LIFE 15 IPE IT 013

IMPROVING AIR QUALITY TOGETHER
LIFE IP PrepAIR:
project's achievements and main results

# The case of Po Valley:
## air quality and coordinated actions

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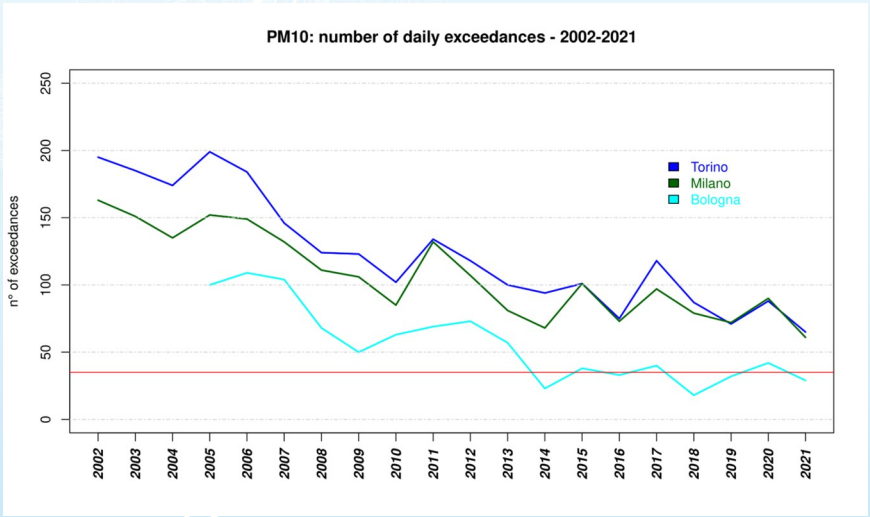
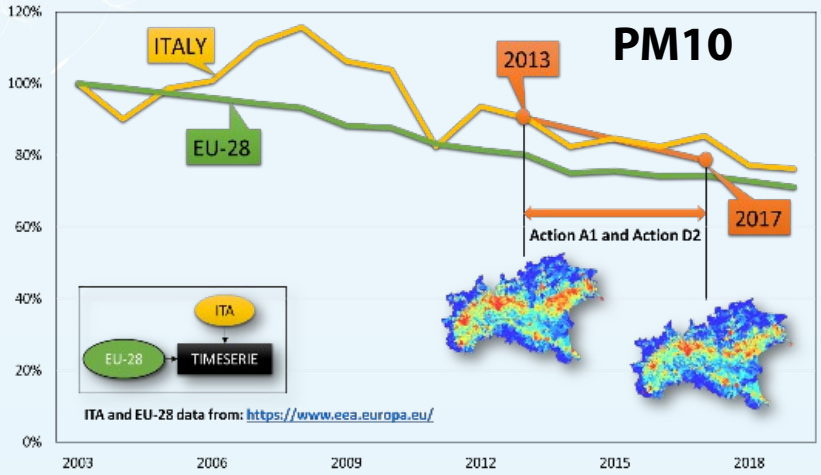
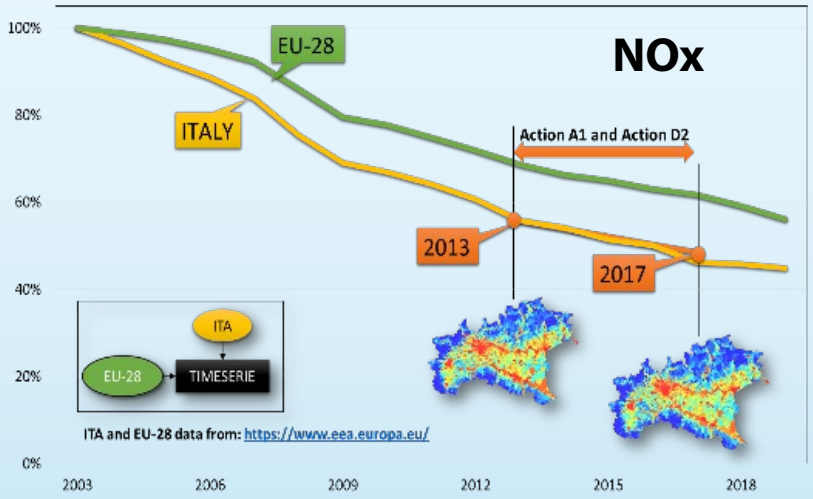
*Bruxelles, May 31 2022*

# The Problem

- Exceedances of the limit values for PM, NO2 and O3
- Infringement procedure for PM10 (2019) and NO2 (2022)
- The trend of emissions and pollutants conc. is decreasing but not enough



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# Prepair concept

The Prepair project was born in 2016-2017 from the awareness, gained in the 2000s, of the interregional-Po Valley character of pollution.

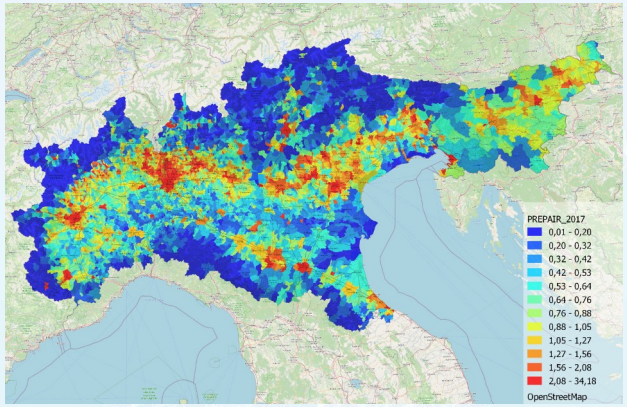
Since the beginning, the Prepair project was strongly related with the AQ plans of the Partner regions and provided the knowledge base for the management of the infringement procedure.

