



› **CONDENSABLES – VOLATILE PARTICULATE MATTER**
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› **OUTLINE**

- › REF2 and use of reported data in EMEP/MSC-W modelling
- › Improvements to emission inventories and the Guidebook

IMPACT ON EMISSIONS

- Alternative inventory (REF2) developed for Europe, consistently including condensables for small combustion
 - Fuel statistics, combined with appliance type split and emission factors based on the dilution tunnel approach
 - Following methodology in [[Denier van der Gon et al., ACP, 2015](#)]
- This alternative inventory has been used in multiple AQ modelling studies, showing significant improvements in comparison between modelled and measured PM levels
- Since 2020, for EMEP modelling reported data are replaced by REF2 to assess PM impacts and for the source receptor relations (GAINS model)

PM_{2.5} emissions for 2015 (kton) from small combustion (GNFR C)

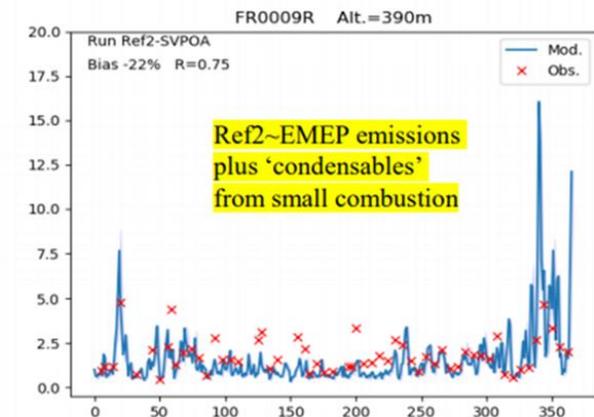
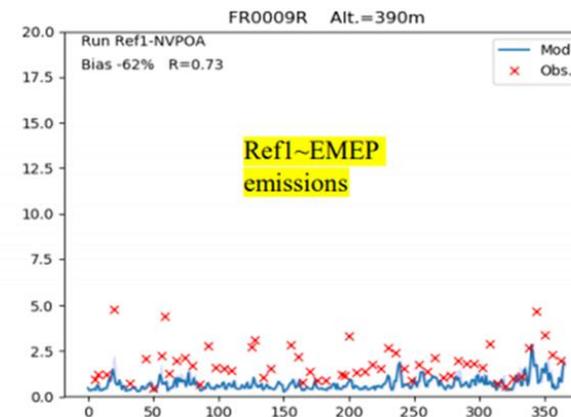
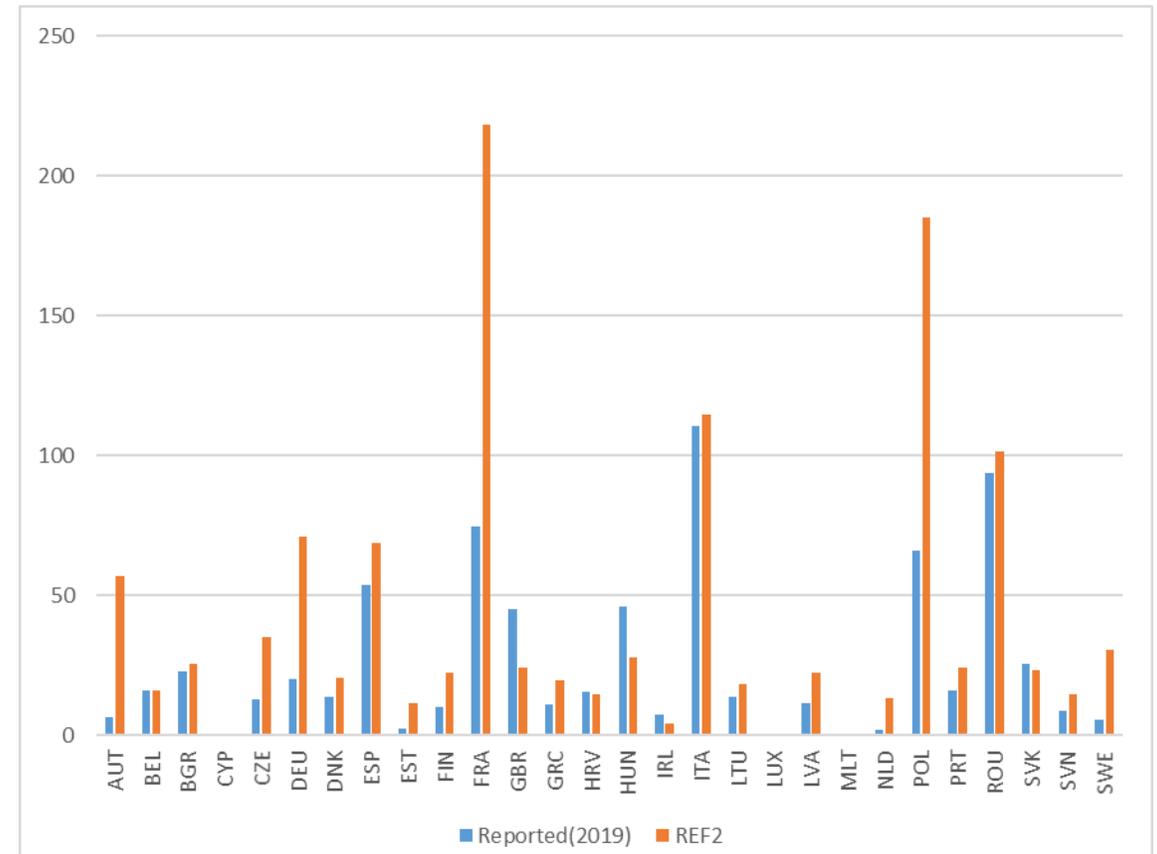


