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# Report for the Stage 3 *ad-hoc* review of emission inventories submitted under the UNECE LRTAP Convention:

# STAGE 3 REVIEW REPORT

# ITALY

# CONTENT

# INTRODUCTION

The mandate and overall objectives for the emission inventory review process under the LRTAP Convention is given by the UNECE document '*Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention*'[1] – hereafter referred to as the 'Review guidelines 2018'.

1. Paragraph 7 (c) of the 'Review guidelines 2018' defines that stage 3 reviews may be annual centralized reviews or ad hoc reviews. Paragraph 18 of the 'Review guidelines 2018' further specifies that such ad hoc reviews could, for instance, focus on specific source sectors, specific pollutants such as heavy metals or persistent organic pollutants, gridded and projections data, or on other areas as requested by the Implementation Committee and that where appropriate, ad hoc reviews could be conducted in line with the present Methods and Procedures for the In-depth (Stage 3) review.

2. At its seventh joint session in September 2021 the Steering Body and the Working Group approved the plan to perform (in 2022) an in-depth review of $PM_{2.5}$ emissions from residential heating and road transport, with a special focus on the topic of '*condensable particulate matter*' and a follow-up review of the implementation of recommendations given as part of the review carried out in 2021. The Parties reviewed in 2021 are Kazakhstan, Liechtenstein, Monaco and Montenegro.

3. Particulate matter can exist as solid or liquid matter (the "filterable" portion) or as gases (the "condensable" portion). Condensable particulate matter is vapour phase at stack conditions, but condenses and/or reacts upon cooling and dilution upon discharge into ambient air to form solid or liquid PM. All condensable PM is assumed to be in the $PM_{2.5}$ size fraction[2]. The inclusion of the condensable component of $PM_{2.5}$ emissions can have a big impact on the emission estimate for certain sources[3].

4. This ad-hoc review has assessed $PM_{2.5}$ emission estimates with a special focus on the topic of '*condensables*' for the years 2000 to 2020.

5. This report covers the results of the stage 3 centralised review (ad hoc review) 2022 of the UNECE LRTAP Convention of Italy coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place between April and June 2022 and was performed as desk review with an in person meeting between 30 of May 2022 and 3 June 2022. The following team of nominated experts from the roster of experts performed the review.

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[1] Decision 2018/1 adopted by EB: *Updated methods and procedures for the technical review of air pollutant emission Inventories reported under the Convention*. ECE/EB.AIR/142/Add.1 https://unece.org/fileadmin/DAM/env/documents/2018/Air/EB/ECE_EB.AIR_142_Add.1-1902937E.pdf

[2] Condensable Particulate Matter Definition | Law Insider

[3] For more technical details please refer to the EMEP/EEA Guidebook (https://www.eea.europa.eu/publications/emep-eea-guidebook-2019) or the report 'How should condensables be included in PM emission inventories reported to EMEP/CLRTAP?' https://emep.int/publ/reports/2020/emep_mscw_technical_report_4_2020.pdf

**Ad hoc review - condensables**

1A3b Road Transport: Gudrun Stranner, Katrina Young, Magdalena Zimakowska-Laskowska, Martina Toceva and Rebecca Rose

1A4bi Residential: stationary: Aleksandra Nestorovska-Krsteska, André Amaro, Benjamin Cuniasse, Canan Esin Köksal, Damian Zasina, Laureta Dibra, Marion Pinterits, Sam Gorji and Wolfgang Schieder

6. Kristina Saarinen and Jeroen Kuenen were the lead reviewers. The review was coordinated by Sabine Schindlbacher (EMEP Centre on Emission Inventories and Projections - CEIP).

7. The review was performed on the basis of CLRTAP emission data officially reported by Italy, due by 15 February 2022 for emission inventories. The Informative Inventory Reports (IIR), reported due 15 March 2022 under the CLRTAP, informed the review.

8. The emission inventory of Italy was received on 15 February 2022 and thus by the deadline of 15 February, with a resubmission on 15 March 2022. The Informative Inventory Report was received on 22 March 2022 and thus after the deadline of 15 March.

# RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

## 1.A.4.b.i Residential: stationary

9. Italy uses a Tier 2 methodology for calculating $PM_{2.5}$ emissions from '1A4bi – Residential: stationary'.

10. The activity data is based on a survey carried out by the Institute of Statistics (ISTAT) on the final energy consumption of households for residential heating and include the fuel consumption of solid biomass, such as wood and pellets[4]. The main source of data on consumption of wood and wood products in the residential sector is the Italian Energy Balance.

11. The activity data for Italy include collected wood, i.e. wood directly harvested from the forest outside formal market activity.

12. Italy has stratified the total fuel consumption for each fuel type into different appliance types, such as boilers and stoves, in a consistent and complete manner. The basis for this split over appliance types is documented in the IIR.

13. Italy uses a country specific methodology for the compilation of the emissions inventory from this category.

14. The Party informed the ERT that the country specific method used in the calculation of emissions is based on the experimental study and conducted by a research institute[5]. The study included measurements for $NO_X$, CO, NMVOC, $SO_X$, TSP, $PM_{10}$, $PM_{2.5}$, PAH and Dioxin emissions from combustion of different wood species typically used in Italy (beech, hornbeam, oak, locust and spruce-fir) in open and closed fireplaces, traditional and innovative stoves, and pellet stoves. The ERT recommends Italy to include this information in the next IIR submission as information regarding combustion of wood and wood waste, disaggregated by type of appliance.

15. During the review Italy also shared a document detailing the sampling method and emission measurements. The ERT recommends to complete the current documentation in the next IIR submission by including information on the measurement standards and/or equipment used. In case different measurements/equipments are used for different types of equipment it is recommended that these be also documented in the IIR.