# Tools (data and models)

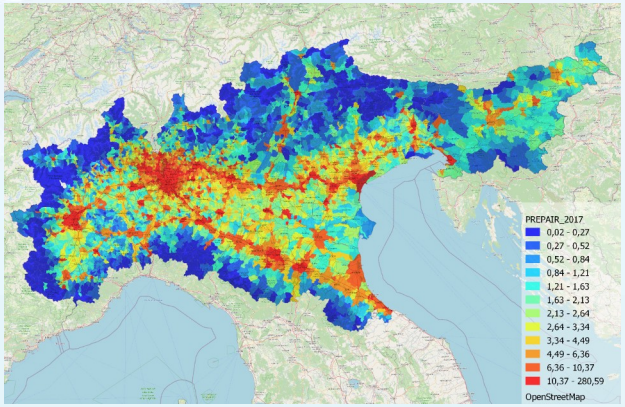
- Emissions data
- Network of special stations
- Chemical Transport Models
- Integrated assessment model RIAT+
- Model for the quantification of gaseous emissions from livestock farmsBAT-Tool
- AQ plans monitoring tool

# Emission density maps in the Po Basin and Slovenia (dataset 2020)

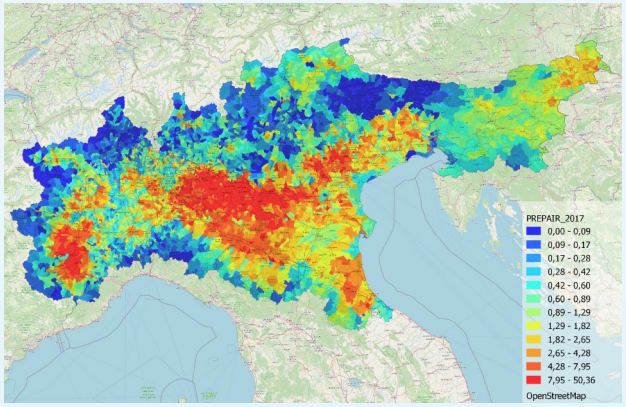
PM10 t/km2




NOx t/km2

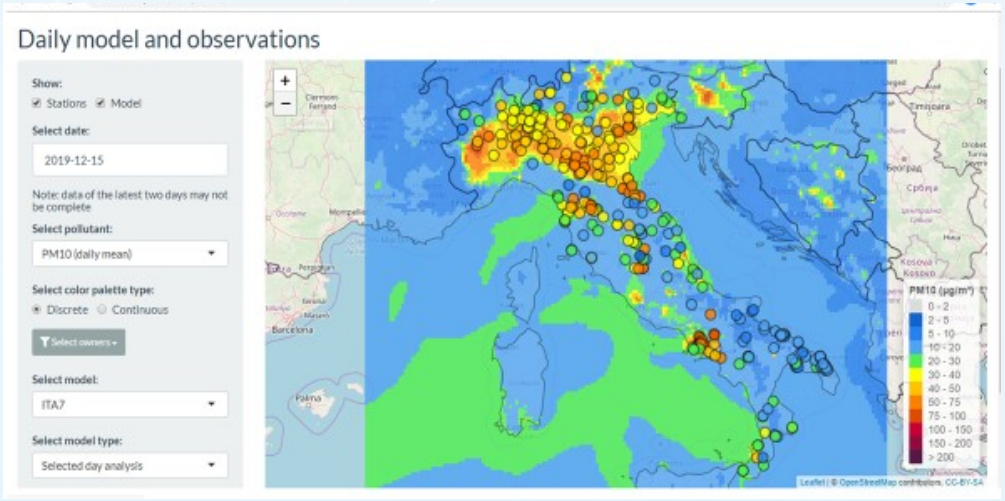


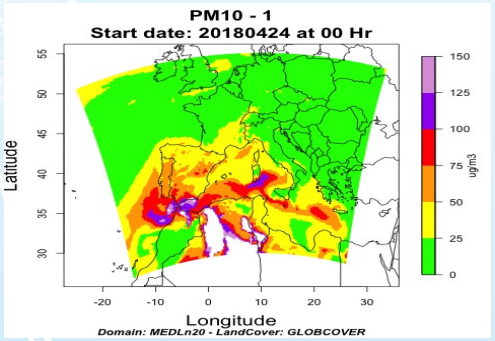

NH3 t/km2

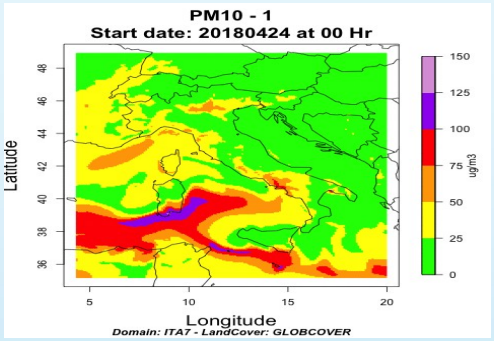


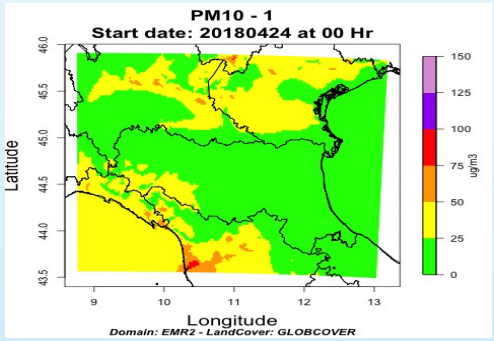

Fonte: PREPAIR Action D2 - Emission dataset 2020

# Evaluation and monitoring tools: CTMs and data sharing



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# Action C5 - Implementation of a common model for evaluation of odours and gaseous emissions resulting from intensive rearing of cattle, pigs and poultry

