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LIFE 15 IPE IT 013

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Po Regions Engaged to Policies of Air

ACTION A.1 Emissions data set

Final Report

Revised on 18.01.2019

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Beneficiary responsible for implementation: ARPA Lombardy

Final report

Key Words: Emission inventories, pollutants, classification details, spatial details, update frequency, biogenic VOC, Point and area sources, Heating demand, Mobile sources, Nomenclature of emission inventories.

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ACTION A.1 Emissions data set

1. *Identification of local sources – report on analysis on existing data and methodologies*

1.1. *Regional and national emission inventories*

This analysis considers the emission inventories developed by: ARPA Lombardy, ARPA Emilia-Romagna, ARPA Piedmont, ARPA Veneto, ARPA Friuli Venezia Giulia, ARPA Valle d'Aosta, Trento Province, Slovenia and APPA Bolzano participating as stakeholder, sharing their datasets.

This ensemble of the existing data on the Po Basin covers both regional and national emission inventories. The Italian law (Decree 155/2010 and its further modifications, Decree 250/2012) defines the administrative functions of regions, provinces and state regarding air quality monitoring and managing. Italian Regions and autonomous provinces are competent for:

- Zones classification in relation to air quality
- Regional emission inventories compilation with update every 2 or 3 years
- Use of models for air quality evaluation and management
- Definition of energy and industrial scenarios
- Definition of air quality plans

As reported by a recent analysis on methodologies (http://www.isprambiente.gov.it/files/snpa/consiglio-federale/DOC78_CFInventariemisisoniinatmconallegati.pdf), the Italian regional emission inventories are all developed on a municipal detail using the SNAP source classification. At the present state of knowledge, this high resolution determines relevant difficulties on producing time series with the same level of spatial detail.

Focusing on the Po Basin, regional emission inventories are mainly compiled using the INEMAR system (www.inemar.eu).

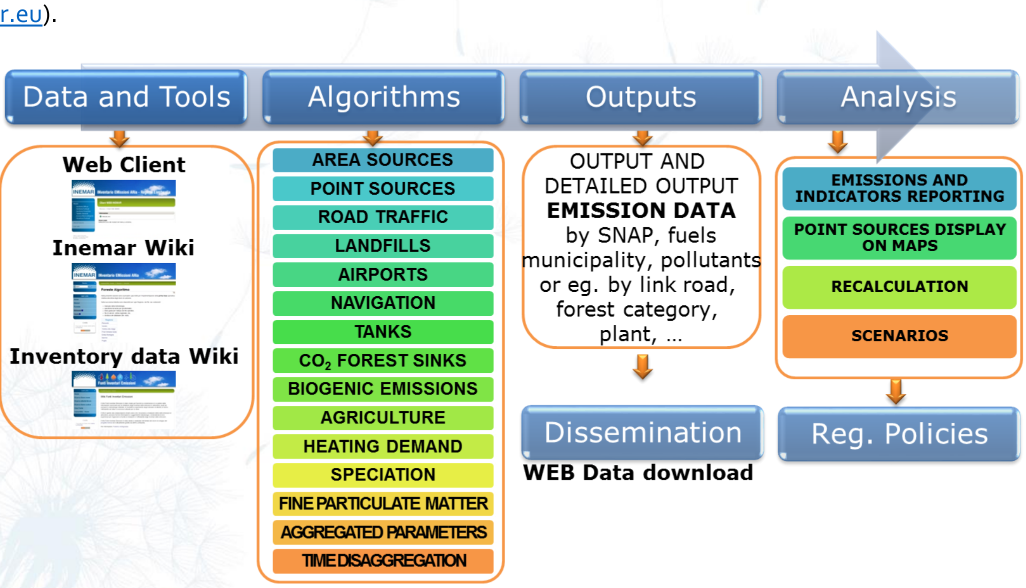


Figure 1. Framework of activities in Lombardy regional emission inventory.

Figure 1 shows the framework of activities for the compilation of a local emission inventory using the INEMAR database. This system was set up in 1998 and is managed by the Regional Environmental Protection Agency of Lombardy (ARPA) since 2003. It can provide emission estimates from a combination of more than 250 activities and 35 fuels for pollutants of interest for air quality, greenhouse gases, PAHs, carbonaceous fraction of particulate and heavy metals at municipality level.

As also required by national law (Decree 155/2010), emissions estimations pass through the specific algorithms and methodologies reported by the EMEP/EEA Atmospheric Emission Inventory Guidebook (AEIG) (https://www.eea.europa.eu/). It is a process based on the collection of a huge number of information like activities indicators (i.e. fuel consumptions, traffic flows, industrial production), emission factors and statistical data for the spatial and time-based distribution of the emissions. The periodic update of the parameters above and their level of details (defined as tier) affect the overall level of uncertainty in calculations.

The system and methodologies implemented by ARPA Lombardy have been shared with other Italian regions, including Piedmont, Emilia-Romagna, Veneto, Trento and Bolzano, Friuli Venezia Giulia. The implementation of a common tool has allowed to increase harmonization in methodologies and estimations between regional emission inventories, but to

go further down this road an increase in complexity regarding the management of local peculiarities must be considered. As a matter of facts, the implemented framework seems effective in answering to users requests with a proper codification of standard algorithms and parameters.
The implementation of an edition of a regional emission inventory goes through the collection of several data as input: as reported in figure 1, different modules have been developed to insert data with the correct codification, manage input and metafiles and share the methodology with other partners in an open and common space such as Wiki pages.
The highest tier algorithms have been implemented into the modules with the database as core system; the publication policy is subjected to a public review process that have been successfully used in many editions of the inventory. In INEMAR, point emission sources are considered as such when data of concentration are available at stack exit (e.g., large industrial plants). With a progressive increase of uncertainties, different algorithms are defined, chosen by the highest tier of AIEG, where the number of parameters can drastically increase (e.g., on-road transportation). When detailed data are not available, or an emission source is spread over the territory (e.g., domestic heating), a statistical approach is used, with the definition of average indicators and emission factors.
As reported for other regions and provinces, also in the case of Valle d'Aosta the main technical reference remains the EEA-EMEP Guidebook.
National emissions of Slovenia can be obtained from the Slovenian National Emission Inventory, compiled using a top-down methodology (http://cdr.eionet.europa.eu/si/eu/nec_revised/inventories/envwj3zmg/overview and for GHG inventories see https://cdr.eionet.europa.eu/si/eu/mmr/art07_inventory/ghg_inventory/envwj26bw/), while more details can be obtained by the inventory report available at http://cdr.eionet.europa.eu/si/un/clrtap/iir/envwmaww/. From these data sources, Slovenian emissions data are reported as national totals following the NFR nomenclature, with updated time series.
In this project ARSO Slovenia has provided detailed information on gridded emissions and point emissions sources with 2013 as reference year. These data have been projected on a municipal level according to the definition of municipal borders - downloaded from the Statistical Office of the Republic of Slovenia - and added to the main dataset. Input data files have been collected in a database detailed for pollutant, NFR source, source classification (area and point source – the latter with emission details and coordinates in LAT/LON). With a database query all the emissions input used for AQ modelling have been associated to municipalities and the query results has been processed with ARCGIS to obtain an attribute table that associates LAT/LON and municipality information.

Region/Province/State	Classification /Detail	Point sources	Spatial details	Frequency	Inhabitants [millions]	Area [Km2]
Valle d'Aosta	SNAP/Fuel	Yes	Municipal/Grid	Annual	0.12	3,261
Piedmont	SNAP/Fuel	Yes	Municipal	2-3 year	4.42	25,387
Lombardy	SNAP/Fuel	Yes	Municipal	2-3 year	10.00	23,864
Bolzano	SNAP/Fuel	Yes	Municipal	2-3 year	0.52	7,398
Trento	SNAP/Fuel	Yes	Municipal	2-3 year	0.54	6,207
Veneto	SNAP/Fuel	Yes	Municipal	2-3 year	4.93	18,407
Emilia-Romagna	SNAP/Fuel	Yes	Municipal	2-3 year	4.45	22,453
Friuli Venezia Giulia	SNAP/Fuel	Yes	Municipal	2-3 year	1.22	7,862
Slovenia	NFR	Yes*	National/Grid	Annual	2.06	20,273

* Point sources emissions are collected from the input data to the Air Quality Model, as are not present in the National Inventory as such.

1.2 Emission dataset on reference year 2013 for Po-Valley and Slovenia and data flow definition

As agreed during the project meetings, year 2013 was chosen as the reference one. According to the task deadlines an updated dataset on reference year 2013 for Po-basin and Slovenia has been released.

The technical database structure encompasses:

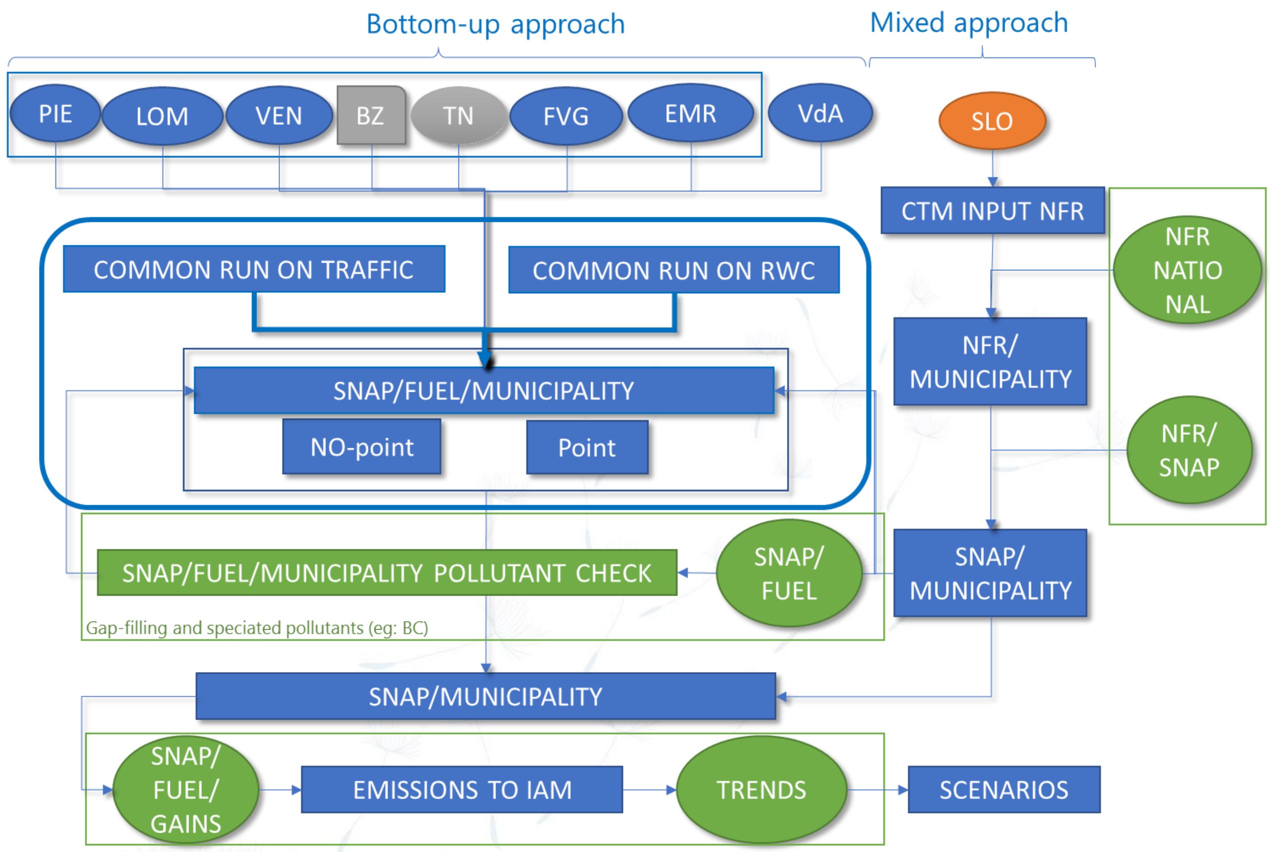
EmiBacino2013-rev2.mdb: emissions data for point and area source in the Po-Valley: tables EMI_PUNTUALI and EMI_DIFFUSE . The other tables report field codes and description.

EmiSlovenia2013.mdb: emissions data expressed in t/year for point and area source in Slovenia: table EMI_SLO_2013. The other tables report field codes and description.

EmiScenari2030.mdb: emission projection coefficients derived from ENEA estimates up to 2030 obtained from GAINS-ITALY for the Italian Regions.

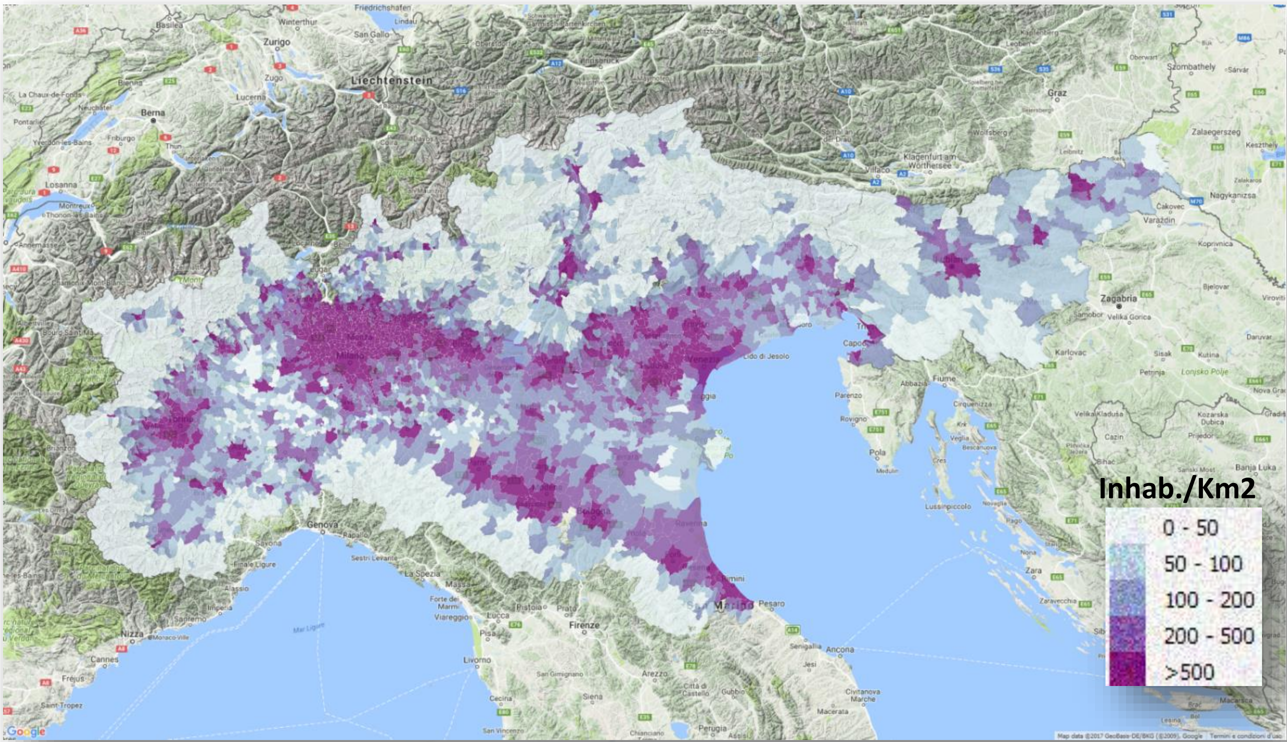
Emi_noplan_2025_rev01.mdb: emission scenario on the Po-basin for 2025 obtained by survey on air quality plan hypothesis without any reduction.

