



RIAT+ and PAIR2020: AN INTEGRATED ASSESSMENT TOOL USEFUL FOR AIR QUALITY PLANNING

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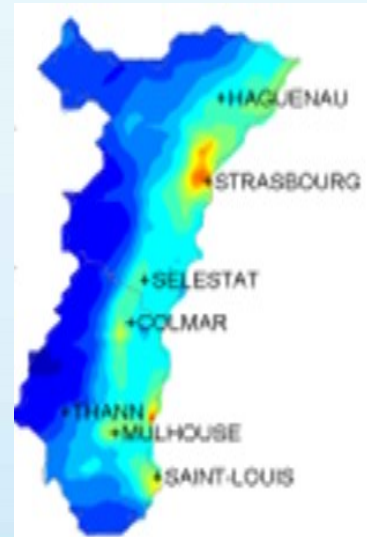
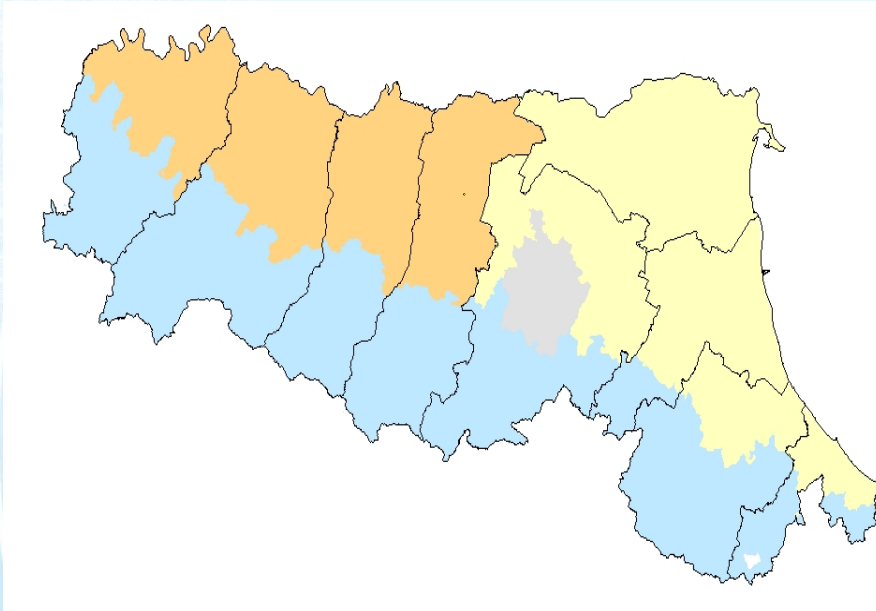
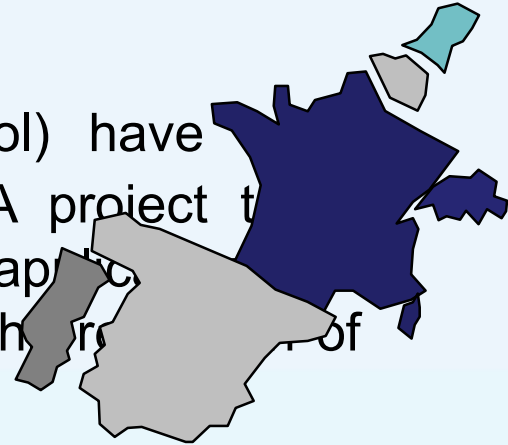
Challenges and questions

- What are the reduction emissions that we have to reach in order to comply EU limit?
- Which is the best way to do this?



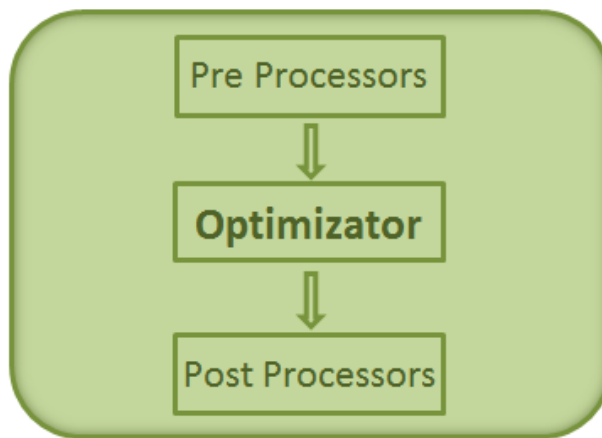
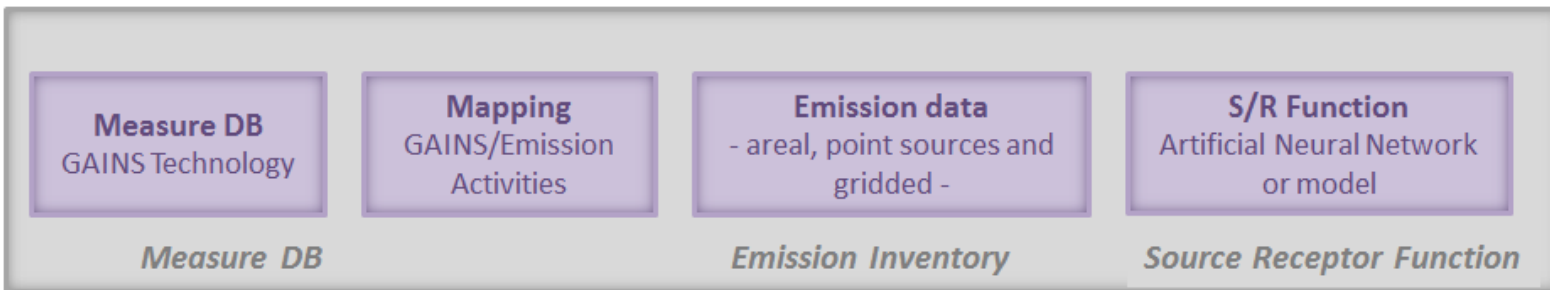
Integrated Assessment Models

- **RIAT+** (Regional Integrated Assessment Tool) have developed in the framework of the LIFE OPERA project to support regional/local authorities in the definition, application and evaluation of air quality plans policies, devoted to the reduction of population exposure to PM10, PM25, NO2, O3



