

Residential combustion – from emissions to air quality



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“Contribution of residential combustion to ambient air pollution...” (ETC/ACM report)

EU policies!



- **Renewable**
- **EU goal:** >20% net energy consumption in 2020= renewable
- **Climate-oriented** policies



ETC/ACM Technical Paper 2015/1
February 2016

Mar Viana, Andrés Alastuey, Xavier Querol, Cristina Guerreiro, Matthias Vogt, Augustin Colette, Serge Collet, Alexandre Albinet, Isaline Fraboulet, Jean-Marc Lacome, Frederic Tognet, Frank de Leeuw



 Section in EEA's 2016 Air Quality Report

The use of biomass, here mainly wood, as a residential fuel shows an increasing trend in Europe.

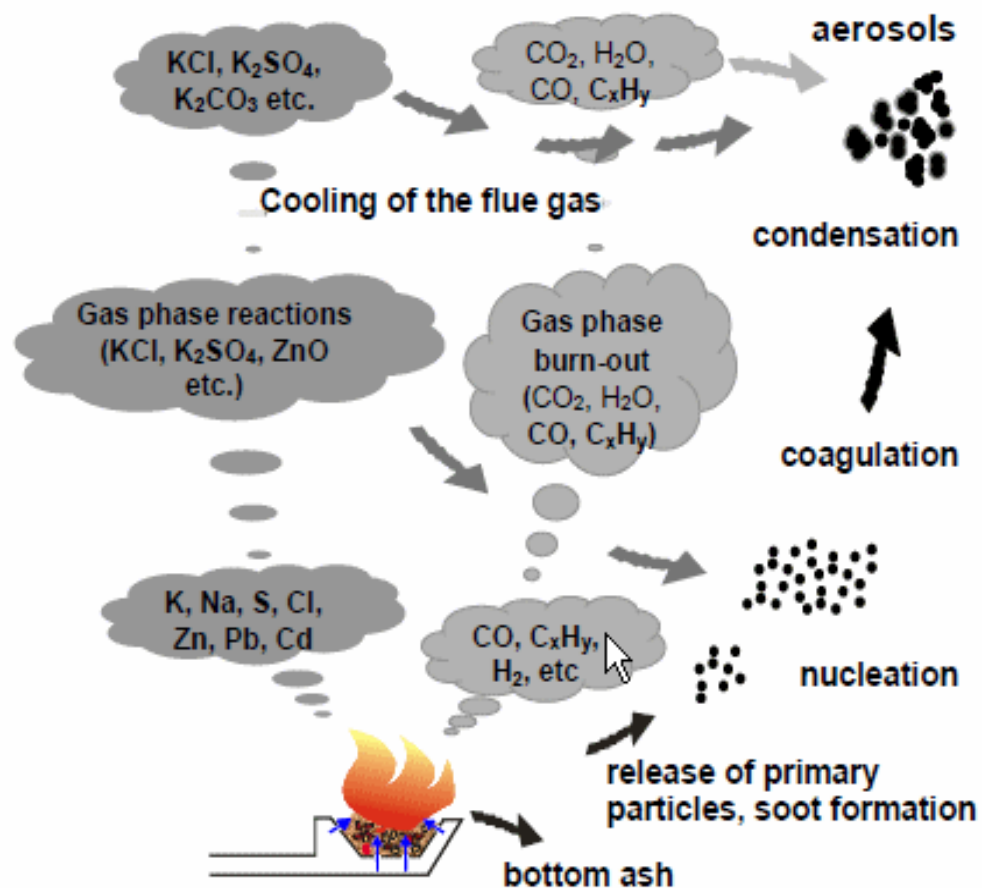
Main reasons for this development are:

- **Government incentives/subsidies;**
- **Rising costs of other energy sources;**
- **Increased public perception that it is a green option.**



Wood burning contributes significantly to air pollution

- particularly in certain areas of Europe.



Air pollutants !

- Hydrocarbons; carbon monoxide; elemental, organic and “black” carbon; particulate matter...
 - ✓ Primary particulate matter is formed at high temperature in the fireplace.
 - ✓ Secondary particulate matter is formed in the plume of smoke or in the atmosphere.