The data-flow of emission collection for action A1 is depicted in the scheme above:

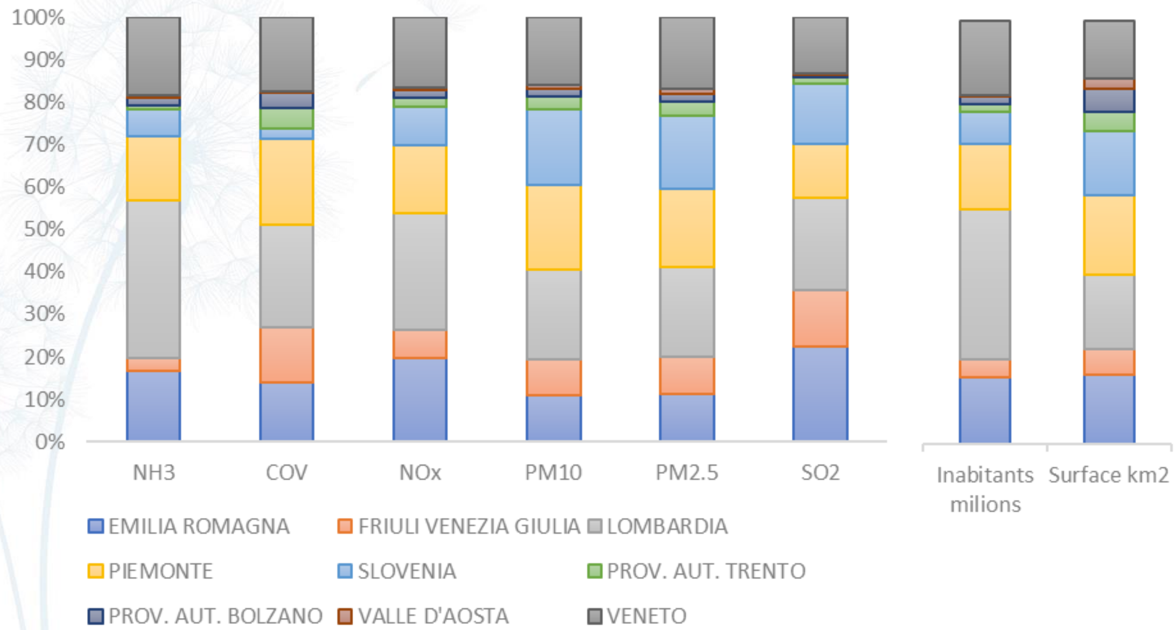


1.3 Dominion of analysis for PREPAIR Project

The extent of the dominion of analysis covers about 135,000 Km^2 and encompasses a population of around 28 million inhabitants. Considering the available framework of emission inventories development, INEMAR project is implemented for about 92% of the population in the dominion and 83% of its surface extension.



A first preliminary analysis consists in the comparison of available data on emissions and the main demographic indicators. Collected information from the emission inventories refers all to year 2013.



In a semi-quantitative evaluation, the emission share for the main pollutants among the group members is comparable to population and surface extension. Some differences can arise from the estimations of biogenic NMVOC even among inventories developed within INEMAR framework.

2. *Quantification of the main divergences in area emission sources among existing emission inventories and procedures for their reduction*

2.1. Source typologies and description

Collected regional emission inventories results for 2013 on the Po-basin have been analysed considering for each SNAP activity the ratio between the number of municipalities where estimations are reported and the total number of municipalities in each region.

$$CI_{SNAP,Region,Pollutant} = \frac{N_{where\ E\neq 0}}{N_{Tot}}$$

Frequency classes $CI_{Freq,\ SNAP,\ Pollutant}$ depending on SNAP activity and pollutant are thus defined for every region (obviously only for those regions where that specific SNAP activity is present):

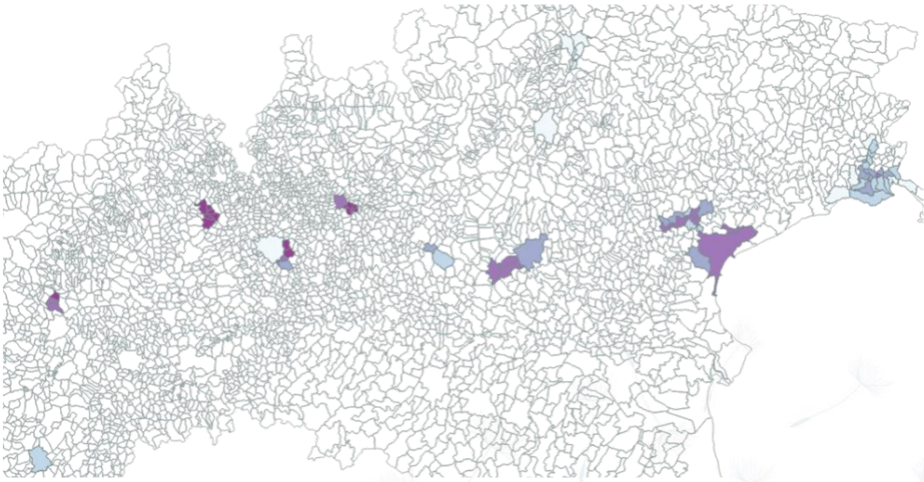
Frequency in Regional Emission Inventory	Description
Less than 10%	Number of regions where the SNAP activity has a spatial detail for less than **10%** of municipalities
10%-50%	Number of regions where the SNAP activity has a spatial detail for **10-50%** of municipalities
50%-80%	Number of regions where the SNAP activity has a spatial detail for **50-80%** of municipalities
Higher than 80%	Number of regions where the SNAP activity has a spatial detail for more than **80%** of municipalities

The frequency classes are to be interpreted as this: in the table above "less than 10%" represent the number of inventories where the emissions of a certain pollutant from a specific SNAP activity is estimated for less than 10% of municipalities of that region.
Evaluating the occurrence of $CI_{Freq,\ SNAP,\ Pollutant}$ among the inventories helps to determine how emissions of a specific SNAP are treated geographically:

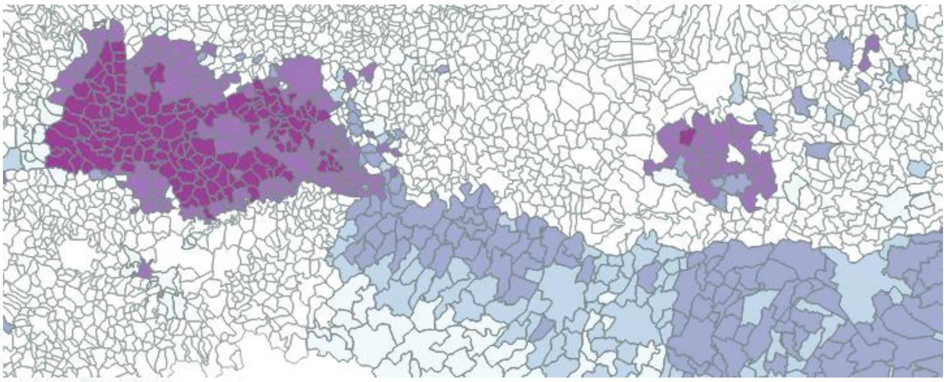
Frequency ($CI_{Freq,\ SNAP,\ Pollutant}$)	Occurrence	Description	Sindex SNAP/Pollutant
Less than 10%	In more than 80% of the Regional Emission inventories	Means that in more than 80% of the regional EI the pollutant source is treated as very limited spatially	Low Spatial ratio
10%-50%	Variable occurrence		Medium Spatial ratio
50%-80%			
Higher than 80%	In more than 80% of the Regional Emission inventories	Means that in more than 80% of the regional EI the pollutant source is treated as widespread	High spatial ratio

The following examples can be more explanative of the above defined $Sindex_{SNAP, Pollutant}$.

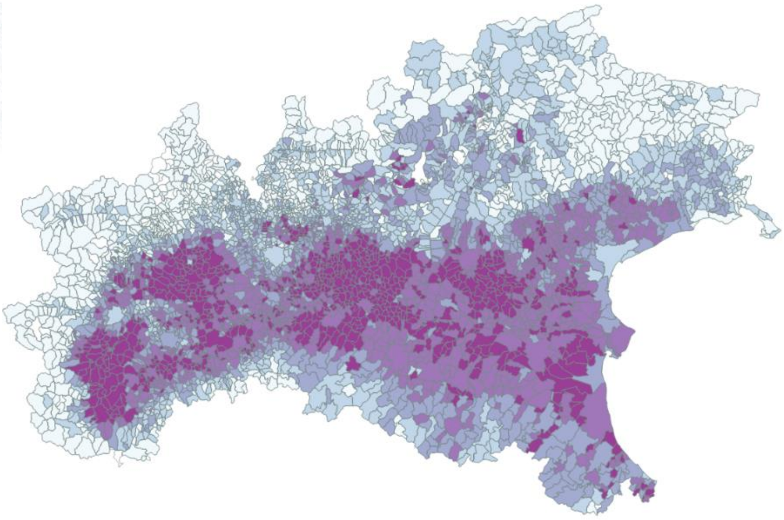
- Emissions of NO_x from SNAP activity 8.5.2 International airport traffic (LTO cycles - < 1000 m) as an example of Low Spatial Ratio source.



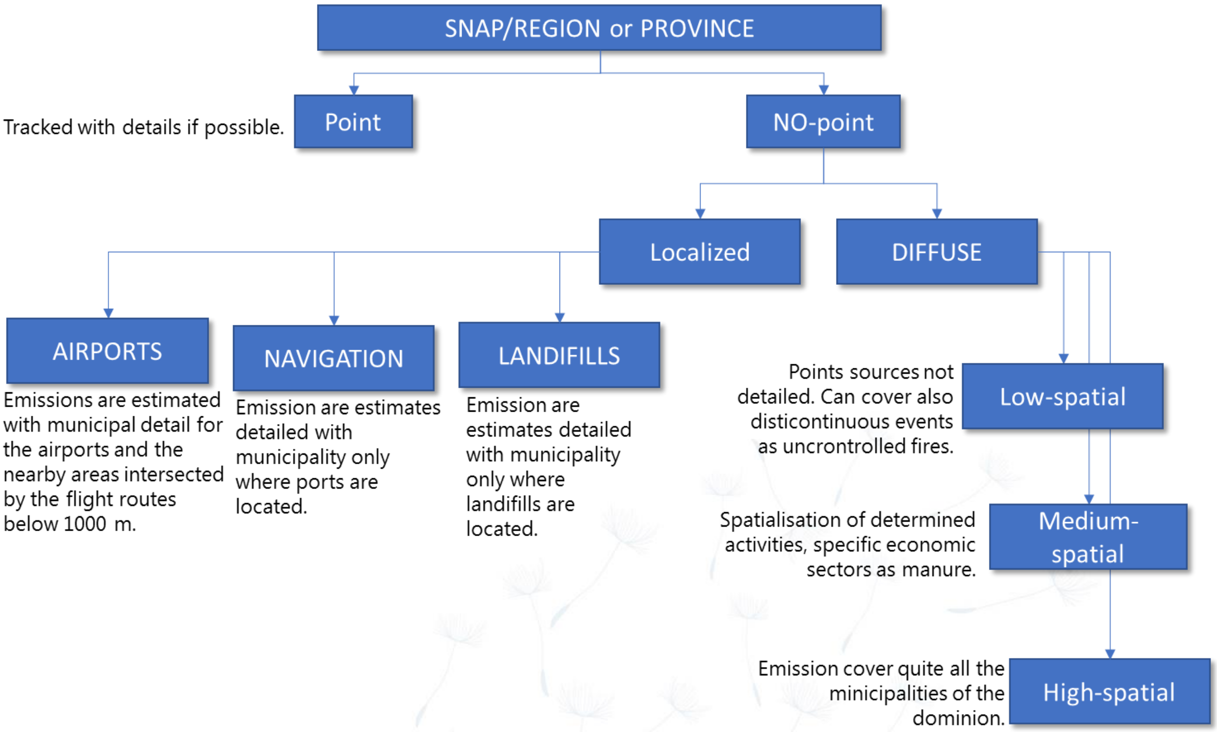
- Emissions of NO_x from SNAP activity 10.1.3 Fertilizers in rice fields as an example of Medium Spatial Ratio source.



- Emissions of NO_x from SNAP activity 8.6.0 Agriculture Off-road as an example of High Spatial Ratio source.



As a matter of facts, emission sources and their spatialization in the Po-basin can be classified according the following scheme:



In the following table, obtained through this preliminary analysis, the square symbol in column 3 is a representation of the spatial ratio level:

High spatial ratio   Medium spatial ratio   Low spatial ratio

The application of the indicators above presented shows a good alignment among the collected emission inventories, confirming the preliminary analysis where it was found a common technical base referring to the EEA-EMEP Guidebook and in many cases also the adoption of the same reference database: INEMAR.
In the next table, the prominent role of residential wood combustion and road traffic respectively on PM, NMVOC and NO_x emissions is highlighted by the coloured cells; both sources are treated as widely spread (fully coloured square symbol). According to the project framework this two sectors will be under common run estimations on the base of data provided by actions: D.3 and D.4.
The relative high role of these emission sources claims for and increase in the details of emission calculation during the common run. Action D.3 and D.4 will deliver new information with different level of details and the development of procedures for the elaboration of these data as input for the common run will play a strategic role. As a matter of facts, the methodologies for including this new information in the framework of the local emission inventories need to be addressed to overcome all possible divergences among the estimates and to improve the quality and knowledge arising from emission dataset.
Due to the relevance of residential wood burning and traffic as emission sources, the main goals in reduction of divergencies of estimates pass from the implementation of common algorithms. A preliminary analysis to support future common runs and update on emission estimations can consider the actual approaches defined in the frame of emission inventory update. The algorithm to estimate the heating demand of municipalities may be a possible starting point to increase the resolution of provincial biomass consumption as discussed in 2.2. Density of the road network will also be evaluated, especially with regards to the computational time and feasibility of future estimations and scenarios on road traffic, 2.3.
As stated in 1.3, some differences arise from the estimations of biogenic NMVOC, and for this reason indicators without the contribution of macrosectors 10 and 11 are also reported.

GEOMETRY	SOURCE	SPATIAL RATIO	SNAP - Group	NMVOC	NH3	NOx	PM10	SO2
POINT	POINT	Low spatial ratio	1. Combustion in energy and transformation industries	1.194	44	23.308	459	8.699
			2. Non-industrial combustion plants	17		71	2	7
			3. Combustion in manufacturing industry	4.566	451	42.081	2.144	15.555
			4. Production processes	19.555	232	9.992	1.708	10.213
			5. Extraction and distribution of fossil fuels and geothermal energy	31		192		2
			6. Solvent and other product use	13.036	198	904	492	34
			9. Waste treatment and disposal	1.269	70	3.914	36	914
AREAL	AIRPORTS	Low spatial ratio	8. Other mobile sources and machinery	885	0	3.089	23	243
		Medium spatial ratio	8. Other mobile sources and machinery				15	
	NAVIGATION	Low spatial ratio	8. Other mobile sources and machinery	1.317	0	9.315	725	4.531
	LANDFILLS	Low spatial ratio	9. Waste treatment and disposal	98		472	1	23
	DIFFUSE	Low spatial ratio	1. Combustion in energy and transformation industries	103	7	798	27	275
			2. Non-industrial combustion plants	3		13	0	0
			3. Combustion in manufacturing industry	482	6	1.676	317	2.183
			4. Production processes	7.690	13	132	176	110
			5. Extraction and distribution of fossil fuels and geothermal energy	82				
			6. Solvent and other product use	7.077	0	0	34	
			8. Other mobile sources and machinery	133	0	960	88	15
			9. Waste treatment and disposal	33	328	977	4	294
			10. Agriculture	9	556		1	
			11. Other sources and sinks	1.755	144	636	1.127	127
	DIFFUSE	Medium spatial ratio	1. Combustion in energy and transformation industries	94		461	4	7
			2. Non-industrial combustion plants	1.522	14	210	1.032	128
			3. Combustion in manufacturing industry	2.538	32	11.828	844	2.851
			4. Production processes	2.587			359	
			5. Extraction and distribution of fossil fuels and geothermal energy	18.777				
			6. Solvent and other product use	161.137		5	3.383	2
			8. Other mobile sources and machinery	1.083	1	3.516	290	17
			9. Waste treatment and disposal		1.470			
			10. Agriculture	19.497	152.374	1.219	2.862	155
			11. Other sources and sinks	272.437				
	DIFFUSE	High spatial ratio	2. Non-industrial combustion plants	5.034		26.081	903	2.028
			3. Combustion in manufacturing industry			4.506		
			4. Production processes	6.546			32	
			6. Solvent and other product use	64.340				
			8. Other mobile sources and machinery	3.615	8	35.646	1.833	115
			9. Waste treatment and disposal	1		3	25	0
			10. Agriculture	178.314	96.613	1.595	332	
			11. Other sources and sinks	94	55	57	1.379	14
	RESIDENTIAL WOOD	High spatial ratio	2. Non-industrial combustion plants	38.383	1.014	10.107	42.987	1.318
LINEAR	TRAFFIC	Medium spatial ratio	7. Road transport	3.912	737	66.174	5.100	73
		High spatial ratio	7. Road transport	53.761	2.215	129.481	10.984	214
			Total amount in the Po-basin	**893.008**	**256.582**	**389.420**	**79.726**	**50.147**

Synoptic table on emissions on the Po-basin for the reference year 2013 expressed in t/year.

