QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR THE ITALIAN EMISSION INVENTORY
YEAR 2019

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

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

CONTENTS

QA/QC GENERAL
2018 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Daniela Romano, Riccardo De Lauretis

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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 2019 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 2018, the Italian inventory was submitted to a desk UNFCCC review; also, the European annual review of GHG emission inventories of Member States took place in 2018 and 2019, 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.

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

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

Also a bilateral independent review between Italy and Spain, with a focus on the revision of the GHG and air pollutant inventories of both the Parties was established in 2012. The Italian team revised part of the energy sector of Spain, specifically the categories public power plants, petroleum refining plants, road transport and off-road, whereas the Spanish team revised the industrial processes and solvent and other product use, and the LULUCF sectors of Italy. Results of these analyses are reported in a technical report[2]. Aim of the review was to carry out a general quality assurance analysis of the inventories in terms of the methodologies, the EFs and the references used, as well as analysing critical cross cutting issues such as the details of the national energy balances and comparison with international data (Eurostat and IEA), and use of plant specific information.

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

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

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

Expert peer reviews of the national inventory also occur annually within the UNFCCC process; results and suggestions can provide valuable feedback on areas where the inventory should be improved. Specifically, the last centralised review of the Italian GHG inventory by the UNFCC Secretariat occurred in September 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 approaches[3]. In 2008, VITO, Öko-Institut and the Institute for European Environmental Policy, for DG Environment, undertook a review on the methodologies and EU Member States best practices used for GHG projections to identify possible ways to improve GHG projections and ensure consistency across the EU. The results were presented at the Workshop 'Assessing and improving methodologies for GHG projections'. Further analyses were presented in the Workshop on 'Quantification of the effects on greenhouse gas emissions of policies and measures'.

The preparation of environmental reports, where data are needed at different aggregation levels or refer to different contexts, such as environmental and economic accountings, is also a verification for emission trends. At national level, for instance, emission time series are reported in the Environmental Data Yearbook published by the Institute[4]. Emission data are also published by the Ministry of Environment in the Reports on the State of the Environment[5], the National Communications[6] as well as in the Demonstrable Progress

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[2] AED, 2013. *Italy-Spain bilateral QA*
[3] Ecofys, 2001. *Evaluation of national climate change policies in EU member states. Country report on Italy*
[4] ISPRA, several years. *Environmental Data Yearbook*. ISPRA. http://www.isprambiente.gov.it/it/pubblicazioni/stato-dellambiente.
[5] MATT, several years. *RSA-Report on the State of the Environment*. Ministero dell'Ambiente. http://www.minambiente.it/biblioteca/relazione-sullo-stato-dellambiente-2009-sintesi
[6] MATT, several years. *National Communication under the UN Framework Convention on Climate Change*. Ministero dell'Ambiente. http://unfccc.int/files/national_reports/annex_i_natcom

report[7]. Moreover, figures are communicated to the National Institute of Statistics to be published in the relevant Environmental Statistics Yearbooks[8] as well as used in the framework of the EUROSTAT NAMEA accounting[9].

Comparisons between national activity data and data from international databases are usually carried out in order to find out the main differences and an explanation to them[10]. Emission intensity indicators among countries (e.g. emissions per capita, industrial emissions per unit of added value, transport emissions per car, emissions from power generation per kWh of electricity produced, emissions from dairy ruminants per tonne of milk produced) can also be useful to provide a preliminary check and verification of the order of magnitude of the emissions. This is carried out at European and international level by considering the annual reports compiled by the EC and the UNFCCC as well as related documentation available from international databases and outcome of relevant workshops.

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

The quality of the inventory has also improved by the organization and participation in sector specific workshops. Follow-up processes are also set up in the framework of the WGI under the EC Monitoring Mechanism, which address to the improvement of different inventory sectors. In 2008 and in 2014, workshops were held, on the implications of the implementation of the 2006 IPCC Guidelines for national GHG inventories. Other workshops addressed: the use of European emissions trading scheme data in the national greenhouse gas inventories, management of uncertainty in national inventories, methodologies to estimate emissions from the agriculture and LULUCF sectors, involving the Joint Research Centre, from the waste sector, involving the European Topic Center on Resource and Waste Management, as well as from international bunkers, involving the International Energy Agency and EUROCONTROL. Presentations and documentation of the workshops are available at the address: http://air-climate.eionet.europa.eu/meetings/past_html.

A national conference on the Italian emission inventory was organized by APAT in October 2006. Methodologies used to carry out national figures and results of time series from 1990 to 2004 were presented detailing explanations for each sector.

In 2007, in the framework of the National Conference on Climate Change, an event previous to the Conference presented the National GHG emission Inventory and specifically the time series of emission estimates from 1990 to 2005; besides a specific session of the Conference was dedicated to the National and local Inventories focusing on methodological issues and policies and measures to be adopted to reduce GHG emissions. In 2010, the time series 1990-2008 was presented in a specific national Kyoto Protocol event. In 2014, emission time series and figure for the compliance with the Kyoto Protocol 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, on a voluntary basis, different institutions, local agencies and industrial associations cooperating for improving activity data and emission factors accuracy. Specifically, for the LULUCF sector, following the election of the 3.3 and 3.4 activities and on account of an in-depth analysis on the information needed to report LULUCF under the Kyoto Protocol, a Scientific Committee, constituted by the relevant national

[7] MATT, 2006. *Italian report on demonstrable progress under article 3.2 of the Kyoto Protocol*. Ministero dell'Ambiente. http://unfccc.int/resource/docs/dpr/ita1.pdf

[8] ISTAT, several years. *Annuario Statistico Italiano* . Istituto Nazionale di Statistica, Roma ,Italia

[9] ISTAT, 2006. *La NAMEA: conti economici nazionali integrati con i conti ambientali*. Istituto Nazionale di Statistica. http://www.istat.it/dati/dataset/20060301_00/.

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

experts has been established by the Ministry for the Environment, Land and Sea in cooperation with the Ministry of Agriculture, Food and Forest Policies.

In addition to these expert panels, ISPRA participates in technical working groups within the National Statistical System (Sistan). These groups, named *Circoli di qualità*, coordinated by the National Institute of Statistics, are constituted by both producers and users of statistical information with the aim of improving and monitoring statistical information in specific sectors such as transport, industry, agriculture, forest and fishing. These activities improve the quality and details of basic data, as well as enable a more organized and timely communication.

QC procedures are also undertaken on the calculations of uncertainties in order to confirm the correctness of the estimates and that there is sufficient documentation to duplicate the analysis.

The assumptions, which uncertainty estimations are based on, are documented for each category. Figures to draw up uncertainty analysis are checked with the relevant analyst experts and literature references and they are consistent with the IPCC Good Practice Guidance[11] and IPCC Guidelines[12].

Quantitative estimates of the uncertainties for the Italian GHG inventory are calculated using Approach 1 as defined in the IPCC 2006 Guidelines, which provides a calculation based on the error propagation equations. In addition, Approach 2, corresponding to the application of Monte Carlo analysis, has been applied to specific categories of the inventory but the results show that, with the information available at present, applying methods higher than Approach 1 does not make a significant difference in figures. The results of the study, 'Evaluating uncertainty in the Italian GHG inventory', were presented at an EU workshop on Uncertainties in Greenhouse Gas Inventories, held in Finland in September 2005, and they are also available on website at the address:

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

A further research on uncertainty, specifically on the comparison of different methodologies to evaluate emissions uncertainty, was also carried out[13].

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

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

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

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

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

Information relating to the planning, preparation, and management of inventory activities are documented and archived. The archive is organised so that any skilled analyst could obtain relevant data sources and spreadsheets, reproduce the inventory and review all decisions about assumptions and methodologies

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[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

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 CO_2 emission calculations: the Italian case"[14].

Carbon Emission Factors Review. A sampling and measurement campaign was carried out jointly with the Stazione Sperimentale Combustibili in order to check the CO_2 emission factors used for emission estimation in the energy sector, specifically the road transport and residential and commercial sector. Representative samples of Italian fuels, specifically gasoline, diesel oil and LPG, were collected and analysed from September 2000 - August 2001. Measurements were compared with default CO_2 emission factors proposed by the IPCC in the 1996 Revised Guidelines and those proposed by the EEA and used in COPERT III methodology. Values of national emission factors resulted higher than the default ones for gasoline and LPG, while those of diesel were lower. Emission factors have been substituted for the years 2000 onwards. The study and the results are described in detail in the APAT report[15]. The analysis was repeated in 2013 with the same methodology by Innovhub (former Stazione Sperimentale Combustibili) and carbon content and main characteristic of coal and natural gas have been added. The methodology, data sources and main results are reported in a final technical paper[16].

Road Transport Emissions Review. The Italian Expert Panel on Transport, which comprises experts from Research Institutes, Universities, Industrial Associations, Local Authorities, Ministries and Public Authorities, continues its work on the improvement and assessment of emission estimations from road transport. There has been a considerable improvement on the details of basic data to be used within the COPERT model, both in terms of availability and timeliness. Studies of the expert panel group as well as presentations held in different meetings can be found on the website http://groupware.sinanet.isprambiente.it/expert_panel.

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

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

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

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. SF_6 estimates improved with the cooperation of the national electrical company ENEL and the main electrical associations. Specifically, for PFC emissions from aluminium production, the estimates were carried out jointly with the only national producer. A revision has also concerned HFC emissions on account of major information on the leakages made available by the European Association of Responsible Use of HFCs in Fire Fighting. In 2013, in response to the UNFCCC review process, the industrial associations have been contacted to verify f-gases emission factors from refrigeration and air conditioning in the different phases of the process from the production to the end of life of gases and appliances. 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 CH_4, N_2O and NH_3 emissions. Besides, studies on NH_3 and PM10 emissions from swine and poultry within the convention signed between APAT and the Ministry for the Environment, Land and Sea, were carried out by CRPA[17] and University of Milan[18]. At the end of 2009 another research study related to land spreading estimations and scenario was completed[19].

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

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

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

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 CO_2 emissions abatement resulting from the implementation of the II phase EU ETS in Italy as well as for the definition of the benchmark in the III phase of EU ETS and the final communication to the EU for benchmark and carbon leakage for the years 2009 and 2013. In this context, additional information has been elaborated data provided by the industry to assess the sectors subjected to potential carbon leakage and relevant benchmarks.

European Pollutant Release and Transfer Register (E-PRTR). Data from the Italian Pollutant Emission Register from some industrial sectors are used in the inventory compilation or as a check with the estimates carried out at national level. In particular, this regards the production of non-ferrous metals, chemical productions, cement and lime productions and the production of iron and steel.

Local inventories. A study on the top-down approach to the preparation of local inventories was conducted and Italian emissions for different local areas were derived. In 2013, ISPRA finalised the provincial

inventory at local scale for the years 1990, 1995, 2000, 2005, 2010[20]. The results were checked out by regional and local environmental agencies and authorities in order to find out the main weak points and contribute with information available to characterise the local environment, this contributing as well as a feedback to the improvement of the national inventory. Final estimates and the detailed methodologies followed for each SNAP sector to carry out emission figures are published in technical reports[21]. In 2017, the provincial inventory at local scale for the years 1990, 1995, 2000, 2005, 2010 and 2015 was finalised[22].

Planned improvements

Specific improvements are identified in the relevant chapters and specified in the 2019 QA/QC plan; 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 with the aim to reduce the differences with the international statistics.

Improvements for road transport sector will be connected to the availability of information regarding activity data, calculation factors and parameters, development of the methodology and update of the software. In particular, an improvement is planned regarding a general review of mileages and speed values with reference to a better distribution between the vehicles categories and driving conditions, subject to the total fuel balance between the sales of national fuels and the estimated total consumption.

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, further 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. Information collected by 2016 Agriculture survey has been now released by the National Institute of Statistics and it is under elaboration for its use in the 2020 submission.

The improvement of the waste production and management database, handled by another unit of ISPRA, is ongoing, facilitating the extrapolation and elaboration of the huge amount of information contained in the database. Analysis and elaboration e.g. on waste composition will be easier and will allow improvements in the emission estimates in the 2020 submission.

