

Implementation of Emission Projections for Air Quality Plan in Lombardy from National to Regional Scale

Alessandro Marongiu, Guido Lanzani

ARPA Lombardia – Regional Environmental Protection Agency of Lombardy
Air and Support to Political Decision Maker
Air Emissions Inventories

Matteo Lazzarini

Regione Lombardia
Directorate General for Environment and Climate
Air Structure

a.marongiu@arpalombardia.it

Summary

- Framework of EU, National and Regional Legislation
- Projections assimilation on local emission inventories
- Emission scenario definition
- Base year harmonisation
- Renewal rates and emission reduction
- Methodology for estimates sectorial regional actions

Framework of EU and National Legislation

The **Gothenburg Protocol** requires states to reduce and maintain emissions of:

- SO₂, NO_x, VOC, NH₃ e PM_{2.5}
- with priority to PM sources that also emit **Black Carbon (BC)**
- To achieve these goals:
- **emission limits** and **BAT (Best Available Technologies)** are adopted
- limits on fuels and VOC content in products are introduced
- national emission inventories are developed and updated

The **NEC Directive (2016/2284/EU)** transposes the targets of the protocol at European level

Other relevant **European regulations**:

- **IED 2010/75/EU**: BAT application and industrial emission limits (with BREF documents)
- **Directive 2015/2193/EU**: limits for medium combustion plants
- **Directive 2008/50/EC**: air quality monitoring system
- **Vehicle Regulations (2018/858, 715/2007, 595/2009)**: limits for CO, HC, NO_x, PM, CH₄ and NH₃ emissions
- **Fuel Directives (2009/30/EC, 2016/802/EU)**: Sulfur, lead and SO₂ reduction limits
- **Nitrates Directive 91/676/EEC**: reduction of nitrates in water with indirect effects on NH₃
- **VOC Directives (94/63/EC, 2004/42/EC)**: prevention of emissions from fuels, solvents, paints
- **Directive 2024/2881/EU**: new, stricter air quality limits by 2030

Framework of EU, National and Regional Legislation

The European framework is transposed into Italian legislation and guides:

- Emission time series
- Future projections
- Air quality plans

Air quality policies can be defined at several levels:

European, national, regional and local

In Italy:

- **ISPRA and ENEA**: emissions analysis and scenarios
- **Regions**: development of air quality plans

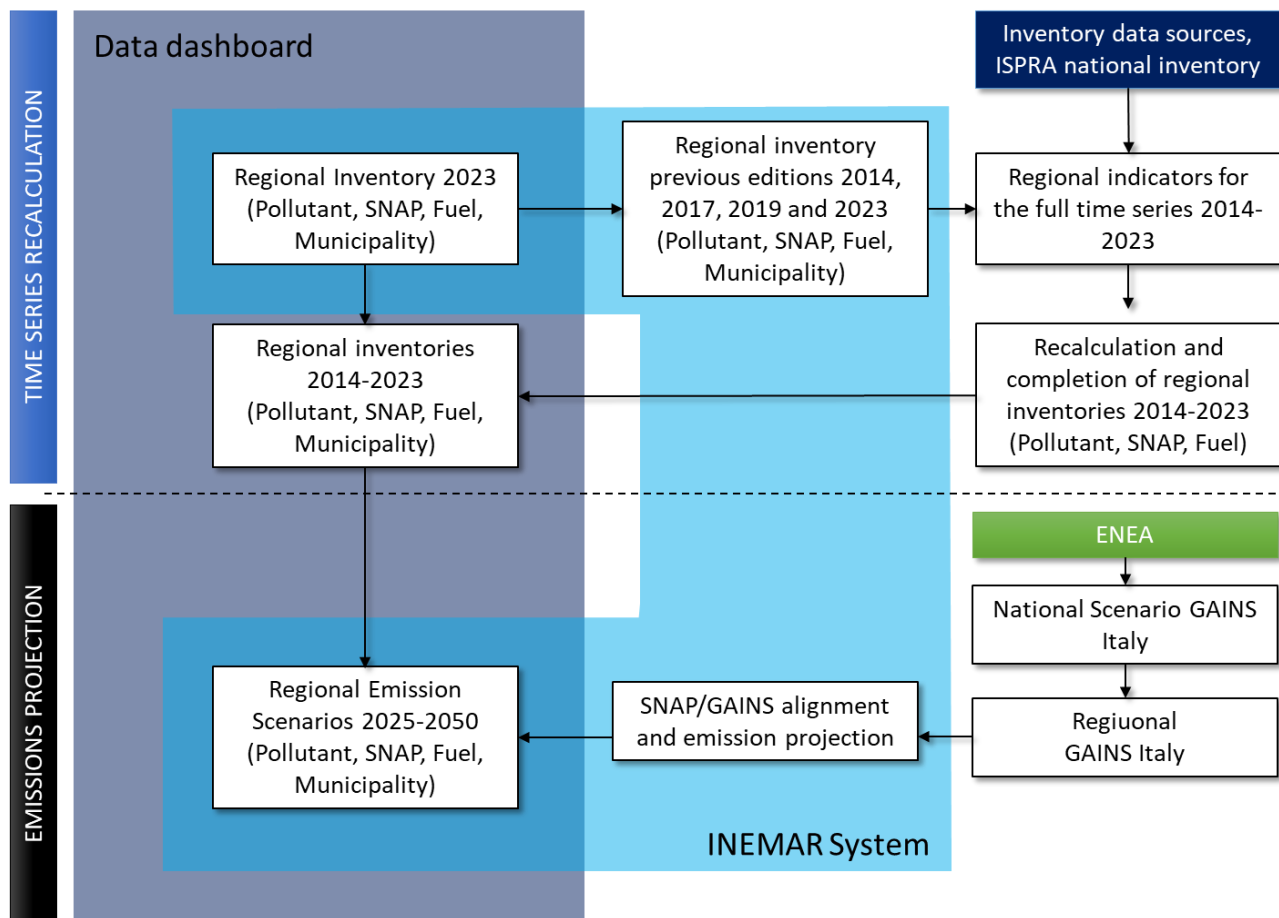
In Lombardy:

the **PRIA** (Regional Plan of Interventions for Air Quality)

Other relevant Italian and Lombardy regulation:

- **Italian D.M. 186/2017**, certifies the environmental quality of biomass stoves and fireplaces (wood and pellets)
- **Regione Lombardia DECREET no. 6260 of 13 July 2012**, technical and operational provisions for the operation, maintenance, control and inspection of heating systems and for the management of the related Registry.
- **Regione Lombardia D.g.r. 30 April 2025 - n. XII/4285**, update of the Regional Guidelines for the protection of waters from pollution caused by nitrates from agricultural sources in non-vulnerable areas pursuant to the Nitrates Directive 91/676/EEC
- The **National Plan for Air Quality** provides for a ban on the use of urea-based fertilizers in the regions of the Po Basin (Veneto, Emilia-Romagna, Lombardy, Piedmont) starting from 1 January 2028

From emission time series to emission projections



INEMAR inventories are published every 2-3 years (2014-2017-2019-2021-2023),

A consistent annual time series (2014-2023) is created with the INEMAR system, that estimates emissions for missing years and updates emission indicators and/or factors in the existing inventories,

To estimate future emissions projections, it was necessary to create a link between INEMAR inventory, and the projections assessed by ENEA using the GAINS-Italy system: the process interpolates the GAINS-Italy evaluations for 2020 and 2025 to obtain an emission scenario for Lombardy, starting from the base year 2023 to the year 2050.

Framework of the projections

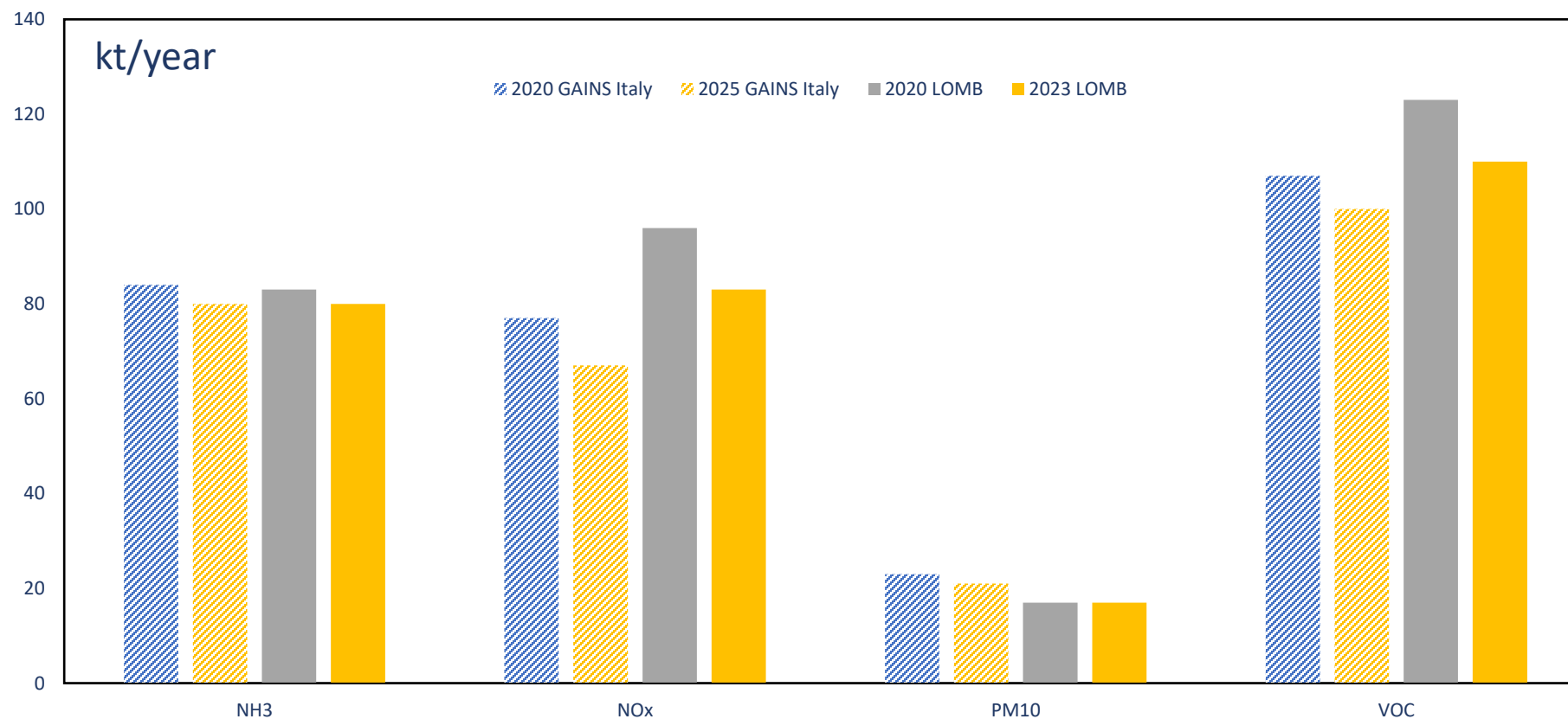
To obtain an emission scenario for **Lombardy** starting from the **base year 2023**, the year for which the most recent INEMAR inventory is available, the process of estimating emissions in future scenarios **interpolates the GAINS_Italy assessments for 2020 and 2025**.