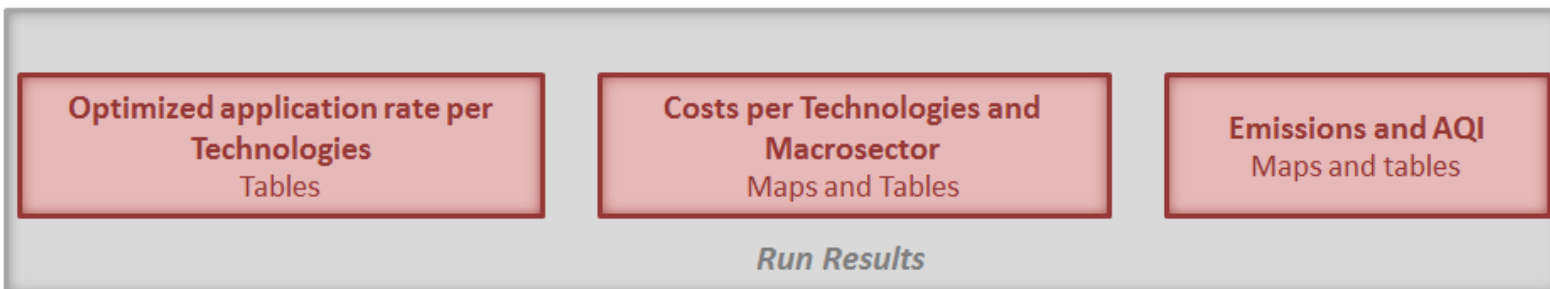


INPUT



RIAT + CORE SYSTEM

OUTPUT





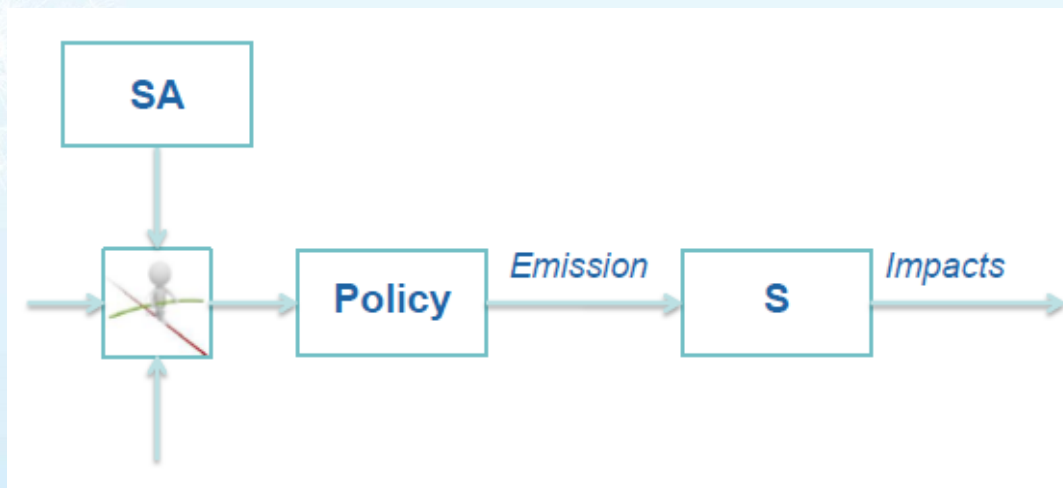
Scenario analysis:
assesses the impacts of
proposed actions

**Optimization
approach:**
identifies emission
reduction measures
maximizing the
environmental benefits
and minimizing costs

Scenario analysis

In RIAT+ scenario analysis is possible in two ways:

1. Emission (macrosector) level – *aggregated approach*
2. Technology level – *detailed approach*

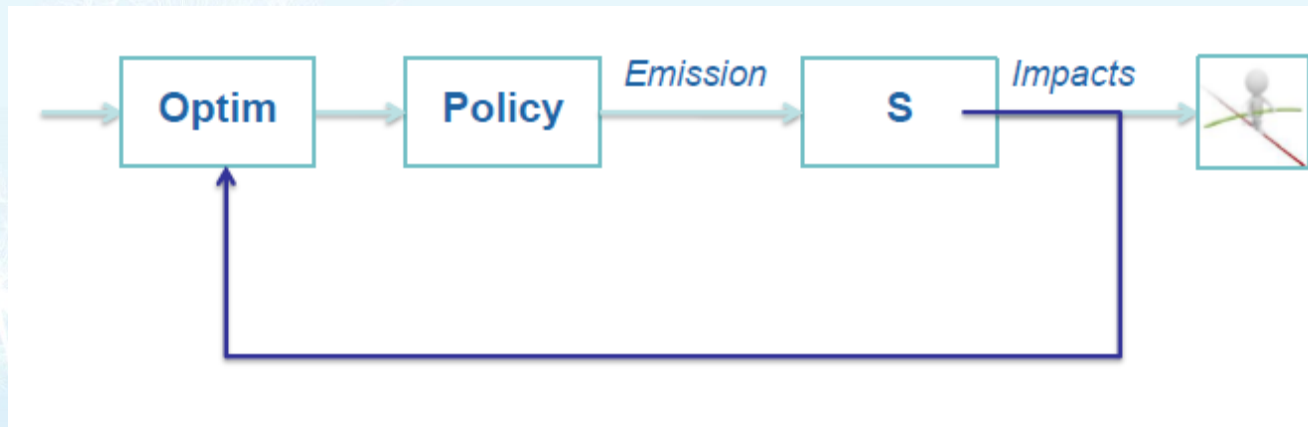




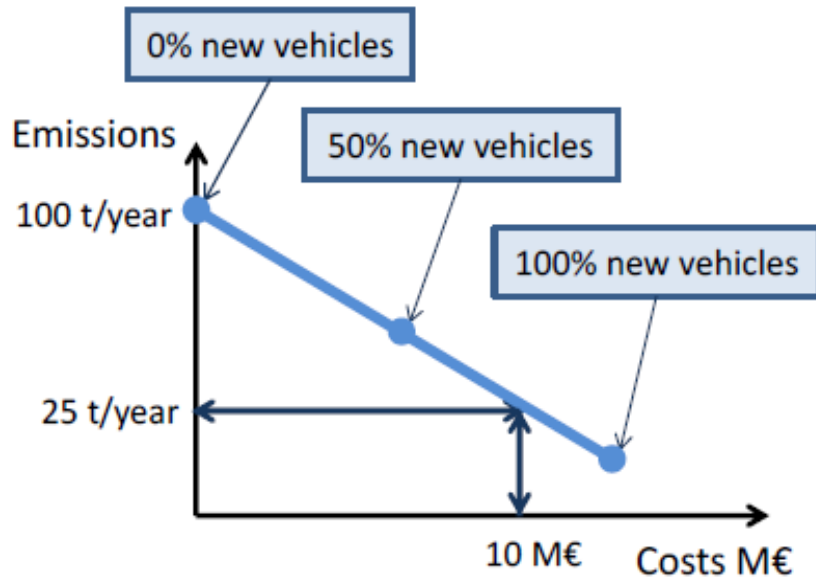
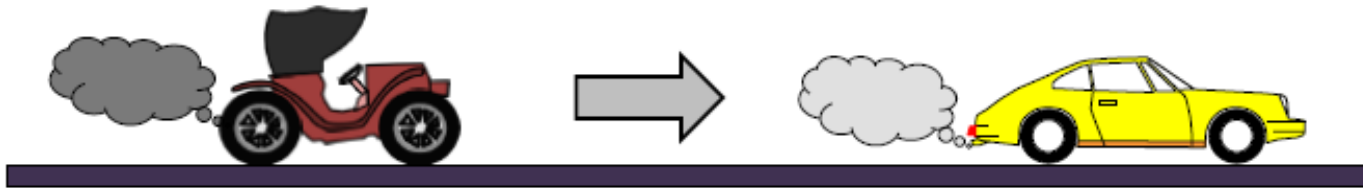
Optimization analysis



- In RIAT+ optimization analysis is possible in two ways:
1. Cost-effectiveness – *best technologies at fixed cost*
 2. Multi-objective – *best technologies at varying costs*



Emissions and technology



When a new technology (t) replace an old technology (0) in a sector of activity (s):

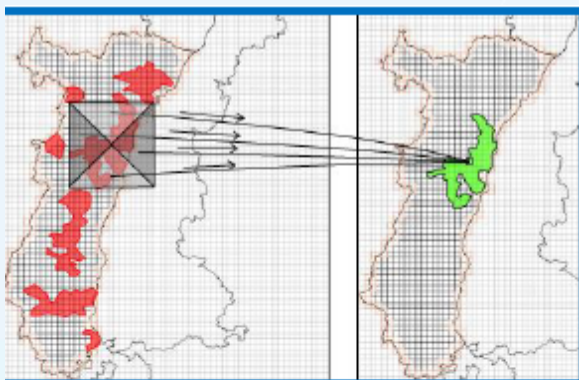
$$C_{s,t} = \alpha_t \cdot c_t \cdot A_s$$