2.2. Heating demand calculation

The annual heating energy demand (GJ/y) and the heating fuel consumption (Mg/y) are estimated with a specific algorithm defined for Lombardy and other regions in the Po Valley. Energy demand to heat buildings and fuel consumption can be detailed considering:

- Type of use of the buildings (i.e., mainly residential);
- Typology of buildings and relative occupation (i.e., residential);
- Typology of heating system (centralized or not);
- Kind of fuel (i.e., natural gas, gas oil, etc.);
- Climatic class (climatic class are determined based on the registered heating degree days – *HDD* -for a reference year)

HDDs are calculated for a defined place as the sum, for all the days of an annual heating seasons, of the positive differences between room temperature, conventionally set at 20°C, and the daily average outside temperature. The annual value of HDD for a locality increases when external registered temperatures decreases.
The annual heating energy demand E can be calculated with the following:

$$E = C_g \cdot V \cdot HDD \cdot \lambda \cdot 86.4 \cdot 10^{-6} \quad \text{[GJ/y]} \qquad (1)$$

Where:

- E: energy demand for heating $[GJ/y]$;
- Cg: Thermal dispersion coefficient $[W/(m^3 \cdot °C)]$;
- V: heating volume of buildings [m^3];
- HDD: heating degree days [$°C\ d$];9
- λ: duration coefficient, which define the ratio of use of the heating system (24 hours/day = 1)

The dispersion coefficients are derived considering both shell and ventilation dispersion:

$$C_g = C_d + \alpha \cdot C_v = (A \cdot S/V + B) + (\alpha \cdot C_P \cdot n) \qquad (2)$$

Where:

- Cd: thermal dispersion coefficient due to the age and position of building $[W/(m^3 \cdot °C)]$;
- S/V: geometric coefficient [m^{-1}], relationship between the radiating surface [m^2] and the heating volume [m^3];
- A, B: empirical coefficients derived from an analysis of the relationship between geometric coefficient and the thermal dispersion coefficient of the building (Cd). This analysis was derived from Regulation on construction technologies;
- $\alpha \cdot C_v$: Thermal dispersion coefficient due to ventilation $[W/(m^3 \cdot °C)]$;
- α: coefficient to count the age of the buildings;
- $C_v = n \cdot C_p$;
- n: number of air changes in a day;
- Cp: air specific heat capacity 0.34 $W/(m^3 \cdot °C)$;

From the annual heating energy demand *E* is then possible to estimate the fuel consumption for the building in the year considered by the following:

$$FC = E/HC/\eta \quad \text{[Mg/y]} \qquad (3)$$

Where:

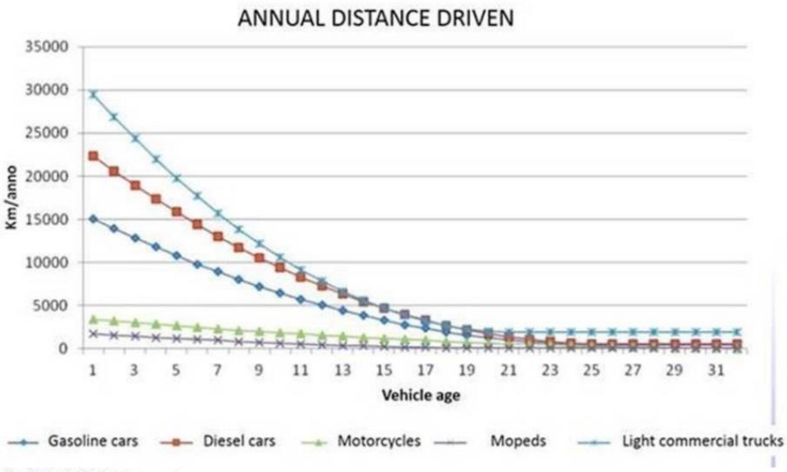
- E: energy demand for heating $[GJ/y]$;
- HC: heat of combustion $[e.g.: GJ/Mg]$
- η: average annual global yield of the heating systems, depending on the thermal unit but also on whether the system is centralized or not.

2.3. Traffic analysis

Within INEMAR, emissions estimation on a road network made of 35,000 oriented links generally can require a computational time of weeks. For each direction, the estimated number of passenger cars, light commercial trucks, heavy-duty vehicles and motorcycles travelling in the reference hour of a working day are assigned. Each reference hourly flux is multiplied by coefficients to calculate the fluxes for all the hours of working days, Saturdays and Sundays. Further details are available by splitting fluxes among vehicle types and legislations: for example, car fluxes are characterized as in the excerpt presented by following table:

Vehicle category	Type	Legislation
Passenger cars	Gasoline < 1.4 l	ECE 15/04
Passenger cars	Gasoline < 1.4 l	Euro 1 — 91/441/EEC
Passenger cars	Gasoline < 1.4 l	Euro 2 — 94/12/EC
Passenger cars	Gasoline < 1.4 l	Euro 3 — 98/69/EC Stage 2000
Passenger cars	Gasoline < 1.4 l	Euro 4 — 98/69/EC Stage 2005
…	…	…

For each vehicle category, the share among types and legislation classes is derived by taking in to account the number of vehicles for every type of legislation registered in the region and the average annual mileage of each type:



For every hour, the average speed is derived by the ratio between the flux of equivalent vehicles (see the next table) and the road capacity, and then the correspondent emissions and consumption factors are calculated.

Vehicle category	Number of equivalent vehicles
Cars	1
light commercial	1.5
Heavy	2.5
Mopeds, motorbikes	0.5

Annual emissions and fuel consumption over the entire road network are obtained by summing up hourly multiplication of emissions and consumption factors by the fluxes and the road length.
To calculate urban emissions (not covered by the road network considered), an evaluation of the total fuel consumption over the entire area of interest needs to be carried on; then the amount of fuels previously assigned to the road network has to be subtracted from it. The residual amount of fuels is shared among vehicles taking in to account their number, their urban consumption factor and their supposed annual urban distance travelled (i.e., 10% of total distance for cars, 1% for articulated trucks). The amounts of fuels are then shared by municipalities using residents as a proxy.

The annual urban travelled distance is calculated dividing the annual urban fuel consumption by the urban fuel consumption factor; annual urban emissions are then calculated multiplying that distance by the urban emission factors.

3. *Emission dataset for the project reference year 2013*

3.1. Main emission indicator on the Po-basin and Slovenia for 2013

According to the emission dataset, main emission sectors are highlighted for the Po-basin in the following table:

Emission share on base year 2013 for Po-basin	NH3	NMVOC	NMVOC without mac 10 and 11	NOx	PM10
1-Combustion in energy and transformation industries	0%	0%	0%	6%	1%
2-Non-industrial combustion plants	0%	5%	11%	9%	56%
3-Combustion in manufacturing industry	0%	1%	2%	15%	4%
4-Production processes	0%	4%	9%	3%	3%
5-Extraction and distribution of fossil fuels and geothermal energy	0%	2%	4%	0%	0%
6-Solvent and other product use	0%	28%	58%	0%	5%
7-Road transport	1%	6%	14%	50%	20%
8-Other mobile sources and machinery	0%	1%	2%	13%	4%
9-Waste treatment and disposal	1%	0%	0%	1%	0%
10-Agriculture	97%	22%	0%	1%	4%
11-Other sources and sinks	0%	31%	0%	0%	3%
Total Emissions	**100%**	**100%**	**100%**	**100%**	**100%**

The same in the following table, but including also Slovenia estimates for 2013:

Emission share on base year 2013 for Po-basin and Slovenia	NH3	NMVOC	NMVOC without mac 10 and 11	NOx	PM10
1-Combustion in energy and transformation industries	0%	0%	0%	8%	1%
2-Non-industrial combustion plants	0%	6%	13%	9%	59%
3-Combustion in manufacturing industry	0%	1%	2%	14%	4%
4-Production processes	0%	4%	8%	3%	3%
5-Extraction and distribution of fossil fuels and geothermal energy	0%	2%	4%	0%	0%
6-Solvent and other product use	0%	27%	56%	0%	4%
7-Road transport	1%	7%	14%	51%	18%
8-Other mobile sources and machinery	0%	1%	2%	12%	3%
9-Waste treatment and disposal	1%	0%	0%	1%	0%
10-Agriculture	97%	22%	0%	1%	6%
11-Other sources and sinks	0%	30%	0%	0%	3%
Total Emissions	**100%**	**100%**	**100%**	**100%**	**100%**

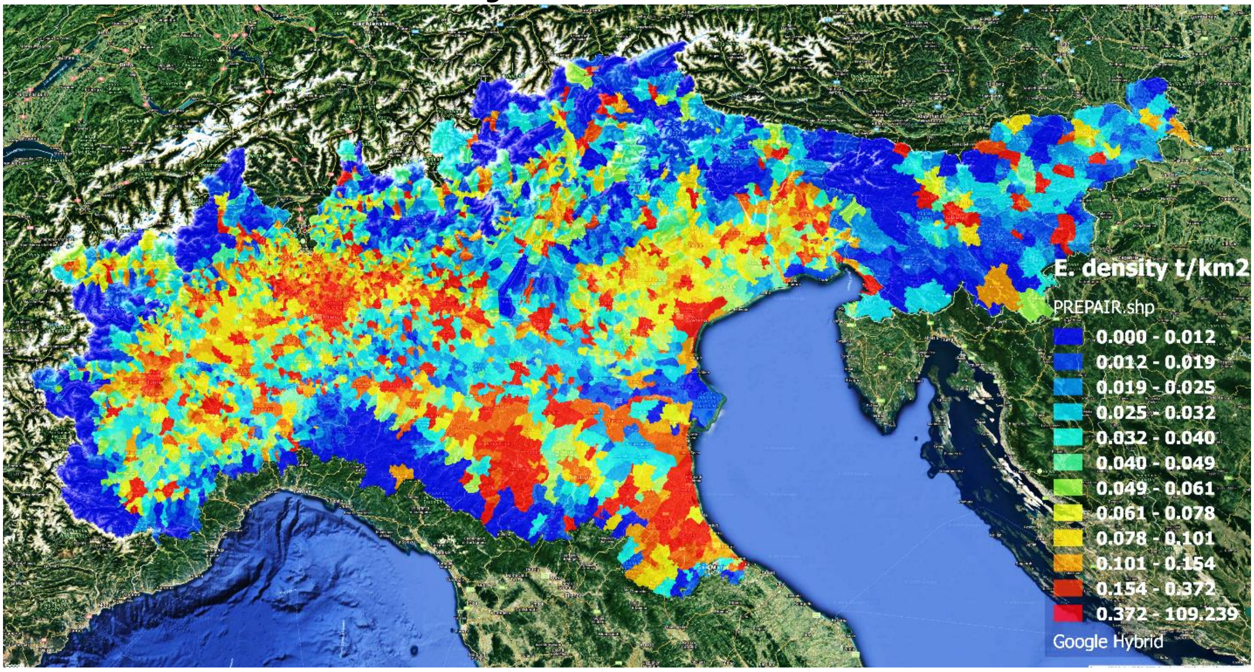
Combining emission dataset and inhabitants of the Po-basin Provinces, Regions and Slovenia the estimates on per-capita emissions reported in the following table are reckoned:

Per capita emissions g/inhab/y	NH3	NMVOC	NMVOC without mac 10 and 11	NOx	PM10
Piedmont	9.251	41.640	13.372	15.450	4.325
Aosta Valley	13.394	23.867	14.673	16.012	6.955
Lombardy	10.215	22.117	13.204	11.853	2.069
Autonomous Province of Trento	4.391	78.742	10.189	17.550	5.817
Autonomous Province of Bolzano - South Tyrol	10.149	66.668	7.683	14.527	3.296
Veneto	10.166	32.449	17.298	14.531	3.127
Friuli Venezia Giulia	6.786	98.426	68.445	23.010	6.555
Emilia Romagna	10.328	28.591	11.067	18.849	2.413
Slovenia	8.443	11.827	9.251	18.667	8.351

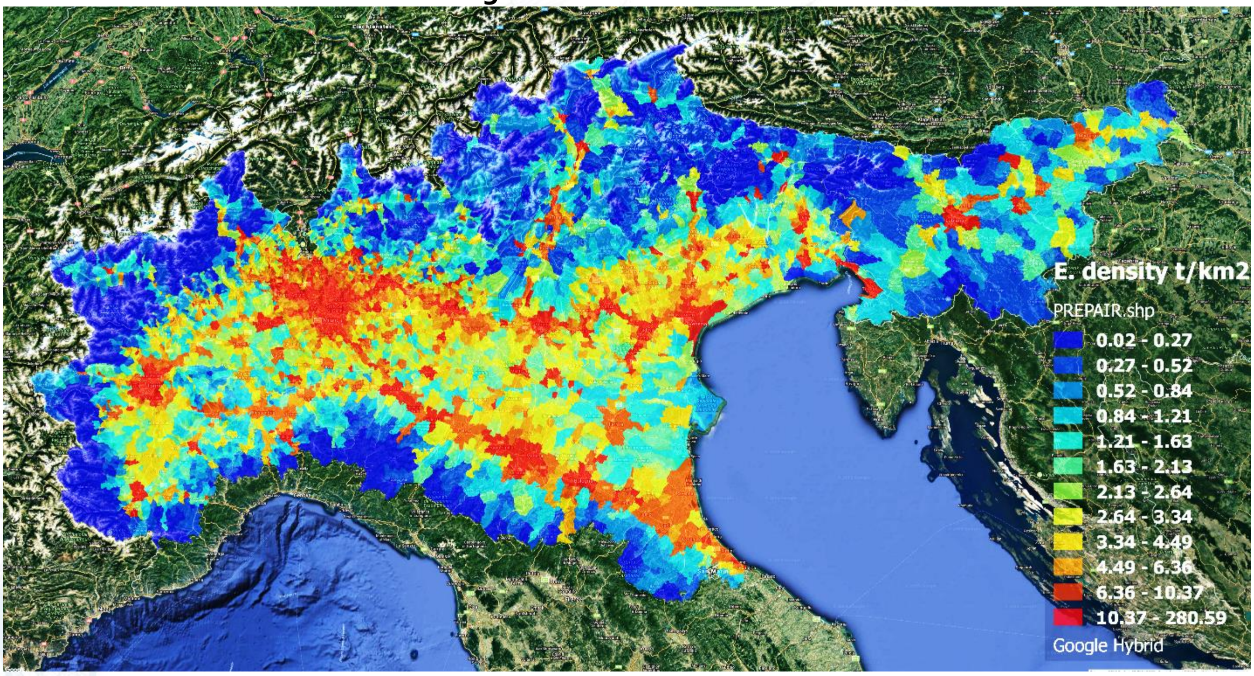
3.2. Emission maps for the base year 2013 on the domain

Starting from the emission dataset for the Po-basin and Slovenia some emission density maps can be drawn:

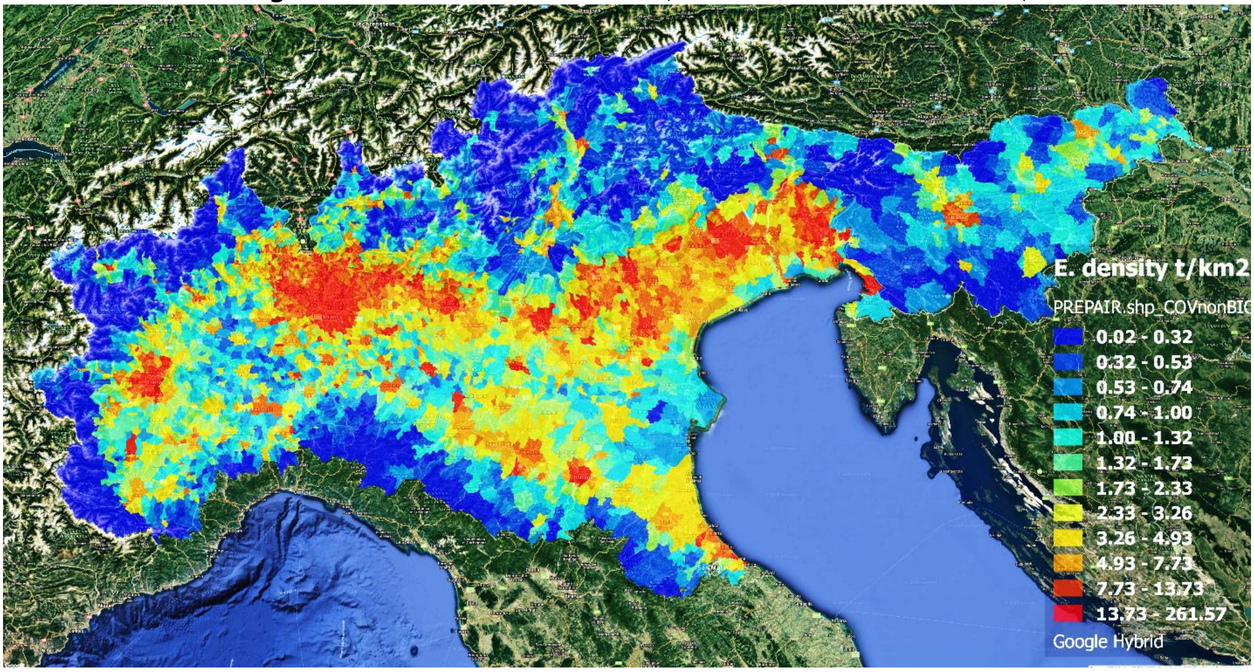
2013 Year Emissions of SO_2



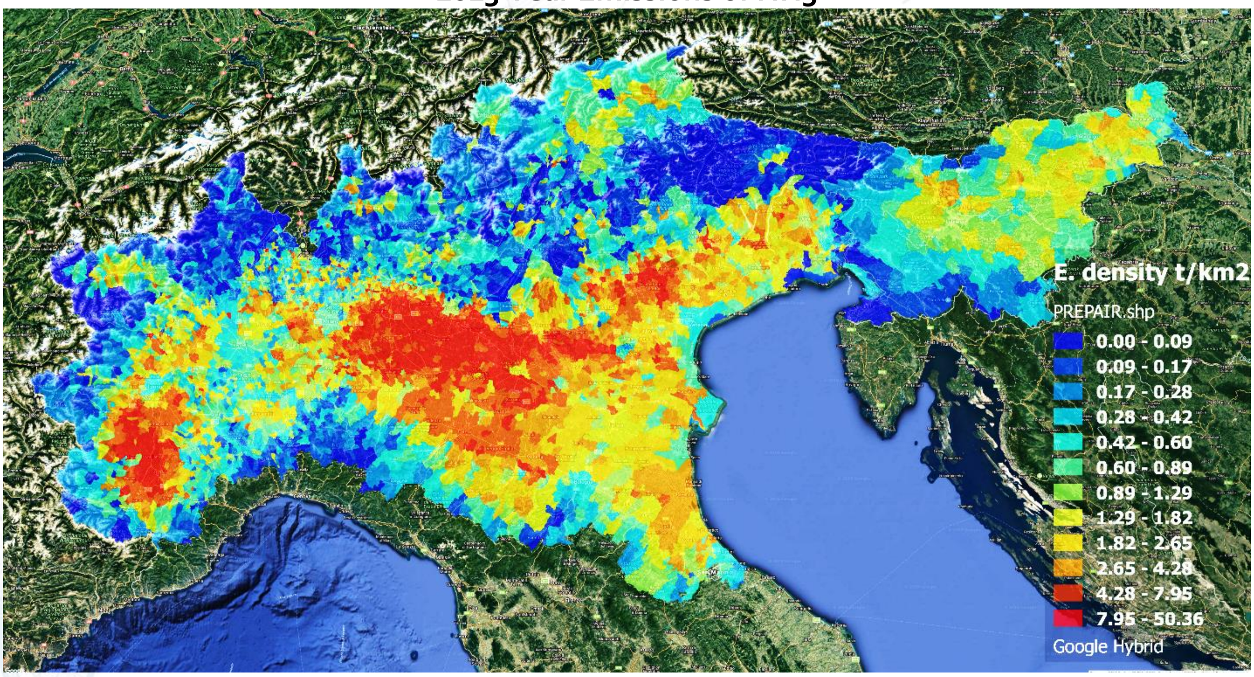
2013 Year Emissions of NO_x



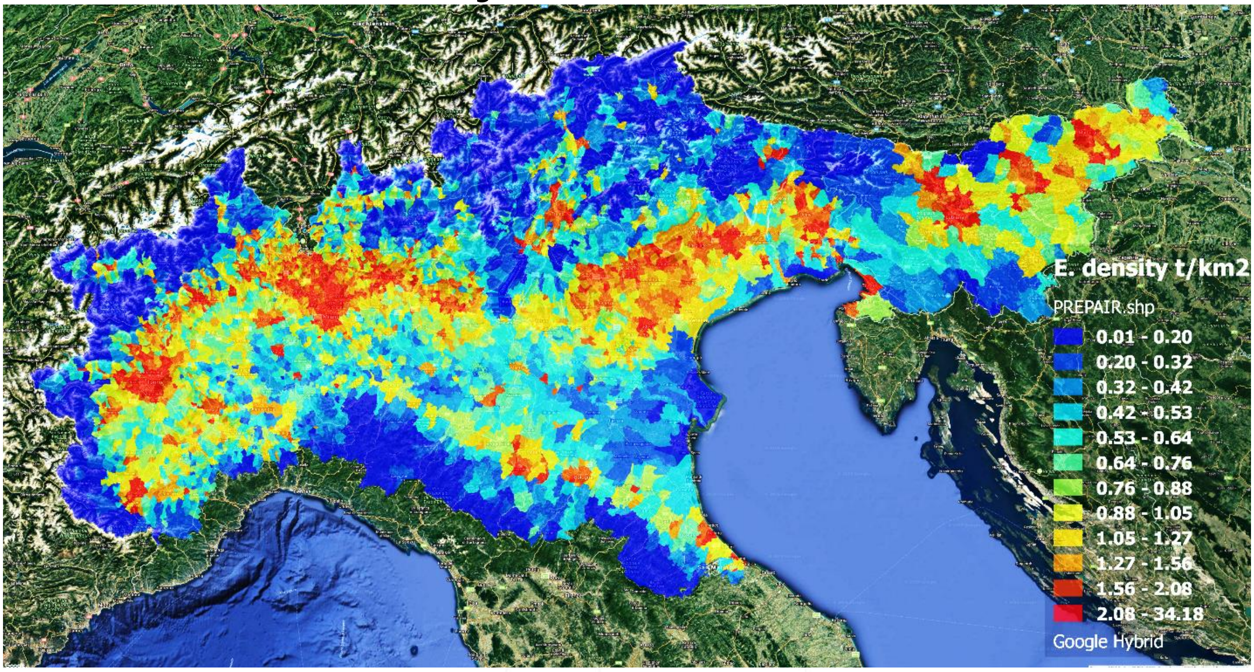
2013 Year Emissions of NMVOC (without sectors 10 and 11)



2013 Year Emissions of NH3



2013 Year Emissions of PM10



4. Definition of the procedure for the preparation of emission scenarios according to future trend analysis

4.1. Emission projection in Air Quality plans

This activity has been performed considering only the Italian partners in Prepair, thus only on the Po-basin, and in collaboration with action A.2 and A.3. By comparing the emission scenarios proposed in the partners' Air Quality plans, a common procedure during the project meetings has been shared among partners for the development of a Current Legislation scenario emerged: the use of emission projection provided for the Italian regions by the GAINS – Italy model implemented by Italian ENEA. Starting from a reference year, projections are calculated by a time proxy obtained from GAINS sector activities trends remapped to SNAP and fuel categories used in the inventories. The emission scenarios calculated from ENEA are set considering many information and the national energetic scenario. Analysing the reference documentation for air quality plans, it has been stated that the main common update was the local scaling of these scenarios. For a certain number of specific and local situations, some different hypothesis on road traffic and wood domestic heating over these baseline scenarios have been adopted.

4.2. Emission scenario on the Po-basin: 2025 (no-plans)

This scenario 2025 (no plans) has been derived from a survey among local regional emission inventory compilers and from the collection of all the information available. The emission scenario obtained has the same data structure of the reference year 2013, if detailed data were available, they have been included as received by the reference partners, if more aggregated data were given, e.g. total local emission estimates, they have been apportioned according to the same emission distribution of 2013. In data scenario filling, the reference and default emission scenario for all region and province was the SEN14 calculated with GAINS-Italy by ENEA.
As agreed during the project meetings these are the main process and hypothesis:

- If emission details were given for 2025, projection have been reported as it is.
- If total emission on local base for 2025 were given, the scenario maintains all the details and implements the same spatialization of base year 2013.
- If information on the reference GAINS scenario were given, the same process has been recalculated in the projection

- If special hypothesis were formulated, they have been implemented as reported, e.g. the recalibration of emission trend for biomass burning in 2025.

Comparable starting point of the emission projection on 2025, without any action of AQ plans, is the dataset on 2013. Applying the procedure described as above, the main characteristics of the projections are reported in the following synoptic table. The column SEN14, means that the projection has been compared with calculation of GAINS – Italy and this trend were assumed as default. RWC column indicates that trend on biomass burning on the residential sector were modified to consider univariate indicator of energy and a natural renewal of technologies. Traffic column indicates that in the projection was documented a different trend analysis from SEN14 for road traffic emissions. Spatial details report if the local compilers have given the detailed spatialization of the emission or information supporting the distribution in comparison with the base year 2013.

Framework of the main hypothesis on emission scenario 2025 – no plans:

	REGIONE/Province	Overall description	SEN14	RWC	Traffic	Spatial detail
1	PIEMONTE	Implementation of SEN14 trend applied to base year 2013. Exception for Macrosector 1 and Macrosector 2 maintained constant from 2013 to 2025. For specific activities in Sector 2 has sent the reduction estimated for 2030 and detailed on Municipalities involved.	●	●		●
2	VALLE D`AOSTA	Implementation of SEN14 trend applied to base year 2013.	●			
3	LOMBARDIA	Implementation of SEN14 trend applied to base year 2013 except for biomass burning in the residential sector and for biomass in non-ets industrial combustion according to regional energy projection.	●	●		
4	PROV.AUT TRENTO	Reports specific hypothesis on transport and residential biomass burning on SEN14. Gave the total amount estimates used and fit to the spatialization for reference year 2013. Trend analysis has been also extended to PM2.5 and PTS.	●	●	●	
5	VENETO	Implementation of SEN14 and exception for residential biomass burning. Gave the municipal detail estimated for 2025 (no-plan). Data used also to fit the detail for point sources.	●	●		●
6	FRIULI VENEZIA GIULIA	Implementation of SEN14 trend applied to base year 2013 except for biomass burning in the residential sector	●	●		
8	EMILIA ROMAGNA	Implementation of SEN14 trend applied to base year 2013 except for biomass burning in the residential sector	●	●		

5. Emission dataset for the no-plan scenario for 2025

5.1 Main emission indicator on the Po-basin and Slovenia for 2025 (no-plans)

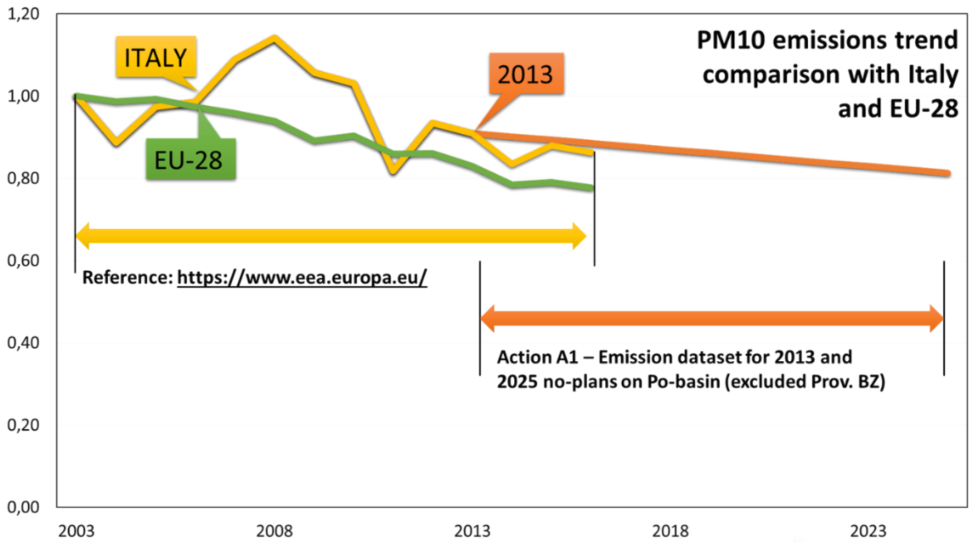
According to the emission scenario, the emission share on year 2025 are reported for the Po-basin:

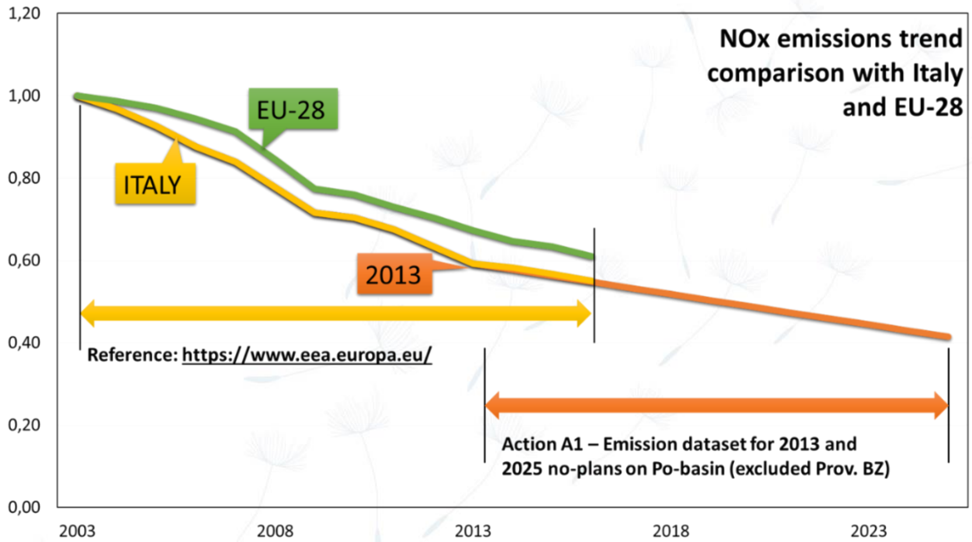
Emission share on year 2025 for Po-basin	NH3	NOx	PM10
1-Combustion in energy and transformation industries	0%	9%	1%
2-Non-industrial combustion plants	0%	12%	59%
3-Combustion in manufacturing industry	0%	20%	4%
4-Production processes	0%	3%	3%
5-Extraction and distribution of fossil fuels and geothermal energy	0%	0%	0%
6-Solvent and other product use	0%	0%	5%
7-Road transport	1%	37%	16%
8-Other mobile sources and machinery	0%	15%	3%
9-Waste treatment and disposal	0%	2%	0%
10-Agriculture	98%	1%	5%
11-Other sources and sinks	0%	0%	4%
Total Emissions	**100%**	**100%**	**100%**