For the LULUCF, the final result of the third NFI, hopefully available in late 2019, 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. In this regards we plan to reassess the

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[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

uncertainty for the same categories reported in the annex of the NIR because these are the main categories for which the analysis makes sense in consideration of the information available on parameters and underlying distributions. We will try to extend the analysis to some other key categories in the IPPU sector (chemical and mineral).

QA/QC ENERGY
2018 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Antonella Bernetti, Riccardo De Lauretis

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NATIONAL AIR EMISSION INVENTORY: ENERGY

Objective

The improvements carried out during the preparation of the 2019 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 2018), then implemented, are reported.

Table 1. *Issue raised for the Energy sector during the UNFCCC review in 2018*

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_2O	Include a discussion in the NIR on the impact of any recalculations on the trend in CO2, CH4 and N2O emissions at the category, sector and national total levels, as appropriate.	E.1	The NIR has been updated accordingly	chapter 3 paragraph 4
Energy/ 1.A.2.d Pulp, paper and print - biomass – CO_2	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.2	The NIR has been updated accordingly	chapter 3 paragraph 4
Energy/ 1.A.2.e Food processing, beverages and tobacco – biomass– CH_4	Further analyse and collect information at the plant level in order to verify, and if appropriate update, the CH4 EF.	E.3	The NIR has been updated accordingly	chapter 3 paragraph 4
Energy/ 1.A Fuel combustion – sectoral approach – CO2, CH4 and N2O	In many cases recalculations in the energy sector were explained with the update of the energy conversion factors in accordance with the international statistics and due to changes in fuel consumption in accordance with the data provided to the joint questionnaire compiled by the Organisation for Economic Co-operation and Development, IEA and Eurostat. However, the information provided in the NIR does not specify the fuels and years affected by the changes. During the review, Italy explained that, up to the 2016 submission, the value used to convert Tcal to TJ was 4.18398, and from the 2017 submission it was changed to 4.1868 for comparability with Eurostat and IEA energy data. This change affected the whole time series. With regard to the AD submitted to Eurostat and IEA, some have been updated and are different from those published in the national energy balances (in general not updated for the time series) resulting in spot changes for some years and for some fuels.	E.9	The NIR has been updated accordingly	chapter 3 paragraph 2

	The ERT recommends that the Party clearly justify the recalculation in the NIR in line with paragraph 44 of the UNFCCC Annex I inventory reporting guidelines, explaining the choice of change of AD across years, as well as the fuels and years affected by the recalculations.			
Energy/ 1.A.3.b Road transportation – liquid fuels – CH4 and N2O	The Party has reported recalculations for the energy sector for the period 1990–2015. The ERT observed a large range of differences in N2O emissions, particularly for the period 1996–2004 (drops of emissions between 20.8 and 59.7 per cent), as well as a reduction in CH4 emissions of about 6–7 per cent annually over the period 1994–2004. During the review, the Party explained that the large differences in the recalculations for the period 1996–2004 were due to changing the model from COPERT version 4.11.4 (September 2016) to COPERT version 5.1 (December 2017), which involved different steps in the updating process and resulted in substantial changes in the estimation model structure. In particular the differences outlined are due to the differences in the EFs for the gasoline catalysed passenger car categories until 2004. Regarding N2O, the Party explained that the emissions are also linked to the use of after-treatment devices, such as catalytic converters. Therefore, the observed differences are particularly due to the updated fuel specification values, considering that in the model, fuel advanced specifications are based on the four reference years 1996, 2000, 2005 and 2009, explaining also the jump between 2004 and 2005. The ERT recommends that the Party include in the NIR a discussion on the impact of the application of COPERT version 5.1 on the trend in CH4 and N2O emissions at the category and sectoral level, also specifying the different drivers behind the trends (e.g. the introduction of abatement devices) and any significant inter-annual changes.	E.10	The NIR has been updated accordingly	chapter 3 paragraph 2
Energy/ 1.A.1.c Manufacture of solid fuels and other energy industries – biomass – CH4	In the NIR (chapter 3.3.3.1) Italy reported that CH4 emissions from charcoal production are not accounted because of a lack of methodology in the 2006 IPCC Guidelines applicable to the type of furnace technology in use. However, in CRF table 1.A(a)s1, "NO" has been used, suggesting CH4 emissions do not occur in Italy. During the review the Party stated that in the next submission the notation key "NE" will be appropriately used in the CRF table to ensure consistency between the CRF table and the NIR. The ERT recommends that Italy use the appropriate notation key for emissions from charcoal production and provide justification for the use of "NE" in the NIR and CRF table 9.	E.13	CRF and NIR have been updated accordingly	chapter 3 paragraph 1
Energy/ 1.A.3.b Road transportation – liquid fuel – CO2, CH4 and N2O	The ERT noted that chapter 3.5.3.2 of the NIR defines the method used to estimate emissions from road transportation, referring both to a national methodology and to the COPERT model (version 5.1). At the same time, CRF table summary 3 indicates the approaches used for transport as T1, T2 and T3. During the review, Italy explained that until the 2017 submission, a country-specific model was applied for the vehicle category compressed natural gas passenger cars. Nevertheless, in the 2018 submission, COPERT version 5.1 with its updated classification of the fleet is the reference model for all vehicle categories. The ERT recommends that Italy update its NIR,	E.14	The NIR has been updated accordingly	chapter 3 paragraph 5.3

			clarifying that the COPERT methodology is used for the entire category and that country specificities are taken into account in the model in line with the tier 3 method of the 2006 IPCC Guidelines.			

During the EEA greenhouse gases review related to the 2018 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 2018.

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

Observation	Key Category	NFR, Pollutant(s), Year(s)	Recommendation	RE or TC	Implementation
IT-1A1-2018-0001	No	1A1 Energy Production, SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, 2000-2015	The TERT reiterates the previous recommendation IT-1A1-2017-0002 from the 2017 NECD Review in which the TERT recommended to continue to improve the transparency of the IIR chapters for energy (1A1, 1A2 and 1A4) by providing more details of the methodology and EFs used for the NECD pollutants including the references. During the 2018 NECD Review, Italy confirmed that the recommendation would be addressed by the 2019 submission. The TERT notes that progress of the implementation of this improvement of the IIR will be reviewed in 2019.	No	Additional information has been added in the IIR
IT-1A1-2018-0003	No	1A1 Energy Production, SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, 2000-2015	The TERT reiterates recommendation IT-1A1-2017-0006 from the 2017 NECD Review. The TERT recommended 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. During the 2018 NECD Review, Italy explained that the issue was discussed with the Ministry of Environment (IMELS). Italy explained that the confidence intervals must result from quality assurance procedure and therefore the validated average values are even closer to the measured value than the validated average value calculated on the ground of confidence interval included in the IED. From the answer, it was not entirely clear to the TERT if the companies use the validated average values to calculate the emissions, or whether they use average values (without a confidence interval subtracted) to calculate the emissions. The guidance explained in the IED (regarding the subtraction of the confidence interval) is only for comparison of the emissions to emission limit values (ELVs). The TERT recommends Italy to continue their discussions with IMELS to asses if emissions from companies are calculated with or without the confidence interval subtracted and to report on this in the IIR.	No	Additional information has been added in the IIR

			If the confidence interval is subtracted, then the TERT recommends Italy to 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. The TERT notes that there might be a potential under-estimate and recommends Italy to continue studying the issue and to report on the progress of the work in the next submission. The TERT kindly notes that progress in the implementation of the issue will be reviewed in 2019.		
IT-1A4ai-2018-0001	Yes	1A4ai Commercial/Institutional: Stationary, SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, 2000-2015	The TERT reiterates the previous review recommendation IT-1A4ai-2017-0001 in which the TERT recommended that emissions from waste incineration facilities with energy recovery are reported under category 1A1. During the 2018 NECD Review, Italy explained that this recommendation could result in an inconsistent time series and that the energy produced in incinerators is still prevalently used to satisfy the internal energy demand of the plants (auto production) and in this sense it would be wrong, according to the guidelines, to report them under 1A1a Public Electricity and Heat Production instead of 1A4a. Italy is looking for the best way to implement the recommendation without introducing bias by the 2019 submission. The TERT kindly notes that progress of the implementation of the improvement will be reviewed in 2019.	No	Additional information has been added in the IIR
IT-1A4ai-2018-0002	Yes	1A4ai Commercial/Institutional: Stationary, NMVOC, 2000-2015	The TERT reiterates the previous recommendation IT-1A4ai-2017-0002 from the 2017 NECD Review, in which the TERT recommended that Italy states more precisely in the IIR the reference of the Guidebook version used for the category 1A4a and that Italy updates this methodology in line with 2016 EMEP/EEA Guidebook in the next submission. During the 2018 NECD Review, Italy confirmed that the recommendation would be addressed by the 2019 submission. The TERT kindly notes that progress in the implementation of this improvement will be reviewed in 2019.	No	Additional information have been included in the IIR while emission factors from 2007 EMEP/EEA Guidebook have not been updated
IT-1A4ai-20182017-0003	No	1A4ai Commercial/institutional: Stationary, SO_2, NO_X, $PM_{2.5}$, 2000-2015	Implemented regarding the description of methodology, regarding reallocation of emissions see IT-1A4ai-2018-0001	No	Additional information has been added in the IIR
IT-1A4aii-2018-0001	No	1A4aii Commercial/Institutional: Mobile, SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, 1990-2015	For category 1A4aii Commercial/Institutional: Mobile, pollutants SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$ for the time period 1990-2016, and with reference to the previous review recommendation IT-1A4aii-2017-0001, the TERT noted that emissions are reported as 'IE' without explaining where these emissions are included. In response to a question raised during the review, Italy explained that these emissions are included in category 1A3b and calculated with COPERT. The TERT notes that this issue does not relate to an over or under-estimate and recommends that Italy includes this explanation in the IIR. The TERT kindly notes that progress in the implementation of the improvement will be reviewed in 2019.	No	Additional information have been included in the IIR
IT-1A4bi-	Yes	1A4bi Residential:	The TERT reiterates the previous	No	Additional information

2018-0002		Stationary, NO$_X$, NMVOC, PM$_{2.5}$, 2000-2015	recommendation IT-1A4bi-2017-0001, in which the TERT recommended that Italy provides in the IIR a more precise description of the methodology used for category 1A4b Residential. The TERT also recommended that Italy updates the methodology, where relevant, in line with the 2016 EMEP/EEA Guidebook in the next submission. During the 2018 NECD Review, Italy confirmed that the recommendation would be addressed by the 2019 submission. The TERT kindly notes that progress in the implementation of this improvement will be reviewed in 2019.		have been included in the IIR while emission factors from 2007 EMEP/EEA Guidebook have not been updated
IT-1B1b-2018-0001	No	1B1b Fugitive Emission from Solid Fuels: Solid Fuel Transformation, SO$_2$, NO$_X$, NH$_3$, 1990-2015	The TERT reiterates recommendation IT-1B1b-2017-0001 from the 2017 NECD Review. The TERT recommended that Italy includes an estimate of NH$_3$ emissions from coke production in the next submission, and document the methodology used in the IIR. Furthermore, the TERT recommended that Italy corrects the notation keys for NO$_X$ and SO$_2$ in 1B1b Fugitive Emission from Solid Fuels: Solid Fuel Transformation to 'IE'. During the 2018 NECD Review, Italy confirmed that the recommendation would be addressed by the 2019 submission. The TERT kindly notes that progress in the implementation of this improvement will be reviewed in 2019.	No	Implemented
IT-1B2aiv-2018-0002	Yes	1B2aiv Fugitive Emissions Oil: Refining / Storage, SO$_2$, NO$_X$, NH$_3$, NMVOC, PM$_{2.5}$, 1990-2015	The TERT reiterates the previous recommendation IT-1B2aiv-2017-0001, where the TERT recommended that Italy includes the estimation of NH$_3$ emissions from refineries under NFR 1B2aiv Fugitive Emissions Oil: Refining / Storage in the next submission. During the 2018 NECD Review, Italy confirmed that the recommendation would be addressed by the 2019 submission. The TERT recommends Italy to implement the recommendation to the 2019 submission and kindly notes that the progress in the implementation of the improvement will be reviewed in 2019.	No	Implemented
IT-1A4ciii-2018-0001	No	1A4ciii Agriculture/Forestry/Fishing: National Fishing, Pb, 2002-2016	For category 1A4ciii Agriculture/Forestry/Fishing: National Fishing, pollutant Pb and for the time period 2002-2016, the TERT noted that emissions are reported as 'NA', even though methodology and activity data exist. In response to a question raised during the review, Italy explained that this is due to the introduction of unleaded petrol in 2002. The TERT notes that this issue does not relate to an over or under-estimate and recommends that Italy includes this explanation in the IIR. The TERT also kindly notes that progress in the implementation of the improvement of the IIR will be reviewed in 2019.	No	Additional information has been added in the IIR

NIR and IIR report additional information about the last review processes (e.g UNFCCC[23] and UNECE [24]), addressing the recommendations of the review teams.