Application rate of the new technology t

$$E_{p,s,t} = \alpha_t \cdot e_{p,t} \cdot A_s + (1 - \alpha_t) \cdot e_{p,0} \cdot A_s$$

Emission [ktonnes/year] Emissions factor of the new technology Emission factor of the old technology

Source Receptor Relationship



$AQI(x,y) = F_{S/R}$ (quadrant Emissions)
4 quadrants emissions (point/areal) for
6 precursors

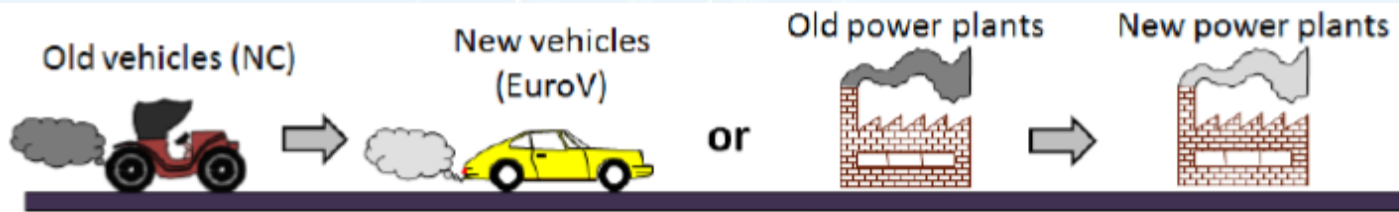
| SCENARIOS | AREAL AND POINT EMISSIONS | | | | |
|-----------|---------------------------|-----|-----|----|-----|
| | NOX | VOC | NH3 | PM | SO2 |
| 0 | B | B | B | B | B |
| 1 | L | L | L | L | L |
| 2 | H | H | H | H | H |
| 3 | H | L | L | L | L |
| 4 | L | H | L | L | L |
| 5 | L | L | H | L | L |
| 6 | L | L | L | H | L |
| 7 | L | L | L | L | H |
| 8 | H | H | L | L | L |
| 9 | H | L | H | H | H |
| 10 | H | L | H | L | L |
| 11 | H | L | H | L | H |

CTM training
scenarios:

B = CLE + 15%

H = MFR - 15%

Optimization



Multi-objective approach

$$\min_x J(x) = \min_x \left[\begin{array}{l} AQI(x) \\ C(x) \end{array} \right]$$

$$x \in X$$

Cost-effective approach

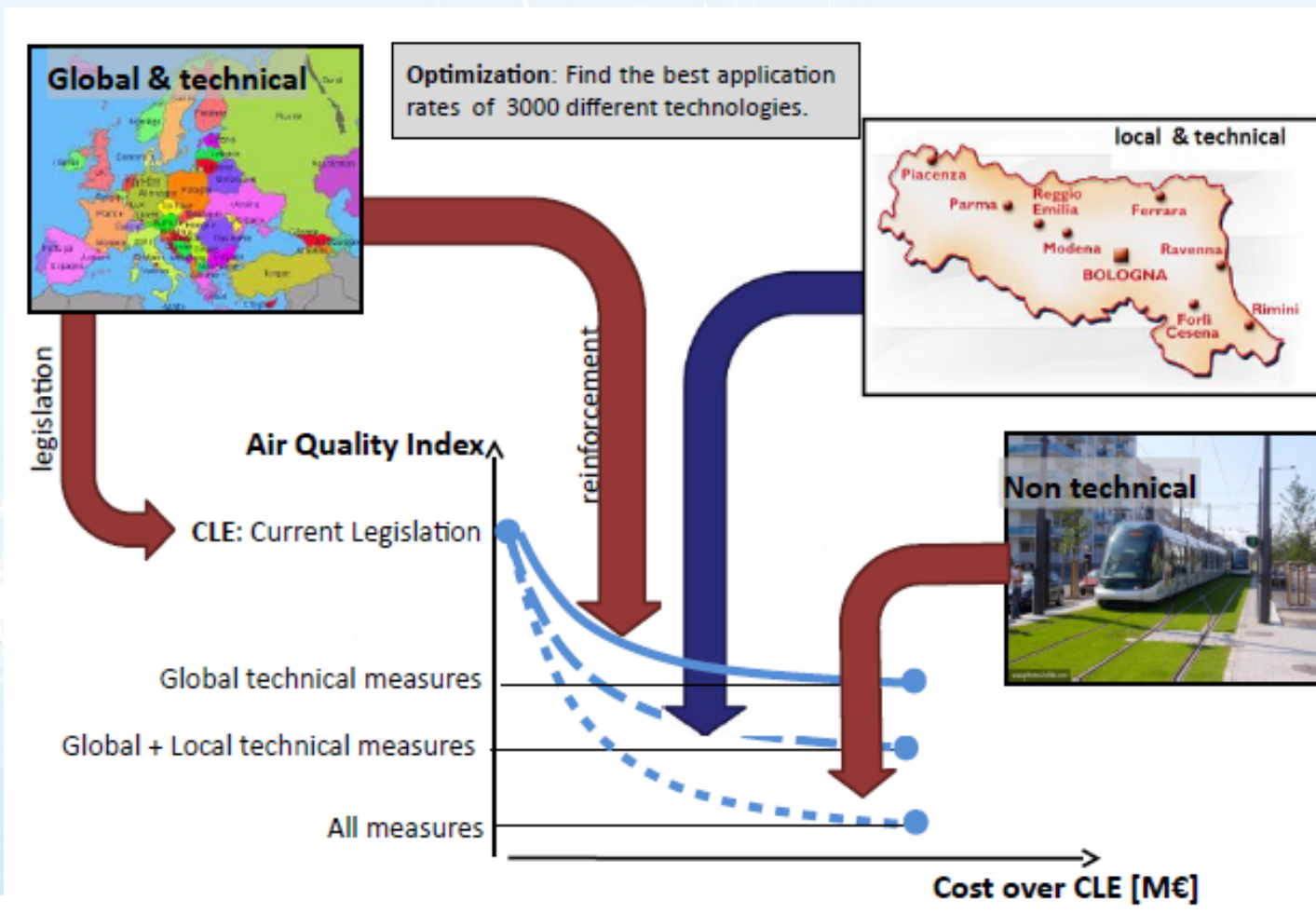
$$\min_x AQI(x)$$

$$C(x) \leq L$$

Control variables
(application rates):

