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maîtriser le risque pour un développement durable

REAL-LIFE EMISSIONS PROJECT – ACTION C3

Economic and environmental impact

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Real-LIFE Emissions

Presentation plan

- Economic impact: estimation of the added cost of implementation of the protocol and method proposed within Real Life

- Environmental impact: case study of France

1. Economic impact: estimation of the cost of implementation of the protocol and method proposed within Real Life

Principle and objectives

Objectives of the study :

- to estimate the added costs due to method change from EN16510 to the novel ENPME-dual-filter-method with porous tube dilution and using the novel test protocol

Principle of the added-cost evaluation

- Calculated per stove test
- Several cases evaluated: implementation of one entire REal-life protocol , implementation of one entire REal-life protocol+ Extended EN_PME method (2 options evaluated)
- Takes into account additional investment, consumables, and man-hour costs (extra day of sampling, extra man-hour necessary)
- General assumption:

Duration of use of measurement equipment	15	years
Interest rate	4,5%	
Capital recovery factor	0,093	
Maintenance and repair	4,0%	%/a

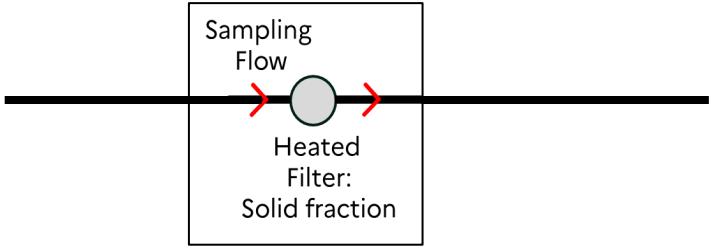
- Further assumptions:

Number of testing days performed in the lab per year	45
Cost of consumables	80 € HT for a box of 50 quartz filters
	0,43 €/kg of wood
Average labour price (€/h)	50€/hour (according to the French institute of satistics)

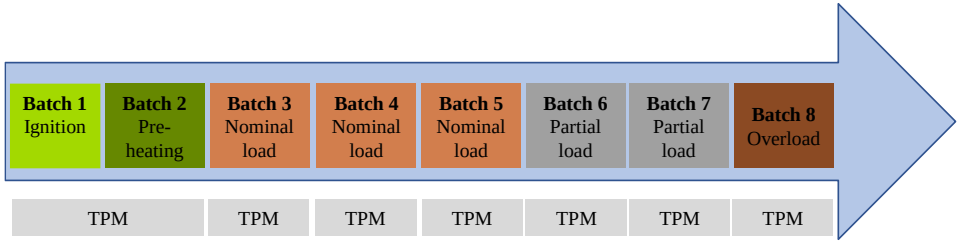
Principle and objectives

EN 16510:

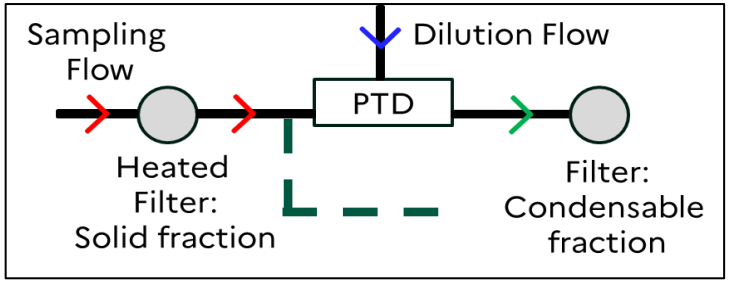
- Measurement method : EN PME method,
- Operation : nominal output and a partial output if described in the operating manual



Real Life protocol:

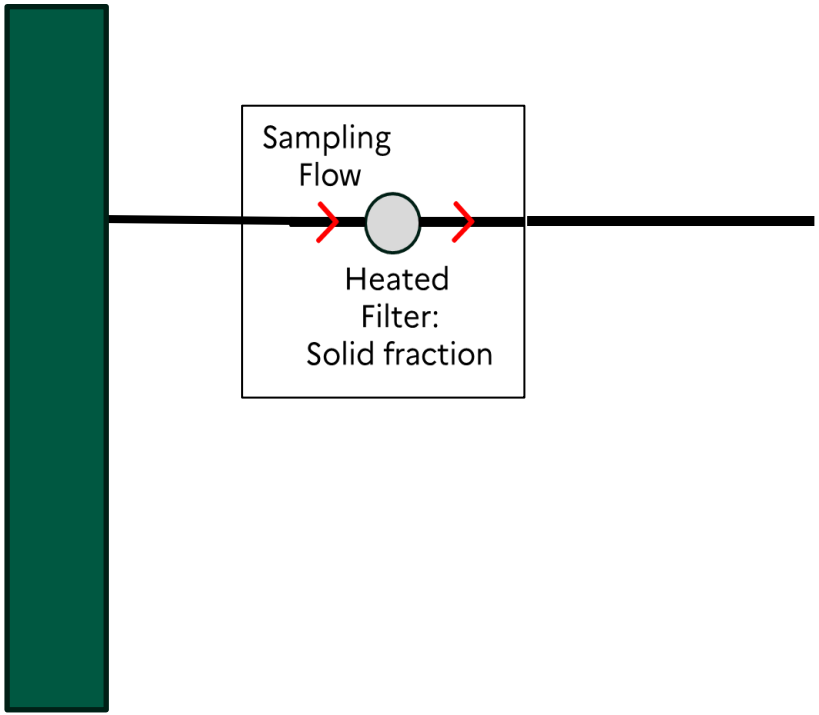


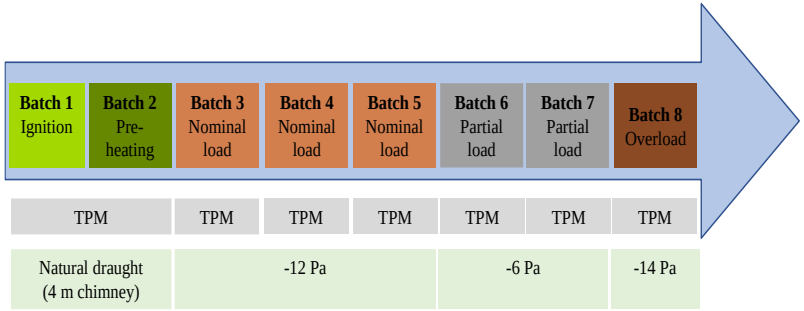
ENPME- extended (dual-filter)-method



Case 1 : Change of protocol from EN 16510 protocol to Real life protocol

One sampling line EN PME used on all batches



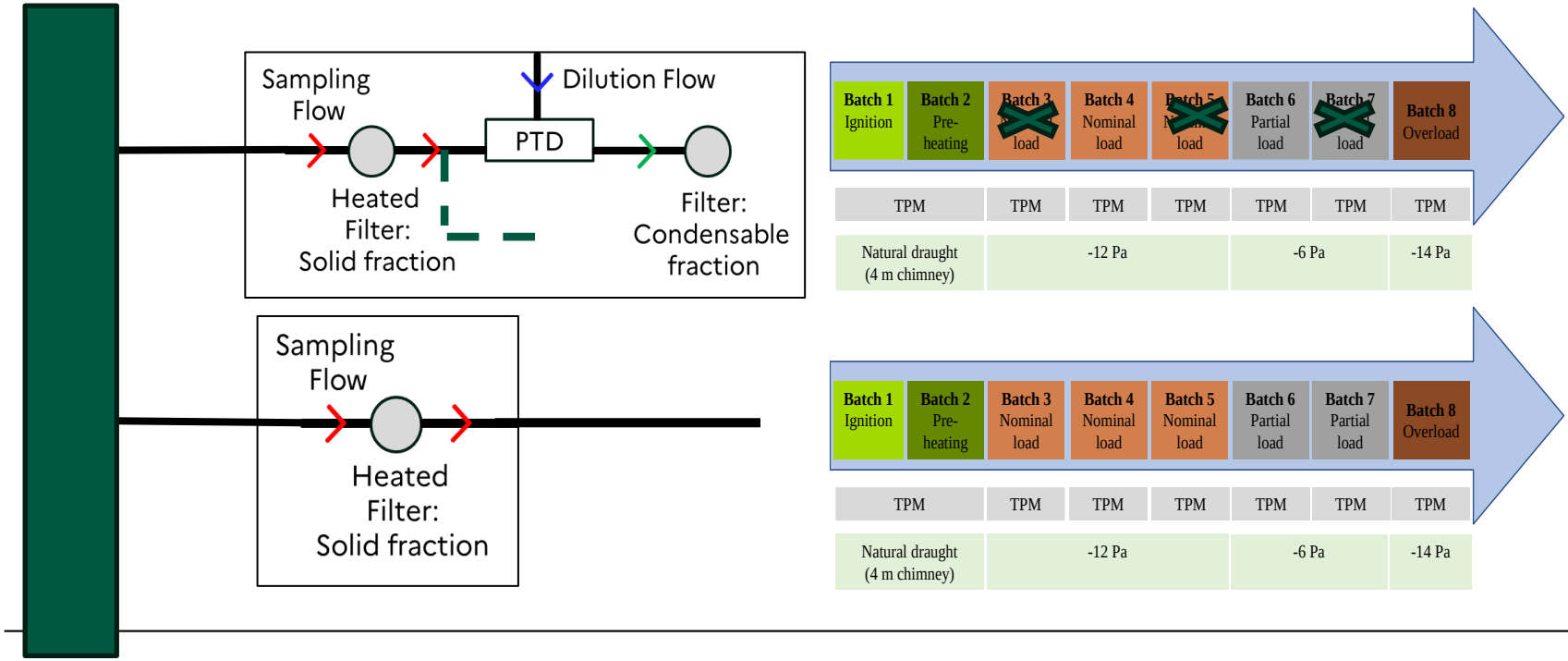


Case 1 : Change of protocol from EN 16510 protocol to Real life protocol

- Investments costs about 2000 € i.e about 200 € per year including maintenance and repair
- 0,5 extra day of sampling
- 3h extra man-hour necessary/day of sampling
- Additional labour cost 225€/tested stove
- Additional costs for filters 10€/ tested stove
- Additional costs for fuel 6€/tested stove
- **Total added-costs: about 250€ per stove tested**