Burning of wood pollutes the air “where we breathe” and puts human health on risk.

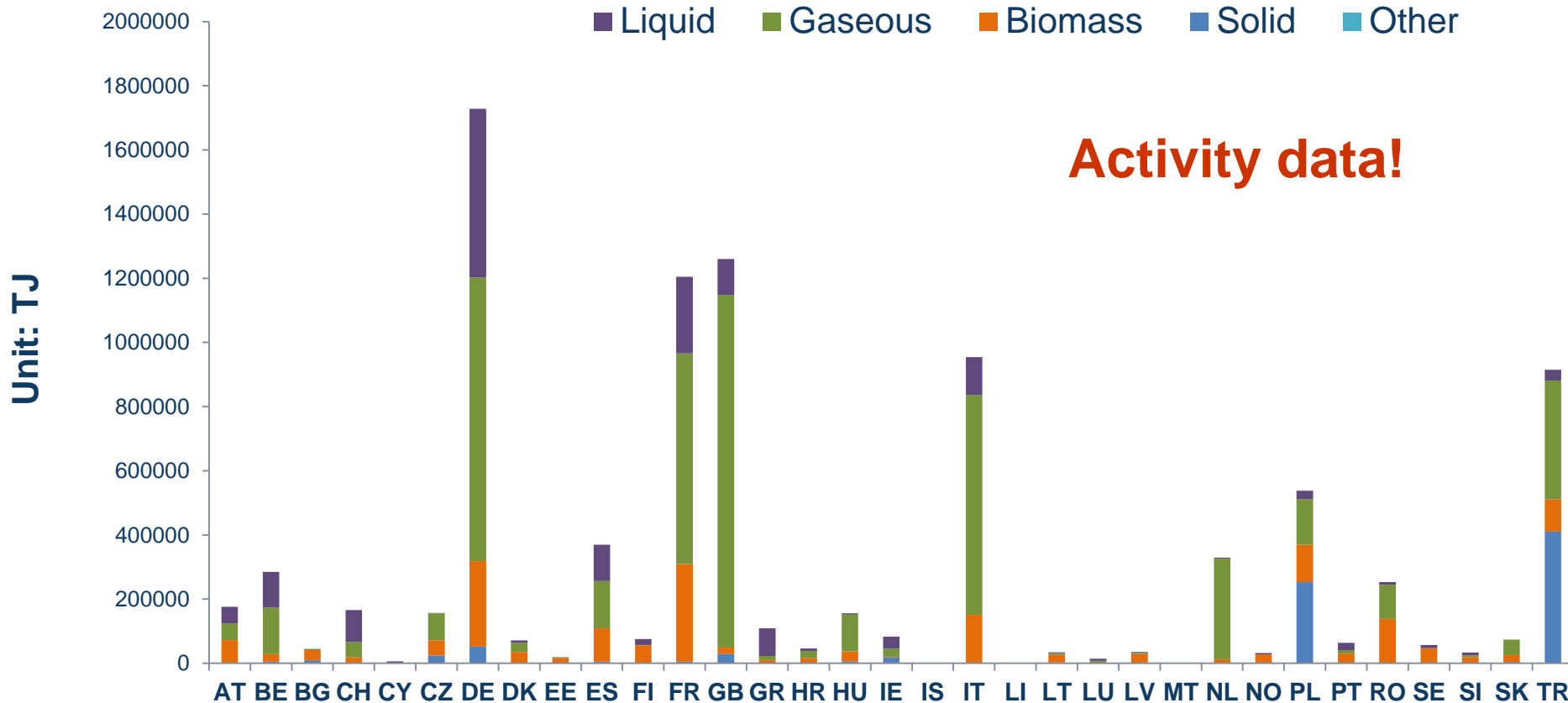


- Emissions take place at low height, often at locations where air convection is restricted (e.g. in mountain valleys).
- Air pollutant levels can be very high during winter and (night-time) inversions or short air stagnation events.
- The emissions make therefore a relatively large contribution to air pollutant concentrations at ground level where people are exposed.