- Technical measures
- Non technical measures

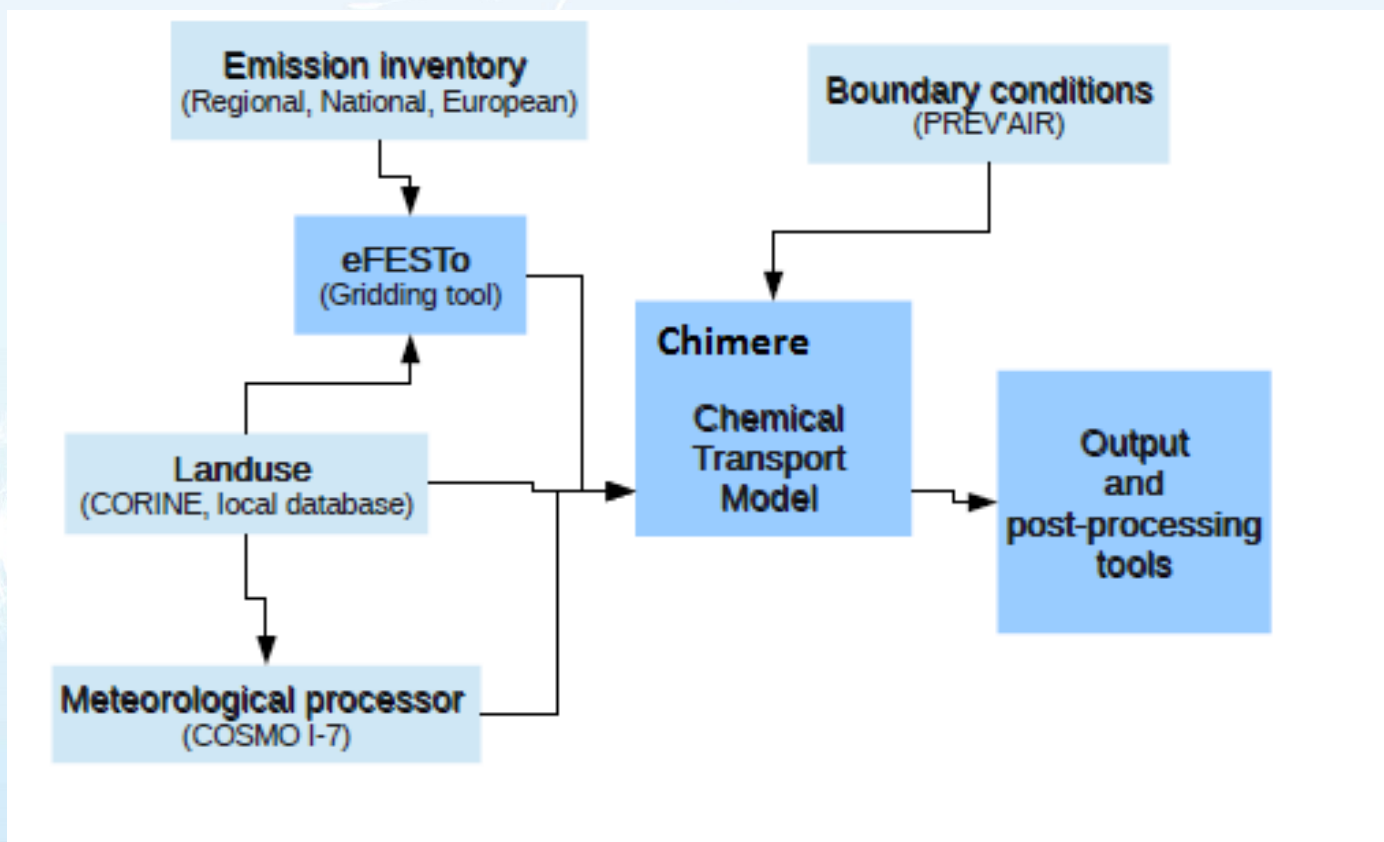
The most effective measure



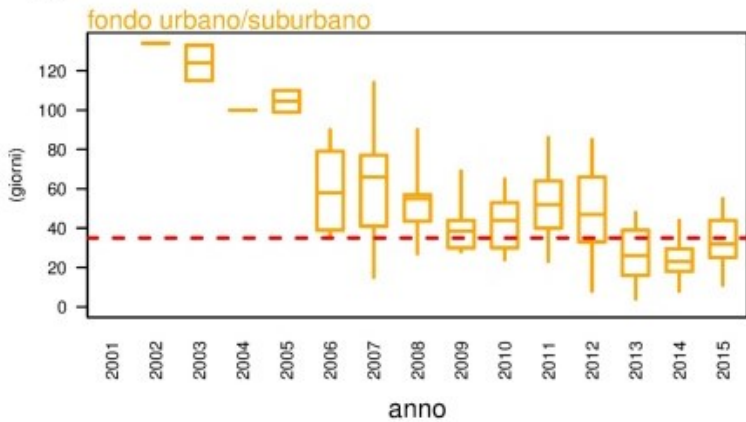
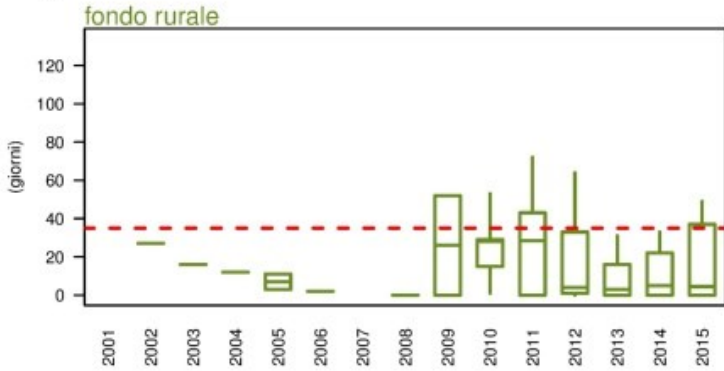