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[23] UNFCCC, 2019. Report on the individual review of the annual submission of Italy submitted in 2018. Note by the expert review team. http://unfccc.int/resource/docs/2017/arr/ita.pdf.

[24] UNECE 2018. Final Review Report 2018, Second phase of review of national air pollution emission inventory data pursuant to the Directive on the Reduction of National Emissions of Certain Atmospheric Pollutants (Directive (EU) 2016/2284 or 'NECD'). https://www.ceip.at/ms/ceip_home1/ceip_home/review_results/review_results_2019

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, the whole time series of road transport emissions has been recalculated because of the application of the new version of the model COPERT 5.2.2. N2O and CH4 emissions recalculations derive basically from the correction of an error occurred in submission 2018 regarding sulphur content in the fuel, parameter used in the model Copert affecting also the calculation of such emissions. Waste fuel consumption for commercial heating activity data has been updated from 2015 because the update of activity data for industrial waste.

Gaseous fuel consumptions for energy production and energy consumption in industry have been updated from 2005 on the basis of the last submission of energy balance provided by the Ministry of Economic Development to the Joint Questionnaire OECD/IEA/EUROSTAT.

Planned improvements

In this paragraph further improvements identified during the preparation of the National Inventory, National Inventory Report 2019 and of the Informative Inventory Report 2019 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 has been carried out by Ispra and Ministry of Economic Development. In particular ISPRA has analyzed in depth 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.

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 with the aim to reduce the differences with the international statistics. Improvements for road transport sector will be connected to the availability of information regarding activity data, calculation factors and parameters, development of the methodology and update of the software. In particular, an improvement is planned regarding a general review of mileages and speed values with reference to a better distribution between the vehicles categories and driving conditions, subject to the total fuel balance between the sales of national fuels and the estimated total consumption.

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
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.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 have been planned by the National Institute of Statistics (ISTAT).	2019-2021

QA/QC INDUSTRIAL PROCESSES AND PRODUCT USE
2018 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Andrea Gagna, Barbara Gonella, Ernesto Taurino, Daniela Romano

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NATIONAL AIR EMISSION INVENTORY: INDUSTRIAL PROCESSES AND PRODUCT USE

Objective

The improvements carried out during the preparation of the 2019 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.F.3 Fire protection – HFCs	Implement the plans for collecting and updating AD for this category.	I.9	The investigation is still on-going	Chapter 4 paragraph 7.2
IPPU/ 2.F.3 Fire protection – HFCs	Correct the description in the expected trend of HFC emission estimates for the years 2010–2014 and explain that for these years the emissions are assumed to be constant and not decreasing.	I.10	The NIR has been updated accordingly	Chapter 4 paragraph 7.2
IPPU/ 2.A.4 Other process uses of carbonates – CO2	The ERT noticed significant inter-annual changes in the AD for other (other process uses of carbonates, 2.A.4.d), including 2001/2002 (38.7 per cent), 2010/2011 (31.7 per cent), 2011/2012 (–37.7 per cent), 2012/2013 (45.5 per cent) and 2015/2016 (–35.4 per cent). The category includes emissions from carbonates used in pulp and paper and in power plants. During the review, Italy explained that the emission trend is driven by the trend of using carbonates in power plants as reported under the EU ETS and indicated that an error has been found for both emissions and AD in 2012 and that it will be corrected in the 2019 submission. The ERT recommends that the Party correct the 2012 AD and CO2 emission values reported for the use of carbonates in power plants.	I.14	Values have been corrected	Chapter 4 paragraph 2
IPPU/ 2.A.4 Other process uses of carbonates – CO2	Significant variations in the emissions from carbonate use in pulp and paper and in power plants are reported in the last years of the time series. In particular, a large drop in AD and emissions is noted from 2015 to 2016 (emissions decreased from 156.97 kt CO2 to 101.58 kt CO2, which is a decrease of 35.4 per cent). The NIR has not explained the reason behind the inter-annual change. During the review, Italy explained that the AD are based on data provided by operators in the framework of the EU ETS and the reduction in carbonate use in power plants in 2016 is due to the reduced energy production in three coal-fuelled power plants. In total the three plants produced 20,436,912 MW in 2015 and 13,407,521 MW in 2016; consequently, they reduced the use of calcium carbonate from 211,640 t in 2015 to 97,599 t in 2016.	I.15	The NIR has been updated accordingly	Chapter 4 paragraph 2

			The ERT recommends that the Party improve the transparency of reporting on the emissions from carbonate use by providing information on the AD and any significant changes in the trend at the subcategory level in the NIR.				

Table 2 reports responses to the recommendations under the review of the European National Emission Ceiling Directive (NECD) conducted in 2018.

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

Observation	Key Category	NFR, Pollutant(s), Year(s)	Recommendation	RE or TC	Implementation
IT-2A5a-2018-0001	No	2A5a Quarrying and Mining of Minerals Other Than Coal, $PM_{2.5}$, 1990-2015	For category 2A5a Quarrying and Mining of Minerals Other Than Coal and pollutant $PM_{2.5}$ for the years 1990-2015 the TERT noted with reference to the previous review recommendation IT-2A5a-2017-0001 that the TERT recommended Italy to estimate emissions from the category 2A5a for the 2018 submission, using the national statistics or international statistics on quarrying such as USGS Minerals Yearbook as the basis for emissions reporting. The TERT notes that Italy has explained on page 118 of the IIR 2018 that there is no activity data available to apply the Tier 1 methodology for other mineral mines, except for bauxite, copper, manganese and zinc for which there is no evidence of active mines. The TERT noted that there is some information in the USGS Minerals Yearbook on the production of mineral commodities and also a list of major operating companies in Italy. In response to a question raised during the review, Italy explained that the USGS Mineral Yearbook provides info for Italy only for Feldspar, Gypsum, Pumice and Sand and gravel extraction. Italy stated that all the data are estimated, and they are verifying the activity level with the industry and local competent authorities. Moreover, Italy needs to verify if the emission factors available in the Guidebook are applicable to these national extractive activities because of the abatement technologies and the type of minerals. Italy also provided a rough estimation of emissions, based on a Tier 1 approach and USGS activity data. The TERT agreed with the explanation provided by Italy and recommends that Italy continues the work on resolving that issue and if possible, includes the emission estimates in the inventory in its next submission with the methodology description. If that is not possible then the TERT recommends Italy to include in the IIR a plan with a schedule for implementing the improvement. The TERT kindly notes that progress in the implementation of the improvement will be reviewed in 2019.	No	Not implemented
IT-2A5b-2018-0001	No	2A5b Construction and Demolition, $PM_{2.5}$, 1990-2015	For category 2A5b Construction and Demolition and pollutant $PM_{2.5}$ for the years 1990-2015 the TERT notes with reference to the previous review recommendation IT-2A5b-2017-0001 which recommended Italy to collect the base information for estimating the	No	Not implemented

			emissions from the category 2A5b and to include $PM_{2.5}$ estimates in the 2018 submission. The TERT notes that on page 118 of the IIR 2018 Italy explains that no statistical data is available (as annual surfaces) to allow estimation of emissions and that further investigations are under way. In response to a question raised during the review, Italy explained that they will try to implement the recommendation for the 2019 submission. The TERT agreed with the explanation provided by Italy. The TERT did not calculate a technical correction but noted that there may be a possibility for the emissions to be above the threshold of significance. The TERT recommends Italy to include emission estimates from this category in its next submission or, if that is still not possible, to include in the IIR an improvement plan with schedule. The TERT kindly notes that inclusion of this information in the IIR will be reviewed in 2019.		
IT-2C-2018-0001	No	2C Metal Industry, SO_2, $PM_{2.5}$, 2005-2015	For category 2C Metal Industry and pollutants SO_2, $PM_{2.5}$ for the years 2005-2015 with reference to the previous review recommendation IT-2C-2017-0001 the TERT notes that Italy did not report SO_2 and $PM_{2.5}$ emissions from lead, zinc and copper production, although the 2016 EMEP/EEA Guidebook provides EFs for those activities. Italy explained that those emissions were reported under the energy sector, but as more detailed information became available, Italy stated that the emissions between the energy and the process sectors can now be separated and that they would be reallocated by the 2018 submission. According to the data reported in the NFR tables, the TERT notes, that Italy has not yet carried out this improvement. In response to a question raised during the review, Italy explained that the implementation of this issue requires more time because some technical aspects have to be better evaluated to realise a consistent split between combustion and process emissions. In addition, in Italy there is a sole integrated plant for the primary production of zinc and lead and this makes it difficult to ensure a good breakdown between the activities. Italy added that during the latest year more information about the plant has been supplied exploiting a direct contact with the facility through the E-PRTR registry. The TERT agreed with the explanation provided by Italy and recommends that Italy continues working on that issue and includes the revised estimates in its next submission. The TERT also recommends, if this improvement still is not possible to implement, Italy to include in the IIR and explanation for the delay and an improvement plan with a schedule in the IIR. The TERT kindly notes that progress in the implementation of the improvement will be reviewed in 2019.	No	The relevant notation key has been introduced in the NFR and additional information in the IIR
IT-2D3e-2018-0001	No	2D3e Degreasing, NMVOC, 2005, 2010, 2015	For category 2D3e Degreasing and pollutant NMVOC for the years 2005, 2010 and 2015 the TERT notes with reference to the observation IT-2D3e-2017-0001 from the 2017 NECD Review that Italy provided on page 132 of the IIR 2018 the description of the methodology used for NMVOC	No	Not implemented

			emission calculations from this category. The TERT also notes that the recommendation to update the emission factor to be in line with either the 2016 EMEP/EEA Guidebook or well-documented national values has not been adopted and that Italy still referred to the use of the "Corinair 1992 Default Emission Factors Handbook". The TERT assumed that this issue may be related to the fact that there is no data on the volumes of cleaning products used, but there is information on the solvent included in those products. The TERT asked Italy if that is the case and if there is a possibility to calculate NMVOC emissions using the volumes of solvents and the shares of compounds therein with their volatility rates to solve this problem of using emission factors from the "Corinair 1992 Default Emission Factors Handbook". In response to a question raised during the review, Italy explained that they could try to obtain information on the composition of the products but because of the issue of confidentiality, it probably will be difficult. In Italy's view it could be easier to verify the assumption that 10% of the solvent used remains in the product or is destroyed and if it is not possible, to update emission estimates assuming that all the solvent is emitted into air. Italy stated that they will try to update this category for the next submission. The TERT agreed that in case it would be difficult to obtain the information on the composition of cleaning products regarding the different NMVOC compounds, then one way is to take into account the whole amount of used cleaning products (not only the solvent part), apply the 2016 EMEP/EEA Guidebook Tier 2 emission factor with the abatement efficiency, if appropriate, and calculate NMVOC emissions. The TERT recommends that Italy investigates this option to apply the 2016 EMEP/EEA Guidebook emission factor and includes the new estimates in its next submission. The TERT notes that progress in the implementation of the improvement will be reviewed in 2019.		
IT-2G-2018-0001	No	2G Other Product Use, SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, 2005, 2010, 2015	For category 2G Other Product Use and pollutants SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$ for the years 2005, 2010, 2015 with reference to the previous review recommendation IT-2G-2017-0001, which noted that there may be an under-estimate of $PM_{2.5}$ emissions that may be above the threshold of significance and recommended Italy to estimate and report $PM_{2.5}$ emissions from the use of tobacco and fireworks in the 2018 submission. The TERT noted that Italy has included an explanation in the IIR 2018, that for both activities no statistical data sets are available to estimate a complete emission time series. The TERT did not agree with that explanation as statistical data on international trade (import/export) and production are available from the Eurostat database to estimate provisional amounts of used fireworks and tobacco to calculate emissions of the main pollutants (and also for heavy metals and POPs), at least for the years from 2005 and forth. In response to a question raised during the review, Italy thanked the TERT for the comment and the	No	Not implemented

