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

31st May 2022
Emilia-Romagna Region
Delegation to the EU

NEXT GEN EU

Impact of Covid-19 lockdown on air quality in Po valley

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Prepair team

1° & 2° Report

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3° Report

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IMPACTS of the COVID-19 LOCKDOWN on AIR POLLUTION in the PO VALLEY

- The lockdown measures
- Sources analysis
- Impact on polluting emissions
- Meteorological data analysis
- Model analysis (NINFA-ER and FARM-PI)
- RRQA data Analysis: PM and gas

Whole basin;
1° and 2° report

- PM10 chemical composition

5 sites; 3° report

https://www.lifeprepair.eu/wp-content/uploads/2020/06/COVIDQA-Prepair-19Giugno2020_final.pdf --> 1° Report
https://www.lifeprepair.eu/wp-content/uploads/2020/09/COVIDQA-Prepair-2-17Settembre2020.pdf --> 2° Report
https://www.lifeprepair.eu/wp-content/uploads/2021/02/Prepair_covidQA_Report3_def2.pdf --> 3° Report
And many others!

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COVID & METEOROLOGICAL ANALYSIS

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Analysis based on 3 indicators capable of providing a daily estimate of the atmosphere ability to favor the accumulation or dispersion of pollutants.
COSMO-5M meteorological model hourly analysis (Turin, Milan, Bologna, Padua and Trieste: 20 January to 31 May 2020)

Recirculation: identifies the wind regimes that keep pollutants in a limited area

Stagnation:
identifies days with very low wind

Ventilation:
indicator of the ability to dilute pollutants

Mese	Periodo	Descrizione
gennaio	20-24	stabile per campo alta pressione
	25-27	debole perturbazione, correnti sud-occidentali con scarso rimescolamento del BL
	28-29	graduale aumento ventilazione per passaggio perturbazione
	30-31	Stabile
febbraio	1-3	stabilità per condizioni anticicloniche
	4-5	perturbazione da nord con irruzione aria artica, rinforzo della ventilazione (Foehn)
	6-10	stabilità per alta pressione
	11-12	onda depressionaria atlantica, aumento della ventilazione
	13-16	stabilità per alta pressione
	17-19	debole perturbazione, correnti da sw in quota, scarso rimescolamento dei bassi strati
	20-23	stabilità per alta pressione
	25-29	dispersione, aumento ventilazione per correnti settentrionali (Foehn)

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COVID & AIR and ROAD TRANSPORT

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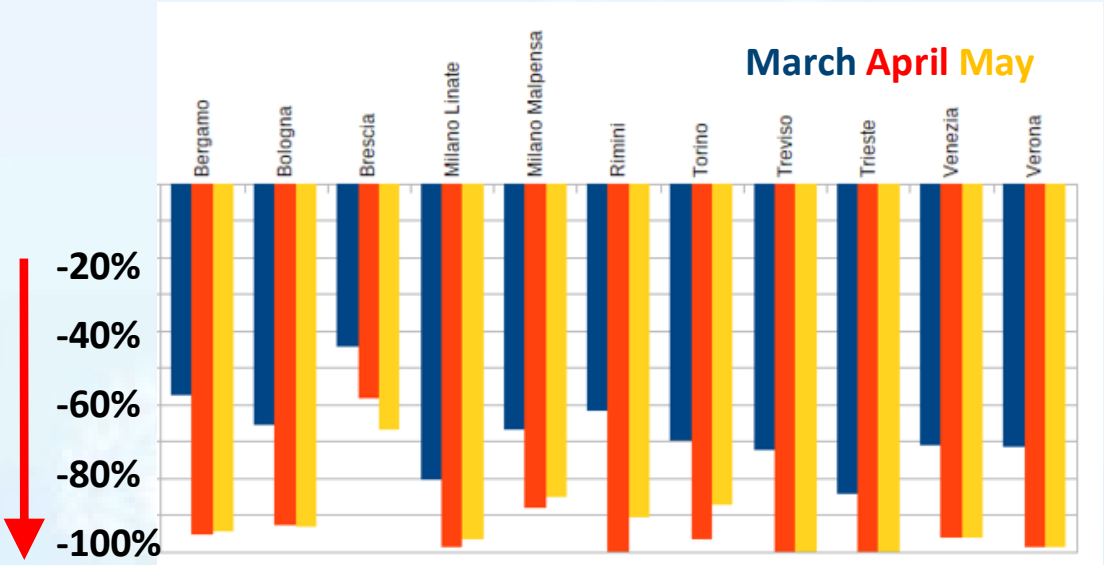
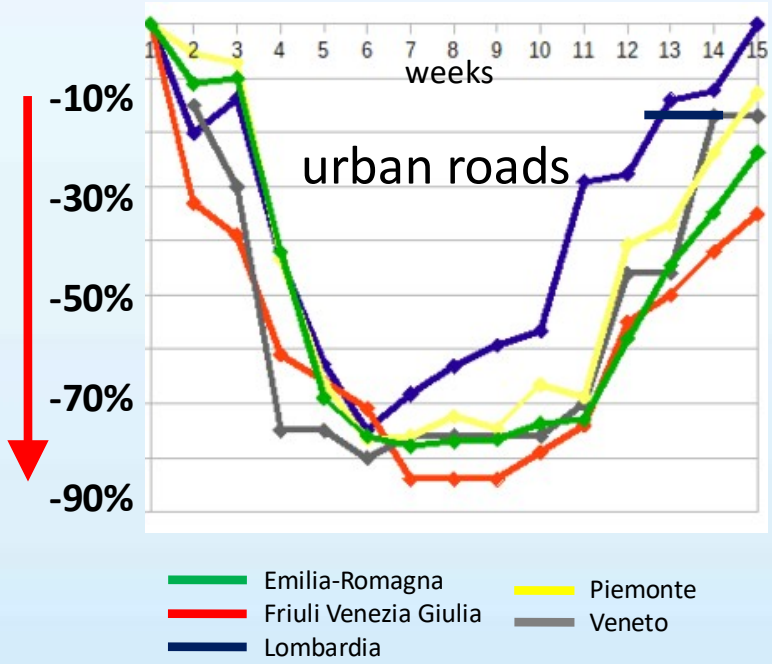
Reduction of flights