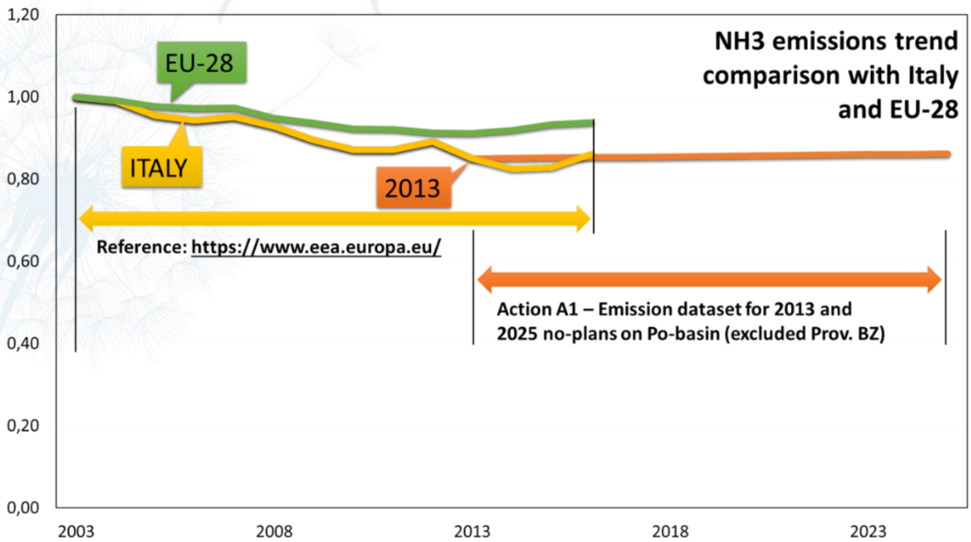
Combining emission scenario dataset and inhabitants of the Provinces and Regions, the estimates on per capita emission are reported for 2025:

Per capita emissions g/inhab/y	NH3	NOx	PM10
Piedmont	9 001	10 471	4 079
Aosta Valley	13 067	16 279	7 366
Lombardy	9 954	7 671	1 765
Autonomous Province of Trento	4 177	14 428	4 891
Autonomous Province of Bolzano - South Tyrol	9 581	11 690	3 029
Veneto	10 577	11 985	2 731
Friuli Venezia Giulia	6 707	19 008	6 301
Emilia Romagna	10 170	11 330	2 009

The emission trend depicted comparing the calculation for baseyear 2013 and projection for 2025 without the effects of AQ plans can be compared with the reported emission timeseries from Italy and the 28 European states. Data of timeseries were collected from EEA web-site and expressed as the ratio between yearly annual emission and the total emission reported for 2003. The period starts with 1.0, emission of 2003 on 2003, and stops on 2016, depicted as emission reported on 2016 divided by reference year 2003.
This trend analysis has been joined with emission for Po-basin on 2013 and 2025. The following pictures clearly show how the trend reported in the dataset of action A1 for 2013 and 2025 are compatible with the timeseries of Italy and EU-28 of the last decades.


PM10 emissions trend comparison with Italy and EU-28
ITALY
EU-28
2013
Reference: https://www.eea.europa.eu/
Action A1 – Emission dataset for 2013 and 2025 no-plans on Po-basin (excluded Prov. BZ)
1,20
1,00
0,80
0,60
0,40
0,20
0,00
2003
2008
2013
2018
2023

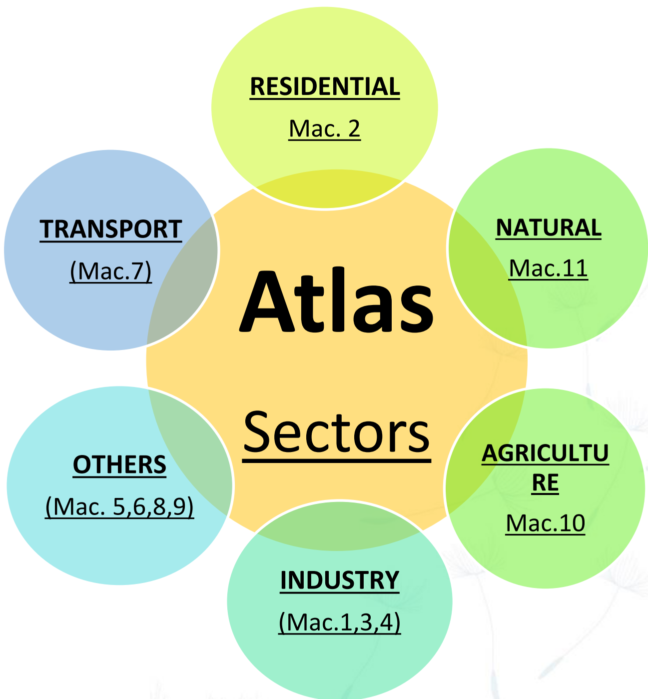

NOx emissions trend comparison with Italy and EU-28
EU-28
ITALY
2013
Reference: https://www.eea.europa.eu/
Action A1 – Emission dataset for 2013 and 2025 no-plans on Po-basin (excluded Prov. BZ)
1,20
1,00
0,80
0,60
0,40
0,20
0,00
2003
2008
2013
2018
2023


NH3 emissions trend comparison with Italy and EU-28
EU-28
ITALY
2013
Reference: https://www.eea.europa.eu/
Action A1 – Emission dataset for 2013 and 2025 no-plans on Po-basin (excluded Prov. BZ)
1,20
1,00
0,80
0,60
0,40
0,20
0,00
2003
2008
2013
2018
2023

5.2. The emission Atlas for the Po Valley: Objective and structure

The developed action a.1 dataset provides information on the type and location of the main emission sources in the air of the 4270 municipalities on the Po-basin.
An atlas has been created using the common data set of emissions for 2013 (covering only the Po Valley) and a common emission scenario for 2025 (no plans). Emissions from the province of Bolzano are not included in the emission scenario for 2025.
It focuses on PM10, NOx and NH3.

This Atlas distinguishes and quantifies the contributions from anthropogenic activity sectors and from natural sources as classified in the report "Urban PM2.5 Atlas Air Quality in European cities"[1]:



- **R- Residential** (Macrosector 2): this sector includes emissions from combustion in fireplaces, medium and single-house boilers, cooking and heating stoves in commercial, institutional and residential activities;
- **T- Transport** (Macrosector 7): this sector includes exhaust and evaporative emissions from light and heavy-duty vehicles and motorcycles as well as non-exhaust emissions due to road abrasion and tyres and brake wear;
- **A- Agriculture** (Macrosector 10): this sector includes emissions from livestock, fertilizer use and agricultural waste burning;
- **I- Industry** (Macrosectors 1, 3, 4): this sector combines emissions related to combustion in energy industries, industrial combustion and industrial processes;
- **N- Natural** (Macrosector 11): this sector includes emissions from vegetation;
- **O- Others** (Macrosectors 5,6,8,9): the remaining emissions are grouped in a single category. They include activities such as extraction and distribution of fossil fuels, solvent use, other mobile sources, machinery and waste treatment and disposal.

The choice to aggregate in macrosectors prevents a loss of information due to a different location and classification of emissions in the Po Valley regions.

[1] P. Thunis, B. Degraeuwe, E. Pisoni, M. Trombetti, E. Peduzzi, C.A. Belis, J. Wilson, E. Vignati, Urban PM2.5 Atlas - Air Quality in European cities, EUR 28804 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73876-0, doi:10.2760/336669, JRC108595

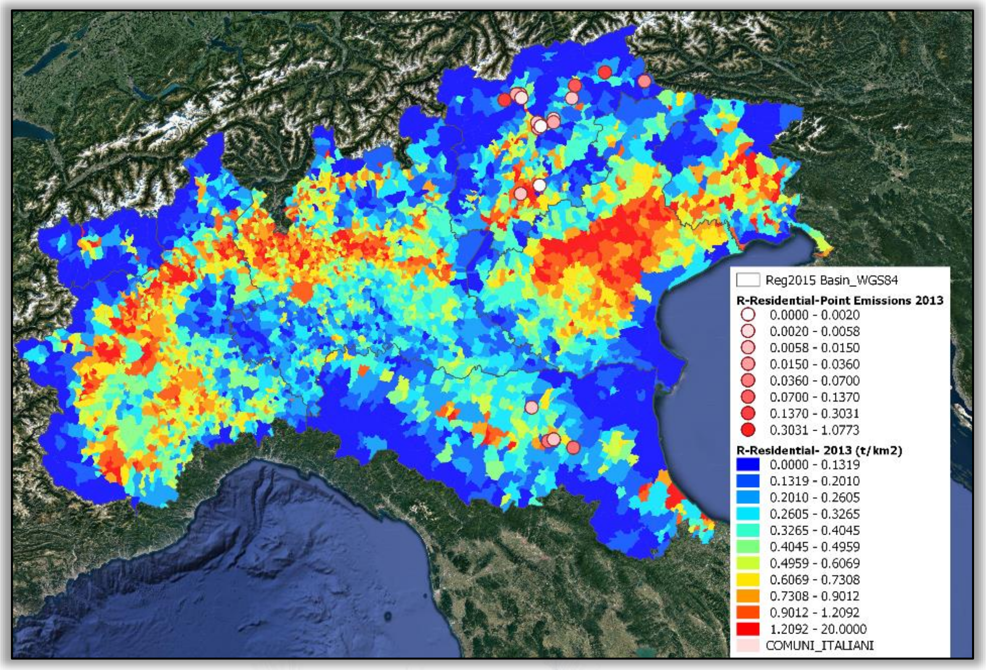
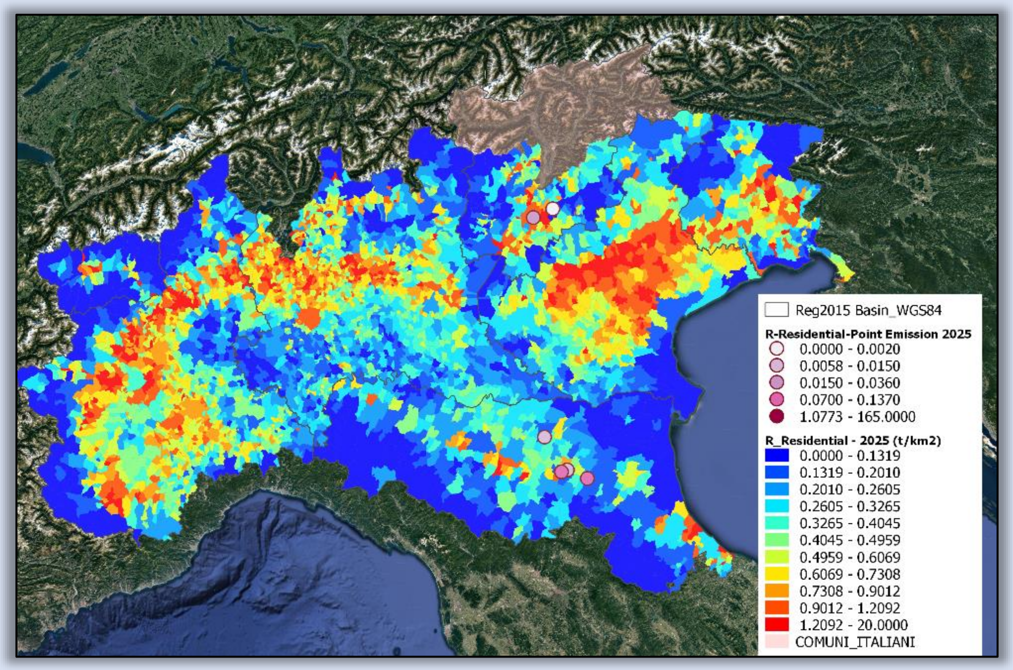
5.3. Emission maps of PM10 for the base year 2013 and 2025 (no-plans)

The following tables analyse the relative contribution of macrosectors and regions for the PM10 in 2013 and 2025. Indicator is calculated as $E_{region,macrosecotor}/E_{total}$.

EMISSION PM10 2013 (%)								
MACROSECTOR	PIEMONTE	VALLE D'AOSTA	LOMBARDIA	PROV. AUT. BOLZANO	PROV. AUT. TRENTO	VENETO	FRIULI VENEZIA GIULIA	EMILIA ROMAGNA
1-Combustion in energy and transformation industries	0%	0%	0%	0%	0%	0%	0%	0%
2-Non-industrial combustion plants	14%	1%	12%	1%	3%	13%	4%	7%
3-Combustion in manufacturing industry	1%	0%	2%	0%	0%	0%	0%	1%
4-Production processes	0%	0%	1%	0%	0%	0%	0%	1%
5-Extraction and distribution of fossil fuels and geothermal energy								
6-Solvent and other product use	0%	0%	1%	0%	0%	1%	2%	0%
7-Road transport	6%	0%	6%	0%	0%	3%	1%	4%
8-Other mobile sources and machinery	1%	0%	1%	0%	0%	1%	1%	1%
9-Waste treatment and disposal	0%	0%	0%	0%	0%	0%	0%	0%
10-Agriculture	1%	0%	1%	0%	0%	1%	0%	0%
11-Other sources and sinks	0%		1%	0%	0%	0%	1%	

no -plans PM10 2025 (%) with Bolzano 2013								
MACROSECTOR	PIEMONTE	VALLE D'AOSTA	LOMBARDIA	PROV. AUT. BOLZANO	PROV. AUT. TRENTO	VENETO	FRIULI VENEZIA GIULIA	EMILIA ROMAGNA
1-Combustion in energy and transformation industries	0%	0%	0%	0%	0%	0%	0%	0%
2-Non-industrial combustion plants	16%	1%	13%	2%	3%	14%	4%	7%
3-Combustion in manufacturing industry	1%	0%	2%	0%	0%	0%	0%	1%
4-Production processes	0%	0%	1%	0%	0%	0%	1%	1%
5-Extraction and distribution of fossil fuels and geothermal energy								
6-Solvent and other product use	1%	0%	1%	0%	0%	1%	2%	0%
7-Road transport	6%	0%	4%	0%	0%	1%	1%	3%
8-Other mobile sources and machinery	0%	0%	0%	0%	0%	1%	1%	0%
9-Waste treatment and disposal	0%	0%	0%	0%	0%	0%	0%	0%
10-Agriculture	1%	0%	1%	0%	0%	1%	0%	1%
11-Other sources and sinks	0%		1%	0%	0%	0%	1%	

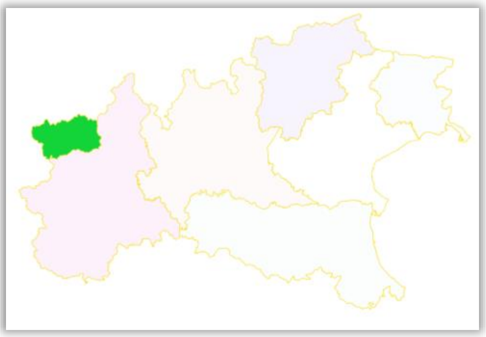
Residential emissions represent the main contribution to the PM10 levels both in years 2013 and 2025.
PM10 emission density maps for residential sector comparing the emission data set for 2013 and the emission scenario for 2025 (no-plan) are reported below.

