

AN INTEGRATED ASSESSMENT TOOL TO EVALUATE EFFECTIVE AIR QUALITY MEASURES AT REGIONAL SCALE

Air Quality 2016, Milan, 14-18 March 2016

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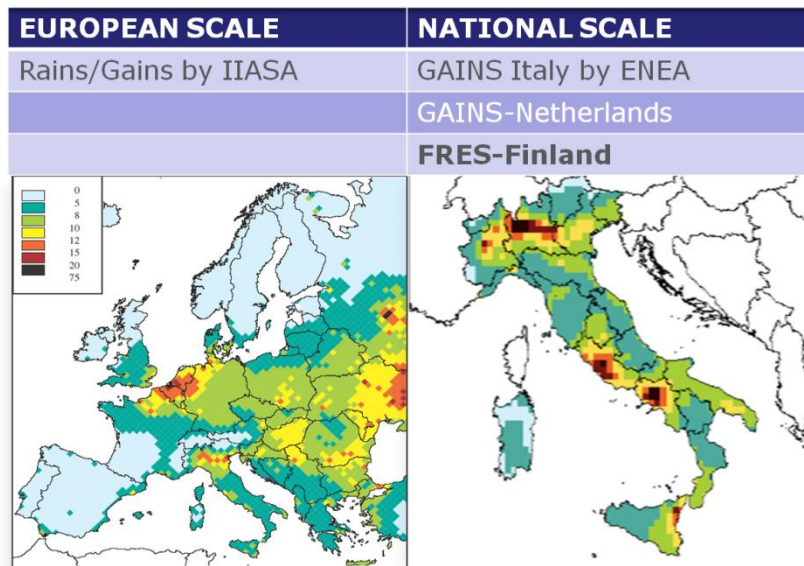
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RIAT+: the starting point

The definition of a methodology and its implementation in a software tool, RIAT+, 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, PM2.5, NO₂ and O₃.



RIAT+ answers to the aim to develop, at regional scale, a tool to plan cost-effective air quality policies harmonized with national and EU actions



RIAT+ : the team



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**OPERA: Operational Procedure for
Emission Reduction Assessment**

Core: the idea

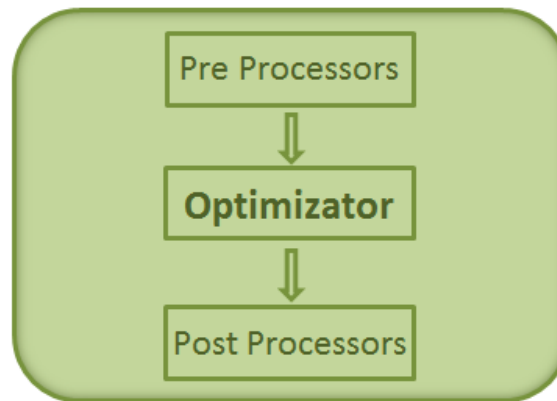
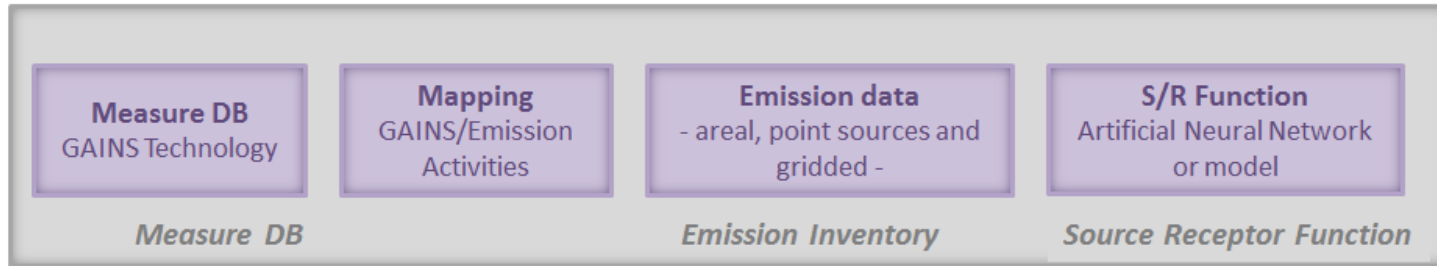