Case 2 : Change of protocol from EN 16510 protocol to Real life protocol + EN PME extended every other batch

One sampling line EN PME used on all batches and one sampling EN PME extended used every other batch

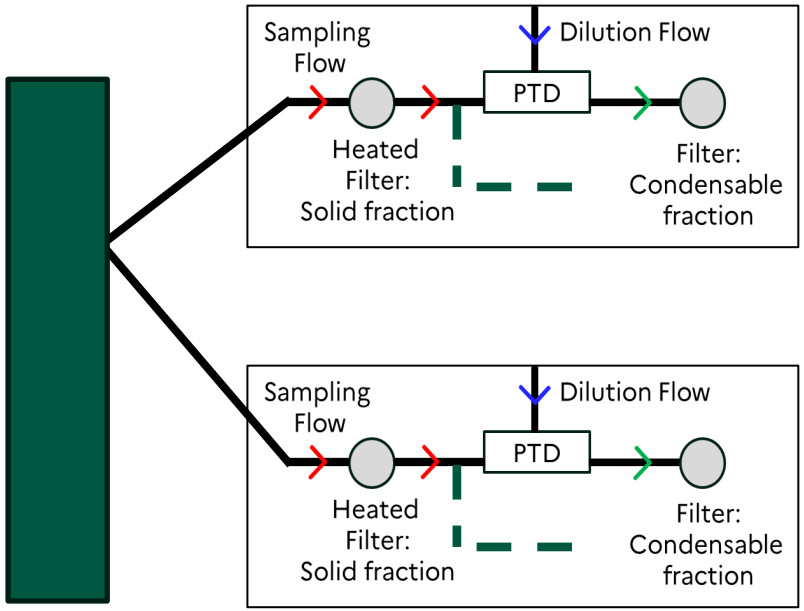


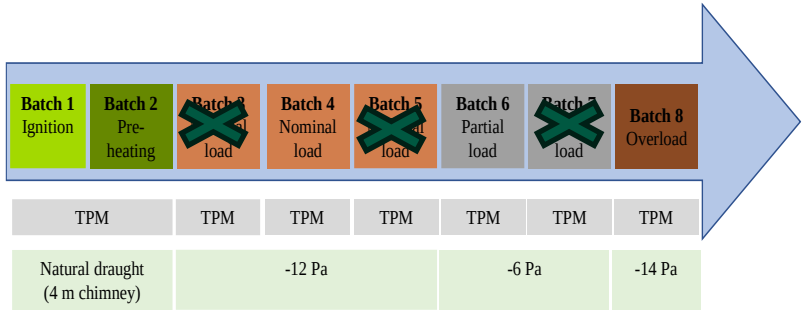
Case 2 : Change of protocol from EN 16510 protocol to Real life protocol + EN PME extended every other batch

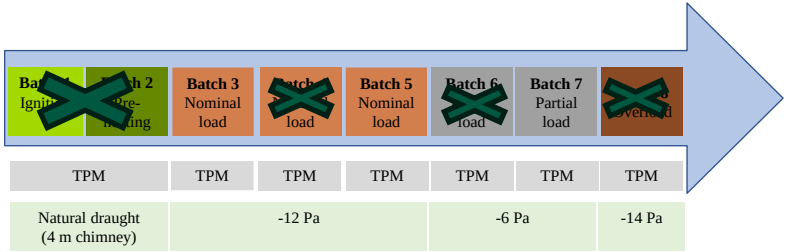
- Investment costs about about 20 000€ i.e 2000 € per year including maintenance and repair
- 0,5 extra day of sampling
- 3,5h extra man-hour necessary/day of sampling
- Additional labour cost 260€/tested stove
- Additional costs for filters about 20€/tested stove
- Additional costs for fuel about 6€/tested stove
- **Total added-costs: about 325€ extra per tested stove**