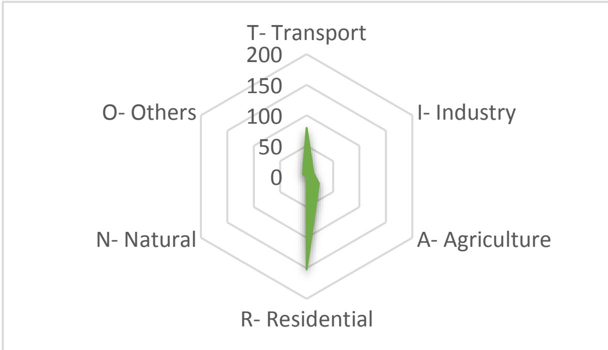
<table>
<tr><th colspan="2">PM10</th></tr>
<tr><th>Sector</th><th>R-Residential (Macrosector 2)</th></tr>
<tr><td>2013</td><td>
</td></tr>
<tr><td>2025
(no-plans)</td><td>
</td></tr>
</table>

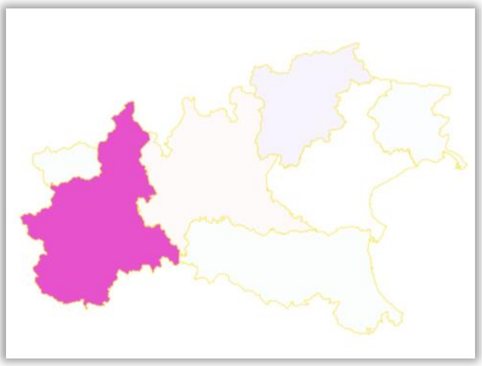
In these maps, single-point emission sources are expressed in t/year and diffuse emissions expressed in t/km² for the Po Valley. The single point emissions are represented with circles of different colours and the diffuse emissions are represented with a colour scale, ranging from red to blue.

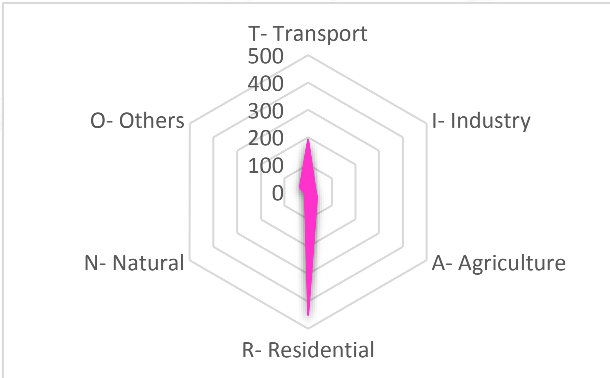
In the following table the radar charts of average emission density of PM10 for regions of the Po Valley are reported. The indicator is defined as the main sector contribution (R-Residential, T-Transport, A-Agriculture, I-Industry, N-Nature and O-Others) to the overall emission density for the Italian regions and provinces on the Po-basin.

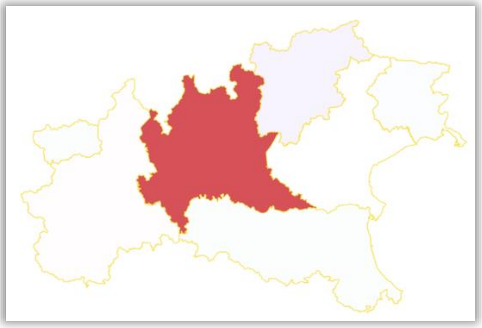
PM10: RADAR CHARTS- Emissions 2013 (Kg/km2)

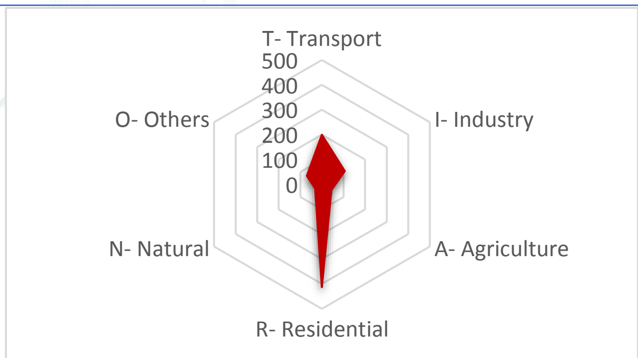


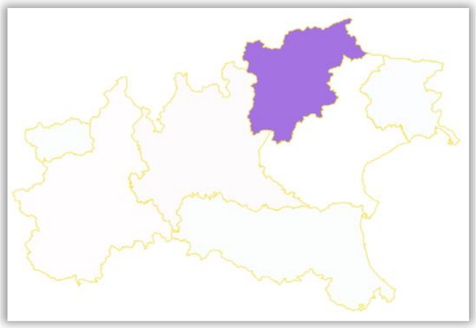


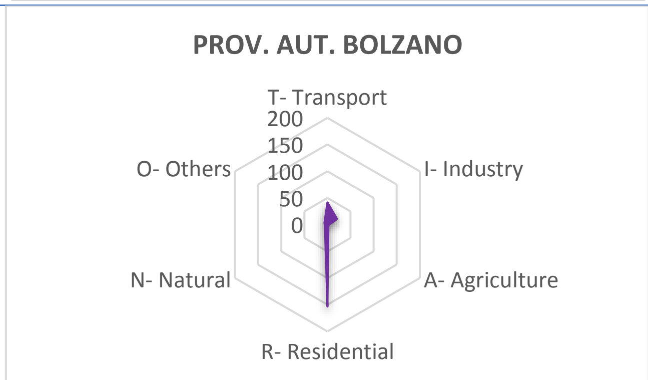


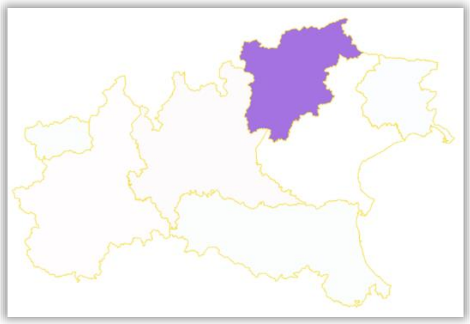


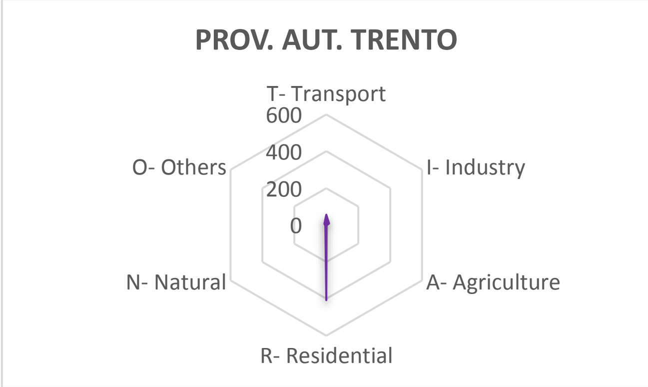


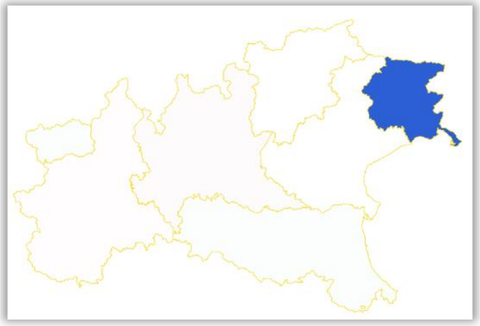


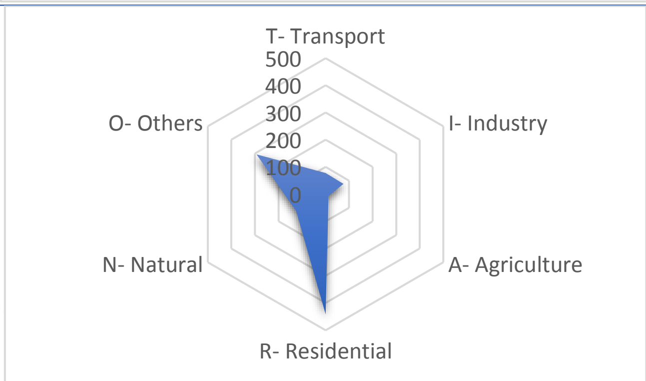


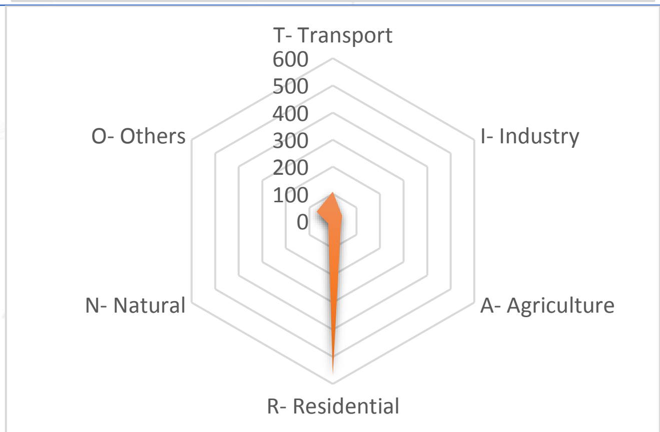


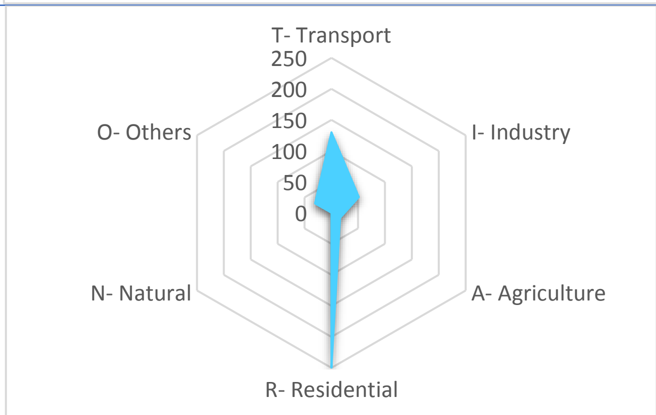



PROV. AUT. TRENTO
T- Transport
600
400
200
0
I- Industry
A- Agriculture
R- Residential
N- Natural
O- Others




T- Transport
500
400
300
200
100
0
I- Industry
A- Agriculture
R- Residential
N- Natural
O- Others


T- Transport
600
500
400
300
200
100
0
I- Industry
A- Agriculture
R- Residential
N- Natural
O- Others


T- Transport
250
200
150
100
50
0
I- Industry
A- Agriculture
R- Residential
N- Natural
O- Others

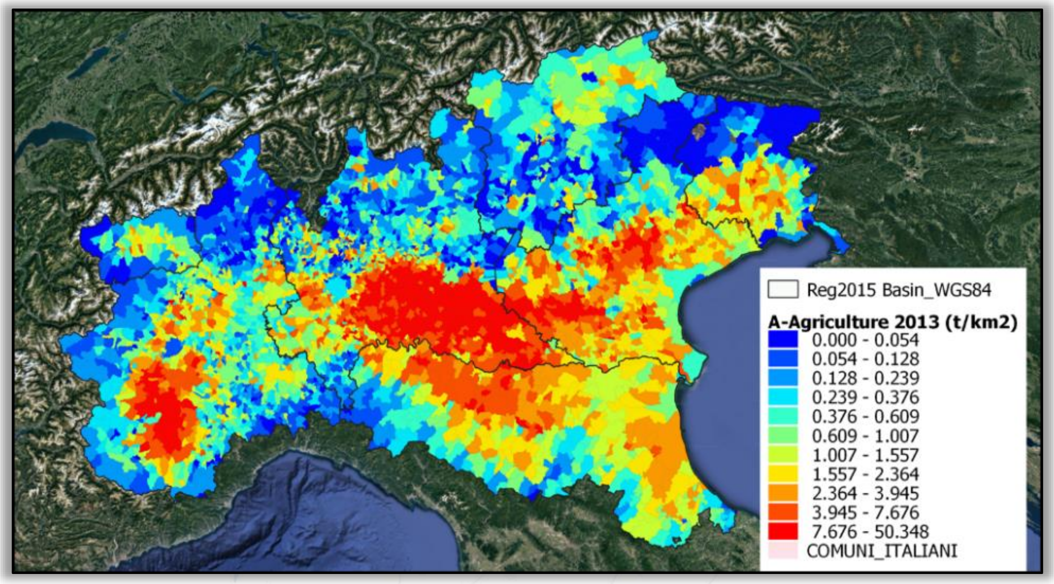
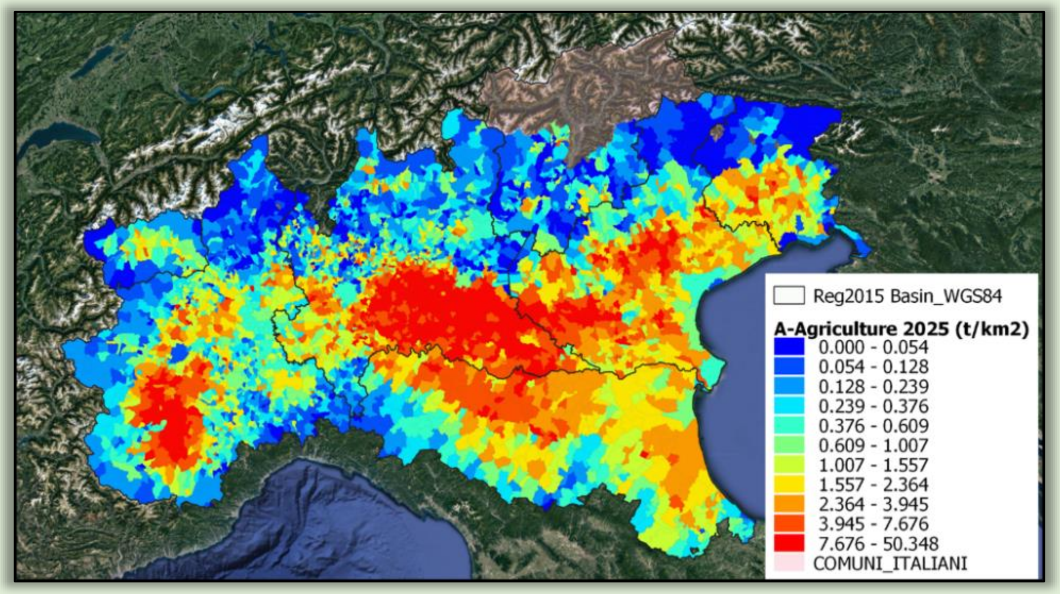
5.4. Emission maps of NH3 for the base year 2013 and 2025 (no-plans)

The following tables analyse the relative contribution of macrosectors and regions for the NH3 in 2013 and 2025. Indicator is calculated as $E_{region,macrosecotor}/E_{total}$.

EMISSION NH3 2013 (%)								
MACROSECTOR	PIEMONTE	VALLE D'AOSTA	LOMBARDIA	PROV. AUT. BOLZANO	PROV. AUT. TRENTO	VENETO	FRIULI VENEZIA GIULIA	EMILIA ROMAGNA
1-Combustion in energy and transformation industries	0%		0%			0%		0%
2-Non-industrial combustion plants	0%	0%	0%	0%	0%	0%	0%	0%
3-Combustion in manufacturing industry	0%		0%	0%	0%	0%	0%	0%
4-Production processes	0%		0%			0%	0%	0%
5-Extraction and distribution of fossil fuels and geothermal energy								
6-Solvent and other product use	0%		0%		0%	0%	0%	0%
7-Road transport	0%	0%	0%	0%	0%	0%	0%	0%
8-Other mobile sources and machinery	0%	0%	0%	0%	0%	0%	0%	0%
9-Waste treatment and disposal	0%		0%	0%	0%	0%	0%	0%
10-Agriculture	15%	1%	39%	2%	1%	19%	3%	18%
11-Other sources and sinks	0%		0%	0%	0%	0%	0%	

no-plans NH3 2025 (%) with Bolzano 2013								
MACROSECTOR	PIEMONTE	VALLE D'AOSTA	LOMBARDIA	PROV. AUT. BOLZANO	PROV. AUT. TRENTO	VENETO	FRIULI VENEZIA GIULIA	EMILIA ROMAGNA
1-Combustion in energy and transformation industries	0%		0%			0%		0%
2-Non-industrial combustion plants	0%	0%	0%	0%	0%	0%	0%	0%
3-Combustion in manufacturing industry	0%		0%	0%	0%	0%	0%	0%
4-Production processes	0%		0%			0%	0%	0%
5-Extraction and distribution of fossil fuels and geothermal energy								
6-Solvent and other product use	0%		0%		0%	0%	0%	0%
7-Road transport	0%	0%	0%	0%	0%	0%	0%	0%
8-Other mobile sources and machinery	0%	0%	0%	0%	0%	0%	0%	0%
9-Waste treatment and disposal	0%		0%	0%	0%	0%	0%	0%
10-Agriculture	15%	1%	38%	2%	1%	20%	3%	18%
11-Other sources and sinks	0%		0%	0%	0%	0%	0%	

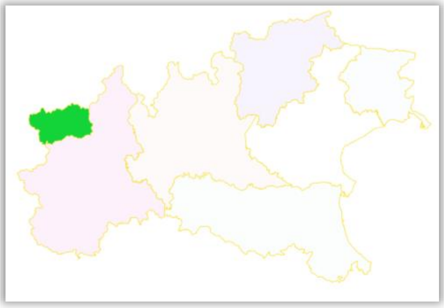
The agricultural activities represent the main contribution to the NH3 levels in the years 2013 and 2025.
NH3 emission density maps for residential sector comparing the emission data set for 2013 and the emission scenario for 2025 (no-plan) are reported below.