Scenario analysis:
assesses the impacts of
proposed actions

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

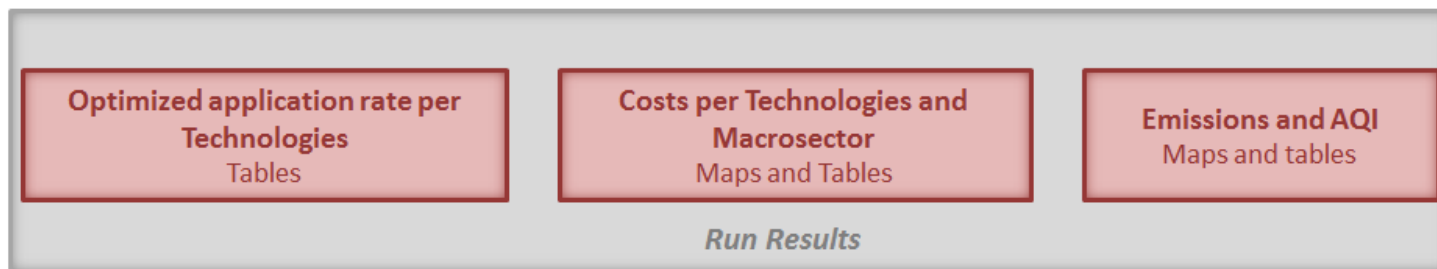
Core: the sistem

INPUT

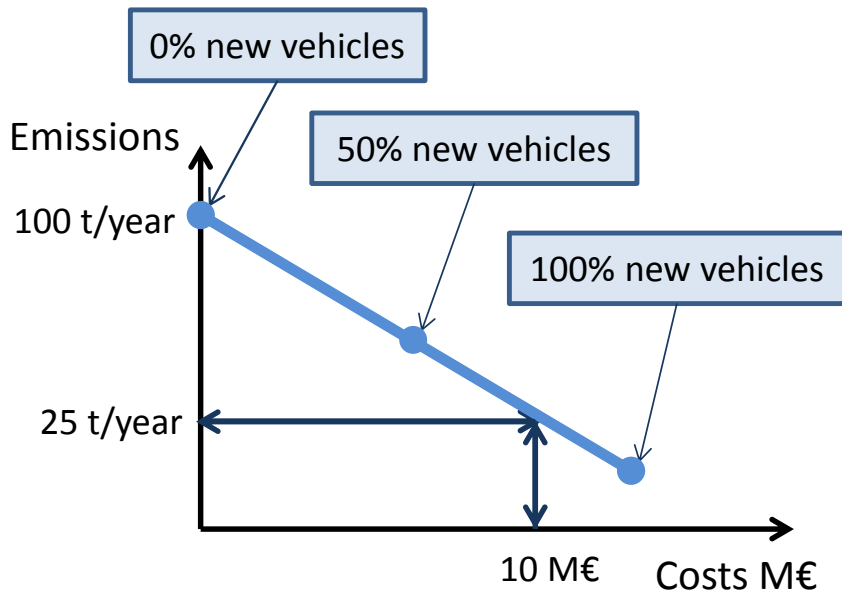
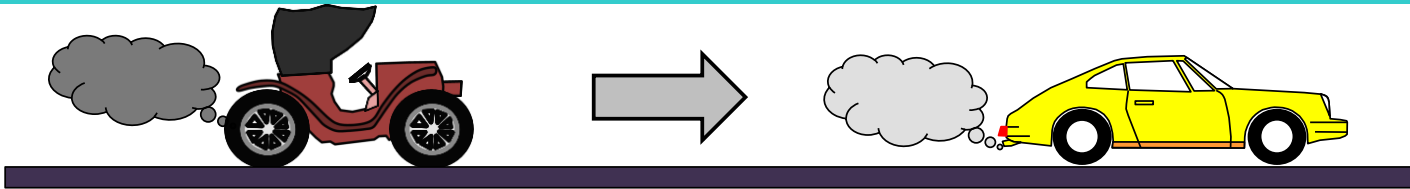