			reference to the available database and stated that they will implement the recommendation for the 2019 submission. The TERT agreed with the explanation provided by Italy. The TERT did not calculate a technical correction but noted that there may be a possibility for that issue to be above the threshold of significance. The TERT recommends that Italy includes the emission estimates from the use of fireworks and tobacco combustion in the inventory in its next submission. The TERT also notes that progress in the implementation of the improvement will be reviewed in 2019.		
IT-2D3g-2018-0001	Yes	2D3g Chemical Products, PAHs, 1990, 2005, 2016	For category 2D3g Chemical Products and pollutant PAHs for the years 1990, 2005, 2016 the TERT noted with reference to Table 5.2 of the IIR 2018 that asphalt blowing as an activity has been included in the inventory, but notes that Italy has reported in the NFR tables the notation key 'NA' for PAH emissions for the whole time series, although the 2016 EMEP/EEA Guidebook provides an emission factor for Benzo(a)pyrene. In response to a question raised during the review, Italy explained that according to the relevant industrial association PAH emissions are negligible because all the asphalt blowing plants have abatement filter systems for PM emissions and afterburners of gas. Italy also stated that these plants should respect the national environmental legislation which sets a stack ELV of 0.1 mg/Nm3 for total PAHs. The TERT agreed with the explanation provided by Italy, but recommends that Italy estimates the emissions in the inventory according to the ELV or another country-specific emission factor and includes the justification of the method in the IIR in its next submission. The TERT also notes that there exists a Tier 2 method and EF in the GB2016 (Tables 3-9 and 3-10 of 2.d.3.g Chemical products), for the PAH Benzo(a)pyrene. At the moment the EF given in this table is wrong, but it will be replaced with a correct EF.	No	Not implemented
IT-2A3-2018-0001	No	2A3 Glass Production, Cd, Hg, Pb, 1990, 2005, 2016	For category 2A3 Glass Production and pollutants Cd, Hg, Pb for the years 1990, 2005, 2016 the TERT noted with reference to the NFR tables that Italy has reported in the category 2A3 the notation key 'NA' for Cd, Hg and Pb for the whole time series, although the 2016 EMEP/EEA Guidebook provides both Tier 1 and Tier 2 emission factors for those pollutants. In response to a question raised during the review, Italy explained that this is an allocation issue and that Italy reports emissions for these pollutants, calculated with country specific emission factors for lead and IPPC BREF emission factors for other pollutants, in category 1A2f, because in this case emissions are clearly linked to the combustion activities. The TERT agreed with the explanation provided by Italy and recommends that Italy uses the notation key 'IE' (Included Elsewhere) instead of 'NA' as the emissions for those pollutants are included in category 1A2f and also includes an explanation for that allocation in the IIR in its next submission. The TERT kindly notes that progress in the implementation of the improvement will be	No	Notation key has been updated

			reviewed in 2019.		
IT-2C1-2018-0001	No	2C1 Iron and Steel Production, HCB, 1990, 2005, 2016	For category 2C1 Iron and Steel Production and pollutant HCB for the years 1990, 2005 and 2016 the TERT noted with reference to the NFR tables that Italy has reported the notation key 'NA' for HCB in this category for the whole time series, although the 2016 EMEP/EEA Guidebook provides Tier 1 and Tier 2 emission factors for HCB. In response to a question raised during the review, Italy explained that this is an allocation issue and that they have reported HCB emissions from sintering production, which are calculated with the 2006 EMEP/Corinair Guidebook EF = 0.032 mg/Mg and are allocated under category 1A2a. Italy states that because of it, in this case, the HCB emissions are clearly linked to the combustion activity. The TERT agreed with the explanation provided by Italy and recommends that Italy includes the explanation in the IIR and for better transparency also includes a justification for the use of the 2006 EMEP/Corinair Guidebook EF, or recalculate the emissions using the 2016 EMEP/EEA Guidebook EFs to the next submission. The TERT notes that progress in the implementation of the improvement will be reviewed in 2019.	No	Additional information has been included in the IIR
IT-2C3-2018-0002	No	2C3 Aluminium Production, HCB, 1990, 2005	For category 2C3 Aluminium Production and pollutant HCB for the years 1990 and 2005 the TERT notes with reference to the NFR tables that Italy has reported the notation key 'NA' for HCB although the 2016 EMEP/EEA Guidebook provides a Tier 2 emission factor for HCB for secondary aluminium production. In response to a question raised during the review, Italy explained that HCB emissions from secondary aluminium derive from the degassing of aluminium when hexachloroethane is used, but hexachloroethane is banned in Italy since 1990s. The TERT agreed with the explanation provided by Italy and recommends that Italy includes that explanation in the IIR in its next submission. The TERT kindly notes that progress of inclusion of the information in the IIR will be reviewed in 2019.	No	Additional information has been included in the IIR
IT-2C3-2018-0001	No	2C3 Aluminium Production, PCDD/F, 1990, 2005	For category 2C3 Aluminium Production and pollutant PCDD/F for the years 1990 and 2005 with reference to the NFR tables the TERT notes that Italy has reported the notation key 'NA' for PCDD/F for the years 1990-2012, although the 2016 EMEP/EEA Guidebook provides a Tier 2 emission factor for PCDD/F from secondary aluminium production. In response to a question raised during the review, Italy explained that PCDD/F emissions from aluminium production have been calculated and allocated to sector 1A2b, because PCDD/F emissions occur almost exclusively from secondary aluminium production and are consequently linked to the combustion process. The TERT agreed with the explanation provided by Italy and recommends that if the emissions between combustion and process cannot be divided then a proper notation key should be used, in this case the notation key 'IE' (Included Elsewhere). The TERT recommends Italy to correct the notation key and to include a proper explanation	No	No changes in the NFR because the category refer to primary aluminium production. Additional information has been added in the IIR.

			about that issue in the IIR in its next submission. The TERT kindly notes that progress in the implementation of the improvement will be reviewed in 2019.		
IT-2C5-2018-0001	No	2C5 Lead Production, PCBs, 1990, 2005, 2016	For category 2C5 Lead Production and PCB emissions for the years 1990, 2005, 2016 the TERT noted with reference to the NFR tables where Italy has reported the notation key 'NA' for PCBs in this category for the whole time series, although the 2016 EMEP/EEA Guidebook provides Tier 1 and Tier 2 emission factors for PCBs from lead production. The TERT also noted that the information provided by Italy in the IIR 2018 could suggest that the emissions might be reported with combustion processes, but this was not fully clear. In response to a question raised during the review, Italy explained that in this case, in addition to the difficulties connected to the split of emissions between combustion and process and between lead and zinc production of the sole integrated plant in Italy, PCB emission factors have large uncertainties. Italy also elaborated that according to the 2016 EMEP/EEA Guidebook the PBCs emission factor may be revised in the future for this sector based on new information from UNEP. The TERT agreed with the explanation provided by Italy and recommends that if the emissions between combustion and process cannot be divided then a proper notation key should be used, for this case the notation key 'IE' (Included Elsewhere). The TERT recommends Italy to correct the notation key and to include a proper explanation about the issue in the IIR in its next submission. The TERT also notes that progress in the implementation of the improvement will be reviewed in 2019.	No	Notation key has been updated
IT-2C7a-2018-0001	No	2C7a Copper Production, Pb, 1990, 2005, 2016	For category 2C7a Copper Production and pollutant Pb for the years 1990, 2005 and 2016 the TERT noted with reference to the NFR tables that Italy has reported the notation key 'NA' for Pb in the NFR category 2C7a for the whole time series, although the 2016 EMEP/EEA Guidebook provides Tier 1 and Tier 2 emission factors for Pb from copper production. The TERT noted that this may lead to under-estimating Pb emissions from this category. In response to a question raised during the review, Italy explained that Pb emissions from copper production have been calculated and allocated under sector 1A2b, because the process is considered as a combustion process with contact, consequently emissions are linked to the combustion process. The TERT agreed with the explanation provided by Italy and recommends that Italy corrects the notation key from 'NA' to 'IE' (Included Elsewhere) and include that explanation in the IIR in its next submission. The TERT also notes that progress in inclusion of this information in the IIR will be reviewed in 2019.	No	Notation key has been updated
IT-2C7a-2018-0002	No	2C7a Copper Production, Cd, 1990, 2005, 2016	For category 2C7a Copper Production and pollutant Cd for the years 1990, 2005, 2016 the TERT noted with reference to the NFR tables that Italy has reported the notation key 'NA' for Cd in the NFR category 2C7a for the whole time series, although the 2016 EMEP/EEA Guidebook provides Tier 1 and	No	Notation key has been updated

			Tier 2 emission factors for Cd from copper production. The TERT noted that this may lead to under-estimating Cd emissions from this category. In response to a question raised during the review, Italy explained that Cd emissions from copper production have been calculated and allocated under sector 1A2b, because as copper production is considered a combustion process with contact, consequently the emissions are linked to the combustion process. The TERT agreed with the explanation provided by Italy and recommends that Italy corrects the notation key from 'NA' to 'IE' (Included Elsewhere) and includes that explanation in the IIR in its next submission. The TERT also kindly notes that progress in the implementation of the improvement will be reviewed in 2019.		
IT-2D3a-2018-0001	No	2D3a Domestic Solvent Use Including Fungicides, Hg, 1990, 2005, 2016	For category 2D3a Domestic Solvent Use Including Fungicides and pollutant Hg for the years 1990, 2005 and 2016 the TERT noted that Italy has reported 'NA' for Hg emissions for years 1990-2016, although the 2016 EMEP/EEA Guidebook provides an emission factor for Hg from fluorescent tubes, which may lead to under-estimating Hg emissions. In response to a question raised during the review, Italy explained that they are going to explore if emissions occur from this activity. The TERT agreed with the explanation provided by Italy and recommends that Italy explores if that activity is taking place in Italy and in case it exists and includes emission estimates and a description of this activity in the IIR in its next submission. The TERT kindly notes that progress in the implementation of the improvement will be reviewed in 2019.	No	Not implemented
IT-2G-2018-0002	No	2G Other Product Use, Cd, Pb, 1990, 2005, 2016	For category 2G Other Product Use and pollutants Cd and Pb for the years 1990, 2005 and 2016 the TERT noted with reference to the NFR tables that Italy has reported the notation key 'NA' for Cd and Pb, although the 2016 EMEP/EEA Guidebook provides emission factors for Cd (the use of fireworks and tobacco combustion) and Pb (the use of fireworks). The TERT notes that this may lead to under-estimate of Cd and Pb emissions. The TERT also noted that suitable activity data to estimate the emissions are available from the Eurostat database, at least from the year 2005 onwards. In response to a question raised during the review, Italy explained that they will implement the recommendation for the 2019 submission. The TERT recommends that Italy estimates emissions from the use of fireworks and tobacco combustion and includes them in the inventory in its next submission. The TERT notes that progress of inclusion of the information in the IIR will be reviewed in 2019.	No	Not implemented

Inventory improvements and QA activities

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

CO_2 emissions have been checked with the relevant industrial associations. Activity data and emissions reported under EU-ETS and EPER/EPRTR are compared with the information provided by the industrial associations. In particular, comparisons have been carried out for 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 CO_2 emissions from the decarbonation process in the national cement industry: resulting suggestions to focus on raw materials fed to clinker kilns[25] were considered and the description of the fluctuation of the CO_2 implied emission factor was already improved in the previous NIR accordingly. Specifically, further investigations about the amount of limestone & dolomite used has led to an update of the activity data and CO_2 estimates along the whole time series.