Table 3.1: Information on the inclusion of the condensable component in PM₁₀ and PM_{2.5} emission factors.

Party	NFR category	Source/sector name (according to Annex I, Reporting Guidelines, modified in selected cases)	Status of inclusion of PM emissions
Austria	1A4bi	Residential: Stationary	partially included + unclear status
Belgium	1A4bi	Residential: Stationary	Wood: included Other fuels: excluded
Croatia	1A4bi	Residential: Stationary	unclear status
Denmark	1A4bi	Residential: Stationary	Wood: included Other fuels: excluded
Estonia	1A4bi	Residential: Stationary	excluded
Finland	1A4bi	Residential: Stationary	partially included
France	1A4bi	Residential: Stationary	excluded
Germany	1A4bi	Residential: Stationary	excluded
Latvia	1A4bi	Residential: Stationary	partially included
Lithuania	1A4bi	Residential: Stationary	excluded
Luxemburg	1A4bi	Residential: Stationary	excluded
Netherlands	1A4bi	Residential: Stationary	included
Poland	1A4bi	Residential: Household and gardening (mobile)	solid fuels :included
Portugal	1A4bi	Residential: Stationary (wood combustion)	included
Romania	1A4bi	Residential	partially included + unclear status
Slovakia	1A4bi	Residential: Stationary	unclear status
Slovenia	1A4bi	Residential: Stationary	partially excluded + unclear status
Spain	1A4bi	Residential: Stationary	partially included + unclear status
Sweden	1A4bi	Residential: Stationary	included
Switzerland	1A4bi	Charcoal use Bonfire	included
United Kingdom	1A4bi	Residential: Stationary	partially included + unclear status

Source: EMEP Status Report 1/2020

REPORTING OF CONDENSABLES

- › Approach differs between countries, but even between sectors, and between different fuels within a sector
- › Harmonizing this is a time consuming process
- › Current reported PM emissions for small combustion are not used by EMEP for modelling, because of the difficulty to disentangle individual country approaches)
 - › Shame, because we know there are several countries with good quality inventories that do include condensables
- › How to move forward?
 - › Updated REF2 will be necessary to account for those countries where condensables are not (or not consistently) included
 - › Where possible, use reported data from the countries
 - › Increase transparency of the IIRs regarding the inclusion of condensables in each sector, especially for small combustion

› WHAT'S NEXT...

- › This/next year(s): EMEP/MSC-W will use an updated REF2 for modelling but replace with country reported data in case it's clear condensables are indeed included
 - › This inclusion of condensables is checked in 2 independent steps:
 1. Assessment of reported emissions & activity data to calculate IEF; magnitude to be in line with typical EF range including condensables
 2. IIR to clearly confirm the inclusion of condensables

› IEF CALCULATION APPROACH

- › Currently based on the approach in NFR category 1A4bi (residential) only (largest sector in terms of energy consumption, and also most relevant for condensables)
- › Countries with no or incomplete reporting excluded from analysis
- › Basic idea: from the implied emission factor (EM/AD) it should be clear if condensables are included or not
 - › Complication: fuel mix differs considerably between countries
- › Reported activity data used to estimate contribution of each fuel to total emissions (%), using Tier 1 emission factors. Three cases:
 1. Only biomass is important (>5%) representing 2/3 of Parties (*in 2018*)
 2. Both biomass and solid fuels are important (>5%) representing 1/5 of Parties
 3. Contributions (>5%) from other fuels representing few Parties, including some small ones

› IEF CALCULATION APPROACH

› IEF calculated as ratio between total emissions and total relevant energy use (specific fuel cases)

1. Biomass only cases:

Consider that condensables may be included if $IEF >$ lower limit of Guidebook default Tier 1 EF for biomass (which includes condensables)

Review for countries where condensables may still be included despite (too) low IEF

2. Biomass & solid fuels: check country by country

For solid fuels combustion EFs in the Guidebook are significantly lower than biomass, it's not clear if condensables are included or not

Review on a country by country basis, since the situation may be different between fuels

3. Other cases: check country by country (only few)

WHAT DOES THIS MEAN?