Progressive reduction up to an almost **total reduction**

Reduction of road traffic

Reduction of light and heavy traffic over ≃ 80% and 50% for main roads and highway



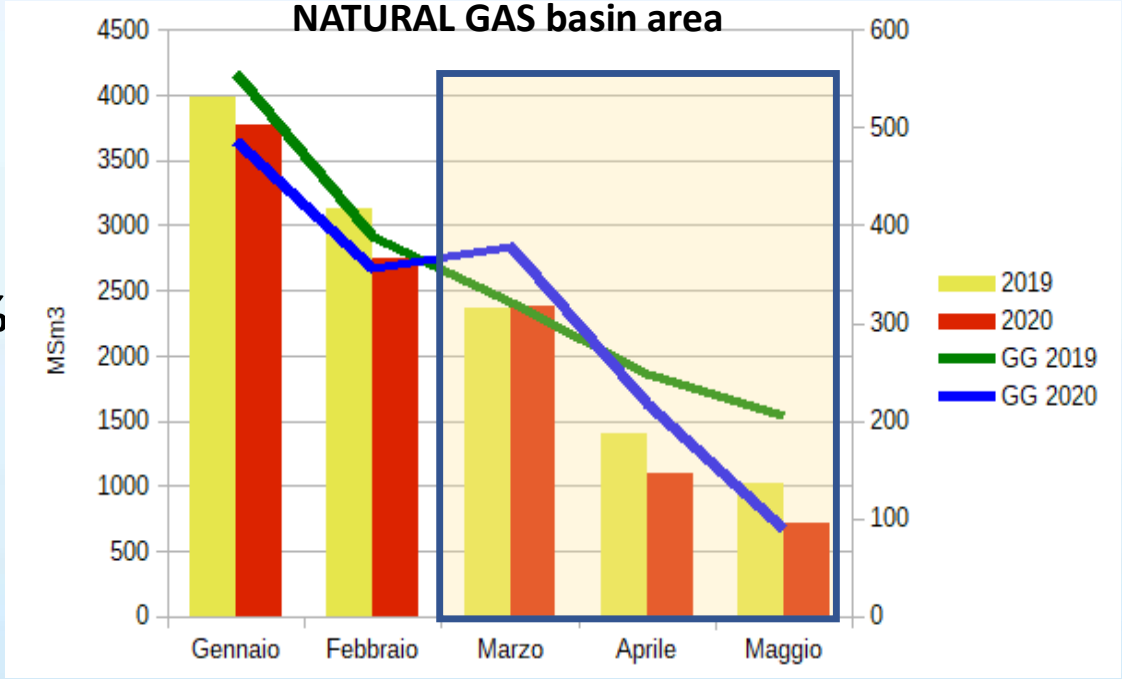
COVID & ENERGY

Public or private services: reduction from **25% to 65%** (consistent with ISTAT data relating to the number of employees in the ATECO activities affected by lockdown)