Also emissions from the metal sector are checked with the relevant process operators. 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, CO_2 emissions are checked with the relevant industrial associations at national level.

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

Activity data and emissions reported under EU-ETS and EPER/EPRTR are compared to the information provided by the industrial associations. The general outcome of this verification step shows consistency among the information collected under different pieces of legislations and the information provided by the relevant industrial associations. Further investigations regarding completeness of CO_2 emissions sources from the activities of this sector are planned, as well as additional checks 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.

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

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
Mineral products	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 are planned in order to gathered further data on emissions from the use of heat transfer fluids. For the foam blowing improvements are planned in order to investigate the consumption of other F-gas used and the different contribution of closed cell and open cell foams to the emissions. Investigation is ongoing in order to verify the presence of different Consortia of fire protection systems in the country. In the air conditioning and refrigeration sectors improvements are planned to improve the evaluation of disposal and recovered emissions. Improvements in the SF6 emissions from particle accelerators are expected because ENEA, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, should provide information about their laboratories	2019-2020

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
CO_2 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 CO_2 emissions, the disaggregation for other gasses is planned.

Consumption of halocarbons and SF$_6$

Electronics Industry Emissions (2E)
Emissions from the use of heat transfer fluids in the semiconductor industry started to be collected for the year 2017. The national industry is part of the European Semiconductor Industry Association (ESIA) and is involved in the activity of WSC (World Semiconductor Council), including gathered emissions from the use of heat transfer fluids. A further investigation in order to better specify the whole time series is planned.

Emissions of fluorinated substitutes for ozone depleting substances (2F)
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 (ISPRA [a], 2018). In the meanwhile, an historic global climate deal was reached in Kigali, Rwanda, at the Twenty-Eighth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer (MOP28). The so called Kigali Amendment which amends the 1987 Montreal Protocol aims to phase out Hydrofluorocarbons (HFCs), by the late 2040s.
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, but at present they are not enough to make a balance of chemical sales and use a top down approach to cross check emission estimates.
Further improvements in the air conditioning and refrigeration sectors are planned for the next submission. In particular, investigation is planned to improve the evaluation of disposal and recovered emissions, by checking data reported in the National Database and by contacting the national association and experts.
For the foam blowing improvements are planned in order to investigate the consumption of other F-gas used in the sectors (in example HFC-365mfc and l'HFC-227ea) and the different contribution of closed cell and open cell foams to the emissions.
Regarding the fire extinguishers sector, the European Association for Responsible Use of HFCs in Fire Fighting was contacted (ASSURE, 2005), as well as the Consortium of fire protection systems (Clean Gas, 2001). Because other Consortium of fire protection systems are present in the country, ANIMA, the Federation of National Associations of Mechanical and Engineering similar which include fire protection industry, has been contacted in order to verify the presence of these Consortia. At present the Federation did not provide update information. The main national fire protection industries (Gielle and Gastec Vesta), have been contacted and approved the estimation approach. However the investigation is still ongoing.

Other production (2G)
Regarding the other production - (SF6 Emissions from electrical equipment, SF6 used in equipment in university and research particle accelerators, N2O from product uses), the new Presidential Decree, n° 146 of 16 November 2018 adopted due to the enter into force of the F-Gases Regulation n. 517/2014 (EU, 2014), including in its scope also electrical equipments, will improve the control and monitoring system of the appliances. Improvements in the SF$_6$ emissions from electrical equipment are expected because ENEA, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, should provide information about their laboratories.

Categories 2D3a_d_e and 2G

Review process recommendations

The UNFCCC review processes did not result in specific recommendations for the categories 2D3 and 2G of the IPPU sector, whereas Table 1 reports responses to the recommendations under the review of the European National Emission Ceiling Directive (NECD) conducted in 2018.

Inventory improvements and QA activities

In this paragraph, specific improvements of the national air inventory for the specified categories are reported.

In the framework of the MeditAIRaneo project, ISPRA commissioned to Techne Consulting S.r.l. a survey to collect national information on emission factors in the solvent sector. The results, published in the report "*Rassegna dei fattori di emissione nazionali ed internazionali relativamente al settore solventi*"[26] have been used to verify and validate the emission estimates. ISPRA commissioned to Techne Consulting S.r.l. another survey to compare emission factors with the last update published in the EMEP/EEA guidebook[27]. The results are reported in "*Fattori di emissione per l'utilizzo di solventi*"[28]) and have been used to update emission factors for polyurethane and polystyrene foam processing activities.

In addition, for paint application, data communicated from the industries in the framework of the EU Directive 2004/42, implemented by the Italian Legislative Decree 161/2006, on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products have been used as a verification of emission estimates. These data refer to the composition of the total amount of paints and varnishes (water and solvent contents) in different subcategories for interior and exterior use and the total amount of products used for vehicle refinishing and they are available from the year 2007.

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 were 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.

In the actual submission, minor recalculations occurred for paint application subcategories mainly due to the update of emission factors in paint application for the manufacture of automobiles and wood and the update of some activity data in 'Other' (fat edible and non edible oil extraction).

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[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

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
Cross cutting	Paint application for construction and building; Polyester processing; Polyurethane processing	-	Assess the possibility to obtaining information to derive the apparent consumption to be used instead of production data as activity data	2018-2019
Paint application	Other industrial paint application	8%	Assess the possibility to split non industrial application according to the Guidebook EMEP/EEA	2018-2019
Degreasing, dry cleaning and electronics	Metal degreasing	4%	Update information, from the national chemical industrial association (Federchimica), on activity data and emission factor	2018-2019
Chemical products manufacturing and processing	Leather production	5%	Update emission factor for the last years on the basis of the information collected by the industrial association and EPRTR registry and local emission inventories	2018-2019
Other use of solvents	Printing industry	4%	Update emission factor for the last years on the basis of the information collected by the industrial association	2018-2019
Other use of solvents	Application of glues and adhesives	5%	Update emission factor for the last years on the basis of the information collected by the industrial association	2018-2019

QA/QC AGRICULTURE
2018 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Eleonora Di Cristofaro

April, 2019

NATIONAL EMISSION INVENTORY: AGRICULTURE

Objective

This report describes activities and improvements carried out during the preparation of the 2019 national inventory submission for the agriculture sector.

Review process recommendations

During the last UNFCCC Greenhouse gases review process in 2018 the following issues were raised.

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

CRF category / issue	Review recommendation	Review report / paragraph	MS response / status of implementation	Chapter/section in the NIR
Agriculture/ General – CH_4, N_2O	In the NIR (chapter 5.5.2, p.209) Italy states that when estimating the amount of animal manure N applied to soils "the amount of nitrogen from bedding materials is considered". The Party further states that "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 revised using the fixed residues/removable residues ratio for each crop considered (ENEA, 1994), also used to estimate the emissions from category 3F (see para. 5.6.2)" (NIR, chapter 5.5.4, p.214). Finally, the Party states that among the parameters taken into account for estimating emissions from field burning of agricultural residues was the "amount of 'fixed' residues (t), estimated with annual crop production, removable residues/product ratio, and 'fixed' residue/removable residues ratio" (NIR, chapter 5.6.2, p.216). Based on this information the ERT found it difficult to assess where the N in bedding material (or the bedding material as such) has been accounted for and where it has not. During the review, Italy provided further clarification, including an Excel spreadsheet that allows a detailed assessment of the consideration of bedding material in the different emission categories. Based on this information, the ERT considers the method applied accurate and commends Italy for the detailed approach. The ERT recommends that Italy improve the description of the consideration of bedding material in the estimates for the categories animal manure applied to soils (3.D.a.2.a), crop residues (3.D.a.4) and field burning of agricultural residues in the NIR. The ERT encourages the Party to consider developing a flow chart and the use of clear terminology in this respect.	A.9	Additional information has been included in the NIR	Chapter 5 paragraph 5.5 and Annex 7.3
Agriculture/ 3.A.1 Cattle – CH_4	Italy uses an average Ym of 4.35 per cent for non-dairy cattle (CRF table 3.As1, 2016). This value is the second lowest compared with all other Parties (range 0.07–7.88 per cent). In annex 7 to the NIR Italy explains that "the rations consist mainly of silage and cereals and for fattening animals, the ration has been assumed more digestible". Furthermore, the NIR explains (annex 7, p.474) that the lower default values of the Ym (from the 2006 IPCC Guidelines) have been assigned to certain	A.10	Additional information has been included in the NIR	Chapter 5 paragraph 5.2 and Annex 7.1

	categories. However, the 2006 IPCC Guidelines distinguish only two values of Ym in table 10.12 for non-dairy cattle, of which the lower (3 per cent) should only be used "when fed diets contain 90 percent or more concentrates". The ERT considers that this prerequisite is not fulfilled in this case. Furthermore, the 2006 IPCC Guidelines allow using the lower bound of the range provided for "other cattle and buffaloes that are primarily fed low quality crop residues and by-products" when "good feed is available". The respective value for the lower bound would be 5.5 per cent. Consequently, the ERT could not fully assess how the Italian Ym for non-dairy cattle given in NIR table 5.5, in particular the values for non-dairy cattle <1 year (4.0 per cent), 1–2 years male for breeding (4.5 per cent), 1–2 years for slaughter (4.0 per cent) and 1–2 years female for slaughter (4.0 per cent), were derived from the default values in table 10.12 of the 2006 IPCC Guidelines. During the review, Italy provided further explanation and supporting documentation (see Ellis et al. (2007)). Particularly, Italy could demonstrate that, given the specific feed ratios, the Ym values should be in the range applied by the Party by using prediction equations for the CH4 production of beef cattle from Ellis et al. (2007). The ERT thus considers that the Ym values used by Italy are sufficiently supported. The ERT recommends that Italy transparently demonstrate in the NIR that the Ym values for all non-dairy cattle subcategories are accurate by providing sufficient scientific evidence for the country-specific values (e.g. referring to the prediction equations in Ellis et al. (2007)).				
Agriculture/ 3.B Manure management – CH₄	Table 5.13 of the NIR (p.195) provides the distribution of animals in temperate and cool climate zones. Percentage values are given in two columns, once as "% animals" (consistent with values in CRF table 3.B(a)s1) and once as "% animals: Based on temperature non weighted by % animals". The two values differ significantly. During the review, Italy clarified that the values in the first column ("% animals") are more appropriate since the average provincial temperature was calculated as the average of the temperatures weighed with the percentage of the heads in the different altimetric areas. The ERT commends Italy for the sophisticated method used for animal distribution analysis and encourages the Party to describe the difference between the two climate-zone assessments in detail in the NIR and/or to increase transparency by only referring to the more accurate distribution of climate zones.	A.11		Additional information has been included in the NIR	Chapter 5 paragraph 5.3