The regional inventory for the period between 2025 and 2030 is therefore estimated using the **trend changes provided by GAINS Italy detailed by sector and fuel**. The emission assessment thus obtained therefore represents the estimated trend of emissions in Lombardy and harmonized with what is expected according to the scenario of the legislation in force for Italy and Lombardy.

This assessment is affected by some hypotheses adopted by **ENEA** in relation to the implementation of certain **national and European policies** with reference to **energy and industrial emissions**, as well as having to appropriately estimate the technological evolution of systems already widely regulated such as that of **road vehicles** with a progressive improvement of the **circulating fleet**.

As reported in ENEA's transmission note of the data provided "The scenario is produced with a top-down approach using the **national baseline WM (With Measure)** scenario sent to the European Commission in March 2023, the references of which are available in the IIR2023 (https://www.isprambiente.gov.it/files2023/pubblicazioni/rapporti/rapporto-385_2023_iir2023.pdf). In the absence of official energy scenarios updated as required by Legislative Decree 155/2010, ENEA has produced its own regional scaling using the available proxies of the **latest official scenario (REG_NEC_2014)**".

Emission estimates – base year



Source for GAINS Italy:

Nota ENEA prot 0056818 dell'080424

Piersanti, A.; D'Elia, I.; Gualtieri, M.; Briganti, G.; Cappelletti, A.; Zanini, G.; Ciancarella, L. The Italian National Air Pollution Control Programme: Air Quality, Health Impact and Cost Assessment. Atmosphere 2021, 12, 196. <https://doi.org/10.3390/atmos12020196>;

D'Elia, I.; Bencardino, M.; Ciancarella, L.; Contaldi, M.; Vialeto, G. Technical and Non-Technical Measures for air pollution emission reduction: The integrated assessment of the regional Air Quality Management Plans through the ItalItalan national model. Atmos. Environ. 2009, 43, 6182–6189, <https://doi.org/10.1016/j.atmosenv.2009.09.003>;

Ciucci, A.; D'Elia, I.; Wagner, F.; Sander, R.; Ciancarella, L.; Zanini, G.; Schöpp, W. Cost-effective reductions of PM2.5 concentrations and exposure in Italy. Atmos. Environ. 2016, 140, 84–93, <https://doi.org/10.1016/j.atmosenv.2016.05.049>

Alignment of CLE Hypothesis – renewal rates

Natural evolution of the technologies, examples of cars fleet and biomass burners, reduction versus time

CARS

New registration in Lombardy (2024): 236 557

Total circulating in Lombardy (2024): 6 426 326

% of annual renewal = **3,7%** (around 20-25 years for a complete fleet regeneration, it can depend also by the year).

BIOMASS BURNERS

New registration in Lombardy: 18 257

Total estimated biomass burners: 600 000

% of annual renewal = **3,04%** (around 30 years for a complete fleet regeneration, it can depend also by the year).

LIVESTOCK MANURE STORAGE AND SPREADING

Annual increase in abatement efficiency <2% for liquid storage and spreading