Case 3 : Change of protocol from EN 16510 protocol to Real life protocol + extended EN PME on every batch

Two extended EN PME sampling lines used alternatively







Case 3 : Change of protocol from EN 16510 protocol to Real life protocol + EN PME extended on every batch

- Investment costs about 30 000€ i.e 3000€ per year including maintenance and repair
- 0,5 extra day of sampling
- 4h extra man-hour necessary/day of sampling
- Additional labour cost 300€/tested stove
- Additional costs for filters 25 €/tested stove
- Additional costs for fuel 6€/tested stove
- **Total added-costs: about 380€ /tested stove**

Economic impact, conclusions

- 3 cases evaluated:
- Implementation of Real life protocol (Case 1)
- Implementation of Real life protocol+Extended EN PME every other batch (Case 2)
- Implementation of Real life protocol+Extended EN PME on every batch (Case 3)

- Evaluation takes into account additional investment, consumables, and man-hour costs (extra day of sampling, extra man-hour necessary)

- Extra costs mainly impacted by Labour costs

- Extra costs comprised between 250€ (Case 1) and 400€ (Case 3)

2. Environmental impact: case study of France

Emission factors (EFs) and national inventories

National emission inventory:

- Emission declared each year per pollutant and sector by a country
- Emission inventory: EFs combined to activity data, for domestic wood combustion it requires EFs per categories of appliances and information on the fleet of appliances that people are using
- In France, the CITEPA is in charge of the emission inventory, it was recently updated

Categories/French EFs Solid+condensable (g/GJ)	Categories/EMEP Guidebook EFs Solid+condensable (g/GJ)
Conventionnals (<2005)/ 590	Conventional 800
Performant 1- (2005 – 2015) /417	Highly efficient 400
Performant 2 – (2015 – 2021)/282	
Advanced (starting from 2022)/ 128	Advanced 100

French EFs includes:

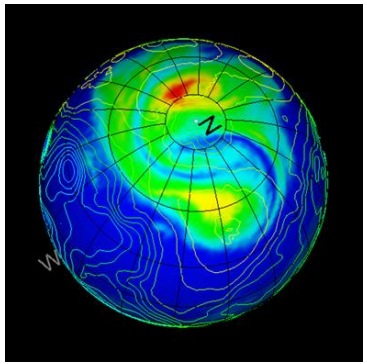
- ignition,
- nominal and low output,

- Used to make scenario of emission reduction and check is reduction objectives can be achieved
- Used as input data to air quality modelling activities

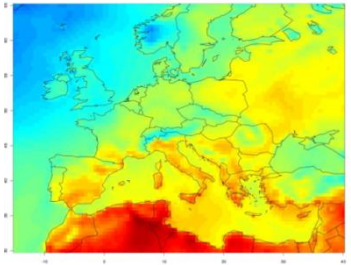
Modeling Air Quality using emissions

Chemical-Transport Models are deterministic models aiming at representing the physicochemical processes occuring in the atmosphere