Agriculture/ 3.B Manure management – CH$_4$	Italy uses an MCF of 1.13–1.14 per cent for animal manure digested in anaerobic digesters and provides detailed information in annex 7 (chapter A7.2) of the NIR. Italy also explains (chapter 5.3.2) that CH4 emissions from anaerobic digestion of manure are estimated based on the biogas produced. Values for MCF and Bo are then calculated backwards using equation 10.23 of the 2006 IPCC Guidelines and the estimated amount of volatile solids used as feedstock for the digesters. Accordingly, MCF and Bo are not directly used for emission calculation but only calculated for reporting purposes. Based on the information contained in the NIR and the CRF tables, the ERT found it difficult to reconstruct the values in CRF tables 3.B(a)s1 and 3.B(a)s2. Part of the problem is that the values provided by Italy in the CRF tables are weighted averages and not all assumptions and parameters are described in the NIR. During the review, Italy provided further information on this issue, including a spreadsheet that facilitates comprehension of the approach used. The ERT considers the emission estimates accurate and commends Italy for the detailed approach. The ERT encourages Italy to improve transparency on the reporting of CH4 emissions from digesters, in particular by providing clear and concise information (assumptions made, parameters used) on how the weighted average values for MCF and Bo reported in the CRF tables were estimated.	A.12	Additional information has been included in the NIR	Chapter 5 paragraph 5.3 and Annex 7.2
Agriculture/ 3.B Manure management – CH$_4$, N$_2$O	Italy uses in its inventory a share of manure excreted on pasture, range and paddock of approximately 5 per cent for dairy cattle (NIR, p.184; CRF table 3.B(a)s2) and a respective share for non-dairy cattle that is even lower (e.g. 2.5 per cent for the cool climate region for 2016; CRF table 3.B(a)s2). These values are among the lowest reported by Parties (range 2.9–69.9 for the cool climate region for 2016). During the review, Italy explained that for dairy cattle reared in mountain areas (above 600 m) the share of manure directly excreted during grazing was estimated as 5 per cent by the MeditAIRaneo project (CRPA, 2006) and that this assessment was confirmed by the 2010 General Agricultural Census. The same value was assumed for other females in the category non-dairy cattle while no grazing was assumed for males. The ERT considers that the country-specific values are based on best available national statistics and therefore as accurate as the current livestock data assessment permits. The ERT encourages Italy to reassess the share of manure directly excreted on pasture, range and paddock for dairy cattle and non-dairy cattle or to provide further information that supports the current values in the NIR (e.g. information on general cattle husbandry practices).	A.13	Additional information has been included in the NIR	Chapter 5 paragraph 5.2
Agriculture/ 3.B Manure management – N$_2$O	Italy lists in the NIR (p.182) the key categories in the agriculture sector, where indirect N2O emissions from manure management are indicated as a key category by level in approach 2 when excluding the LULUCF sector, while direct N2O emissions from manure management are not identified as a key category. During the review, Italy explained that the indirect N2O emissions from manure management are a key category at level assessment only taking account of the relevant uncertainty, which is assumed for the indirect N2O	A.14	Additional information has been included in the NIR	Chapter 5 paragraph 5.1

	EFs much higher than for the direct N2O EFs.
The ERT encourages Italy to further clarify the key category assessment in the agriculture sector by highlighting in the NIR that indirect N2O emissions from manure management are a key category primarily due to the high uncertainty of the EFs.				
Agriculture/ 3.B.5 Indirect N$_2$O emissions – N$_2$O	Italy assumes a FracleachMS of 1 per cent (NIR table 5.17). However, according to the same table FracleachMS is applied on the amount of N after the N volatilized from manure management is subtracted. The ERT considers that this is not in line with equation 10.28 in the 2006 IPCC Guidelines. During the review, Italy explained that according to the national legislation, storage systems avoiding N leaching are adopted. Nevertheless, manure heaps near the field are permitted for limited times after storage. Leaching of N during manure management is thus restricted to these manure heaps after storage. The ERT considers that the approach used by Italy to apply FracleachMS on the amount of N after the N volatilized from manure management is subtracted is correct, because most N will already be volatilized before installing the manure heaps near the field.
The ERT recommends that Italy describe the approach used when estimating the amount of N lost from leaching during manure management in the NIR, particularly with respect to the default methodology suggested by equation 10.28 in the 2006 IPCC Guidelines.	A.15		Additional information has been included in the NIR	Chapter 5 paragraph 5.3

During the last ESD Greenhouse gases review process in 2018 the following issue was raised.

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

Observation	Key Category	CRF code, Pollutant(s), Year(s)	Observations	RE or TC	Implementation
IT-3D1-2018-0001	Yes	3D1 Direct N2O emissions from managed soils - 3.D.1.2.a (Animal Manure Applied to Soils), N$_2$O, 1990-2016	The amount of N applied with animal manure in 3.D.1.2.a is large as compared to N managed in MMS minus N lost as NH3+NOx or leaching. We compared the manure 'managed' and not lost as NH3+NOx or leaching in MMS (3B2) with Aninmal manure applied to soil (3D12a) and we found that the amount of N applied with animal manure in 3.D.1.2.a is large as compared to N managed in MMS minus N lost as NH3+NOx or leaching. According to IPCC equation 11.4 FAM is calculted from NMMS_Avb as calculated in Equation 10.34. NMMS_Avb is obtained from N managed in MMS and not lost (FracLOSSMS) according to Table 10.23 plus any addition of bedding material. The loss fractions in Table 10.23 include also losses of N2 which are not included in the indirect emissions-volatilizations. Therefore FAM is expected to be smaller than N managed in MMS minus N lost as NH3+NOx+leaching unless bedding material has been accounted for. The issue was identified last year and Italy explained that there is addition of bedding material.	No	Emissions have been estimated and included in the Inventory

| | | | However, it is still not clear for us from the response nor from the NIR (2017) whether N2 emissions are deducted for the calculation of manure N available for application. Note that most manure management systems have volatilization of N2 in addition of volatilization of NH3+NOx, with the exception of Liquid/slurry and pit storage which have no additional N2 losses, but in Italy only around 35-48% of manure is managed in liquid systems. Could you please confirm if N2 emissions are taken into account in the calculation of N manure available for application? | | |

During the last NECD review process[29] in 2018 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, NH_3 and $PM_{2.5}$ with a national ceiling for 2030.

Table 3. *Recommendations from the TERT of the NECD comprehensive review air pollutant inventories*

Observation	Key Category	NFR, Pollutant(s), Year(s)	Recommendation	RE or TC	Implementation
IT-3B-2018-0001	No	3B Manure Management, NMVOC, 1990-2015	For source category 3B Manure management and NMVOC emissions for the years 1990-2016, with reference to the previous review recommendation IT-3B-2017-0003, the TERT noted that Italy has provided NMVOC emission estimates. The TERT also notes that NFR 3B1a Dairy cattle, NFR 3B1b Non-dairy cattle and NFR 3B4giv Other poultry that these are key categories for NMVOC emissions. In response to a question raised during the review Italy explained that for the mentioned animal type key categories, it is planned to estimate the emissions with the Tier 2 methodology for the next submission and that a comparison with the current estimates will be made. Additionally, if possible, a comparison between the emission factors used in the previous submission (included in the US EPA AP 42 Compilation of Air Pollutant Emission Factors Guidebook), and those reported in the National Air Emissions Monitoring Study of the US EPA (available in the 2016 EMEP/EEA Guidebook), will be made to understand the enormous differences that exist between the two versions of the US emission factors. The TERT appreciates Italy's effort to improve the inventory and recommends that Italy apply the Tier 2 methodology for key categories in its next inventory submission as announced in its answer to the TERT. The TERT also kindly notes that progress in the implementation of the improvement will be reviewed in 2019.	No	Implemented
IT-3F-2018-0001	No	3F Field Burning of Agricultural Residues, PAHs, Cd, Hg, Pb, PCDD/F, 2000-2016	For category 3F Field Burning of Agricultural Residues and pollutants Pb, Cd, Hg, PAHs, PCDD/F for the years 2000-2016 the TERT noted that Italy reported the notation key 'NA'. However, for the main pollutants, emissions were reported. In response to a question raised during the review, Italy explained that it has reported	No	Emissions have been estimated and included in the Inventory

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[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).

			'NA' because Italy assumes that there are no metals in the residues of cereals that will be burned. For PCDD/F emissions Italy assumes that there is no basis that provides the chlorine. Regarding PAH, Italy had already started the analysis of Tier 1 and Tier 2 emission factors provided in the 2016 EMEP/EEA Guidebook. Italy observed that in the underlying original study the PAH EFs for cereals refer to the PAH concentrations in particulate matter. Thus, it is necessary to multiply the emission factors reported in the 2016 EMEP/EEA Guidebook with the percentages of dm content. However, a rough estimate of the relevant HM and POPs resulted in values under the threshold of significance. The TERT recommends that Italy provides estimates for heavy metals and PCDD/F because for this activity EFs are included in the 2016 EMEP/EEA Guidebook or Italy provides evidence that these emissions do not result from field burning in Italy. Regarding PAH emissions the TERT recommends that Italy calculates the emissions based on the outcome of its analyses and justifies the approach in the IIR of next submission. The TERT also kindly notes that progress in the implementation of the improvement will be reviewed in 2019.		

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 *2019 submission*[30].

Results from the MeditAIRaneo project[31] have been included in the preparation of the agriculture emission inventory (UNFCCC/UNECE-CLRTAP). Besides, results from the convention signed between APAT and the Ministry for the Environment, Land and Sea have been incorporated.

At the end of 2009 another research study related to land spreading estimations and scenario was completed[32].

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.

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[30] Di Cristofaro E., several years. *Procedura per la preparazione, caricamento e reporting dell'inventario nazionale delle emissioni 1990-2016, del settore Agricoltura. Rapporto interno VAL-ATM/ISPRA.* Roma – Italia.
[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.

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 methodology[35]. An ad-hoc agro-environmental indicator group coordinated by the Ministry of Agriculture is working to determine gross nitrogen balances; therefore, N coefficients will be revised.

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*.

In November 2014 submission, revised CH_4 and N_2O emission estimates from manure management have been calculated using a country-specific methodology and MCF, that separate the manure used in anaerobic digesters from the manure treated as slurry/solid.

In 2014, as regards CH_4 emissions from rice cultivation, the cultivation period (days) for some rice varieties have been updated. Despite the upload of the vegetation period of some varieties, the estimate of the average value for water regime does not change the previous values.

In November 2014, the CH_4 emission factors used for the rice cultivation category in the Italian emissions inventory were presented at the 9th Expert Meeting on Data for the IPCC Emission Factor Database (EFDB) and the values were entered into the database. On the basis of the feedback received during the meeting, the daily emission factor for continuously flooded fields without organic amendments for multiple aeration regime have been updated.

As regards N_2O emissions from agriculture soils, in 2015, data on crop residues and, in particular, on the relationship between crop residues and product were compared with studies and research provided by the 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

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[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

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

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.

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 AGEA[36] 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. FAO data is 30% and 40% higher on average than ISTAT official statistics, for the period 1990-1994 and 1998-2003 respectively. In the following years, the data are practically the same and from 2009 the FAO data are equal to the quantity of milk collected at the farms, provided by ISTAT. The milk directly suckled by lambs is not considered. 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 2012-2016 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 2013-2016. 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.

In 2016, some updates have been done: as regards CH_4 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; N_2O emissions from nitrogen leaching and run-off during manure management activities have been estimated; for liming category, additional information has been collected from the

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[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 rettificate registrate*).

industry on the amount of dolomite and limestone applied and the weighted average emission factor has been used to estimate CO_2 emissions.

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, NH_3 emission factors for cattle, buffalo, swine and poultry categories and CH_4 emission factors on manure storage for swine category have been updated. NO_x emissions from storage have been updated according to the Tier2 methodology reported in the last version of the EMEP/EEA Guidebook (EMEP/EEA, 2016). NH_3 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). N_2O 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.

In 2019 submission, some updates have been done: CH_4 emissions have been recalculated because of the update of the values of some parameters for estimating the manure sent to the digesters (such as data related to the percentages of the different substrates that feed the anaerobic digesters and data relative to the average content of volatile solids by type of substrates). As a result of these changes, the amount of manure sent to the digesters decreases considerably and CH_4 losses of the biogas recovery plants become greater than the methane emissions avoided due to the storage of manure in the digesters. Compared to the previous submission, CH_4 emissions from manure management for cattle and swine are increased throughout the time series. Based on the update of parameters for estimating the manure sent to the digesters described above, also the amount of nitrogen contained in the manure has been updated and has remarkably decreased, leading to an increase in total N_2O direct emissions from manure management. N_2O emissions have been recalculated according to the update of $Frac_{LossMS}$ that now includes the losses of N_2, consequently the amount of managed manure nitrogen available for application to managed soils has decreased.