The Emilia-Romagna AQ plan: PAIR2020

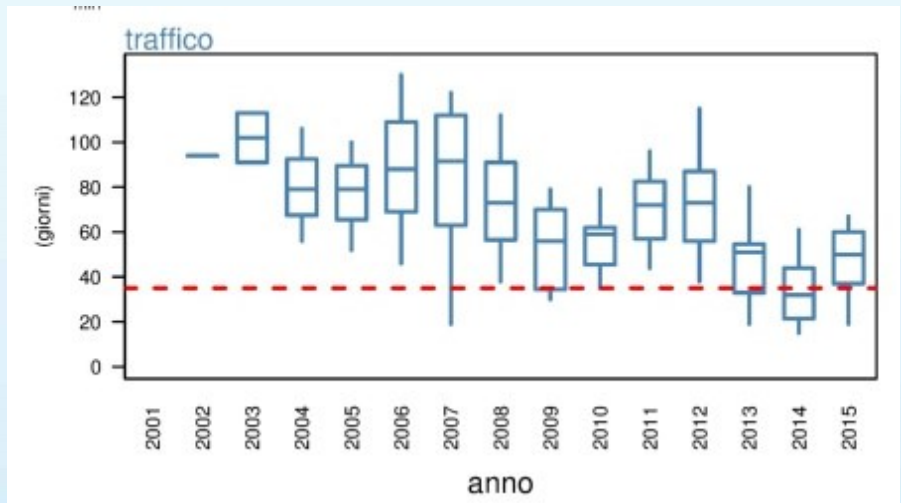
NINFA Air Quality Modeling System

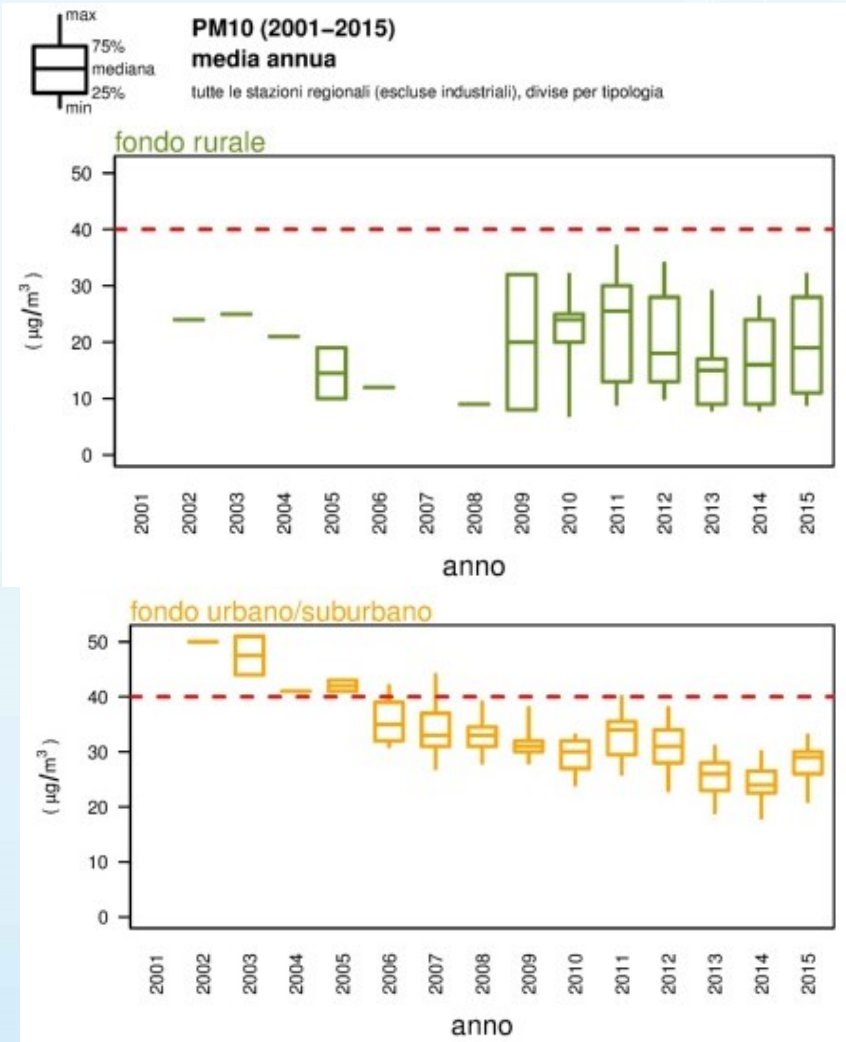


PM10 (2001–2015)
superamenti giornalieri
 tutte le stazioni regionali (escluse industriali), divise per tipologia

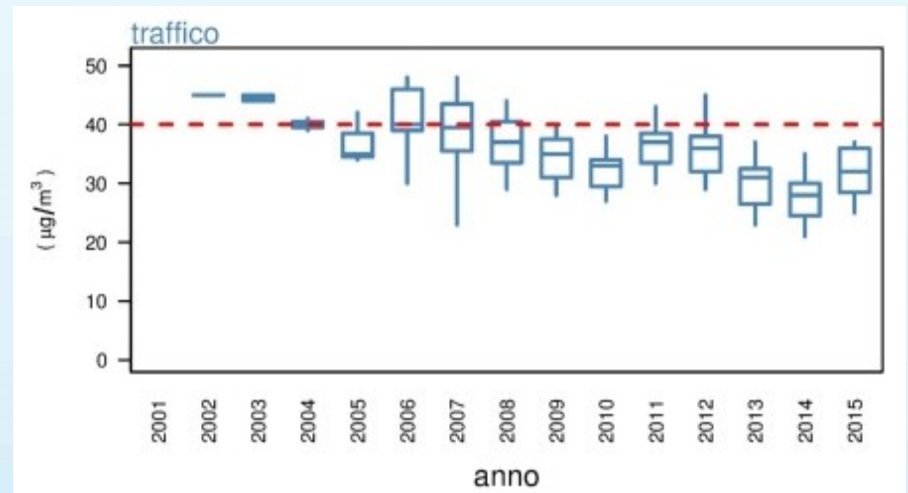


PM10: Number of exceedances of daily values

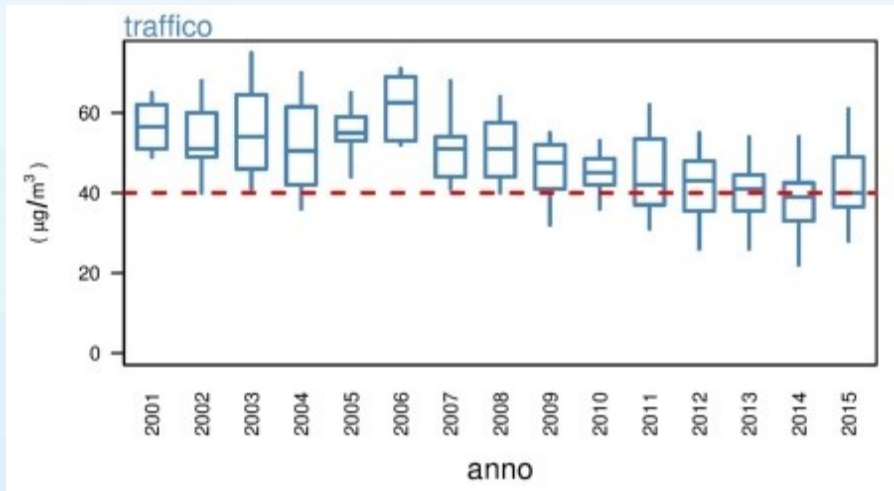
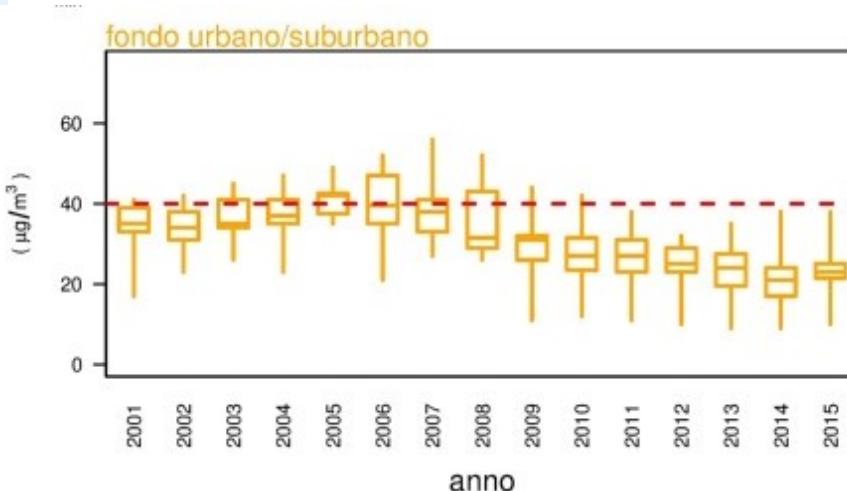
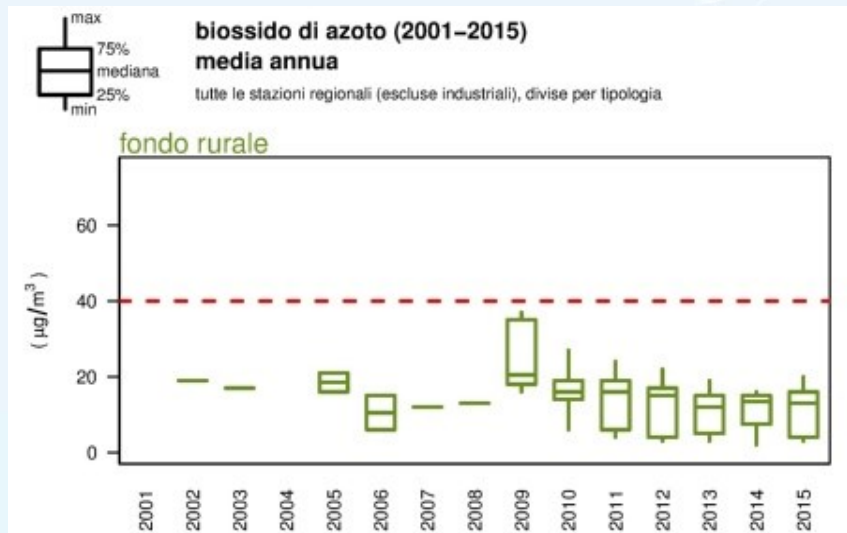