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Nitrogen cycle

**"whole farm" approach:** estimate the overall emissions of the farm, which are produced during the various stages of production and management (nutrition, housing, storage, manure treatment and spreading)

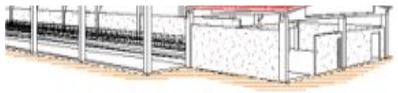
Organic carbon cycle

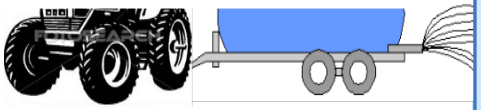
The emission reduction techniques are applied to the respective emission phase, reducing the amount, but increasing the nitrogen that passes to the next phase with a «mass flow» approach

E_totali = E_house + E_treat + E_store + E_spread

BAT-Tool is freely available online at **https://bat-tools.datamb.eu/**

after simple registration

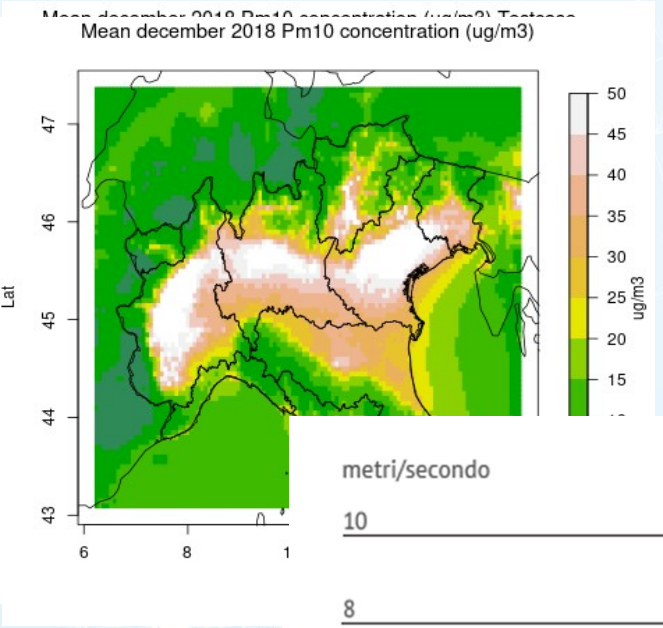


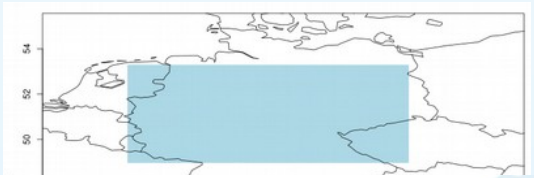
# Main findings

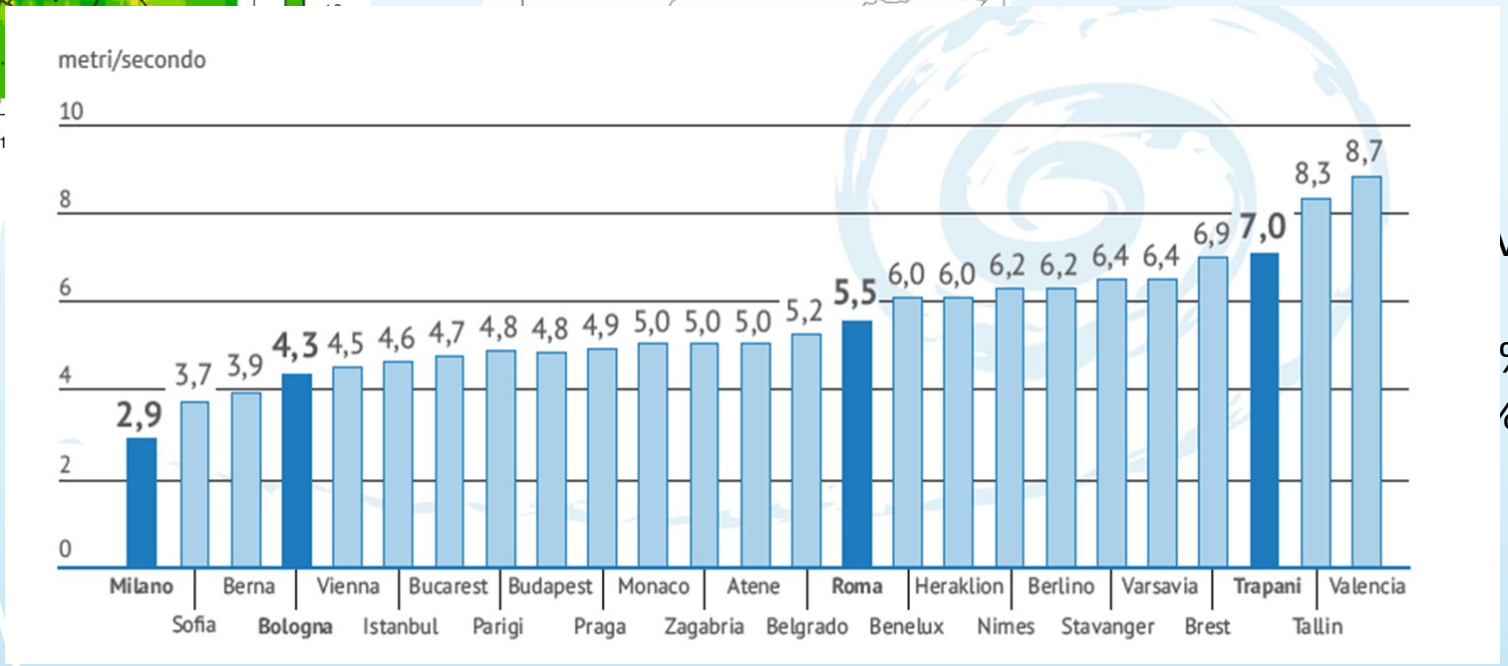
1. The role of Po valley morphology and meteorology
2. AQ during the lockdown: the role of agriculture
3. Emissions reduction target
4. Cost assessment (preliminary)
5. Additional measures