Domestic heating: the normalized data with respect to the temperature trend, showing an **increase** from **5% to 15%**

Industry: **reduction** from **6% to 35%** (confirmed by the data collected in the SME emissions)

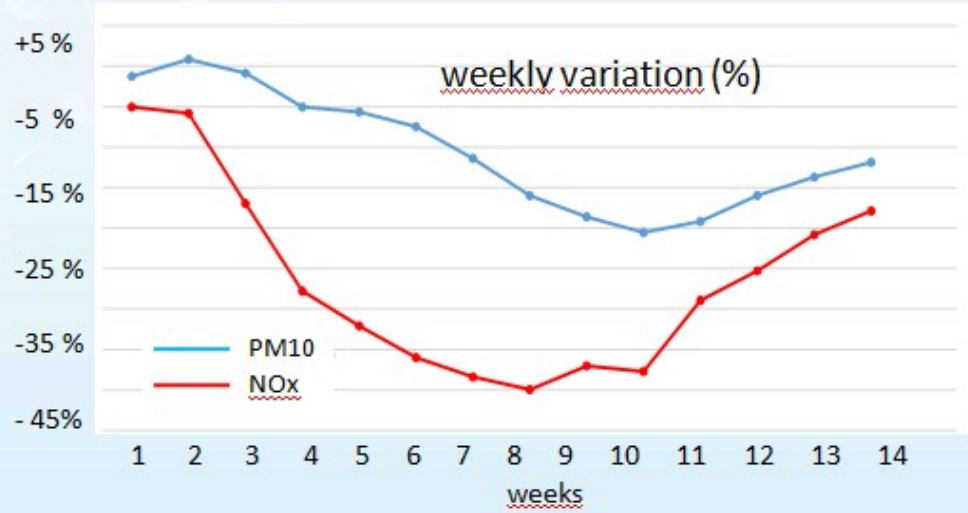
Based on natural gas distributed and electricity supplied from TERNA



COVID & EMISSIONS

% reductions were assessed compared to a theoretical scenario without lockdown with weekly detail

1° week
22/02/2020 -28/02/2020
...
...
14° week
23/05/2020 - 29/05/2020



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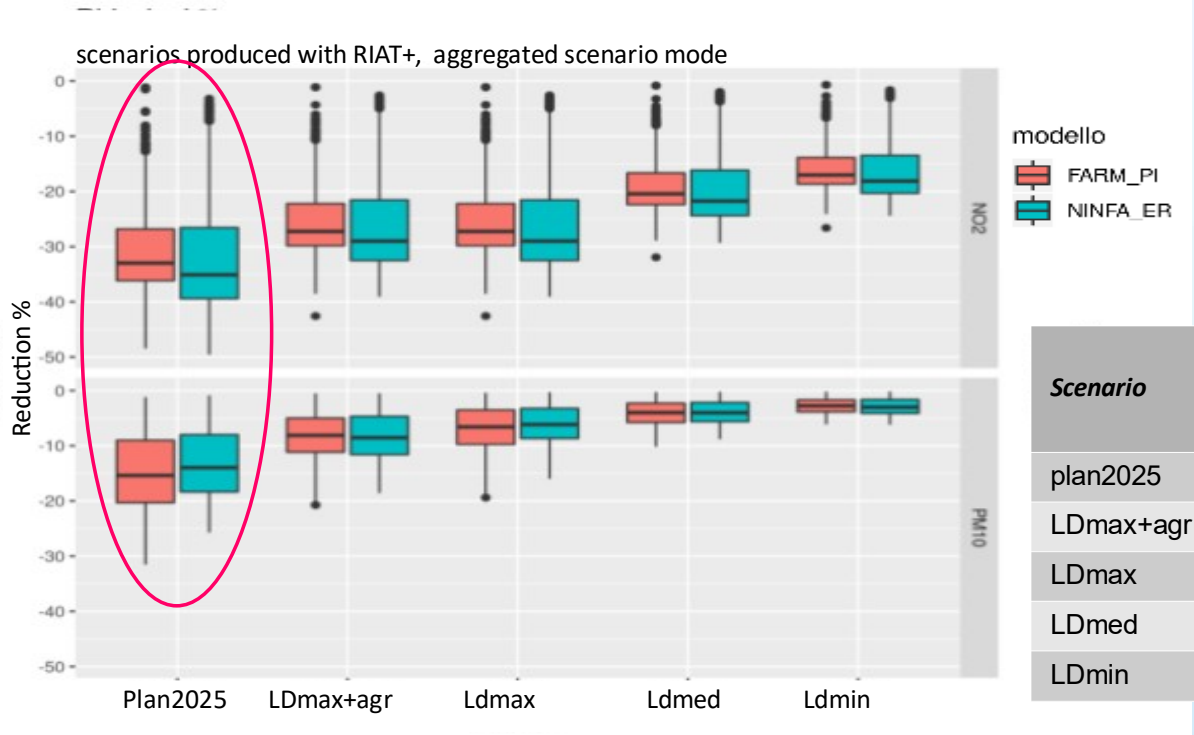
RIAT+ analysis