PM10 Annual mean



NO₂ annual mean

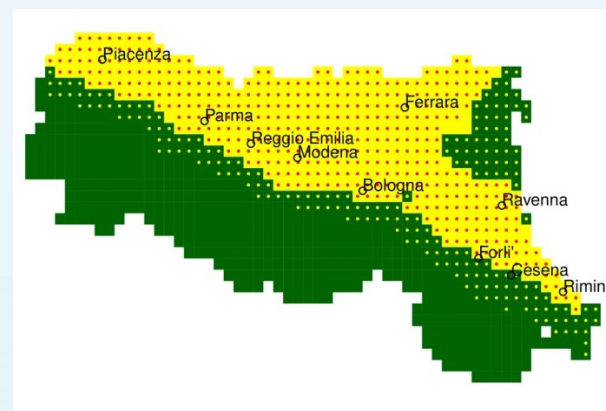
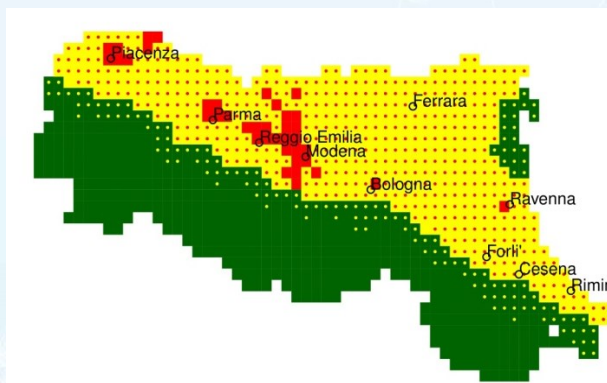




PM10 daily mean: actual and trend scenario

Base case(2010)

CLE 2020 (GAINS-I SEN-v2013 +
Regional Domestic, Traffic, Energy)



Legend:

- RED: exceedances every year at large scale
- YELLOW with RED spots: local exceedances every year
- GREEN with YELLOW spots: local exceedances in "bad" year
- GREEN : no exceedances

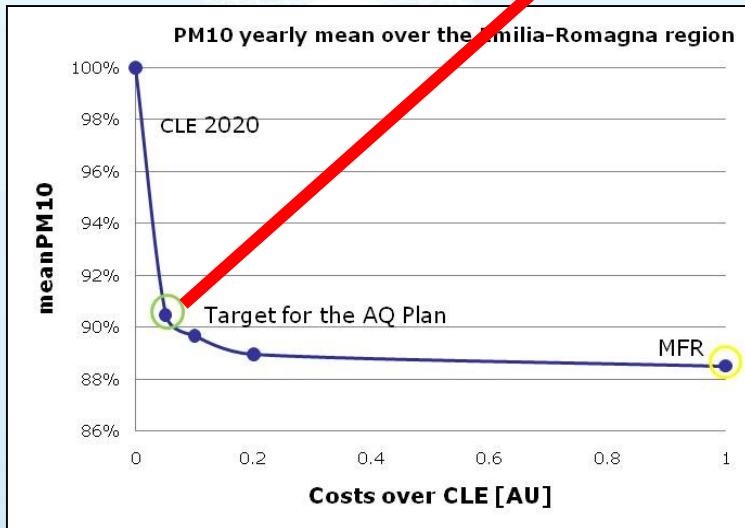
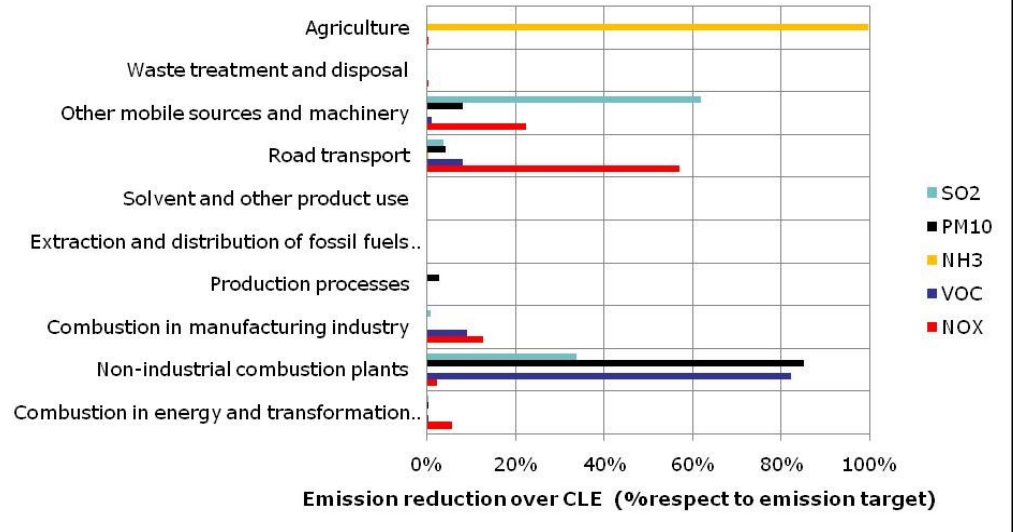
NINFA PM10 outputs: Maps are corrected for the effect of the interannual variability due to meteorology and subgrid variability



RIAT+ output from E-R PAIR2020



Emilia-Romagna A.Q. action plan:
measures per macro-sector for the
target scenario (RIAT+ output)