# 1- Meteorology




What if Po Valley were in Central Europe (with those meteorological conditions)?






vels

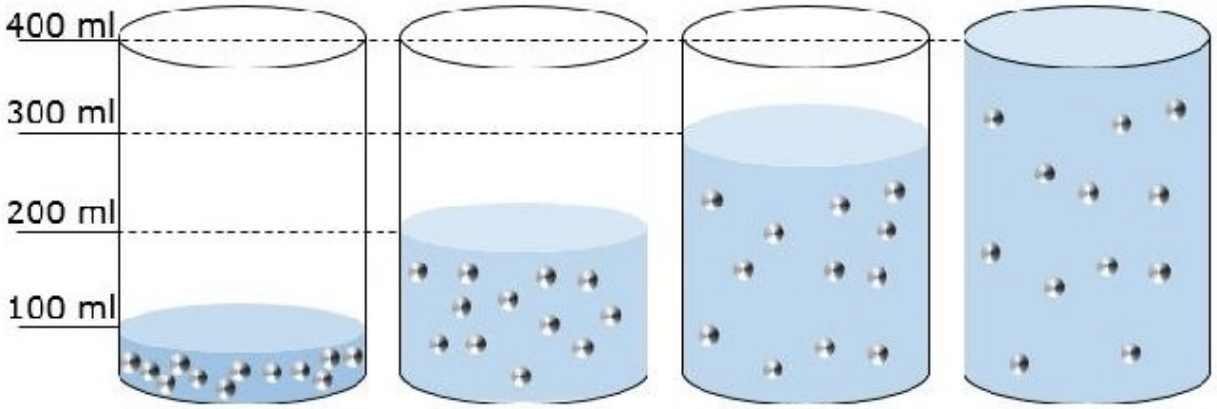
%

%

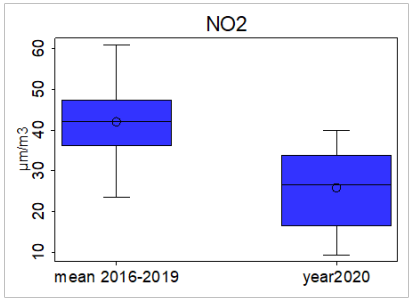
# Dilutions

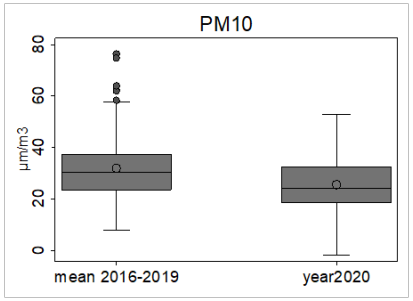
- In a dilution, the amount of solute does not change.
- More solvent is added to change the concentration.

**Example**: If the following solutions each has 12 moles of solute, calculate the molarity of each solution. Which is the most concentrated? Which is the most diluted?



# 2- The effects of «lockdown» on air quality

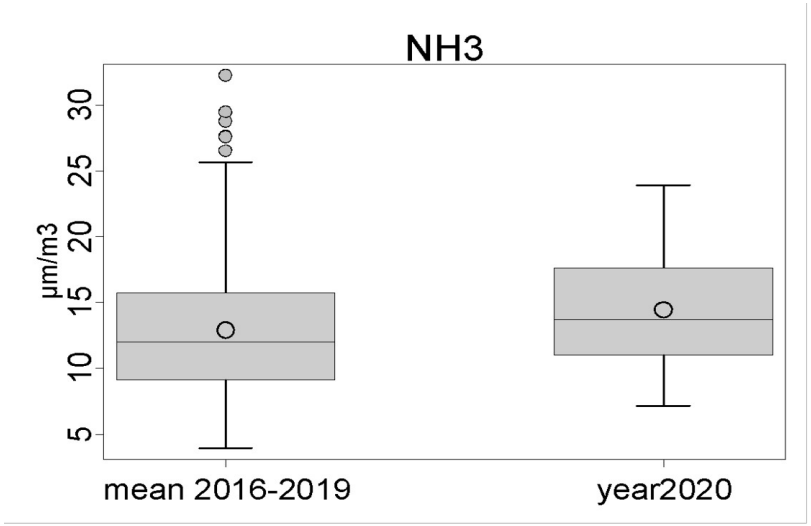



NOX: max weekly reduction 30 – 40% (with a significant contribution from traffic, considering the reduction in flows of about 80% for light vehicles and 50-60% for heavy goods vehicles)

PM10: max weekly reduction 20% (the reduction from traffic and industry partially balanced by the increase in emissions from heating)

•ammonia emissions are not substantially reduced (considering that agricultural and livestock activities have not undergone significant changes during the lockdown



# 3- Emissions reduction targets

To achieve the PM10 limit on the Po Valley, it is necessary to reduce direct emissions of PM10 and of the two main precursors emitted in the area (NOx and NH3), by 38% PM10, 39% NOx and 22% NH3 respectively.