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.	2019
Manure management	Dairy cattle	N excretion	N_2O	Further efforts on theoretical assessment of N excretion data will be done based on N balance methodology (Gruber and Poesch, 2006)[37].	2020

[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

Category	Subcategory	Parameter	Gas	Description	Timing
	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]).	2020
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.	2019

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. The outcomes of the survey, which should be available at the end of 2019, will be used to verify the accuracy of the estimates. A study carried out by the CRPA in 2018 (CRPA, 2018) mentioned before also includes a survey on the digesters and the outcomes of the survey have been used to update the estimates as described in paragraph 5.3.2 of the NIR.

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 is collected every year 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 is 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 is under investigation.

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[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
2018 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Marina Vitullo

March, 2019

NATIONAL AIR EMISSION INVENTORY: LULUCF

Objective

The report summarizes the improvements and remarks, which have been identified during the preparation of the 2019 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 2018, are described.

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

CRF category / issue	Review recommendation	Review report / par.	MS response / status of implementation	Chapter/section in the NIR
LULUCF/ 4.A Forest land – CO_2	Document the For-est model validations in the NIR	L.2	Verification activities have been carried out by independent researchers (i.e. comparison of the model results versus NFI data (Tabacchi et al., 2010), comparison among NFI current increment data and For-est model current increment data), as indicated in the 2016 NIR and the 2018 NIR (chapter 6.2.6). The full validation of the model used for the forest land estimations had not yet been done owing to the unavailability of the data from the second phase (ground visit and attributes collection, currently ongoing) of the third NFI, which is expected to release data by the end of 2019	Chapter 6, Annex 14
LULUCF/ 4.A Forest land – CO_2	Provide definition and thresholds for carbon pools in a table in the NIR	L.5	The table has been included in the NIR	Chapter 6 paragraph 6.2.4
LULUCF/ 4.C.1 Grassland remaining grassland – CO2	Include the subset of "improved grazing" land in the CRF tables and the NIR under the Convention while the new information is becoming available.	L.6	Addressing; the subset of "improved grazing land" currently reported under GM will be included in the grassland category under the Convention, as a fraction of grazing land as soon as data will be available. Verification activities are currently ongoing to assess the data related to the land subject to the organic grazing land from 1990 to 1998 (data are only available from 1999 onwards) 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. General	The ERT recommends that Italy report more detailed explanatory information and a justification of recalculations in the NIR in line with paragraph	L.8	Additional information has been included in the NIR.	Chapter 6; Chapter 9

	44 of the UNFCCC Annex I inventory reporting guidelines (e.g. providing information on the updated AD and/or on errors corrected in the models used). The ERT further recommends that the Party ensure that the NIR contains up-to-date and consistent information on recalculations applied in the sector. The ERT encourages the Party to include a discussion on the impact of the recalculations on the trend of the CO2, CH4 and N2O emissions at the category and sectoral levels.			
LULUCF/ 4.A.1 Forest land remaining forest land – CO2	The ERT noted that in chapter 6.2.8, Italy indicates an update in the For-est model. However, the NIR contains no details on the For-est model (see Federici et al. (2008)) other than an overall presentation and literature reference to it and no information on its latest updates indicated by the Party. The ERT recommends that Italy include a summary on the For-est model in an annex to the NIR, together with information on its verification and regular updates.	L.9	A specific annex has been included to the NIR to provide the requested additional information	Annex 14
LULUCF/ 4.B.1 Cropland remaining cropland – CO2	The ERT noted that the NIR (chapter 6.3.2) explains that land-use changes have been derived using land-use change matrices, smoothing the amount of changes over a five-year period, harmonizing the whole time series, resulting in a constant amount of carbon stock change in the five-year period, following a previous review remark. However, the NIR is not explicit on the way the smoothing is applied and annual data used in the process. During the review, Italy indicated that the area of each subdivision for each category is smoothed over a five-year period (i.e. the 2015–2010 difference in area for each subdivision is divided by five, and the resulting value is added, year by year, to the previous year area to deduce the current area). The smoothing period affects the assessment of the area, depending on the amount of the difference between the two reference years (i.e. 2015–2010), as well as on the number of years included in the smoothing period. The ERT recommends that Italy provide information on the smoothing process applied for the estimates and provide a table with the calculations with and without the smoothing in the NIR.	L.11	A table reporting land use data with and without the smoothing over a 5 years period has been included in the NIR	Chapter 6, paragraph 6.1, table 6.3a, 6.3b
LULUCF/ 4.E Settlements – CO2, CH4 and N2O	The ERT noted that the AD for biomass burning for settlements have been reported for the entire time series, while the relevant emissions were reported as "NO". During the review, Italy indicated that area is derived from the data collected by the National Forest Service. In 2016, the National Forest Service made available the results, starting from 2013, of an additional annual survey. The survey complements the previous set of surveys for fire detection. Areas affected by fires encompassed in the settlements category have been reported, but no emissions are estimated, assuming the carbon losses from the settlements areas affected by fires are negligible. The ERT considered the assumption acceptable based on the available information for the latest years of the time series. However, the ERT noted that the area affected by fire was 6.12 ha in 2016 but 73,259.01 ha in 1990 and 62,393.64 ha in 1998. In addition, for all years in the time series the notation key "NO" is used for the emissions, which is not in line with the notation key use suggested by the UNFCCC Annex I inventory	L.12	An error occurred in the reporting of areas affected by fires encompassed in the settlements category in 2018 submission for the years 1990-1998. The correct burned area, reported in the 2019 submission, are much smaller, and the related GHG emissions are insignificant.	Chapter 6, paragraph 6.12

	reporting guidelines for reporting of categories considered as insignificant, for which notation key "NE" should be used.
The ERT recommends that Italy revise the use of the notation key from "NO" to "NE" for CO2, CH4 and N2O emissions together with the relevant justification for excluding the emissions, in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. The ERT further recommends that Italy include emissions from fires in settlements for the years where the affected area is significant (e.g. 1990–1995, 1998), if emissions prove to be significant, together with supporting methodological information.			
KP-LULUCF/ Article 3.4 activities – CO$_2$	Include transparent and verifiable information that demonstrates that the litter pool and deadwood pools for CM and above-ground biomass, below-ground biomass, litter, deadwood pool for grassland management are not net sources, as stated in the annex to decision 2/CMP.7, and change the notation key from "NO" to "NE".	KL.1	Notation key has been changed and additional information has been added in the NIR	Chapter 9 paragraph 9.5.3
KP-LULUCF/ Forest management– CO2	The FMRL reported in the CRF accounting table of the 2018 submission is –22.166 Mt CO2 eq. In chapter 9.5.2.2 and annex 10 of the NIR it is stated that the FMRL for Italy, inscribed in the appendix to the annex to decision 2/CMP.7, is equal to –21.182 Mt CO2 eq per year assuming instantaneous oxidation of HWP and –22.166 Mt CO2 eq applying a first-order decay function for HWP. The values are consistent with those included in the Report of the technical assessment of the forest management reference level submission of Italy submitted in 2011 (FCCC/TAR/2011/ITA). However, the ERT notes that the NIR does not transparently specify which value of FMRL is used for the accounting of forest management in accordance with decision 2/CMP.7, annex, paragraphs 12–15, although –22.166 Mt CO2 is used in table 9.15 of the NIR and in the CRF accounting table.
The ERT recommends that Italy transparently specify in the NIR the FMRL value used for the purposes of accounting for the forest management in the second commitment period in accordance with decision 2/CMP.7, annex, paragraphs 12–15.	KL.5	The value of FMRL, including the HWP estimate, applying a first-order decay function for HWP, is included in the NIR.	Chapter 9 paragraph 9.5.2.2
KP-LULUCF/ Forest management– CO2	The value of the FM cap reported in the CRF accounting table of the 2018 submission is 145,141.74 kt CO2 eq. The value in the Report on the review of the report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of Italy is 146,237.768 kt CO2 eq (FCCC/IRR/2016/ITA). The ERT notes that, according to paragraph 12 of decision 6/CMP.9, the value of the FM cap shall remain fixed for the second commitment period.
The ERT recommends that Italy correct the reporting of the FM cap in the CRF accounting table.	KL.6	The correct value has been included in the CRF accounting table.	CRF tables
KP-LULUCF/ Cropland management – CO2	The ERT noted that emissions from cropland management (perennial woody crop losses) for the years 2013 and 2014 decreased by almost 45 per cent, while the value for the area subject to the activity experienced a minor update (around 100 ha) in the 2018 submission compared with the 2016 submission. As a result of this change the overall emissions from cropland management decreased by more than 70 per cent for 2013 and 2014. Italy indicated that the change was due to the variation of	KL.7	The Annex 10 has been modified.	Annex 10

the AD (i.e. area of annual and perennial crops) driven by the updated IUTI (inventory of land use) data (related to 2012). However, the ERT does not consider this to explain the change in the IEF for above-ground biomass by 45 per cent (from 0.26 t C/ha in the 2016 submission to 0.14 t C/ha in the 2018 submission for 2013–2015). The value of the IEF further changed to 0.02 t C/ha in 2016.

The ERT recommends that Italy provide detailed information in the NIR on how the IUTI is updated and how it impacts the further refinement of AD classes in woody crops and non-woody crops, together with detailed information on the typologies of perennial woody crops and biomass estimates that are affected by the IUTI updates, which may affect the IEF changes.

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, is fully implemented also in the LULUCF sector of the inventory under the Convention, in order to maintain consistency between the two forest-related reporting.

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 Decree[39] 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.

In the 2019 submission, a specific Annex has been included to the NIR to provide detailed information on *For-est* model.

Cropland (4B) - Grassland (4C)

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.

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[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).

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. 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, the methodological elements listed in paragraph 2.7.5.2 (IPCC, 2014) have been analysed, providing a description on the detected inconsistencies (NIR, §9.5.2.3. Table 9.13).

The changes related to the abovementioned methodological elements trigger 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 2019, §6.2.4, §9.3.1.1, Annex 14); 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 9.14).

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 Regulations[40] 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 stratifies into Italian NUTS2 regions (NIR, Table 9.1).

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.

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[40] 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

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

Table 2. *Planned improvements*

Category	Subcategory	Parameter	Gas	Description	Timing
Forest land	FL-FL; L-FL	-	GHG	− Implementation of the III NFI's outcomes; the final outcomes, related to the field surveys, are expected to be available in 2019. − Update of the model could be planned to allow for disaggregated estimates of C stock changes in land converted to forest land, since the current version of forest model do not discriminate among forest remaining forest and land converted to forest. − A confusion matrix, between forest typologies of the NFI2005 and those of the first forest inventory classification systems will be carried out.	2020-2021
Forest land	FL-FL; L-FL			- the for-est model currently do not remove year by year the impact of deforestation from the calculation of the forest biomass density and consequently from the calculation of the annual increment. - the for-est model currently do not calculate annual biomass increment in the areas converted to forest in the year. The inclusion of such areas is seen needed to address the identified underestimate of the biomass C stock.	2020
Cropland	CL	Activity data	GHG	Verification activities, data collection and model implementation for soils pool; data collection and estimation process at regional level	2020
Grassland	GL	Activity data	GHG	-Verification activities, data collection and model implementation for soils pool; data collection and estimation process at regional level; -Stratification of grassland category with the inclusion of the subset of "improved grazing land" currently reported under GM will be included in the grassland category under the Convention, as a fraction of grazing land as soon as data will be available.	2020
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	2020-2021
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	2020
KP LULUCF	CM	Activity data; emissions/removals	CO_2	Data collection and verification activities	2020

GM	Activity data; emissions/removals	CO$_2$	Data collection and verification activities	2020

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

Forest land (4A)

The following improvements are planned to be implemented in the *for-est* model for the 2020 submission:

- the *for-est* model currently do not remove year by year the impact of deforestation from the calculation of the forest biomass density and consequently from the calculation of the annual increment.
- the for-est model currently do not calculate annual biomass increment in the areas converted to forest in the year. The inclusion of such areas is seen needed to address the identified underestimate of the biomass C stock (see Annex 14on the *for-est* model).