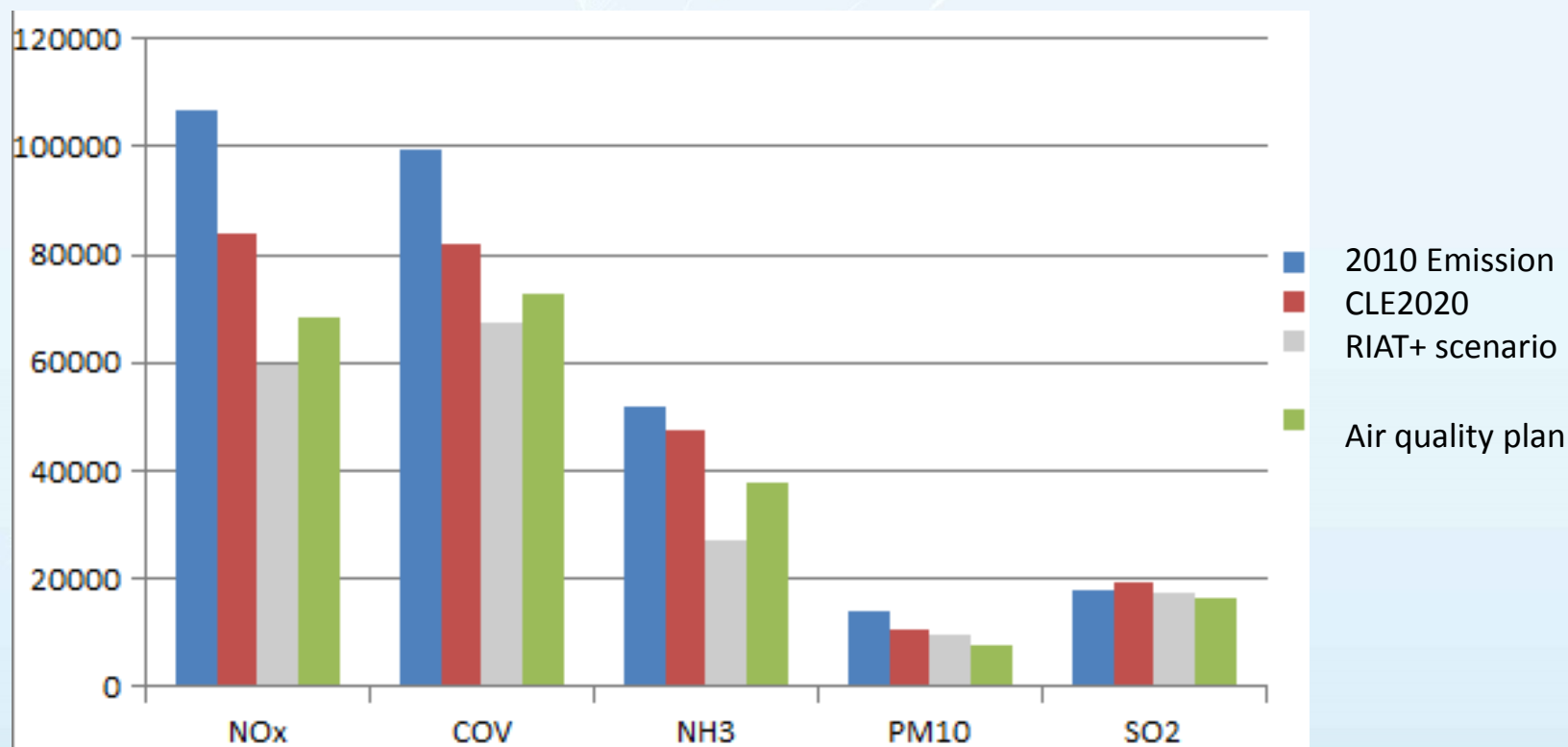
Emilia-Romagna A.Q. action plan:
identification of the target scenario by
the cost-effectiveness analysis (RIAT+)



Emissions reduction target

| % EMISSIONS REDUCTION 2020 | COV | NH3 | NOx | PM10 | SO2 |
|---|------|------|------|------|------|
| Target scenario respect to the 2010 emissions | -32% | -48% | -44% | -30% | -2% |
| CLE 2020 trend scenario respect to the 2010 emissions | -17% | -9% | -24% | -24% | +9% |
| Target scenario respect to the CLE 2020 emissions | -18% | -43% | -26% | -8% | -10% |

Total emissions for each scenario Emilia-Romagna domain (tons)

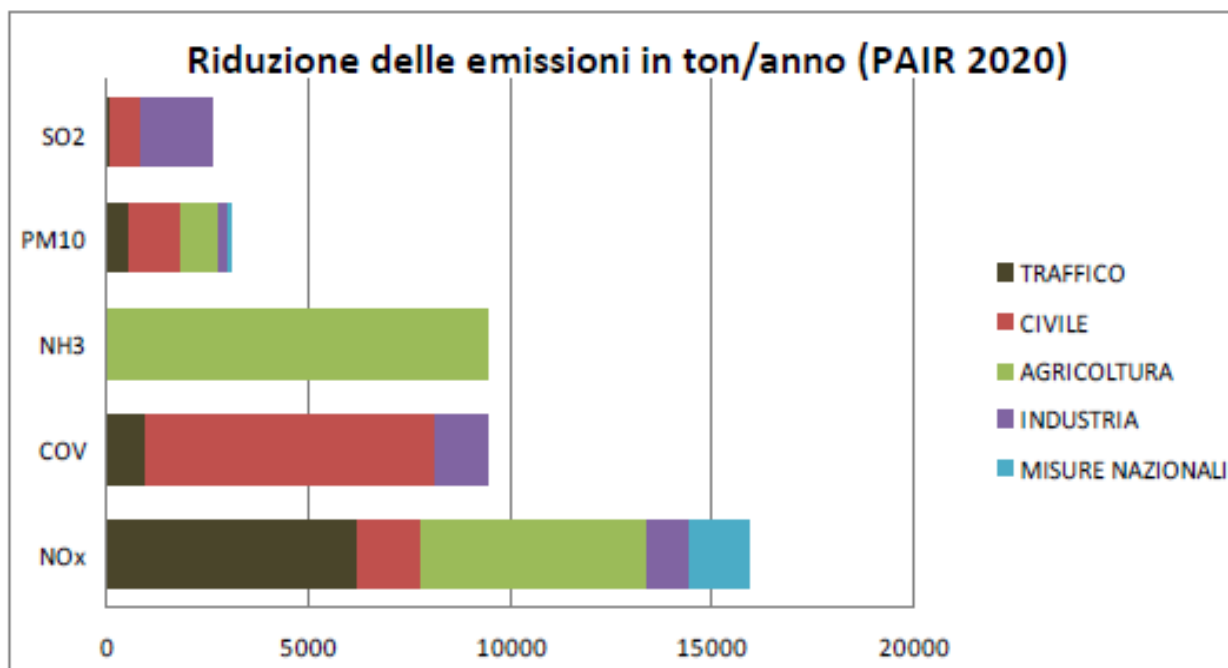




PAIR2020:measures

| Industry | Traffic |
|---|---|
| Building insulation | Stop “old” vehicles (i.e. EURO2 gasolione, EURO3 diesel) |
| Efficiencies in industrial process | Increase Local public transport, pedestrian areas, cycling line,LEZ, etc |
| Substitution of burning oil with diesel fuel | Encourage fleet renewal |
| Domestic | Bus replacement (< EURO3) |
| Building insulation ad high efficiencies boilers | Encourage reduction of private car in small urban area and in around cities |
| Reducing use of fireplaces | Encourage sustainable logistics in the cities |
| Substitution of diesel fuel with natural gas | Ecodriving |
| Increase efficiency of heating | Agriculture |
| National measure | Agriculture: animal house adaption to reduce NH3 |
| Speed reduction in motorway and other measure to be defined | Agriculture urea free fertilizer |
| | Encourage tractor fleet renewal |