This % reduction corresponds to a reduction of 29,876 tons per year of PM10 emitted directly and 147,428 ton/year of NOX, by 54,170 ton/year of NH3

| | Emissions to be reduced in all macro-sectors (CLE-Plans-Agreements-Prepair) | | Macro-sector reductions (CLE-Plans-Agreements-Prepair) | Reductions for CLE macro-sector |
|---|---|---|---|---|
| | % reduction compared to 2013 | Tons | Tons per macro sector (MS) | |
| | | | MS7 | MS7 |
| NOx | 39% | 147528 | 115484 | 94487 |
| | | | MS2 | MS2 |
| PM10 | 38% | 29876 | 20887 | 2485 |
| | | | MS10 | MS10 |
| $NH_3$ | 22% | 54170 | 52285 | -5399 |

*Ref REPORT OF PREPAIR PROJECT - ACTION A3 "Preliminary assessment of the Air Quality Plans"*
http://www.lifeprepair.eu/index.php/azioni/air-quality-and-emission-evaluation/#toggle-id-16

# 4 – cost assesment (preliminary)

| Biomass for domestic use | % abatement | (Euro) |
|---|---|---|
| Replacement of combustors with less than 3 stars | PM10 35% | 12.000.000.000 |
| **Transport** | | |
| replacement of diesel vehicles up to euro 5 (car and commercial | NOx 45% | 200.000.000.000 |
| **Agriculture and animal husbandry** | | |
| Manure storage and application | NH3 19% | 3.400.000.000 |
| | | |
| **Total amount** | **Billion Euro** | **215** |

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# DOMESTIC BIOMASS HEATING - PM10/PM2.5

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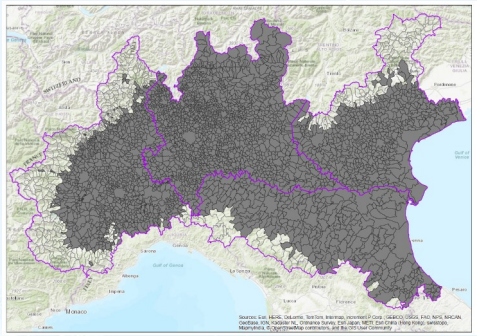
Stoves, fireplaces, cooking, etc. Estimated number in Po Valley (Action D3, LIFE IP Prepair): **2.954.033**



Ban "3 stars" from 2020. Only installation of generators of class "4 stars" by the end of 2019.

**67% of small combustion installation lder thano 10 year, less than 4 stars**

(AIEL, domestic biomass heating analysys, 2018).

More than 1.970.000 generators need substitution to reduce PM emission in Po valley.

**Estimated PM10 Maximum Feasible Reduction in Macrosector 2: 57%**

**Estimated PM10 Maximum Feasible Reduction on the whole PM10 emissions: 35% .**

**Estimated social costs: 12.000.000.000 €**

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# AGRICULTURE - NH3

**Covered manure storage: 20%**

**BAT in manure application: 19%**

**(estimated for farm > 3.000 kg N/y)**

**Estimated NH3 Maximum Feasible Reduction in Macrosector 10: 20%**
**Estimated NH3 Maximum Feasible Reduction on the whole NH3 emissions: 19% .**

**Estimated social costs: 3.400.000.000 €**

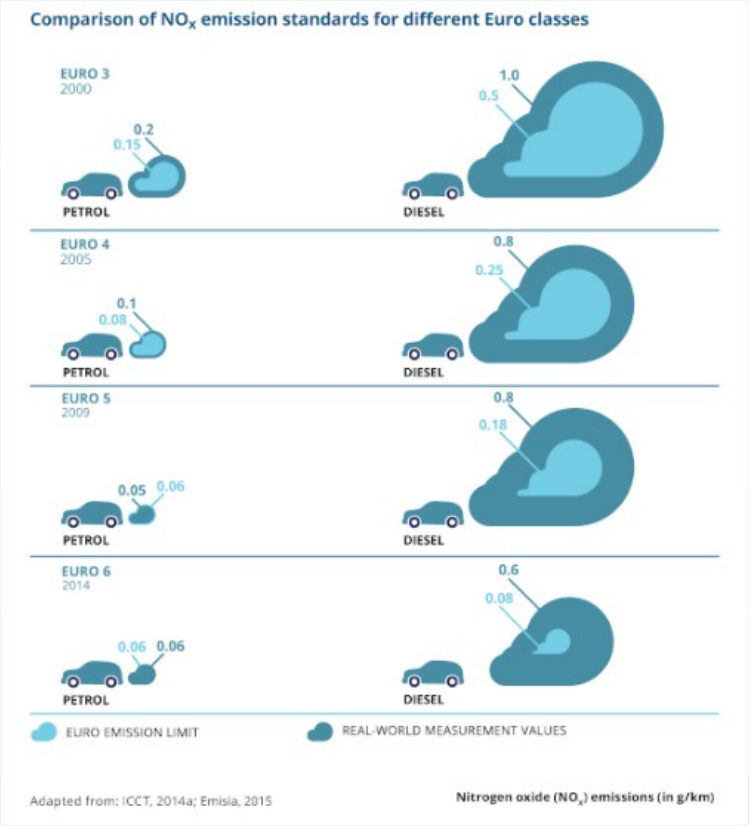
No reduction in number of animals

# TRANSPORT (people, goods) - NOx

Total passenger cars: **13.000.000,**
**25% are diesel up to EURO 5**

Total commercial vehicles (light and duty):
**2.000.000, 77% are diesel up to EURO 5**

More than 4.500.000 vehicles need
substitution to reduce NOx emission in Po valley.