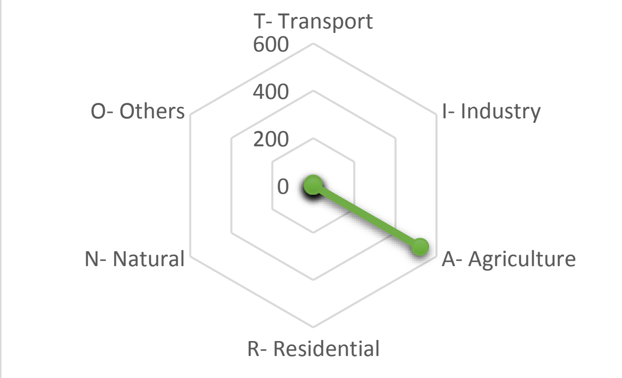
<table>
<tr><th colspan="2">NH3</th></tr>
<tr><th>SECTOR</th><th>A-Agriculture (Macrosector 10)</th></tr>
<tr><td>2013</td><td>
</td></tr>
<tr><td>2025
(no-plans)</td><td>
</td></tr>
</table>

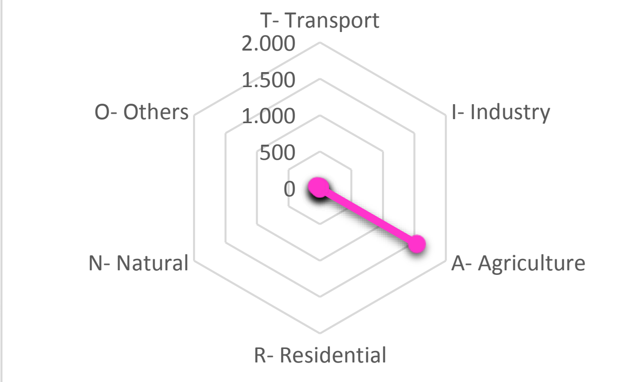
In these maps diffuse emissions are expressed in t/km².

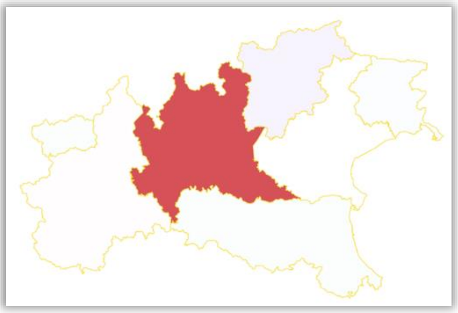
In the following table the radar charts of average emission density of NH_3 for regions of the Po Valley are reported. The indicator is defined as the main sector contribution (R-Residential, T-Transport, A-Agriculture, I-Industry, N-Nature and O-Others) to the overall emission density for the Italian regions and provinces on the Po-basin.

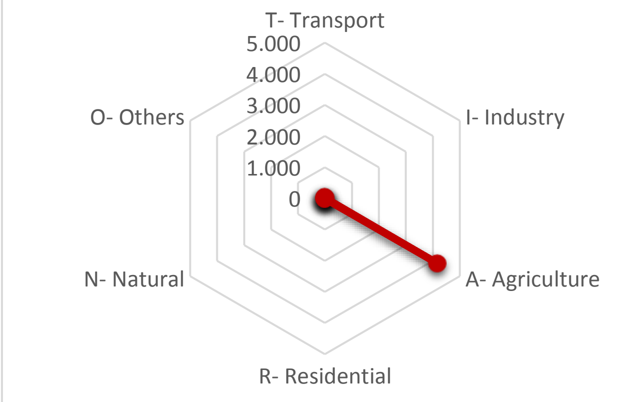
NH_3: RADAR CHARTS- Emissions 2013 (Kg/km2)

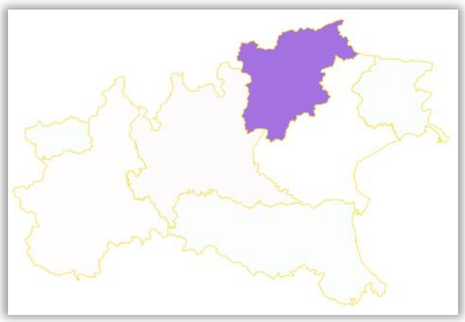




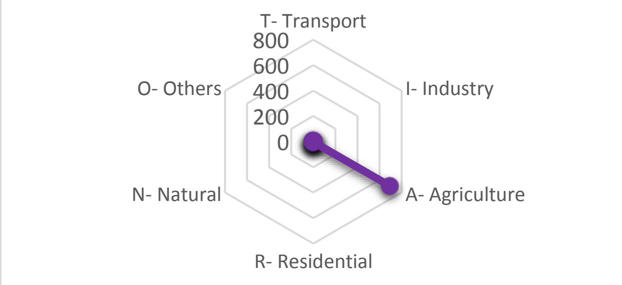


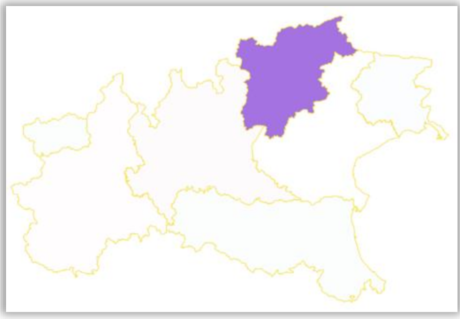




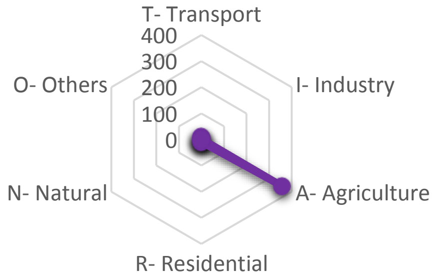


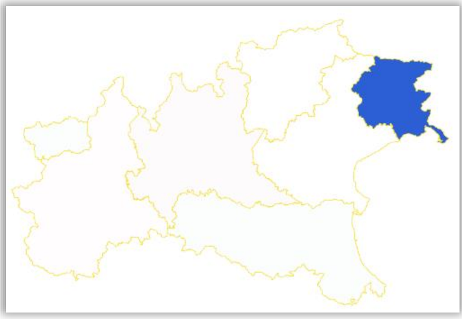
PROV.AUT.BOLZANO

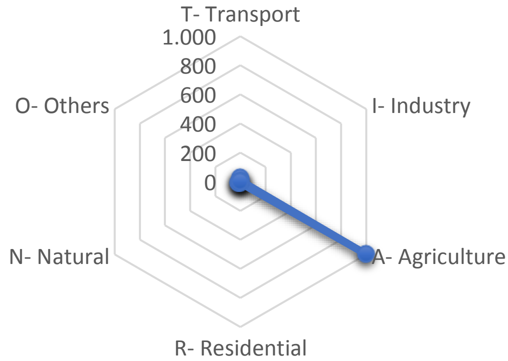


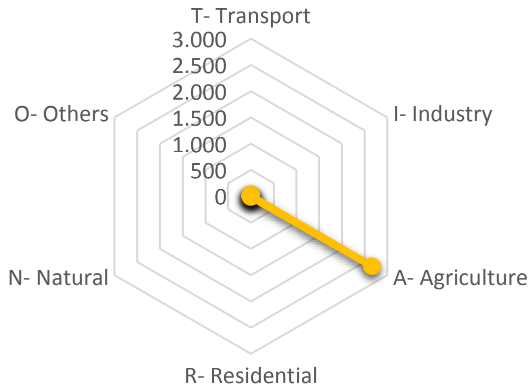


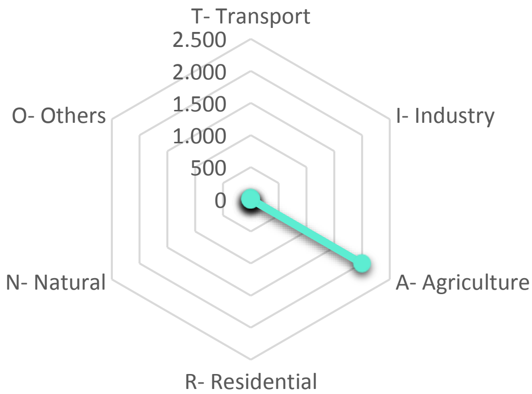
PROV. AUT. TRENTO











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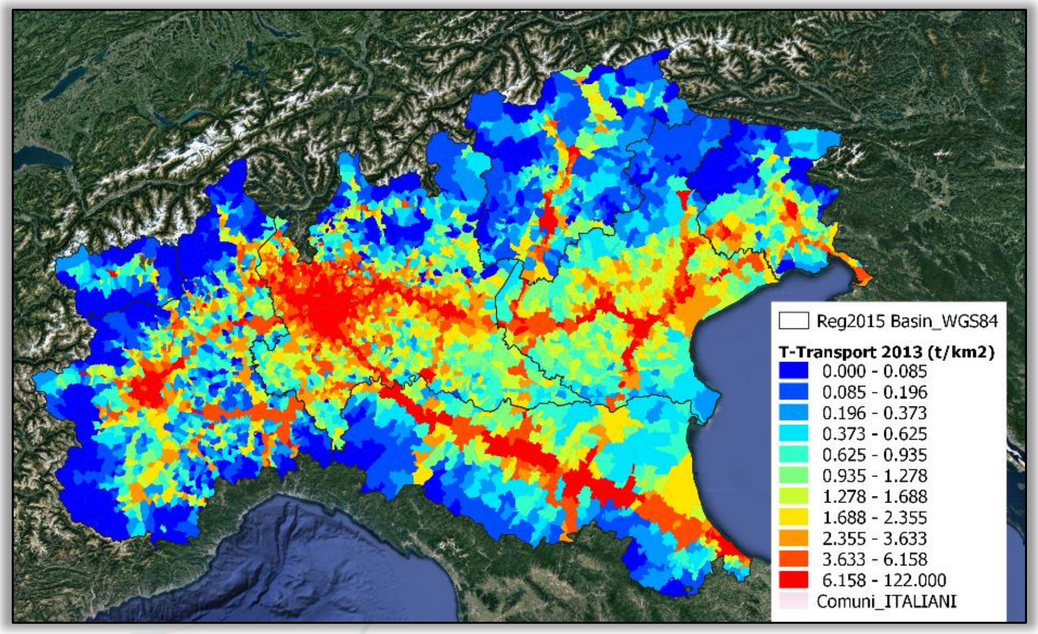
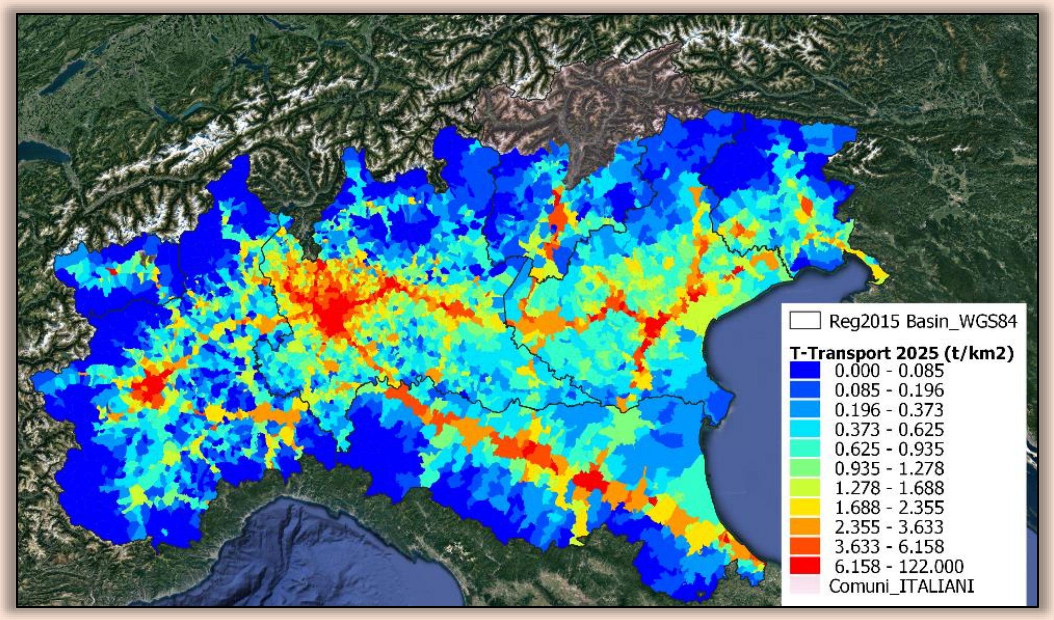
5.5. Emission map of NOx for the base year 2013 and 2025 (no-plans)

The following tables analyse the relative contribution of macrosectors and regions for the NOx in 2013 and 2025. Indicator is calculated as $E_{region,macrosecotor}/E_{total}$.