to calculate the impact reduction of the emission during COVID19

Five homogeneous reduction scenarios across the Po Valley applied for an entire calendar year, 3 scenarios related to the lockdown, one hypothetical and one linked to regional air quality plans:



Scenario	*Emissive input*					
	NOx	*NH_3*	*PM10*	*PM2.5*	*SO_2*	*VOC*
plan2025	39%	22%	38%	41%	4%	16%
LDmax+agr	40%	22%	20%	20%	0	0
LDmax	40%	0	20%	20%	0	0
LDmed	30%	0	10%	10%	0	0
LDmin	25%	0	5%	5%	0	0

COVID & AIR QUALITY CONCENTRATIONS

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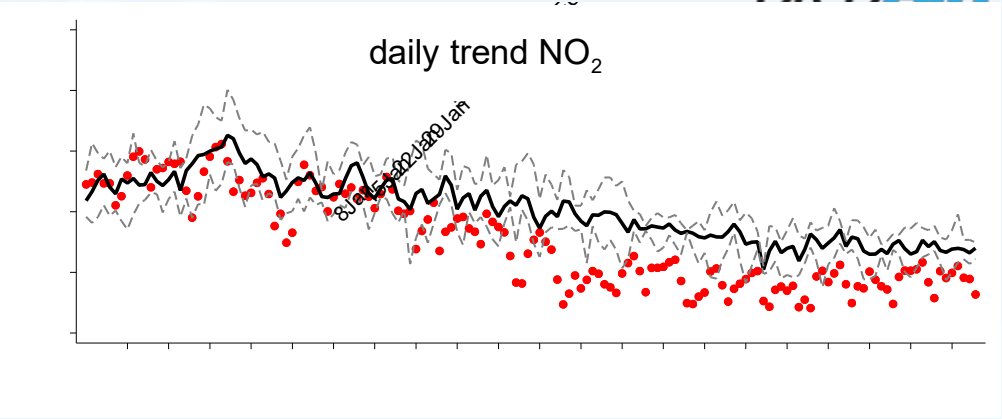
NO, C_6H_6, NO_2 gradually decrease as usual in the transition from January to March. The decrease is evident from March 2020 with concentrations well below the average for the reference period and **close to/below the minimum values.** PM shows a **trend more related to weather conditions** and with a variable spatial distribution on the basin.



DE shows the strong contribution of natural event!