**Estimated NOx Maximum Feasible Reduction in Macrosector 7: 50%**
**Estimated NOx Maximum Feasible Reduction on the whole NOx emissions: 45% .**

**Estimated social costs: 200.000.000.000 €**

# Focus on agriculture-farms

- ACTION C.4: Promoting an ammonia low-emission application of fertilizers based on urea in agricultur (Boccasile) Enforce BAT application
- Action D.6: Secondary is the majority contribution to the PM and its formation is very complex.(Cuccia et. Trentini) Reduce emissions of precursor (NH3), do the impact assessment
- peculiarity of secondary PM2.5 formation in the Po basin, characterised by contrasting chemical regimes within distances of few (hundreds of) kilometres, as well as strong non-linear responses to emission reductions during wintertime. (JRC) compare these results with similar results obtained from other models
- a combined reduction of the two precursors is the most efficient in reducing PM2.5 concentrations. In the winter period (Nov-Feb) the NH3 more sensitive zones include urban areas such as Milan, Bologna, Turin and Venice. However, areas emerge with the same reduction of precursors, in which acting on one precursor turns out to be more advantageous than acting on the other, and in this case the NOx more sensitive zones prevail. Stortini-bande and al.
- more study needed

# Enforce BAT application

ACTION C.4: Promoting an ammonia low-emission application of fertilizers based on urea in agriculture


*Tabella 31 – Stima qualitativa della applicabilità delle buone pratiche di distribuzione dell'urea*

| Pratica | Applicabilità | | | |
|---|---|---|---|---|
| | cereali autunno-vernini | | cereali estivi | |
| | in presemina /semina [1] | in copertura | in presemina /semina | in copertura |
| Interramento superficiale (circa 3 cm) | 0 | 0 | +++ | +++ |
| Iniezione di urea a solco chiuso | 0 | 0/+ | + | ++ |
| Irrigazione a seguito dell'applicazione | 0 | 0/+ | 0 | +++ |
| Fertirrigazione in manichette superficiali | 0 | 0 | 0 | ++ |
| Fertirrigazione in manichette interrate | 0 | 0 | 0 | + |
| Inibitore ureasi | 0 | +++ | ++ | +++ |
| Urea a rilascio controllato | 0 | +++ | ++ | +++ |
| Sostituzione di urea con nitrato ammonico | 0 | +++/++++ | ++/+++ | +++/++++ |
| Agricoltura di precisione (rateo variabile) | 0 | +/++ | +/++ | +/++ |
| Applicabilità | 0 | nessuna | | |
| | + | bassa | | |
| | ++ | media | | |
| | +++ | alta | | |
| | ++++ | molto alta | | |

(1) si considera che l'urea nel caso dei cereali autunno vernini non sia il fertilizzante applicato in fase di pre-semina/semina

# Azione C4 - Buone pratiche uso fertilizzanti azotati
# Potenzialità di riduzione delle emissioni nel Bacino Padano

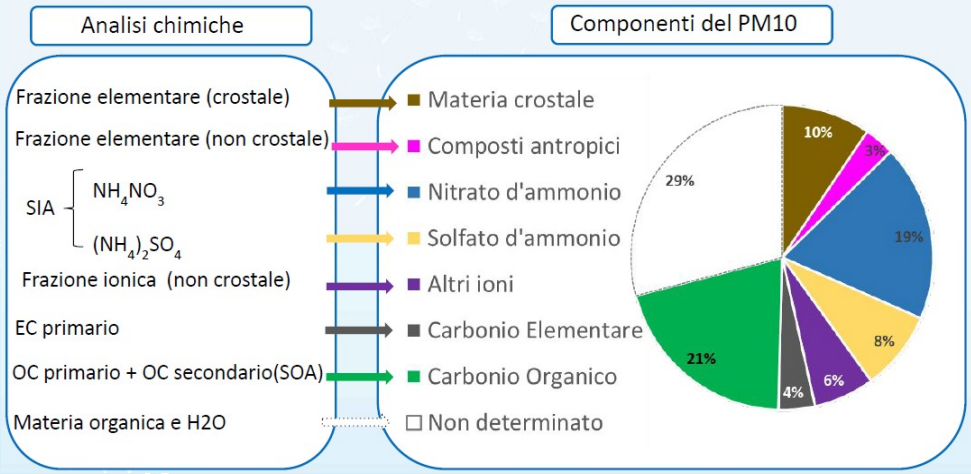
## Scenari

- **SC_BAU:** (Business As Usual)
- **SC_NEC:** prescrizioni contenute nel NAPCP 2019, il Piano Nazionale di Riduzione dell'Inquinamento Atmosferico (interramento urea)
- **SC_EQU:** diffusione equilibrata delle buone pratiche
- **SC_BAN:** bando dell'urea

| Regioni | REF | BAU | NEC | EQU | BAN |
|---|---|---|---|---|---|
| | Emissioni $NH_3$ | Riduzione emissioni | | | |
| | (t $NH_3$/a) | (%) | | | |
| Piemonte | 3245 | -33% | -36% | -44% | -81% |
| Lombardia | 8935 | -36% | -39% | -44% | -82% |
| Veneto | 5795 | -31% | -34% | -44% | -81% |
| Friuli VG | 2114 | -38% | -40% | -45% | -83% |
| Emilia Romagna | 7969 | -22% | -26% | -43% | -79% |
| Regioni Padane | **28058** | **-31%** | **-34%** | **-44%** | **-81%** |

Action D.6: Secondary is the majority contribution to the PM and its formation is very complex.