RIAT + CORE SYSTEM

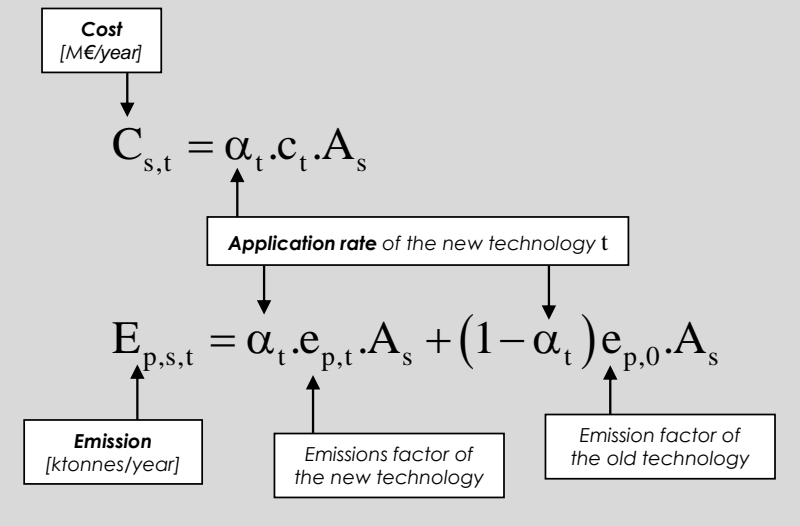
OUTPUT



Input: emission & techno



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

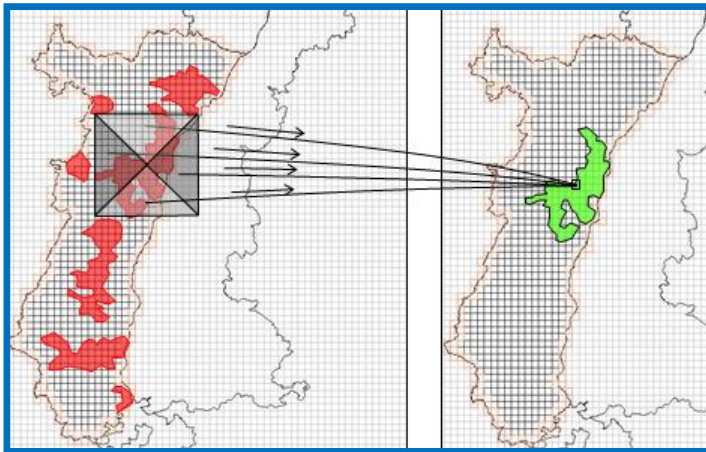


$$E_{V_REF_YEAR\ i,j,k,p}$$

$$E_{REF_YEAR\ j,j,k,p}$$

$$= \frac{\sum_{t=1}^{T_{i,j,k}} [(1 - eff_{i,j,k,t,p}) * AR_{REF_YEAR\ i,j,k,t}] + (1 - \sum_{t=1}^{T_{i,j,k}} AR_{REF_YEAR\ i,j,k,t})}{}$$