EMISSION NOx 2013 (%)								
MACROSECTOR	PIEMONTE	VALLE D'AOSTA	LOMBARDIA	PROV. AUT. BOLZANO	PROV. AUT. TRENTO	VENETO	FRIULI VENEZIA GIULIA	EMILIA ROMAGNA
1-Combustion in energy and transformation industries	1%	0%	2%	0%	0%	1%	1%	1%
2-Non-industrial combustion plants	2%	0%	3%	0%	0%	2%	1%	2%
3-Combustion in manufacturing industry	3%	0%	5%	0%	0%	3%	2%	3%
4-Production processes	1%	0%	0%	0%	0%	1%	0%	1%
5-Extraction and distribution of fossil fuels and geothermal energy								0%
6-Solvent and other product use	0%		0%		0%	0%	0%	0%
7-Road transport	8%	0%	16%	1%	1%	9%	2%	12%
8-Other mobile sources and machinery	2%	0%	3%	0%	0%	3%	1%	3%
9-Waste treatment and disposal	0%	0%	1%	0%	0%	0%	0%	0%
10-Agriculture	0%		0%	0%	0%	0%	0%	0%
11-Other sources and sinks	0%		0%	0%	0%	0%	0%	

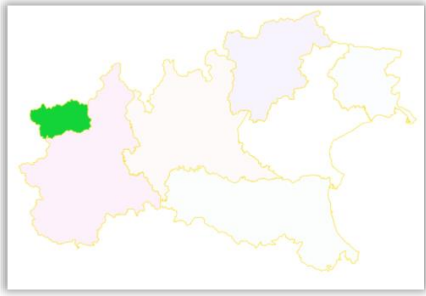
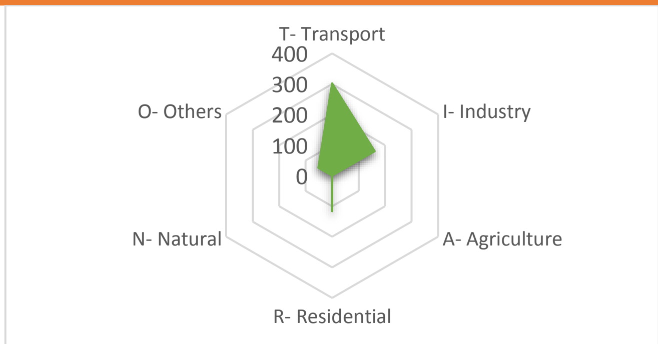
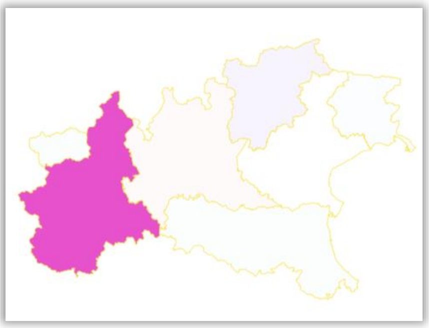
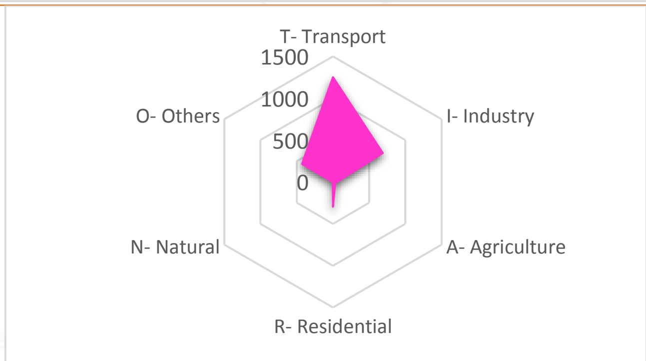
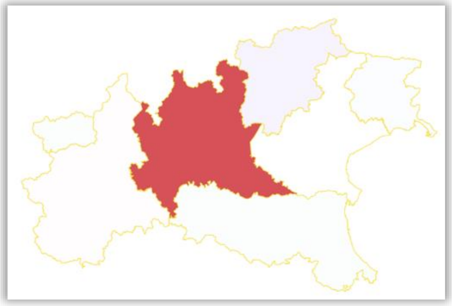
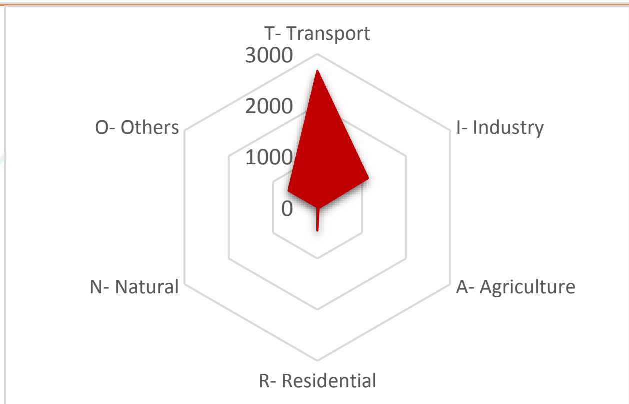
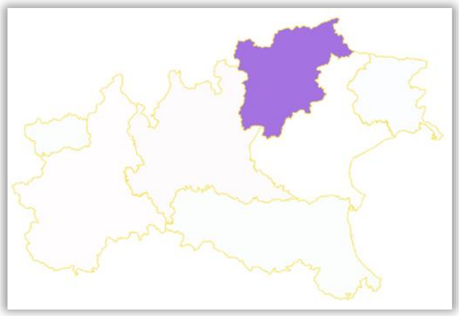
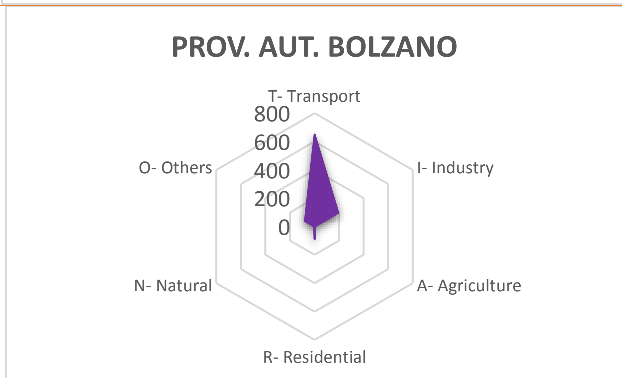
no-plans NOX 2025 (%) with Bolzano 2013								
MACROSECTOR	PIEMONTE	VALLE D'AOSTA	LOMBARDIA	PROV. AUT. BOLZANO	PROV. AUT. TRENTO	VENETO	FRIULI VENEZIA GIULIA	EMILIA ROMAGNA
1-Combustion in energy and transformation industries	1%	0%	2%	0%	0%	3%	1%	1%
2-Non-industrial combustion plants	3%	0%	3%	0%	0%	2%	1%	2%
3-Combustion in manufacturing industry	3%	0%	6%	0%	0%	3%	2%	4%
4-Production processes	1%	0%	1%	0%	0%	1%	0%	1%
5-Extraction and distribution of fossil fuels and geothermal energy								0%
6-Solvent and other product use	0%		0%		0%	0%	0%	0%
7-Road transport	6%	0%	11%	2%	1%	7%	2%	8%
8-Other mobile sources and machinery	2%	0%	3%	0%	0%	4%	2%	2%
9-Waste treatment and disposal	0%	0%	2%	0%	0%	0%	0%	0%
10-Agriculture	0%		0%	0%	0%	0%	0%	0%
11-Other sources and sinks	0%		0%	0%	0%	0%	0%	

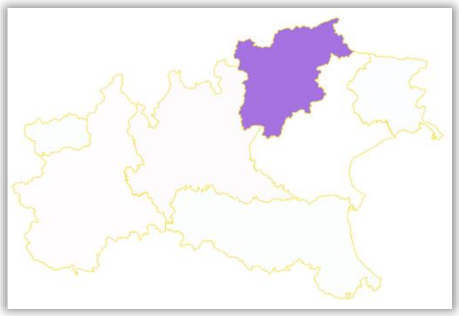
Transport emissions represent a main contributor to the NOx emissions in the years 2013 and 2025.
NOx emission density maps comparing the emission data set for 2013 and the emission scenario for 2025 (no-plans) are reported below.

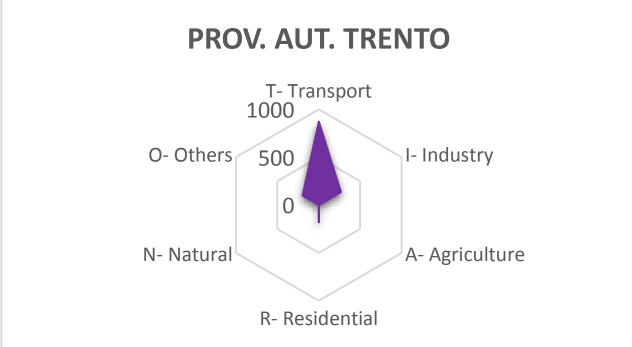
NOx	
SECTOR	***T-Transport (Macrosector 7)***
2013	
2025 (no-plans)	

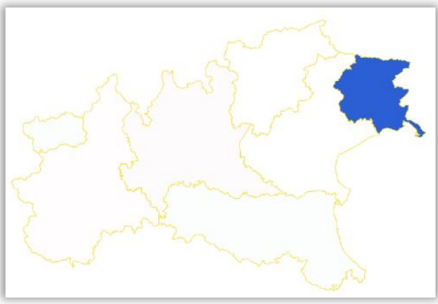
In these maps diffuse emissions are expressed in t/km².

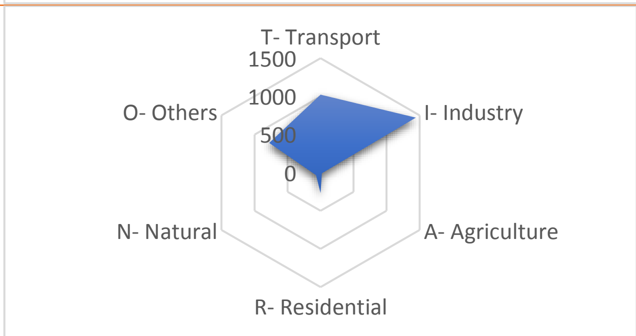
In the following table the radar charts of average emission density of NOx for regions of the Po Valley are reported. The indicator is defined as the main sector contribution (R-Residential, T-Transport, A-Agriculture, I-Industry, N-Nature and O-Others) to the overall emission density for the Italian regions and provinces on the Po-basin.

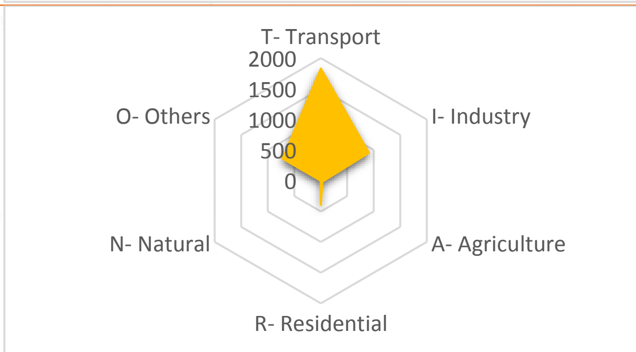
NOx RADAR CHARTS- Emissions 2013 (Kg/km2)	
	
	
	
	

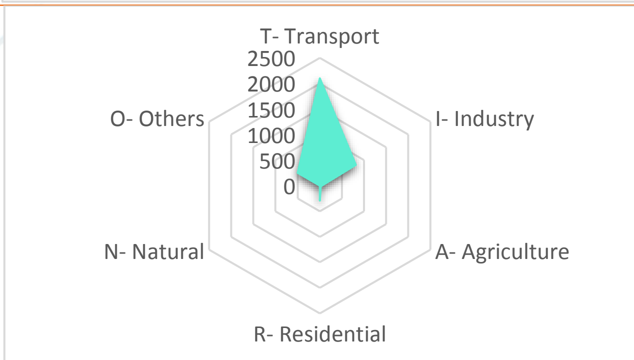



PROV. AUT. TRENTO
T- Transport
I- Industry
A- Agriculture
R- Residential
N- Natural
O- Others
1000
500
0



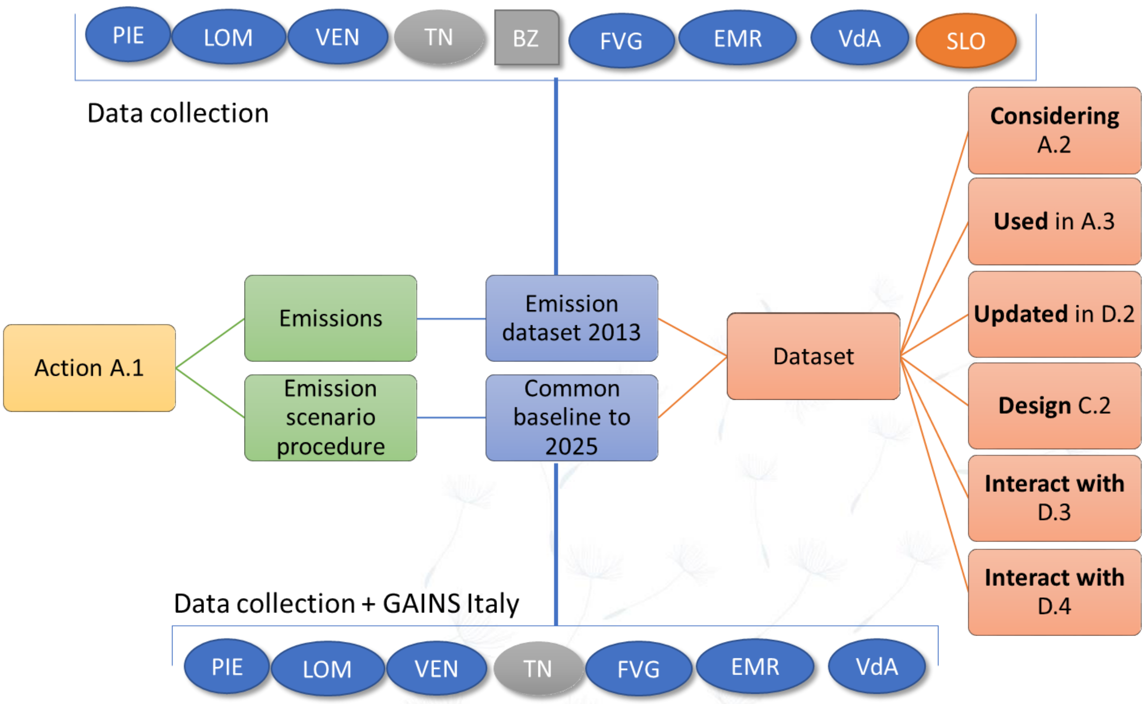

T- Transport
I- Industry
A- Agriculture
R- Residential
N- Natural
O- Others
1500
1000
500
0


T- Transport
I- Industry
A- Agriculture
R- Residential
N- Natural
O- Others
2000
1500
1000
500
0


T- Transport
I- Industry
A- Agriculture
R- Residential
N- Natural
O- Others
2500
2000
1500
1000
500
0

6. *Conclusions*

The action A1 has investigated the main methodologies and emission results reported on the Po-basin and Slovenia. In the first part of this document the main details are reported. By collecting data, the action has delivered two different datasets on emission estimates: the first dealing with emission on the Po-basin and Slovenia and the second one on emission projection on 2025 on the Po-basin without implementation of AQ measures. The following picture shows the interaction of the main deliverables and the other project actions.



With the contribution of the LIFE Programme of the European Union

LIFE 15 IPE IT 013

prepAIR

Po Regions Engaged to Policies of Air

THE PROJECT PREPAIR

The Po Basin represents a critical area for the quality of air, as the limit values of fine powders, nitrogen oxides and ozone set by the European Union are often exceeded. The northern Italian regions re included in this area as well as the metropolitan cities of Milan, Bologna and Turin. This area is densely populated and highly industrialized. Tons of nitrogen oxides, powders and ammonia are emitted annually into the atmosphere from a wide variety of polluting sources, mainly related to traffic, domestic heating, industry, energy production and agriculture. Ammonia, mainly emitted by agricultural and zootechnical activities, contributes substantially to the formation of secondary powders, which constitute a very significant fraction of total powders in the atmosphere.

Because of the weather conditions and the morphological characteristics of the basin, which prevent the mixing of the atmosphere, the background concentrations of the particulate, in the winter period, are often high.

In order to improve the quality of the air in the Po Valley, since 2005 Regions have signed Program Agreements identifying coordinated and homogeneous actions to limit emissions deriving from the most emissive activities.

The PREPAIR project aims at implementing the measures foreseen by the regional plans and by the 2013 Po Basin Agreement on a wider scale, strengthening the sustainability and durability of the results: in fact, the project involves not only the regions of the Po valley and its main cities, but also Slovenia, for its territorial contiguity along the northern Adriatic basin and for its similar characteristics at an emissive and meteoclimatic level.

The project actions concern the most emissive sectors: agriculture, combustion of biomass for domestic use, transport of goods and people, energy consumption and the development of common tools for monitoring the emissions and for the assessment of air quality over the whole project area.

DURATION

From February 1st 2017 to January 31 2024.

TOTAL BUDGET

17 million euros available to invest in 7 years: 10 million of which coming from the European Life Program.

COMPLEMENTARY FUNDS

PREPAIR is an integrated project: over 850 million euros coming from structural funds and from regional and national resources of all partners for complementary actions related to air quality.

PARTNERS

The project involves 17 partners and is coordinated by the Emilia-Romagna Region – General directorate for the territorial and environmental care.

www.lifeprepair.eu – info@lifeprepair.eu

Regione Emilia-Romagna | Regione del Veneto | Regione Lombardia | Regione Piemonte | Regione Autonoma Friuli Venezia Giulia | Provincia Autonoma di Trento

arpae agenzia prevenzione ambiente energia emilia-romagna | arpav Agenzia Regionale per la Prevenzione e Protezione Ambientale del Veneto | Arpa Piemonte Agenzia Regionale per la Protezione Ambientale | ARPA Lombardia Agenzia Regionale per la Protezione dell'Ambiente | ARPA Valle d'Aosta | arpa FVG

ARSO ENVIRONMENT Slovenian Environment Agency | Comune di Bologna | Comune di Milano | Città di Torino | ERVET Emilia-Romagna Valorizzazione Economica Territorio | FLA Fondazione Lombardia per l'Ambiente