Summary: POLLUTANTS REDUCTION

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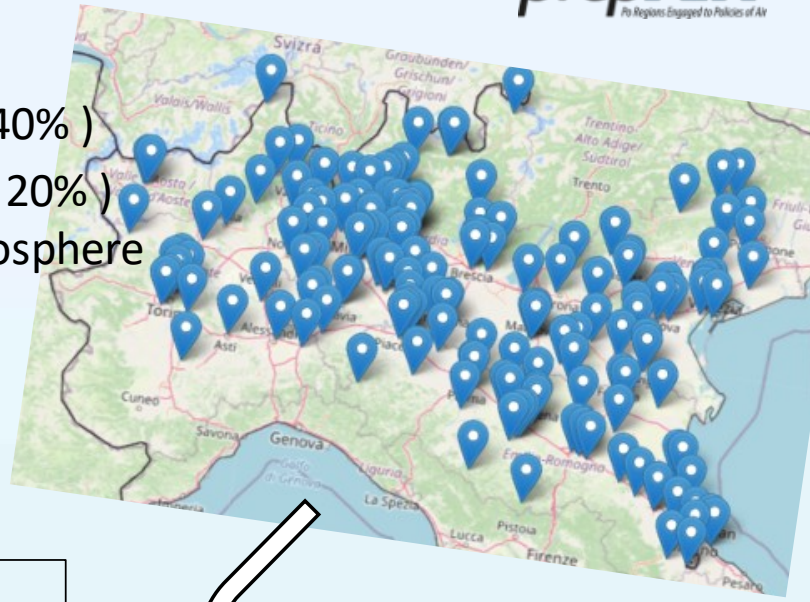
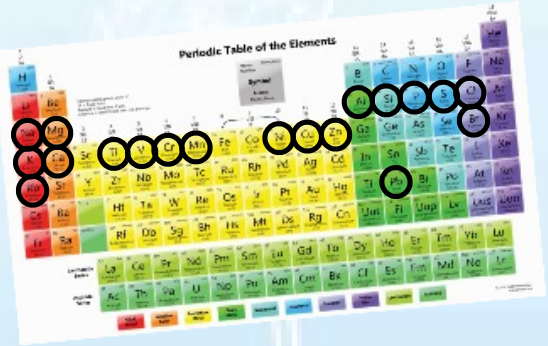
- drastic reduction of **determinants**
- **NO_x** primary emission reduction (max weekly decrease 40%)
- **PM10** primary emission reduction (max weekly decrease 20%)
- important reduction of the gaseous concentrations in atmosphere (NO, benzene, NO_2) in some case over 50%
- variable behavior of the **PM10** concentration: **WHY?**





To answer we need PM10 chemical composition: special stations of Prepair

\+ Aosta (another different laboratory)
* Vicenza: no data in 2020

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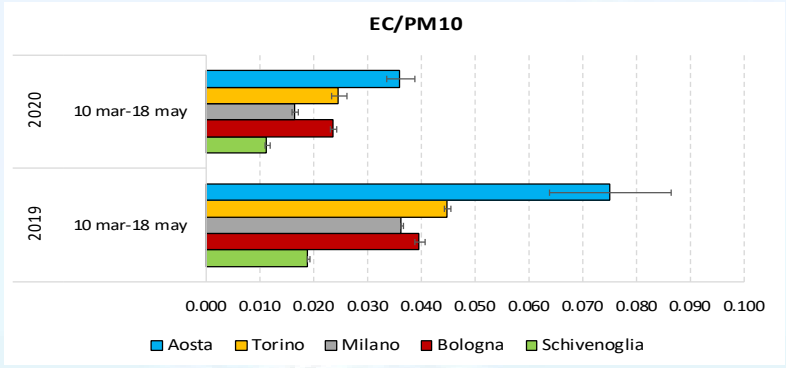
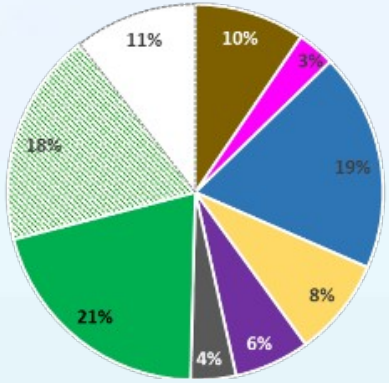
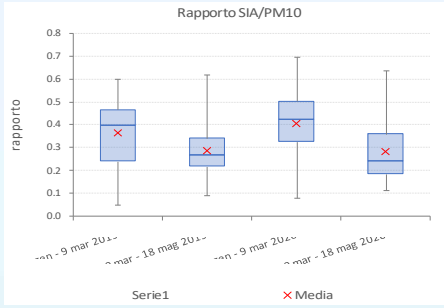
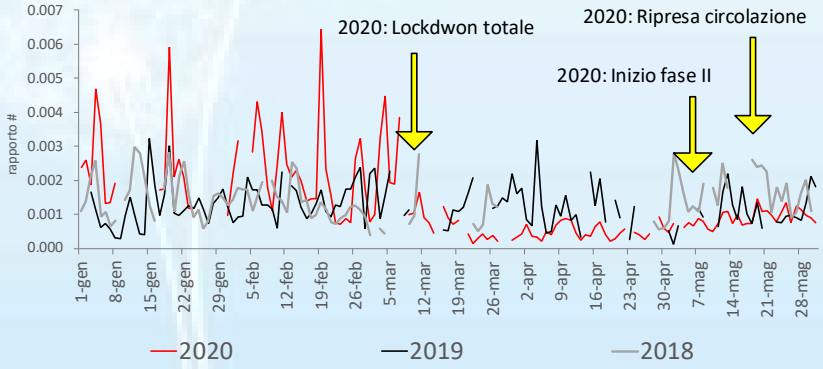
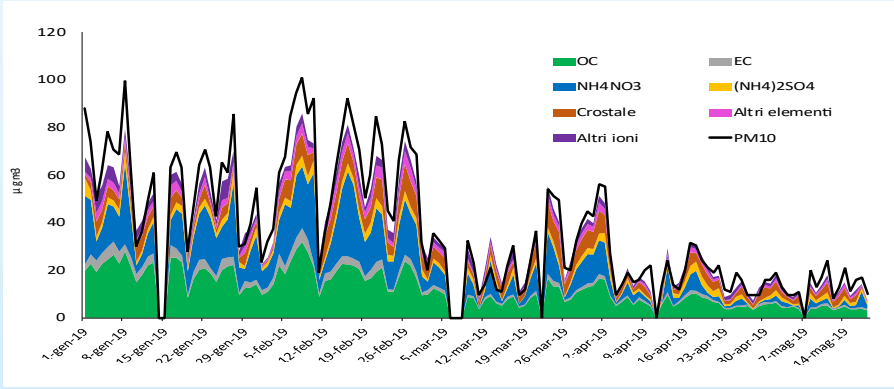
ANALYSIS PM10
CHEMICAL COMPOSTION