The third NFI data, expected in late 2019, will allow the calibration of the increment curve and verification of the *for-est* estimates through a comparison with estimates prepared with the stock-difference method; in addition an update of the model could be planned to allow for disaggregated estimates of C stock changes in land converted to forest land, since the current version of for-est model do not discriminate among forest remaining forest and land converted to forest.

A confusion matrix, between forest typologies of the NFI2005 and those of the first forest inventory classification systems is under finalization and will be implemented in the next NGHGI submission.

Cropland (4B)

Research is ongoing to collect country-specific data on woody crops, with the aim to disaggregate the current estimates in the main categories of woody cropland (orchards, citrus trees, vineyards, olive groves).

In particular, the LIFE project "Mediterranean Network for Reporting Emissions and Removals in Cropland and Grazing land Management" MEDINET[41], aimed to create a solid network among mediterranean institutions involved in the reporting/accounting of emissions and removals at national level, including also universities, research centres and relevant stakeholders, provided a notable data collection, with relevance for reporting croplands and grasslands emissions and removals in Mediterranean conditions, in particular for mineral soil and aboveground biomass of perennial crops. Verification activities are currently ongoing to explore the possibility of the use of factors and parameters deduced by the MEDINED database for the next annual submission.

Grassland (4C)

The subset of "improved grazing land" currently reported under GM will be included in the grassland category under the Convention, as a fraction of grazing land as soon as data will be available. Verification activities are currently ongoing to assess the data related to the land subject to the organic grazing land from 1990 to 1998 (data are only available from 1999 onwards) 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.

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.

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[41] http://www.lifemedinet.com/

In particular, the LIFE project "Mediterranean Network for Reporting Emissions and Removals in Cropland and Grazing land Management" MEDINET[42], aimed to create a solid network among mediterranean institutions involved in the reporting/accounting of emissions and removals at national level, including also universities, research centres and relevant stakeholders, provided a notable data collection, with relevance for reporting croplands and grasslands emissions and removals in Mediterranean conditions, in particular for mineral soil and aboveground biomass of perennial crops. Verification activities are currently ongoing to explore the possibility of the use of factors and parameters deduced by the MEDINED database for the next annual submission.

Wetlands (4D) - Settlements (4E)
No improvements are planned for the next submission.

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 (4(V))
No improvements are planned for the next submission.

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 2020-2021 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**[43]	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

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[42] http://www.lifemedinet.com/

[43] 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)

land covered by arable crops grown using "**conservative practices**", including management practices aimed to preserve the soil[44]	Implementation Report Tables[45] (AIRs) of the regional Rural Development Programmes (RDPs).	Data have been collected at regional level (NUTS2), from 2008
land covered by arable crops and woody crops grown using "**sustainable management systems**[46]"	AIRs of the regional RDPs[47] and the Annual Report of the Operative Programmes of the fruit and vegetables in the framework of CMO[48], 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[49].
land set aside[50]	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 2020 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 2019 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.

[44] 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-content/EN/TXT/PDF/?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
[45] 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)
[46] 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
[47] for 2007-2014 referred to action 214.1 – tables O.214(1) and O.AGRI.ENV
[48] Common Organisation of the Markets (CMO) in agricultural products http://www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuId=FTU_5.2.4.html
[49] Indicatori Agricoli Territoriali", National Rural Network: http://indiciterritorialiagricoli.ismea.it
[50] 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
2018 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Barbara Gonella, Ernesto Taurino

April, 2019

NATIONAL AIR EMISSION INVENTORY: WASTE

Objective

This report summarises the improvements, which have been identified during the preparation of the 2019 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.A.1 Managed waste disposal sites – CH4 (W.2, 2016) (W.2, 2015) Consistency	Develop a continuous time series of the CH4 generation constant instead of using the step function variation over the relevant periods.	Resolved.
w.2	5.A.1 Managed waste disposal sites – CH4 (W.3, 2016) (W.3, 2015) Transparency	Make the necessary changes to the degradable organic carbon fraction in CRF table 5.A to improve the consistency between the NIR and the CRF tables.	Resolved.
w.3	5.A.2 Unmanaged waste disposal sites – CH4 (W.4, 2016) (W.4, 2015) Transparency	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.	Resolved.
w.4	5.C.1 Waste incineration – CO2 (W.1, 2016) (W.1, 2015) (66, 2014) 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.	The recommendation has been implemented, more info in Chapter 7 paragraph 4.2
w.5	5. General (waste)	Recalculations were made to the waste sector that changed the emission/removal estimate for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	Not an issue/problem
w.6	5.A Solid waste disposal on land – CH4	...The ERT recommends that Italy provide in the NIR further explanation on the basis of the assumed disaggregation (studies, references) of slowly degraded waste as well as the reasons for using the aggregated k values for slowly degrading waste instead of the specific k values for wood and paper and thereby applying a different approach (bulk waste) for these waste types to that used for the other estimation of the emissions from solid waste disposal sites...	The NIR has been updated accordingly, see chapter 7 paragraph 2
w.7	5.A Solid waste	...The ERT recommends that Italy provide in the NIR further	The NIR has been updated

	disposal on land – CH4	explanation on how time-series consistency and completeness is ensured. This could be done by including a description on how the historical and more recent waste categorizations are combined (e.g. textiles, leather and wood in historical data are included in other waste type). Related to ID# W.6 above about slowly degraded....	accordingly, see chapter 7 paragraph 2
w.8	5.A Solid waste disposal on land – CH4	The ERT recommends that Italy provide in the NIR summary information on waste disposal amounts for each climate zone.	The NIR has been updated accordingly, see chapter 7 paragraph 2
w.9	5.A Solid waste disposal on land – CH4	The ERT recommends that the Party include in the NIR the information of the delay time used for the estimates.	The NIR has been updated accordingly, see chapter 7 paragraph 2
w.10	5.A.2 Unmanaged waste disposal sites – CH4	The ERT recommends that Italy include in the NIR information to justify why disposal amounts from unmanaged disposal sites related to the Naples waste management issue are not included in the inventory estimates.	The NIR has been updated accordingly, see chapter 7 paragraph 2
w.11	5.B Biological treatment of solid waste – CH4 and N2O	The ERT recommends that the Party include in the NIR the information of dry basis AD and the assumption of moisture content.	The NIR has been updated accordingly, see chapter 7 paragraph 3
w.12	5.D.2 Industrial wastewater – N2O	The ERT recommends that the Party improve the transparency of the NIR and of CRF table 5.D by using the appropriate AD in the CRF table or by including an explanation that the AD reported in CRF table 5.D are in fact the N-N2O in the effluent.	The CRF and the NIR have been updated accordingly, see chapter 7 paragraph 5

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

Review report para	Subject	Description	Response
IT-5A-2018-0001	5.A Solid waste disposal, CH4, 1990-2016	... The TERT recommends that Italy reports the changes in the methodology in a transparent manner in its next NIR.	The NIR has been updated accordingly, see chapter 7 paragraph 2. Further info in ISPRA, 2018. Update of CH4 emission from landfills. Technical note n.1/2018.

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

Review report para	Subject	Description	Response
IT-5D-2018-0001	5D Wastewater Handling, NMVOC, 2005, 2010, 2015	...The TERT recommends that Italy calculates these emissions and reports them in the next submission.	Done.
IT-5E-2018-0001	5E Other Waste SO2, NOX, NH3, NMVOC, PM2.5, 2005, 2010, 2015	...The TERT recommends that Italy include a revised estimate in its next submission for all years.	Revision of estimates is ongoing.
IT-5C2-2018-0001	5C2 Open Burning of Waste, Cd, 1990, 2005, 2016	For category 5C2 Open Burning of Waste the TERT noted that the notation key 'NA' is reported for Cd emissions for 5C2 although an EF is provided in the 2016 EMEP/EEA Guidebook. ...	NMVOC emissions have been considered equal to CH4 emissions. As regards the other pollutants, Cd, Dioxin and PAH emission factors are from the EMEP/EEA Guidebook (EMEP/EEA, 2016) and emissions have been added as requested by the NECD review process (EEA, 2018)
IT-5A-	5A Biological	The TERT recommends that Italy includes TSP, PM10 and	Acquire more information.

2019-0001	Treatment of Waste - Solid Waste Disposal on Land, TSP, PM10 and PM2.5 , 1990-2017	PM2.5 emissions from 5A in the next submission.	
IT-5C-2019-0001	5C Waste incineration, PCBs, HCB, 1990-2017	Therefore, the TERT recommends that Italy apply a higher Tier methodology in its next submission (considering an evolution of the EF over the time series). Moreover, the TERT recommends that Italy applies the updated version of the EMEP/EEA Guidebook (2016 or the 2019 version) and includes HCB and PCBs for 5C1bv Cremation in its next submission.	Check info and acquire more data.
IT-5C1bv-2019-0001	5C1bv Cremation, SO2, NOX, NMVOC, PM2.5, BaP, PAHs, PCBs, HCB, Cd, Hg, Pb, PCDD/F, 1990-2017	Therefore, the TERT recommends that Italy include higher Tier methodology taking into account the implementation of abatement technologies.	Check info and acquire more data.

Inventory improvements and QA activities

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

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)[51] .

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

A thesis on GHG emissions from wastewater handling has been carried out at Environmental, Hydraulic, Infrastructures and Surveying Engineering Department (DIIAR) of Politecnico di Milano[52], 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 CH_4/Mg waste treated on a wet weight basis.

In the same way, detailed information has been acquired about solid waste disposal sites, in particular about:
- Inventory of methane generation rate (k) values for CH4 from landfills;
- Assessment of values and background of k values;
- Spatial distribution of dry and wet zones in Italy and location of landfills;

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[51] TERNA, several years. *Dati statistici sull'energia elettrica in Italia*. Rete Elettrica Nazionale.
[52] 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.

- Formulation of a proposal for emission estimates for CH4 in future NIRs;
- Verification.

On the basis of this information new estimates have been produced.

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.

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

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.	2015-2019 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.	Done
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.	2016-2019
Other waste	-	Activity data and emission factors	AQ pollutants	Acquire more info about data and management system of waste not considered in 5A-5B-5C-5D categories. Focus on accidental episodes.	2019 - ongoing

Solid waste disposal on land

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

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

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

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 CO_2 emission factor on the basis of carbon content, but in the case of incineration combustion technologies are equally important. In order to update the government's strategy to achieve Italy's emissions reduction target under the Kyoto Protocol, the GHG emission projections for 2020, specific to waste management, have been updated with a focus on how this could influence the waste composition. The new information on waste composition has improved also CO2 waste incineration emission estimates reviewed in the 2019 submisison. 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. New updates will come from the new report on energy recovery from waste management published by Utilitalia and ISPRA in 2019 wich will be used for next submissions.

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, 2019

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.

	Category	Parameter	Gas	Description	Timing
Sector	-	-	-	Improve the QA/QC annual plan report with the description of the tier2 QC checks implemented at sectoral level	2018-2020
	-	-	-	Quantitative uncertainty analysis of emission estimates of other pollutants reported in the UNECE/CLRTAP framework	2018-2020
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 (TERNA) 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 are planned in order to gathered further data on emissions from the use of heat transfer fluids. For the foam blowing improvements are planned in order to investigate the consumption of other F-gas used and the different contribution of closed cell and open cell foams. In the air conditioning and refrigeration sectors improvements are planned to improve the evaluation of disposal and recovered emissions.	2019-2020
	Paint application	EFs	HC CO$_2$	Assess the possibility to split non industrial application according to the Guidebook EMEP/EEA	2019-2020
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
Agriculture	Dairy cattle	N excretion	N2O	Further efforts on theoretical assessment of N excretion data based on N balance methodology	2019
LULUCF	-	Uncertainty	-	Re-assessment of uncertainty analysis with Montecarlo	2019-2020
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
LULUCF	Cropland /Grassland	AD/EFs	GHG	Verification activities, data collection and model implementation for soils pool, data collection and reporting at regional level	2019-2020
Waste	Disposal on landfills and incinerators	AD	CO2, CH4	Waste composition and Carbon content of waste managed in landfills or incinerated	2015-2019
Waste	Domestic and commercial wastewater	MCF; AD	CH4	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.	2016-2019