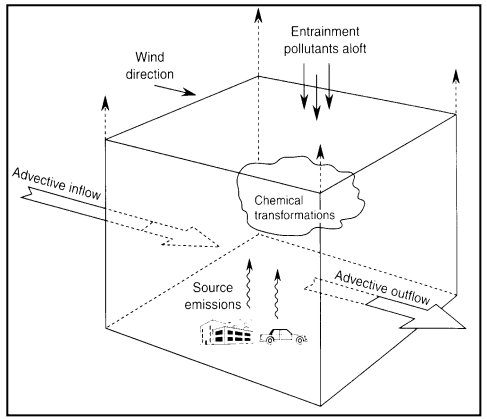
Long-range transport



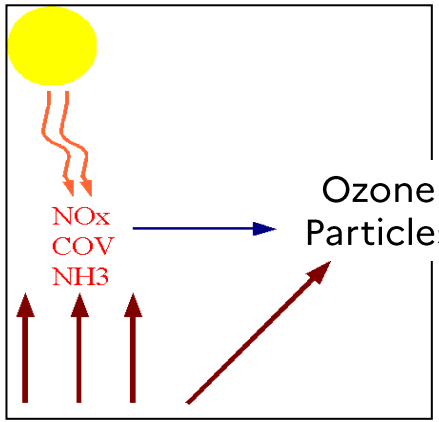
Meteorology



Transport
Advection
Vertical mixing

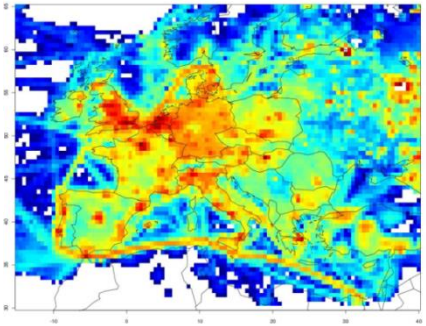


Chemisty:
Photochemistry
Aerosol formation



CHIMERE

Emissions



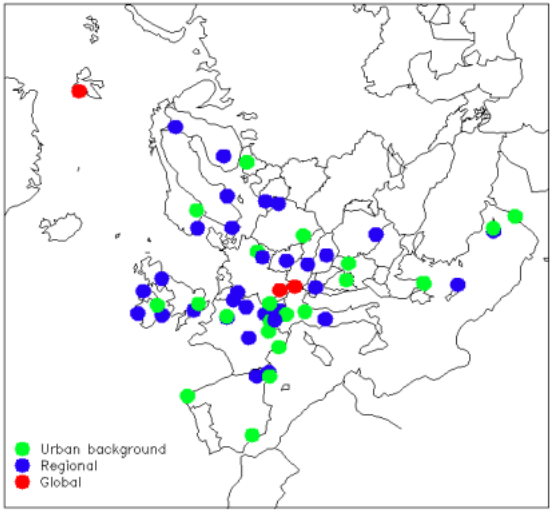
Feedback from the air quality modeling community

Eurodelta-carb modeling exercise. Work carried out inside the EMEP (Evaluation and Monitoring and Evaluation Programme) under the Convention on Long-range Transboundary Air Pollution in collaboration with CAMS (Copernicus Atmosphere Monitoring Service)

Comparison of air quality model to ambient PM2.5 measurements : EMEP/ACTRIS/COLOSSAL Intensive Measurement Period : Dec 2017 - Feb 2018

11 Participating models:

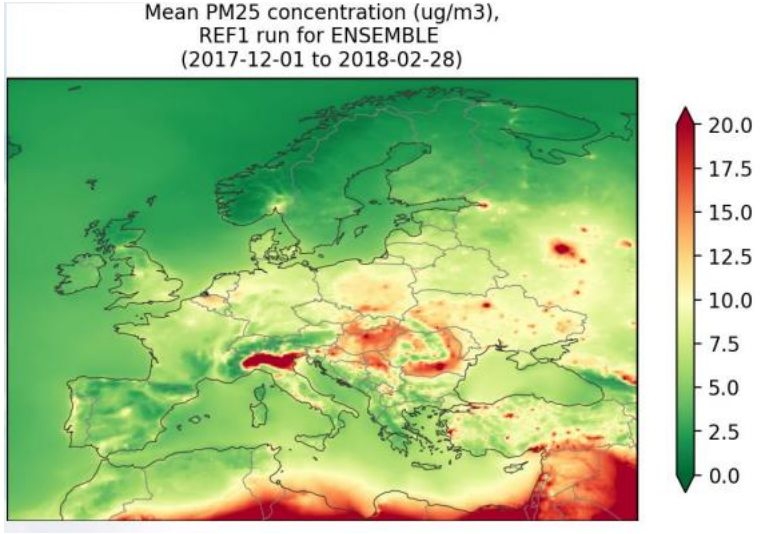
EMEP/MSC-W, Lotos-Euros, EuradIM, IFS, MINNI, DEHM, MONARCH, MATCH, CHIMERE, SILAM, WRFCHEM



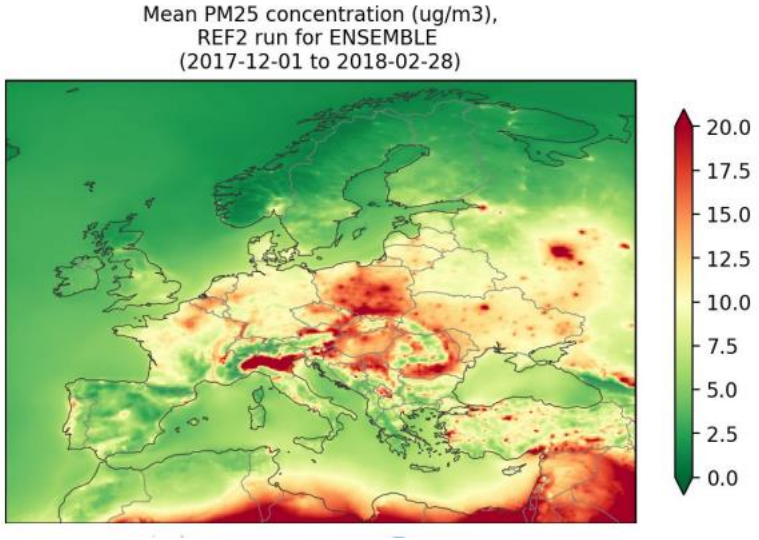
Feedback from the air quality modeling community