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MAIN RESULTS CHEMICAL COMPOSITION

10 March-18 May: 2020 vs 2019

1) No reduction for **secondary compounds** → "secondary" source

2) Levoglucosan increase in many sites →

marker of Biomass Burning source

3) Despite the increase of BB strong reduction of EC and Cu (EC Po Valley=-36%) →

proxy traffic source

EC	Reduction in 2020 vs	
Aosta PM10	-40%	2017-2019
Bologna PM2.5	-42%	2012-2019
Milano PM10	-31%	2013-2019

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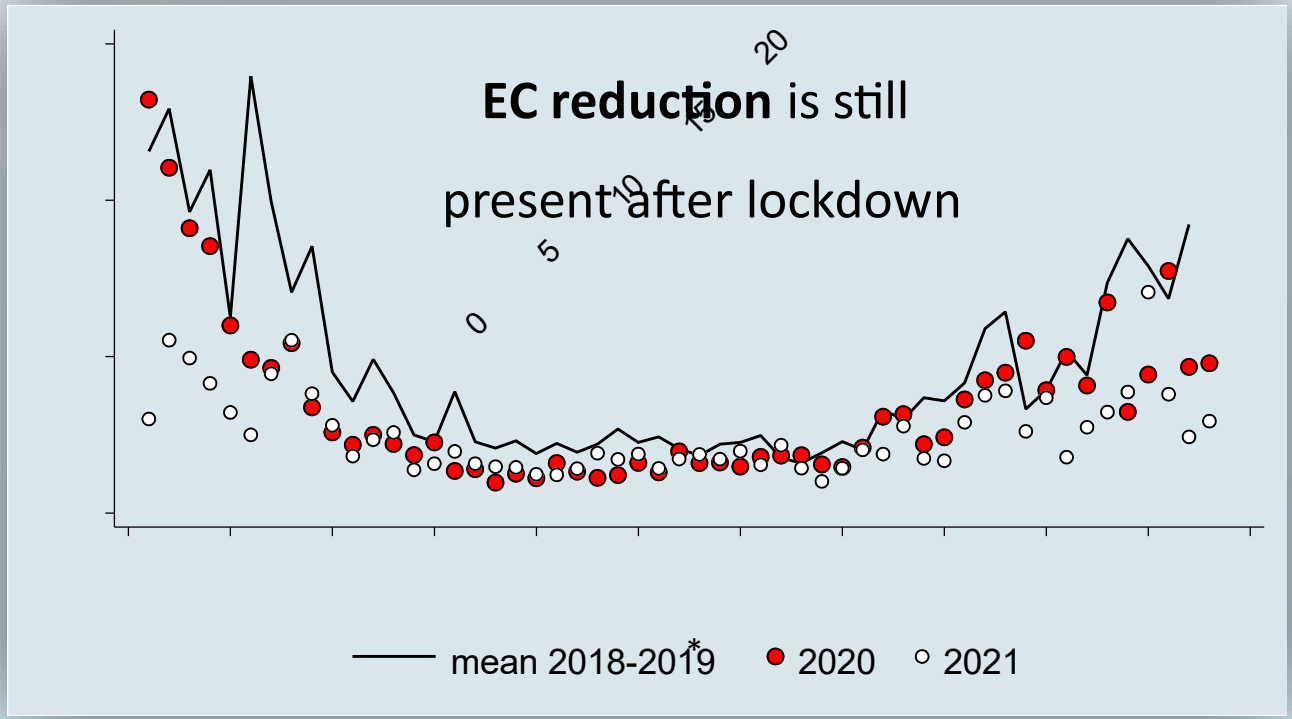
And after total lockdown? 2018-2021