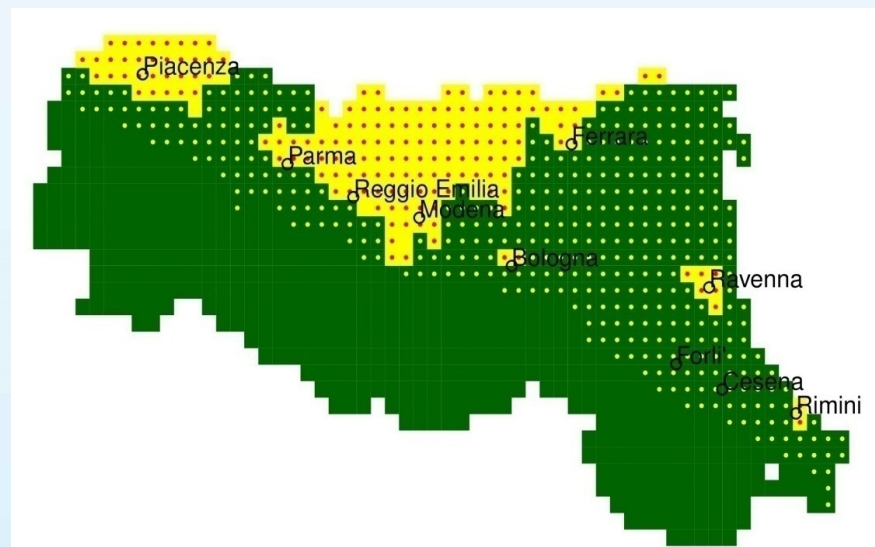
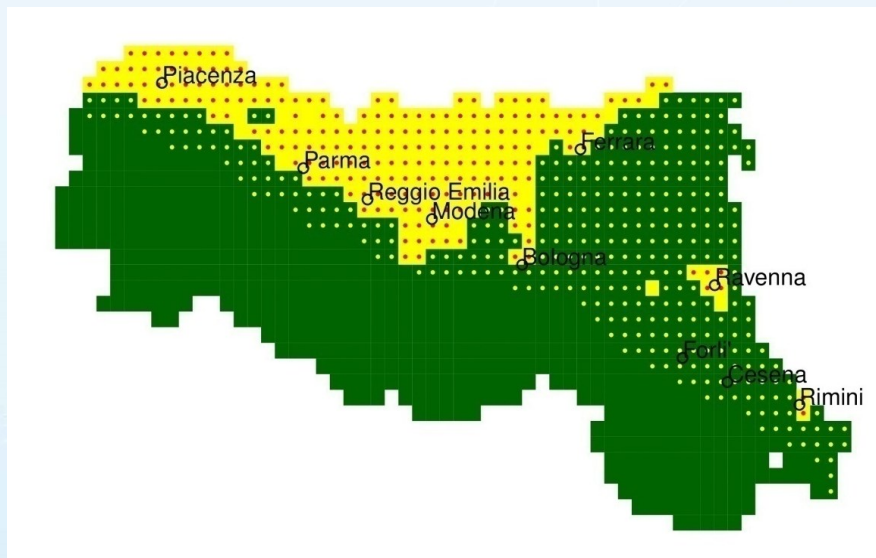
PAIR2020: emission reduction



PM10 daily mean: future scenarios

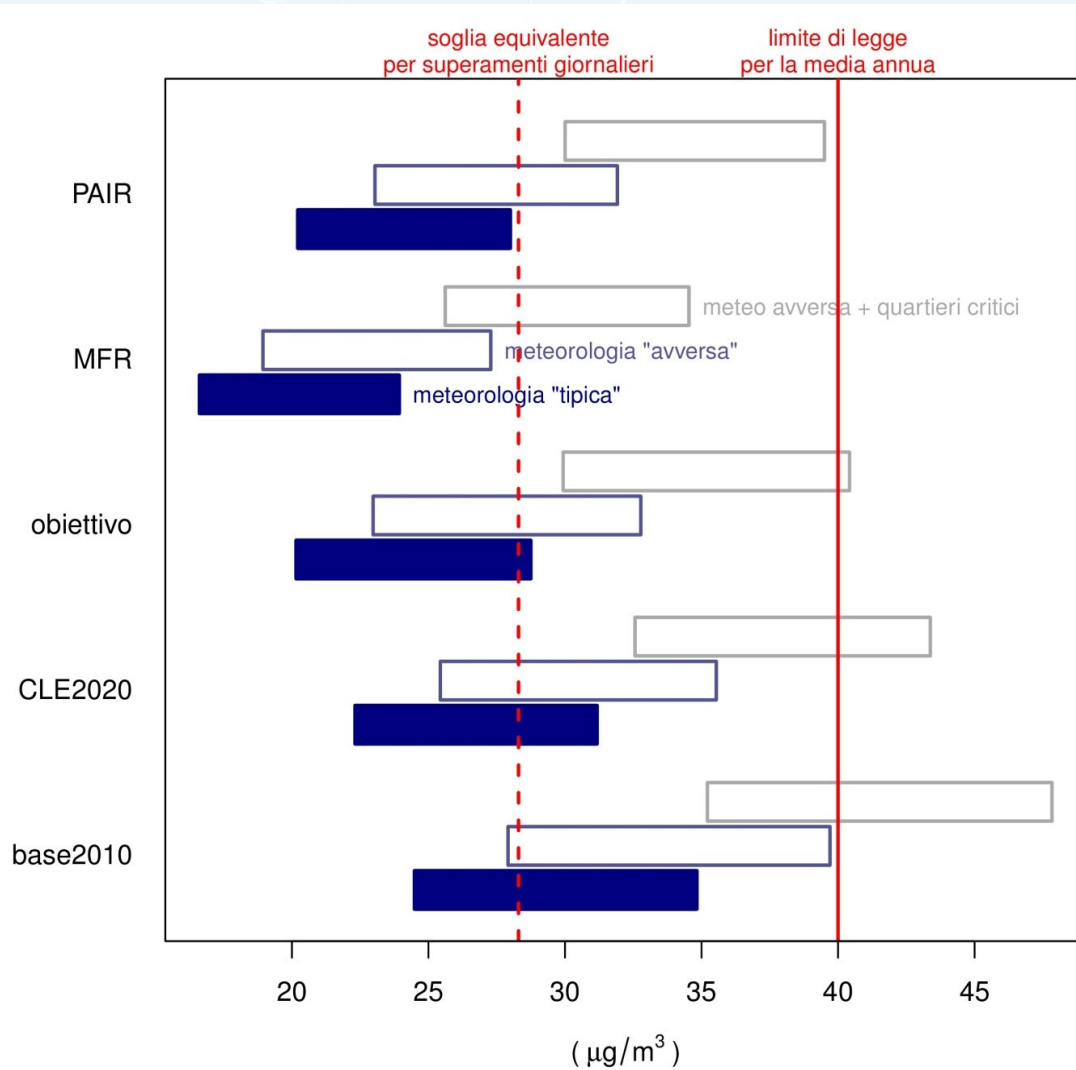
Target scenario
(RIAT+)

PAIR2020





PM10 annual mean: cities monitoring stations





Conclusions

The RIAT+ tool implemented on Emilia-Romagna help ARPAE and Emilia Romagna region to define the Regional Air quality action and most effective actions.

Help us to increase awareness of the importance of action in sectors traditionally not considered in air quality such as agriculture

But this is not the end

At the end of March kick off meeting of **PREPAIR (Po Regions Engaged to Policies of AIR)** , LIFE15 IPE/IT/000013

PREPAIR project

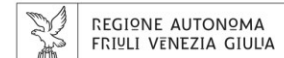
Objectives:

- Implement measures included in the Air Quality Plans (AQPs) in Po Valley and Slovenia and in the Po Valley Agreement
- Increase know-how and reinforce capacity building within public authorities and private operators;
- Strengthen coordination among Po Basin authorities in the field of air quality;
- Establish a permanent networking structure that involves the environmental agencies
- Produce homogeneous assessment reports on the effectiveness of PREPAIR concrete actions on air quality
- Assess the effectiveness and resources needed for measures to improve air quality;
- Create a community that recognises the risks for human health and for the environment posed by air pollution

www.lifeprepare.eu – info@lifeprepare.eu



REGIONE DEL VENETO



PROVINCIA AUTONOMA DI TRENTO



Agenzia Regionale per la Prevenzione e Protezione Ambientale del Veneto



Agenzia Regionale per la Protezione Ambientale



Agenzia Regionale per la Protezione dell'Ambiente



agenzia regionale per la protezione dell'ambiente del Friuli Venezia Giulia



ARSO ENVIRONMENT
Slovenian Environment Agency



Comune di Bologna



Comune di Milano



CITTA' DI TORINO



Emilia-Romagna Valorizzazione Economica Territorio



Fondazione Lombardia per l'Ambiente