Results of ambiant air modeling based on:

official emission inventory
(include or not condensable depending on countries)



emission inventory
including condensables

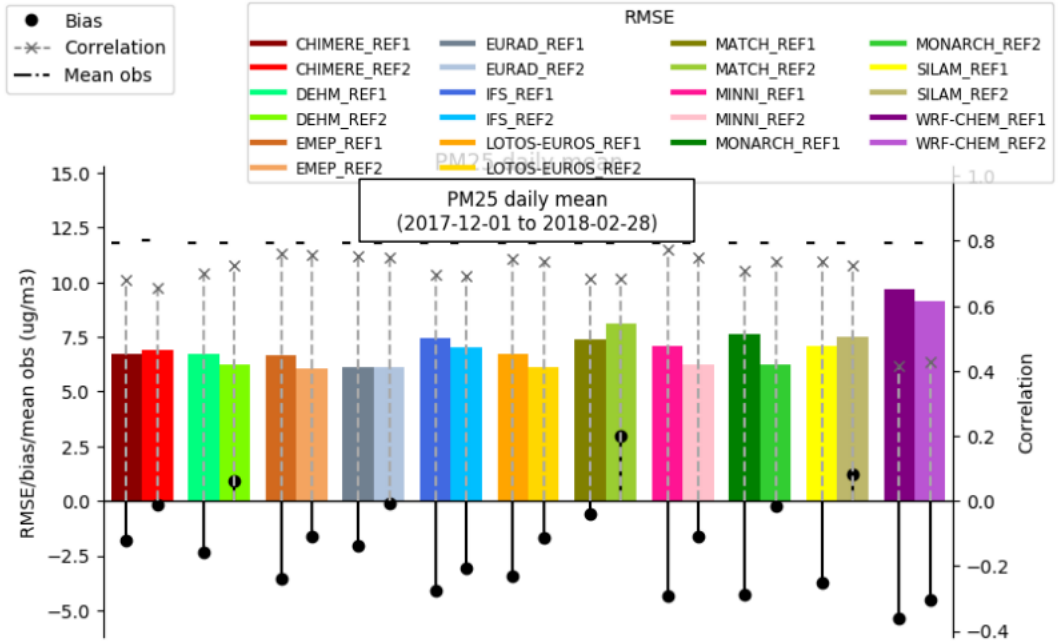


Feedback from the air quality modeling community

All models were strongly underestimated winter PM2.5 concentrations with the official inventory by between 2 to 5 µg/m3.

When condensables are including the bias become close to zero for most models

Consensus from the air quality modeling community, emissions including condensables are more relevant for the study of environmental impacts.



Objectives of the environmental impacts study

To evaluate the impact of using emission factors (EFs) obtained following different protocols/methods

- on the French emission inventory in 2030
- and on the achievement of the reduction objectives of PM2.5 between 2020 and 2030, set in France for the residential wood combustion sector (Plan air bois) :
  - 30% in average
  - 50% for the highly polluted areas covered by an Atmosphere Protection Plan,

Principle of the environmental impacts study

- Evaluation of the impact of replacing the oldest appliances by new ones between 2020 and 2030,
- Average replacement rate of 3,2% per year between 2020 and 2030 (according to the replacement rate of appliances observed in France between 2017 and 2021) by “advanced” appliances
- Emission factors tested :

Avanced appliances	Other appliances
EFs from the current French inventory (CITEPA)	EFs from the current French inventory (CITEPA), including condensables
EFs obtained from tests following Real Life protocol including condensables measured using the EN PME extended method	EFs from the current French inventory (CITEPA), including condensables
EFs obtained from tests following Real Life protocol not including condensables	EFs from the current French inventory (CITEPA), not including condensables
EFs obtained from tests performed under nominal conditions (best 3 batches) not including condensables	EFs from the current French inventory (CITEPA), not including condensables