- Smart working (after covid19)
- Change of vehicle fleet?



* until April there is only 2019

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THE “FAMOUS” PO VALLEY, HIGH VALUES of PM

https://imgur.com/gallery/3kDqX

Transport and dispersion of pollutants are strongly influenced by the morphological characteristics into the basin

⇩

stagnant atmospheric conditions accumulation of particulate and gaseous pollutants

→ cold period

+ METEOROLOGIC CONDITIONS (low wind speeds, stable atmospheric stratification..)
+ Geography of the territory
+ EMISSIONS
+ Chemical reactions

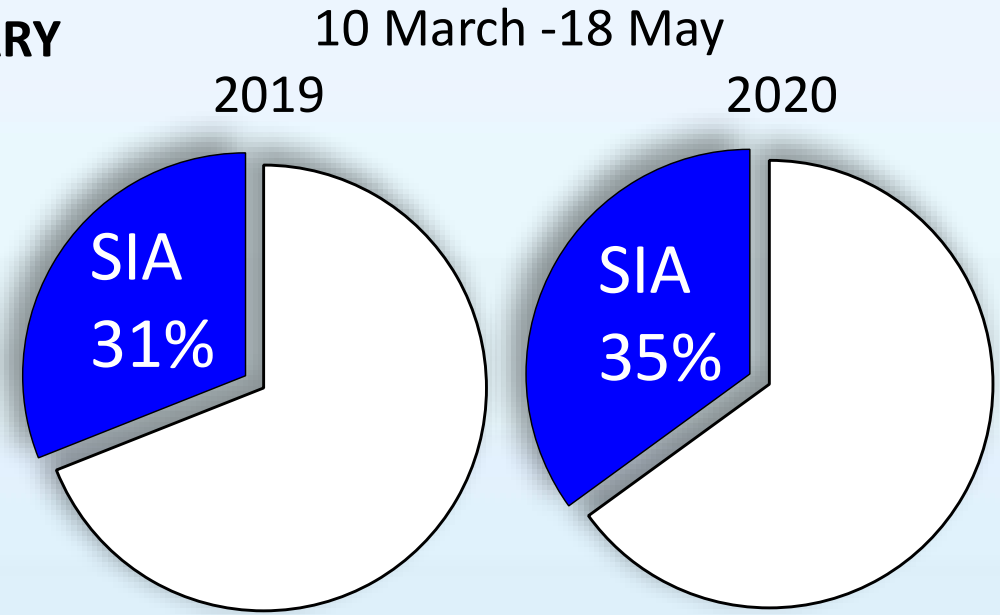
INTERPRETATION

- Despite a strong reduction of many gases (NO, benzene, NOx) other precursors were available during "Covid time": NH_3 .. → **SECONDARY FORMATION** still occurred

→4 urban sites

→ in the rural site SIA up to 54% during winter

- BB could also have contributed, having increased in its tracer
- Need to investigate **SOA**



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HOW TO FIX IT?

Need to reduce precursors in a coordinated, incisive and parallel way in the whole basin: **which ones and how much? Where?**

TO KNOW IT we must FIX the LACK of the INFORMATION necessary TO UNDERSTAND the SIA FORMATION and TO INVESTIGATE the SOA

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merci, thank you, danke, gracias, grazie,..

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