Input: S/R function

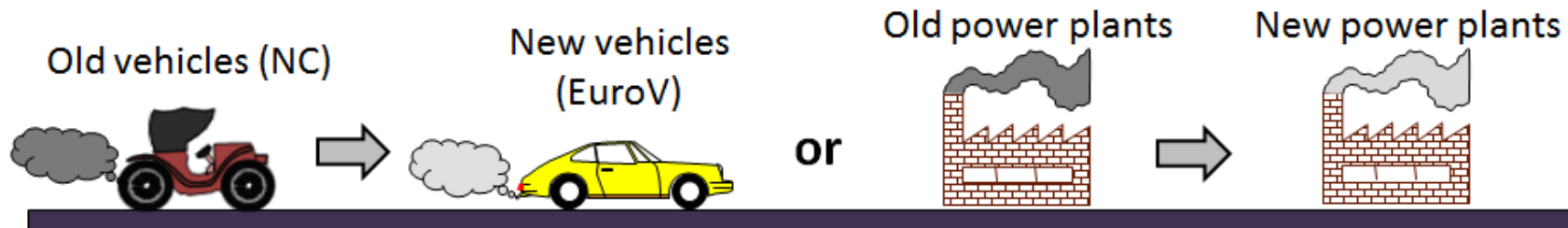


$$AQI(x,y) = F_{S/R}(\text{quadrant Emissions})$$

CTM training scenarios:
 B = CLE + 15%
 H = MFR - 15%

SCENARIOS	AREAL EMISSIONS					POINTEMISSIONS				
	NOX	VOC	NH3	PM	SO2	NOX	VOC	NH3	PM	SO2
0	B	B	B	B	B	B	B	B	B	B
1	L	L	L	L	L	B	B	B	B	B
2	H	H	H	H	H	B	B	B	B	B
3	H	L	L	L	L	B	B	B	B	B
4	L	H	L	L	L	B	B	B	B	B
5	L	L	H	L	L	B	B	B	B	B
6	L	L	L	H	L	B	B	B	B	B
7	L	L	L	L	H	B	B	B	B	B
8	H	H	L	L	L	B	B	B	B	B
9	H	L	H	H	H	B	B	B	B	B
10	H	L	H	L	L	B	B	B	B	B
11	H	L	H	L	H	B	B	B	B	B
12	B	B	B	B	B	L	L	L	L	L
13	B	B	B	B	B	H	H	H	H	H
14	B	B	B	B	B	H	L	L	H	H
15	B	B	B	B	B	L	L	L	L	H
16	B	B	B	B	B	H	L	L	L	H
17	H	H	H	H	H	H	H	H	H	H
18	H	L	H	H	H	H	L	L	H	H
19	L	L	L	L	H	L	L	L	L	H
20	H	L	H	L	H	H	L	L	L	H
21	H	H	L	L	L	H	H	L	L	L

Core: optimization



Multi-objective approach

$$\min_x J(x) = \min_x \left[AQI(x) \quad C(x) \right]$$

$$x \in X$$

Cost-effective approach

$$\min_x AQI(x)$$

$$C(x) \leq L$$

Control variables

(application rates):

- Technical measures
- Non technical measures

AQP: the most effective measures



Optimization: Find the best application rates of 3000 different technologies.