Impact on 2030 emissions

In 2020, old appliances (before 2005) represent 36% of RWB energy production

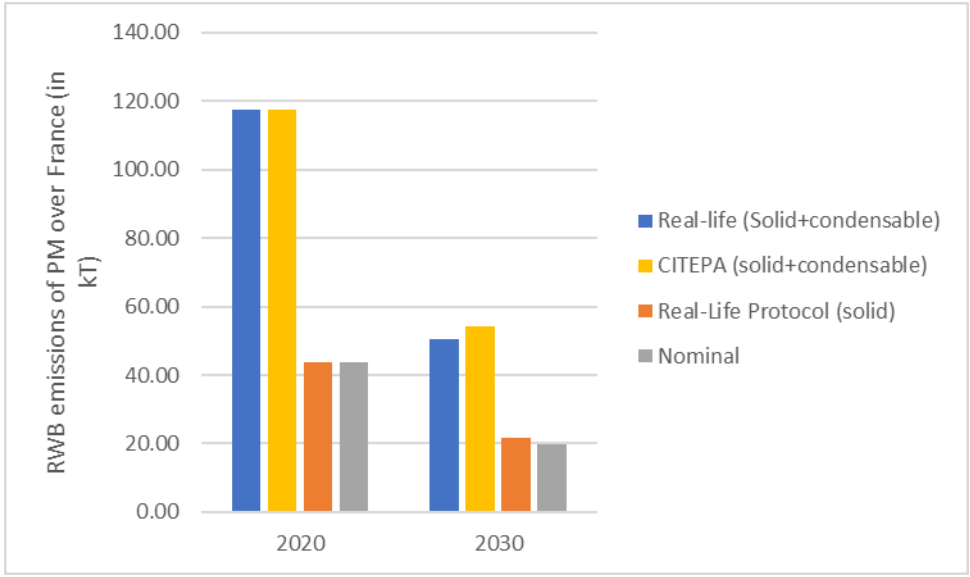
No « advanced » appliances in 2020, emissions are due to emissions factors used in the French emission inventroy (with or without condensable)

Emissions with condensables are higher by almost a factor 3

In 2030, « advanced » appliances are estimated to contribute to 5% of PM RWB emissions with EF not including condensables (Real-life Protocol) and to 3% with EF including condensable.

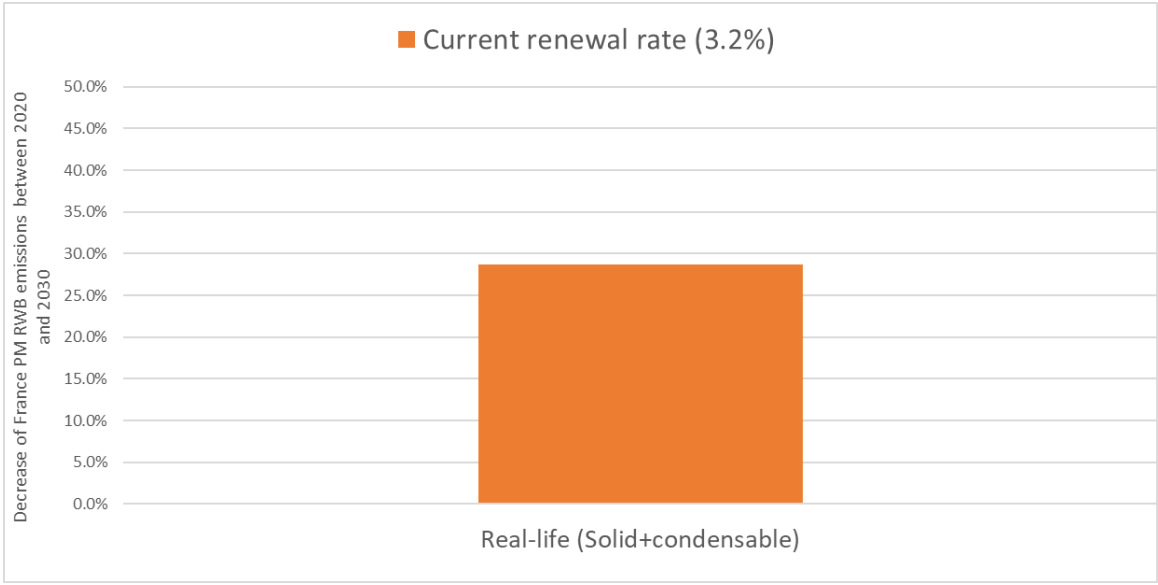
« advanced » appliances should represent around 40% of RWB energy production