› **Preliminary calculation** based on data for 2020 submitted in 2018 – to be reassessed based on 2019 emissions

NFR	ISO2	Relevant fuels	IEF (kg/TJ)	Condensables included based on IEF?	Check in IIR?
1A4bi	AT	Biomass only	88	no	
1A4bi	BE	Biomass only	498	yes	yes
1A4bi	BG	Biomass and solid	655	yes	yes
1A4bi	BY	Biomass only	645	yes	yes
1A4bi	CH	Biomass only	87	no	
1A4bi	CY	Biomass and liquid	19	unclear	yes?
1A4bi	CZ	Biomass and solid	249	unclear	yes?
1A4bi	DE	Biomass only	74	no	
1A4bi	DK	Biomass only	208	no	yes?
1A4bi	EE	Biomass only	137	no	
1A4bi	ES	Biomass only	481	yes	yes
1A4bi	FI	Biomass only	173	no	yes?
1A4bi	FR	Biomass only	215	no	
1A4bi	GB	Biomass and solid	423	yes	yes
1A4bi	GE	Biomass only	744	yes	yes
1A4bi	GR	Biomass only	672	yes	yes
1A4bi	HR	Biomass only	508	yes	yes
1A4bi	HU	Biomass only	581	yes	yes
1A4bi	IE	Biomass and solid	402	yes	yes

NFR	ISO2	Relevant fuels	IEF (kg/TJ)	Condensables included based on IEF?	Check in IIR?
1A4bi	IS	Liquid only	1	not relevant	
1A4bi	IT	Biomass only	353	no	yes?
1A4bi	LT	Biomass and solid	112	no	
1A4bi	LU	Biomass only	610	yes	yes
1A4bi	LV	Biomass only	551	yes	yes
1A4bi	MC	Liquid and gas	2	not relevant	
1A4bi	ME	Biomass only	740	yes	yes
1A4bi	MK	Biomass only	742	yes	yes
1A4bi	MT	Biomass only	894	yes	yes
1A4bi	NL	Biomass only	97	no	
1A4bi	NO	Biomass only	637	yes	yes
1A4bi	PL	Biomass and solid	147	unclear	yes?
1A4bi	PT	Biomass only	571	yes	Yes
1A4bi	RO	Biomass only	713	yes	Yes
1A4bi	RS	Biomass and solid	673	yes	Yes
1A4bi	RU	All fuels relevant	3	unclear	
1A4bi	SE	Biomass only	142	no	yes?
1A4bi	SI	Biomass only	429	yes	yes
1A4bi	SK	Biomass and solid	541	yes	yes

› **CROSS-CHECK WITH IIR**

- › The selected Parties are then cross-checked with the IIR by CEIP
 - › In cases where the IIR confirms that condensables are indeed included, the reported data are found to be fit-for-use
 - › In case this is not clear, reported data are not used
- › All of this will be done in the next 3-4 weeks. The result will be a list of Parties where small combustion emissions are confirmed to include condensables. In these cases, the (spatially distributed) reported data are included in the air quality assessments
 - › For other Parties, the same approach as last year will be used (replace with [updated] REF2)
- › This approach will be continued in the next years as necessary
 - › Hopefully increasing the share of reported data every year and becoming obsolete in a few years

› IMPROVEMENTS IN REPORTING

› Two key aspects:

- › Improvements in the numbers themselves (higher Tier, condensables)
- › Improvements in the documentation (IIR) for better understanding of inventories

› Key questions for IIR:

- › Are condensables included in the emission factors, how?
- › What are the activity data used and how have these been derived?
- › What is the split in appliance types (stoves/boilers, different stove types, traditional/modern)?
- › Which emission factors are used and how have these been derived?

› REF2 IMPROVEMENTS

- › Alternative REF2 set will remain important for years to come for the modelling application
 - › This version is consistent across Europe but also has its shortcomings
 - › Key uncertainty is the mix of appliance types in each country (& modern vs. traditional), which will be updated based on latest information from IIASA and specific discussions with some countries.

... but specific information for your country is always welcome!

- › Review of activity data
- › Review of emission factors
- › Version with condensables included, version with condensables excluded to illustrate the issue

› INVENTORY IMPROVEMENT

- › Further improvement of inventories is needed
 - › Move away from Tier 1 approach where this is still being used for key categories
 - › Clear description if and how condensables have been accounted for
 - › Clear description of how emissions have been calculated (basis for activity data and emission factors)
 - › Clarify how the condensables are calculated in the different countries (substantial different approaches?)

- › Continue to echo the recommendation to include condensables in the emission inventory for the small combustion sector

- › Work on improving the Guidebook
 - › Consistent emission factors incl. condensables (non-biomass solid fuels)
 - › Develop simple Tier 2 approaches (Tier 1.5) to allow all Parties to move away from a Tier 1 approach



› **THANK YOU FOR
YOUR TIME**

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