legislation

Air Quality Index

CLE: Current Legislation

Global technical measures

Global + Local technical measures

All measures

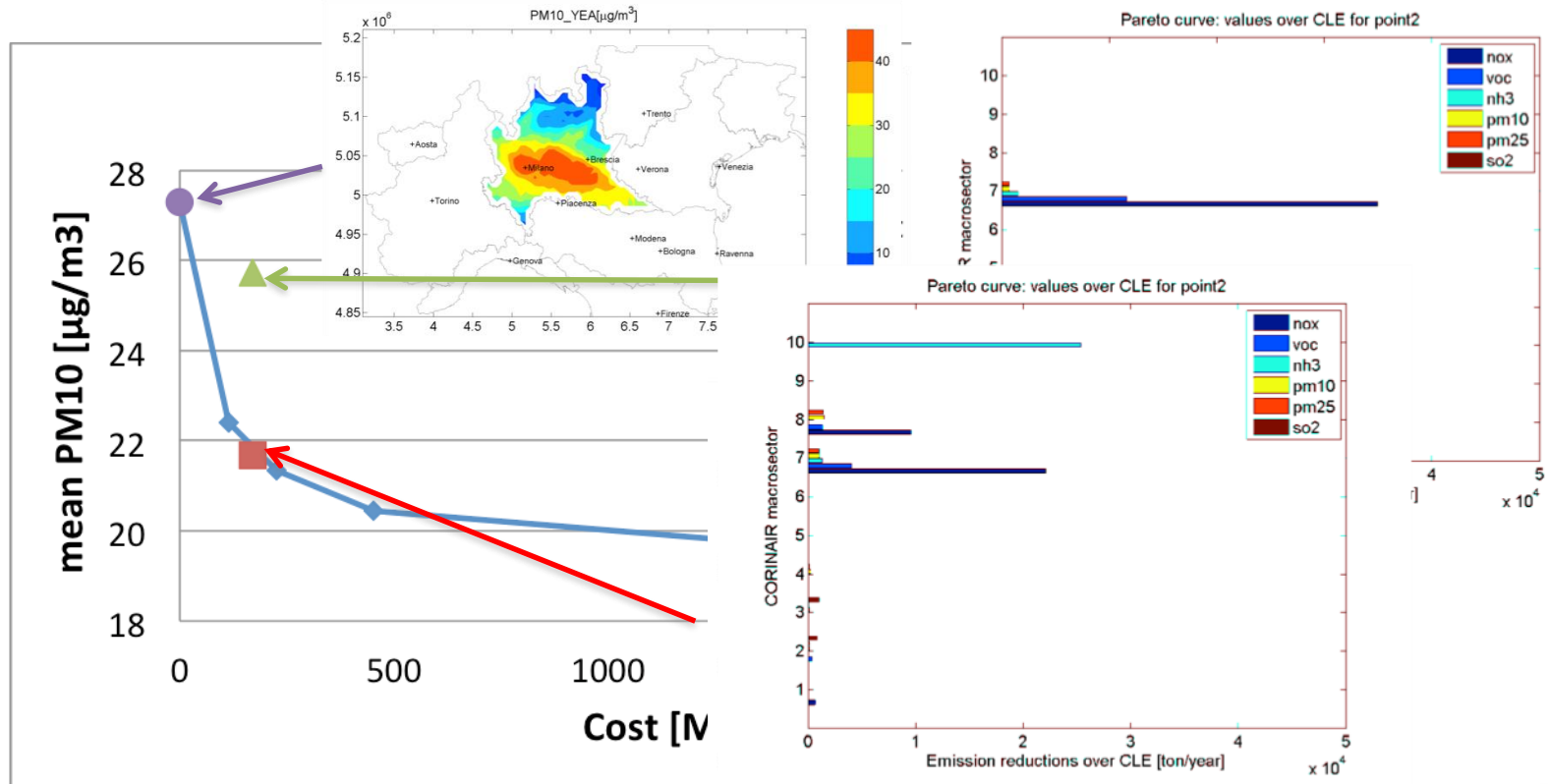
Cost over CLE [M€]

