supporting implementation of legal reforms to reduce to zero, the amount of waste deposited in unmanaged landfills, together with an illustration of the trend in the decrease of waste deposited in unmanaged landfills	

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

Review report para	Subject	Description	Response
IT-5A-2017-0001	5.A Solid waste disposal, CH ₄ , 1990-2015	...The TERT recommends that Italy include a revised estimate in its next submission.	Italy has investigated more deeply the country specific conditions and revised the k-values considering the subdivision of the national territory in dry or wet zones on the basis of georeferenced data (30 km grid) and revised estimates have been supplied

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

Review report para	Subject	Description	Response
IT-5A-	5A Biological	... The TERT notes that this issue does not relate to an over-	More info in the relevant para of the

2017-0001	treatment of waste - Solid waste disposal on land, SO ₂ , NO _x , NMVOC, PM _{2.5} , 2005, 2010, 2015	or under-estimate and recommends that Italy includes a clear description in the next IIR on the recovery and uses of landfill gas and the allocation of associated emissions.	NIR
IT-5D-2017-0001	5D Wastewater handling, NMVOC, 2005, 2010, 2015	...The TERT recommends that Italy calculates these emissions and reports them in the next submission.	Italy is still investigating for a NMVOC national emission factor
IT-5E-2017-0001	5E Other waste, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , 2005, 2010, 2015	...The TERT recommends that Italy include a revised estimate in its next submission for all years.	Done

Inventory improvements and QA activities

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

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)⁵⁴.

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 (DIAR) of Politecnico di Milano⁵⁵, 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 submissions 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.

Following the discussion started during the European review a specific survey on methane emission factor from composting and the relationship with technologies and management practices has been conducted (ISPRA, 2017) resulting in a new emission factor equal to 0.65 kg CH₄/Mg waste treated on a wet weight basis.

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

⁵⁴ TERNA, several years. *Dati statistici sull'energia elettrica in Italia*. Rete Elettrica Nazionale.

⁵⁵ Solini, 2010. *Emissioni di gas serra dallo scarico e trattamento di acque reflue*. PhD tesi ISPRA, 2017. Update of CH₄ emission factor from composting. Technical note n.1/2017.

Table 4. 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.	2015-2018 on going
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.	2015-2018 on going
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.	2016-2018

Solid waste disposal on land

More recent data on the fraction of CH₄ 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.

Biological treatment of solid waste

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

Waste incineration

As reported for solid waste disposal on land, the waste composition is very important to improve CO₂ 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 in 2018.

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.

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. At present no NMVOC national emission factor has been evaluated. In the absence of any additional information, emissions calculated with the Tier 1 default emission factor reported in the EMEP/EEA emission inventory guidebook.

IMPROVEMENT PLAN

Prepared by: Riccardo De Lauretis

April, 2018

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 EMEP/EEA 2016 Guidebook	2017-2018
	-	-	-	Improve the QA/QC annual plan report with the description of the tier2 QC checks implemented at sectoral level	2017-2019
	-	-	-	Quantitative uncertainty analysis of emission estimates of other pollutants reported in the UNECE/CLRTAP framework	2017-2019
Energy	-	AD	-	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 (TERNNA) to the Ministry of Economic Development Activities for publication in the BEN	2017-2019
	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	2017-2019
	Off-road Industry	EFs	All	Survey on activity data and technological parameters of off-road vehicles	2018-2019
	Transport-maritime	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 these sectors	2017-2019
IPPU	Cement /lime production	AD	CO ₂	Further investigations concerning the replacement of natural raw material in clinker manufacture and in lime production	2018-2019

	Building industry	AD	PM10	Estimate and report emissions from categories 2A7a, “Quarrying and mining of minerals other than coal” and 2A7b, “Construction and demolition”	2018
	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	2017-2019
	Lead and zinc production	Allocation	All	Allocation of emission between combustion and process sectors	2017-2018
	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	2017-2018
	Paint application	EFs	HC CO ₂	Assess the possibility to split non industrial application according to the Guidebook EMEP/EEA	2018-2019
Agriculture	Livestock /Agriculture soils	EFs	NH ₃ GHG	Analysis of the information collected from the 2016 Farm structure survey with regard to land spreading	2018
	Dairy cattle	N excretion	N2O	Further efforts on theoretical assessment of N excretion data based on N balance methodology	2019
	-	Uncertainty	-	Re-assessment of uncertainty analysis with Montecarlo	2019
LULUCF	Forest land	-	GHG	Implementation of the III NFI’s outcomes; the final outcomes, related to the field surveys, are expected to be available in 2019	2019-2020
	Cropland /Grassland	AD/EFs	GHG	Verification activities, data collection and model implementation for soils pool, data collection and reporting at regional level	2018-2019
	Settlement	AD	CO ₂	Improvement of data collection	2019
Waste	Disposal on landfills and incinerators	AD	CO ₂ , CH ₄	Waste composition and Carbon content of waste managed in landfills or incinerated	2015-2018
	Domestic and commercial wastewater	MCF;AD	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.	2016-2018