Estimated TSP emissions from Residential Wood Burning (RWB) in 2020 and in 2030



Evaluation of France objectives

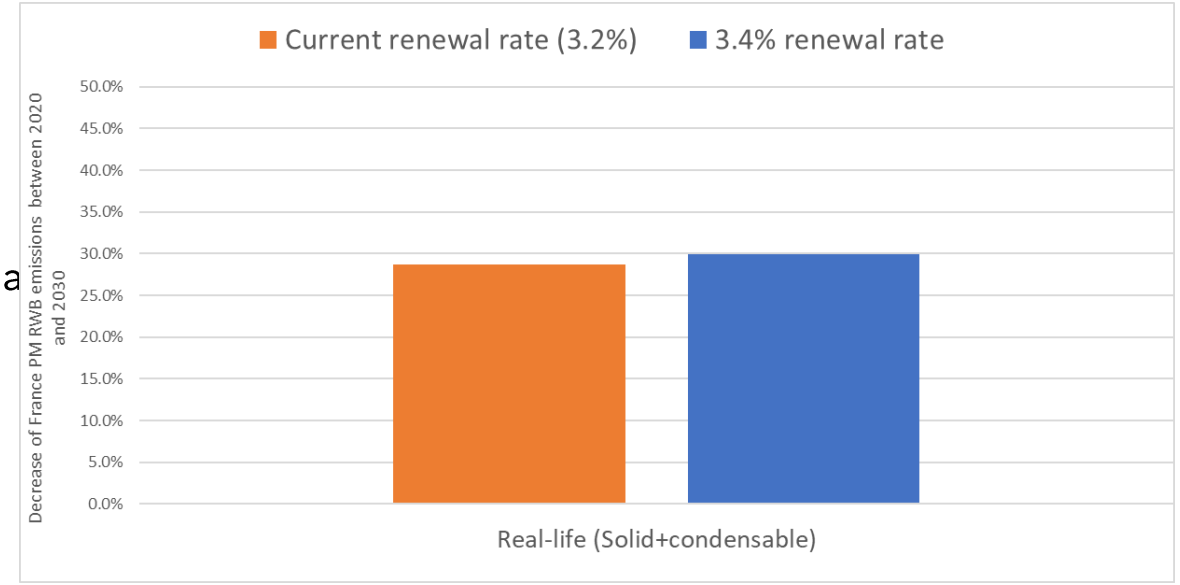
With the current renewable rate, reduction of PM2.5 are close to the objectives (30%)



Evaluation of France objectives

With the current renewable rate (3.2%), reduction of PM2.5 are close to the objectives (30%) but not reached

The objectives can be reached with a 3.4% renewal rate

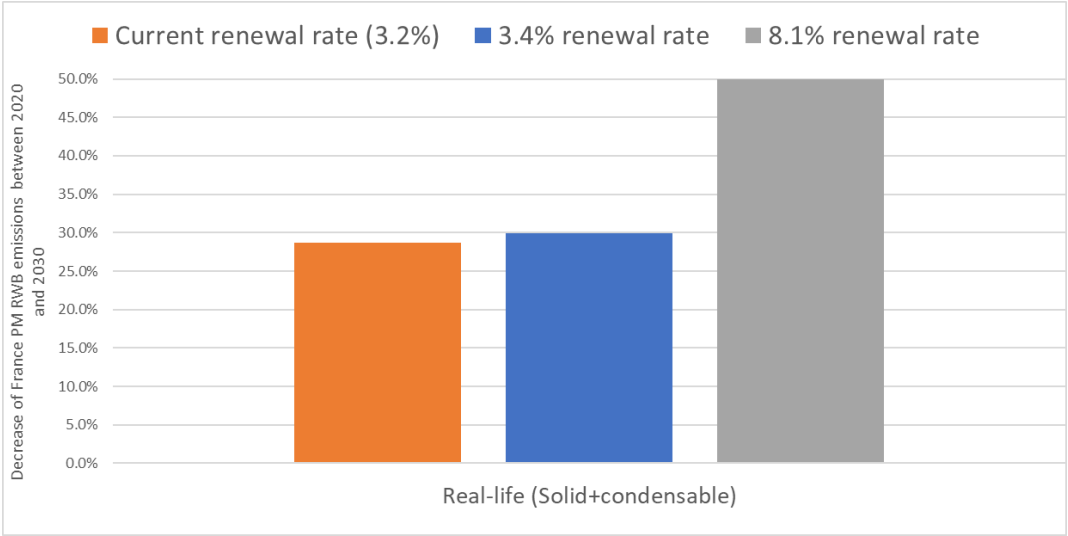


Evaluation of France objectives

With the current renewable rate (3.2%), reduction of PM2.5 are close to the objectives (30%) but not reached

The objectives can be reached with a 3.4% renewal rate

Reaching the 50% reduction objectives is much more ambitious. Appliances after 2005 and open fireplaces (which are stable in France) have to be renewed.



The 50% objective can be reached with an average renewal rate of 8.1%

Environmental impacts, conclusions

Simulations performed with air quality models suggest that emissions including condensables are more relevant for environmental impact studies

Strong increase in RWB emission inventories when condensables are included (by a factor 3 over France)

Based on current renewal rate, « advanced » appliances in 2030 should represent around 40% of RWB energy production but only a few percents of RWB emissions

Similar decrease between 2030 and 2020 whatever the emission factors due to the strong contribution of older appliances in emissions

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Thank you for your attention