20

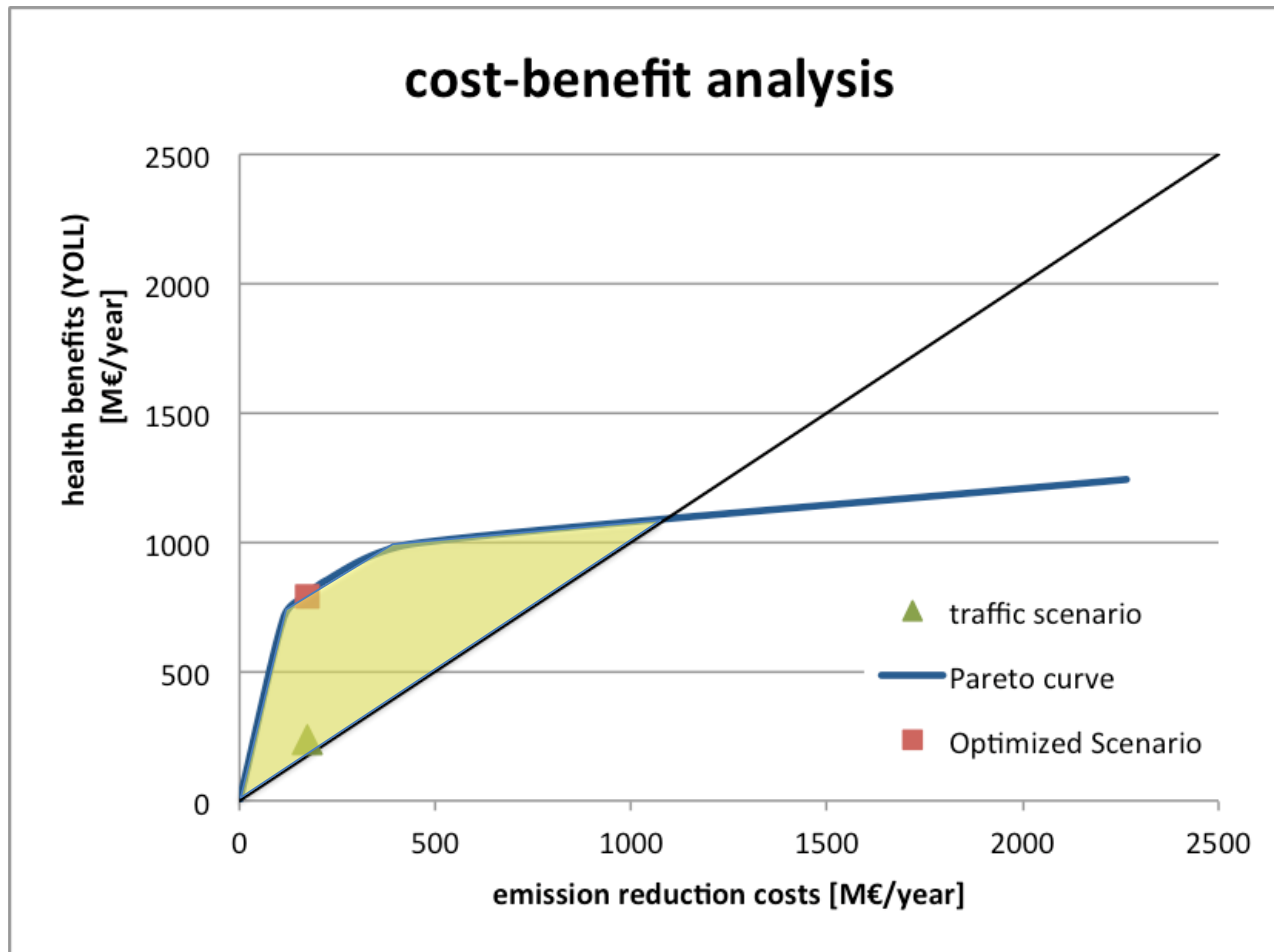


Scenario & optimization - Lombardy

Impacts	CLE	Traffic scenario	Optimized scenario
Emission reduction costs	0 €	170 M€	170 M€
PM10 [$\mu\text{g}/\text{m}^3$]	27,3	- 6%	- 21%
Health costs (PM10)		- 6%	- 19%



Cost effect - Lombardy



RIAT+



RIAT+ is an IAM sw focused at regional scale with a **user friendly** interface. RIAT+ main features are:

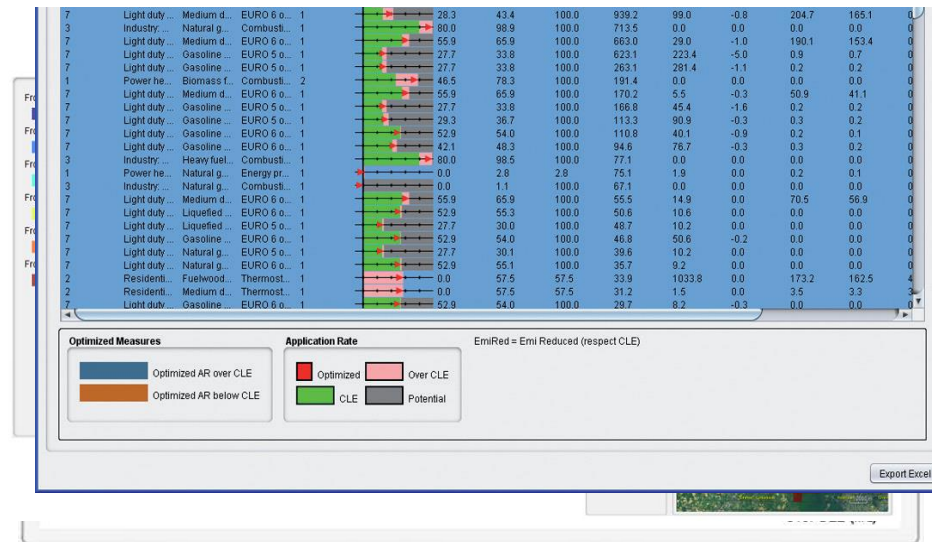
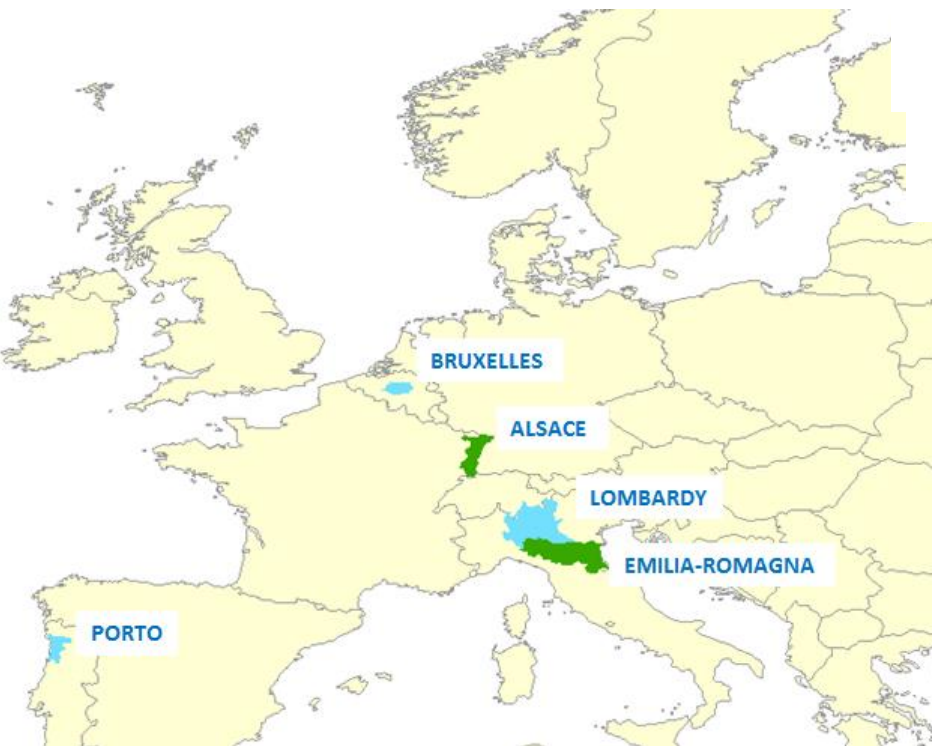
- manage **different input** (e.g. gridded or polygonal, annual or seasonal, SNAP detailed or aggregated emissions);
- **various policies** could be evaluated with RIAT+: emission abatement, energy efficiency and NTM
- multi objective and cost effectiveness (**optimization**), detailed and aggregated (**scenarios analysis**)

Due to these features now RIAT+ is a **concrete instrument** to support AQ planning, as its significant applications shows. Moreover, next slides will illustrate how each EU Region can apply RIAT+.

RIAT+ APPLICATIONS

RIAT+ was applied in EU Regions with different aims.

- In **Lombardy Region** – scenario way, to support AQ Plan. Results shown in **Poster Session A “Assessing the economy value of regional AQ plan”**



APPLYING RIAT+

To apply RIAT+ in your Region at first you need to **download** RIAT+ installation kit (the software, the user guide, and two regional test cases) from its website.

RIAT+ is **free** of charge: only an end user license agreement (**EULA**) should be signed online.