(Cuccia et. Trentini)




Reduce emissions of precursor (NH3),

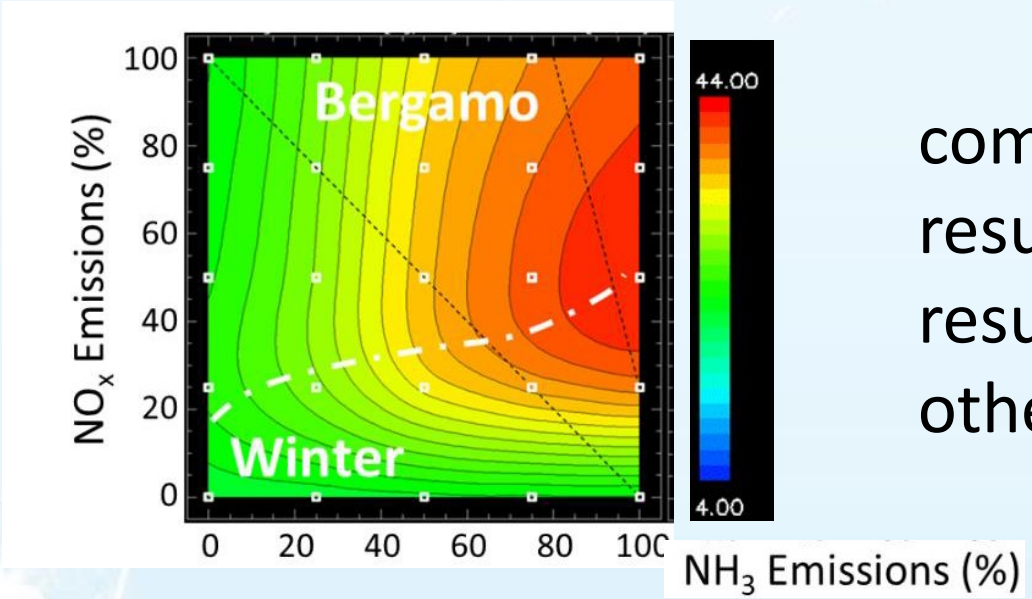
do always the impact assessment

maintain the special stations network

# Nonlinear response of PM2.5 to changes in NOx and NH3

From: "Non linear response of PM2.5 to changes in NOx and NH3 emissions in the Po basin (Italy): consequences for air quality plans" https://doi.org/10.5194/acp-2021-65 P. Thunis et al, Atm Chemistry and Physics

## PM2.5 isopleths during Winter




compare these results with similar results obtained from other models (done !)

"One of the striking results is the increase of the PM2.5 concentration levels when NOx emission reductions are applied in NOx-rich areas, such as the surroundings of Bergamo"


- a combined reduction of the two precursors is the most efficient in reducing PM2.5 concentrations.
- during the winter period (Nov-Feb) the NH3 more sensitive zones include urban areas such as Milan, Bologna, Turin and Venice.
- However, areas emerge with the same reduction of precursors, in which acting on one precursor turns out to be more advantageous than acting on the other, and in this case the NOx more sensitive zones prevail.

•T7
•T8

| *Pollutant* |
|---|
| PM2.5 µg/m$^3$ |
| PM10 µg/m$^3$ |
| $NO_2$ µg/m$^3$ |

| Pollutant |
|---|
| PM2.5 µg/m3 |
| PM10 µg/m3 |
| NO2 µg/m3 |

*Table 3 summary of achievement of the WHO recommended AQG levels, interim target and EU 2008/50/EC Directive for T7 and T8 scenarios. The green/red background highlights respectively achievement/non achievement of selected target, while yellow background means achievement at most monitoring stations.*

# Concluding remarks

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# 5 - Policy actions (after the mid term conference):

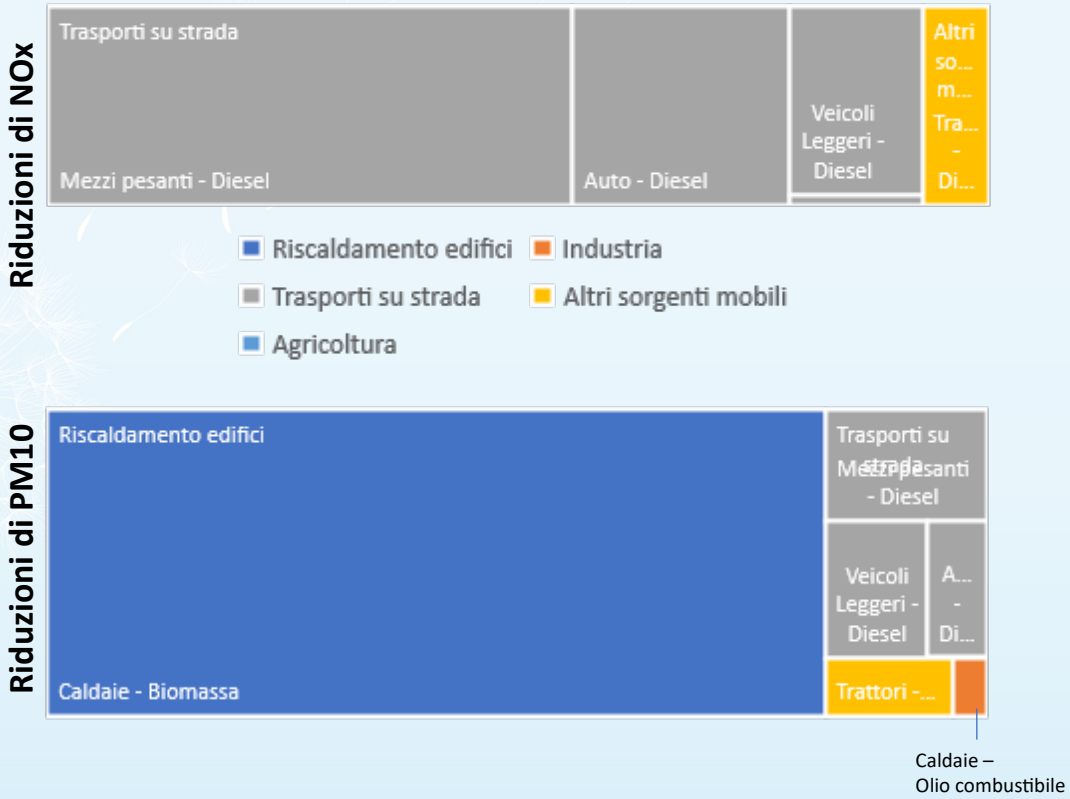
- Art. 9.9: the role of the national action plan
  - heavy vehicles and speedway
  - Enforce Rules/limits to biomass burning from crops
  - Enforce Rules for manure application