16. The measurements include the condensable component of particulate matter (CPM).

17. The measurements used to derive the emission factors also cover the start phase (ignition) and the end (ember) phase of the combustion cycle. The emission factors used in the inventory derived from these measurements include the start phase (ignition) and end (ember) phase.

[4] - ISTAT, 2014. I consumi energetici delle famiglie, 2013. Nota metodologica. Istituto Nazionale di Statistica
[5] Stazione Sperimentale dei Combustibili' now Innovhub (SSC, 2012; INNOVHUB, 2021)

18. The Party takes into account user induced impacts that affect emission levels (the so-called user impact). The shares of combustion of treated wood and waste are not considered in the national estimates because these occur very rarely for residential heating purposes. The ERT found the information included in the IIR not to be transparent and sufficient and recommends the Party to incorporate in the next IIR submission more information on user induced impacts that are included in the inventory with information on their impacts on emission levels (e.g. shares of wet/treated wood, combustion of waste, user management of air circulation in the appliance)

19. The emission factors include the condensable component of $PM_{2.5}$ emissions (Table 1).

**Table 1: Inclusion of condensables per fuel type**

| Fuel Type | Includes the condensable component of $PM_{2.5}$ emissions |
|---|---|
| Biomass | Yes |
| Coal | Yes |
| Liquid | Yes |
| Gaseous | Yes |

20. The ERT notes that the time series is consistent.

21. $PM_{2.5}$ emissions from small combustion are spatially distributed using proxy data such as distributions of resident people and fuels sold at NUTS3 level)[6]

22. Italy lists the following planned improvements for future submissions in their 2022 IIR

- Update average emission factors on the basis of the surveys on wood consumption and combustion technologies planned by ISTAT as well as from the emission factor measurements' campaigns in Italy.
- An in-depth analysis of emission factors resulting from experimental studies and their comparison with the values suggested by the last version of the EMEP/EEA Guidebook 2019.

The ERT commends Italy for their improvement plans and recommends implementing them as soon as possible.

[6] ALTROCONSUMO, 2018 and the measurements campaign on advanced stoves completed by Innovhub

## 1.A.3.b.i-iv Road transport - exhaust emissions

23. Italy's transport sector emissions are calculated using emission factors taken from COPERT version 5.5.1. All emission factors in COPERT are based on the Tier 3 methodology in the 2019 EMEP/EEA Guidebook. The IIR provides details of the main features of the model and describes the calculation of transport emissions transparently.

24. The activity data is taken from total fuel sales from the national energy balance and supplementary information[7], and cross-checked with monthly mileage information for LDV and HDV and yearly vehicle registrations.

25. The inventory includes the condensable component of $PM_{2.5}$ emissions and this is documented transparently on p. 214 in appendix 1 of the IIR. The ERT recommends Italy to add this information also in the road transport chapter.

26. The ERT notes that the method to calculate transport sector emissions is documented transparently in the IIR.

27. The time series is consistent.

28. Italy list the following planned improvements for their submission in 2023 in their 2022 IIR:

- Improvements depend on the availability of data and information regarding activity data, calculation factors and parameters, new developments of the methodology and the update of the software.

The ERT commends Italy for their improvement plan and encourages Italy to be more precise in the description of which specific technical or methodological improvements are planned.

[7] (BEN - Bilancio Energetico Nazionale by Ministry of Economic Development and Infrastructure (MSE)), supplementary information from the Oil Bulletin (Ministero della Transizione Ecologica (MiSE, MiTE)), biofuels from the BEN, fuel specifications from ISPRA, fleet data from Automobile Club Italy (ACI) and the national transport yearbook by the Ministry of Transport (MIMS), motorcycle fleet data from the National Association of Cycle-Motorcycle (ANCMA), bus fleet data from CNIT, mileage from the national transport yearbook by the Ministry of Transport (MIMS), HDV mileage from ISTAT, cross-checked with monthly mileage information for LDV and HDV from the National Association of concessionaries of motorways and tunnels (AISCAT), CONFETRA and a study (Giordano, 2007), yearly vehicle registrations from the national transport yearbook by MIMS.

## REVISED ESTIMATES AND TECHNICAL CORRECTIONS CONSIDERED AND/OR CALCULATED BY ERT

29. In the Appendix of the 'EMEP/UNECE Review Guidelines 2018[8]' it is stated that if the ERT consider that when emissions are significantly under- or overestimated, then during the review, the Party is invited to submit "Revised Estimates" that address the issue raised. Should the Party decline to do this, or should it not be possible to agree on the quantification of the Revised Estimates, then the ERT may calculate a "Technical Correction" in the absence of an updated emission estimate being provided by the Party itself. The threshold for significance for a technical correction for the in-depth review in 2022 was set at 2% of the national total, i.e. findings identified which result in an over- or under-estimate of emissions of more than 2% of the national total can result in a Technical Correction. The methods for calculating the Technical Corrections are set up in the "Review Guidelines 2018" and use the EMEP/EEA Emission "Inventory Guidebook" as a reference for methods and emission factors.

30. Italy did not provide any revised estimates and the ERT did not calculate any technical corrections.

[8] https://www.ceip.at/fileadmin/inhalte/ceip/3_review/advance_version_ece_eb.air_142_add.1.pdf

## LIST OF MATERIAL PROVIDED TO ERT

1. Italy's Stage 2 S&A report
2. Italy's Stage 1 report 2022
3. Italy's IIR 2022
4. NFR tables submitted in 2022 by Italy

## LIST OF ADDITIONAL MATERIAL PROVIDED BY THE COUNTRY DURING THE REVIEW

5. Responses to preliminary question raised prior to the review
6. Responses to questions raised during the review
7. Emission factors by appliance.xls
8. Relazione Finale_29 gennaio 2021.pdf