The screenshot shows the RIAT+ website interface. At the top, there are logos for 'Regional Integrated' and 'Regional Integrated Assessment Tool PLUS'. A navigation menu includes 'Home', 'Applications', 'Download tool', 'Future Developments', 'Training', 'References', 'Dissemination', and 'NEWS'. The main content area is titled 'Download' and 'Welcome'. A login field shows the username 'gianfreda' and a 'Logout' button. The 'END USER LICENCE AGREEMENT RIAT+ 1.0' section contains the following text:

By selecting the "accept licence agreement" (or any equivalent) button and/or by using, copying or distributing this Software or any portion thereof, YOU (the "User") ACCEPT ALL TERMS AND CONDITIONS OF THIS LICENCE, including in particular the limitations on use, transferability, warranty and liability. The following terms and conditions are enforceable against you and any legal entity that obtained the Software and on whose behalf it is used. If you are agreeing to these terms on behalf of a company or other legal entity, you represent that you have the legal authority to bind that company or legal entity to these terms. IF YOU DO NOT HAVE SUCH AUTHORITY OR IF YOU DO NOT WISH TO BE BOUND TO THESE TERMS DO NOT USE THIS SOFTWARE.

The European Union together with:

- Agenzia Prevenzione Ambiente Emilia-Romagna
- Universitv of Brescia Dipartimento di Ineeeneria Meccanica e

I agree

At the bottom, there are logos for the European Union, arpa (agenzia regionale prevenzione e ambiente dell'emilia-romagna), TerrAria s.r.l., cnrs, and UNIVERSITÉ DE STRASBOURG.

RIAT+ : FIRST GUESS by SHERPA

Very soon it will be ready the NEW RIAT+ version linked to SHERPA, so it will be possible to apply RIAT+ in your region in a very **simple way**.

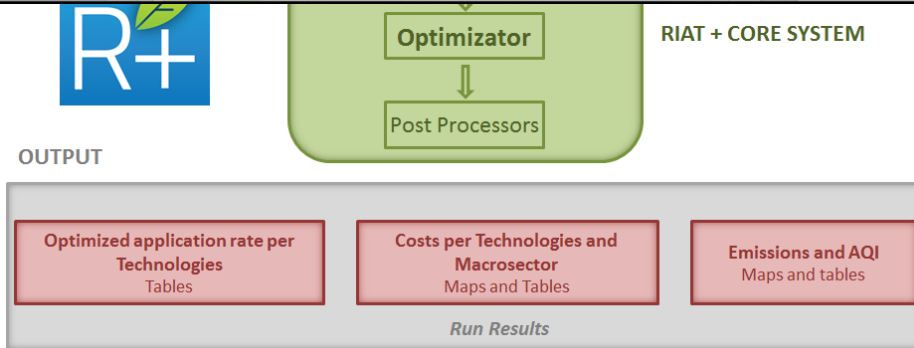
SHERPA will provide all RIAT+ input :

- First: select the domain
- 7x7 km emissions
- S/R function – linear regression relations
- GAINS measure database

SHERPA first guess input are:

- Maybe less detailed
- But easier & quicker

The screenshot shows the RIAT+ software interface. On the left is a list of countries with checkboxes, including Austria, Belgium, Bulgaria, Switzerland, Cyprus, Czech Republic, Germany, Denmark, Estonia, Greece, Spain, Finland, France, Croatia, Hungary, Ireland, Iceland, Italy, Liechtenstein, Lithuania, Luxembourg, Latvia, Republic of Montenegro, Republic of Macedonia, Malta, and Netherlands. The main area displays a map of Europe with a red arrow pointing to a location in the Balkans. Below the map is a 'Reduction table' with columns for ALL, MS1, MS2, MS3, MS4, MS5, MS6, MS7, MS8, MS9, and MS10. The table contains numerical values for various pollutants: ALL, NOx, NMVOC, NH3, PM25, and SOx. On the right side, there are controls for 'Air quality index' (set to PM25) and 'Seasonality' (set to Annual). Buttons for 'Load config', 'Save config', and 'Map' are also visible.



JOIN RIAT+ COMMUNITY

SHERPA/RIAT+ Training Course

- JRC is organizing the SHERPA/RIAT+ training course in June 2016 (Ispra, Italy)

To have RIAT+ demo and more detail please visit **our stand at AQC.**

To be contacted for SHERPA and RIAT+ new version leave your email or join LinkedIn Group



For more info:

- www.riatplus.eu
- riat@terraria.com

THANKS TO

A special thanks to all the authors:

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Thanks for your attention