  - Agire su tutte le fonti a tutti i livelli
  - Es: Agricoltura: concimi chimici, ci sono potenziali (valli)

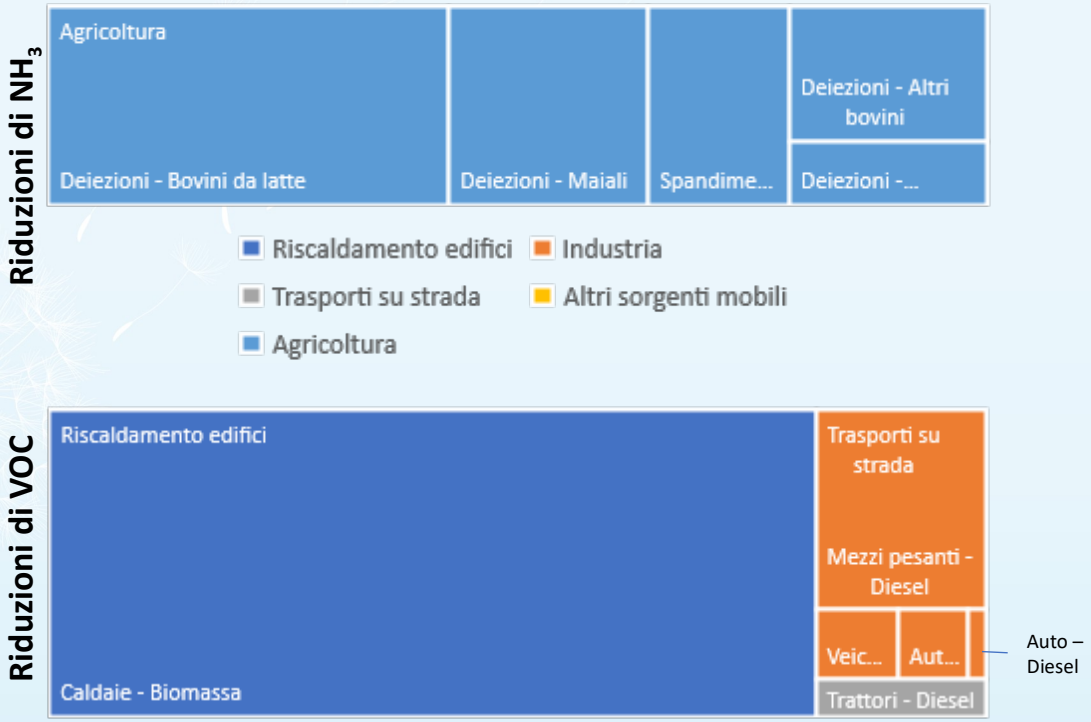
  - Ensure long term durability of the tools
  - maintain the governance (Po basin board)
  - Harmonize air and water policy (N-directive)

- Ambiente e salute project

# Act on all sectors, reduce both primary and precursors



# Acting on all sectors, reducing precursors



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# Capitalize the LIFE PREPAIR results and mantain the common tools

- **Many tools have been realized or improved thanks the project Prepair in the PO Valley**:

  Emissions dataset
  Data sharing infrastructure
  Web tool for monitoring AQP measures
  Network of special stations
  RIAT+
  BAT tool
  Energy Info Point
  ….

- **Many good practices have been developed and tested in the field of**:

  Comunication
  Training
  Education
  Stakeholder engagement
  …

Needs to mantain and update the tools realized and continue the best practices implemented

Strong commitment of the Po Valley Regions and Environmental Agencies to keep the common infrastructure in the future

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# Towards a joint study on HEALTH AND AIR POLLUTION in the Po Valley

Proposal for a joint project in the Po Valley for evaluating the interrelations between Health and air pollution.

**Main objectives are:**

**Monitor the effect of chronic exposure to air pollution** on long- and short-term health outcomes, as well as neonatal and reproductive outcomes;

- realize a platform for the collection and aggregation of socio-demographic, environmental and health data.
- Assess the interactions between air pollution and COVID-19 in terms of health impact including the assessment of the impact of the lockdown
- improve the knowledge related to the interaction between environmental pollutants and respiratory pathogens.

With the contribution of the LIFE Programme of the European Union

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# Grazie per l'attenzione!

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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 Agenzia Regionale per la Protezione dell'Ambiente del Friuli Venezia Giulia
ARSO Environment Slovenian Environment Agency
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