Links between fuel consumption in the residential sector and air pollutant emissions due to wood burning.

Fuel consumption per fuel type in 2012

- residential sector -



IPCC (2006):

- solid fuels (coal, coal briquettes),
- gaseous fuels (natural gas),
- **biomass (wood/wood waste, charcoal, other primary solid biomass),**
- liquid fuels (gasoline or diesel oil).

Source:
EEA, GHG database

In some countries wood burning in homes plays a bigger role than in others.

Fuel consumption per fuel type in 2012

■ Biomass
 ■ Gaseous
 ■ Solid
 ■ Liquid
 ■ Other

Activity data!

Fuel marked in the EEA-33 in 2012 (residential sector):

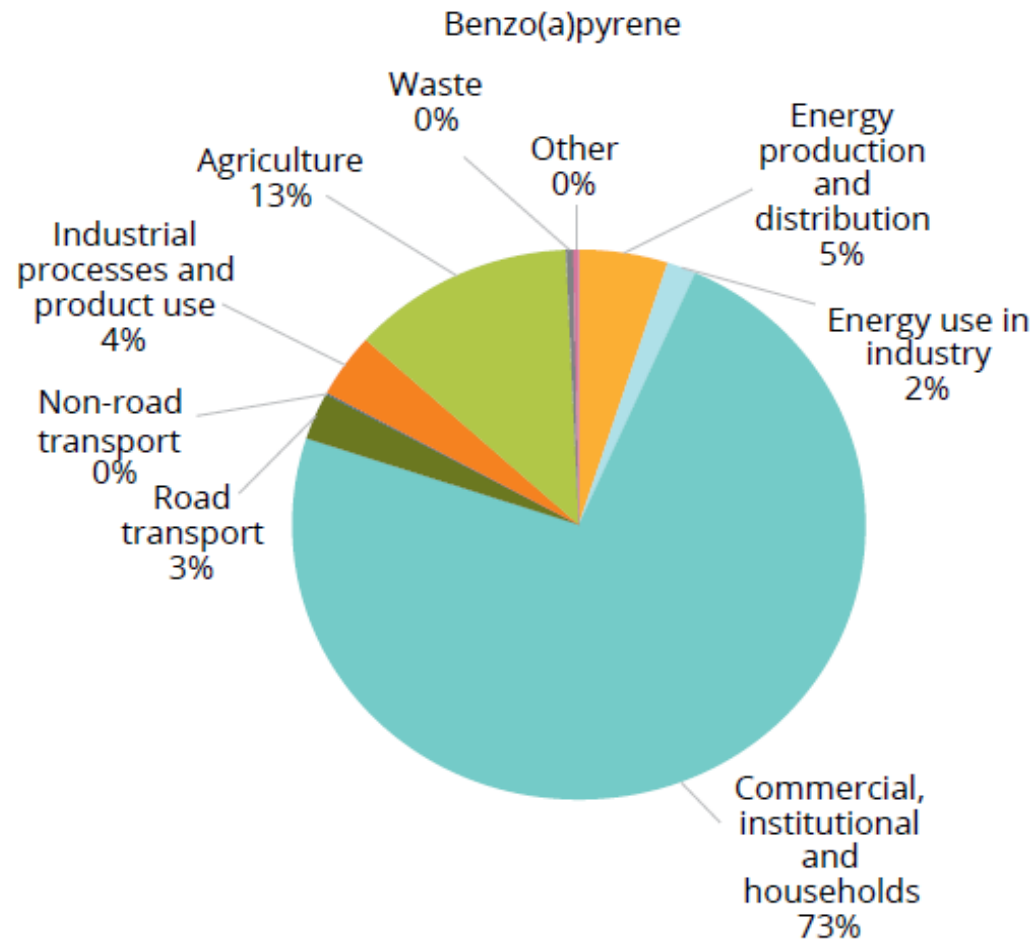
Gaseous fuels → 34%

Biomass → 33%

Source:
EEA, GHG database



Residential combustion contributes to more than 70 % of the total BaP emissions (residential sector).



Source: EEA, LRTAP EU-28 inventory report 2015 (year 2013)

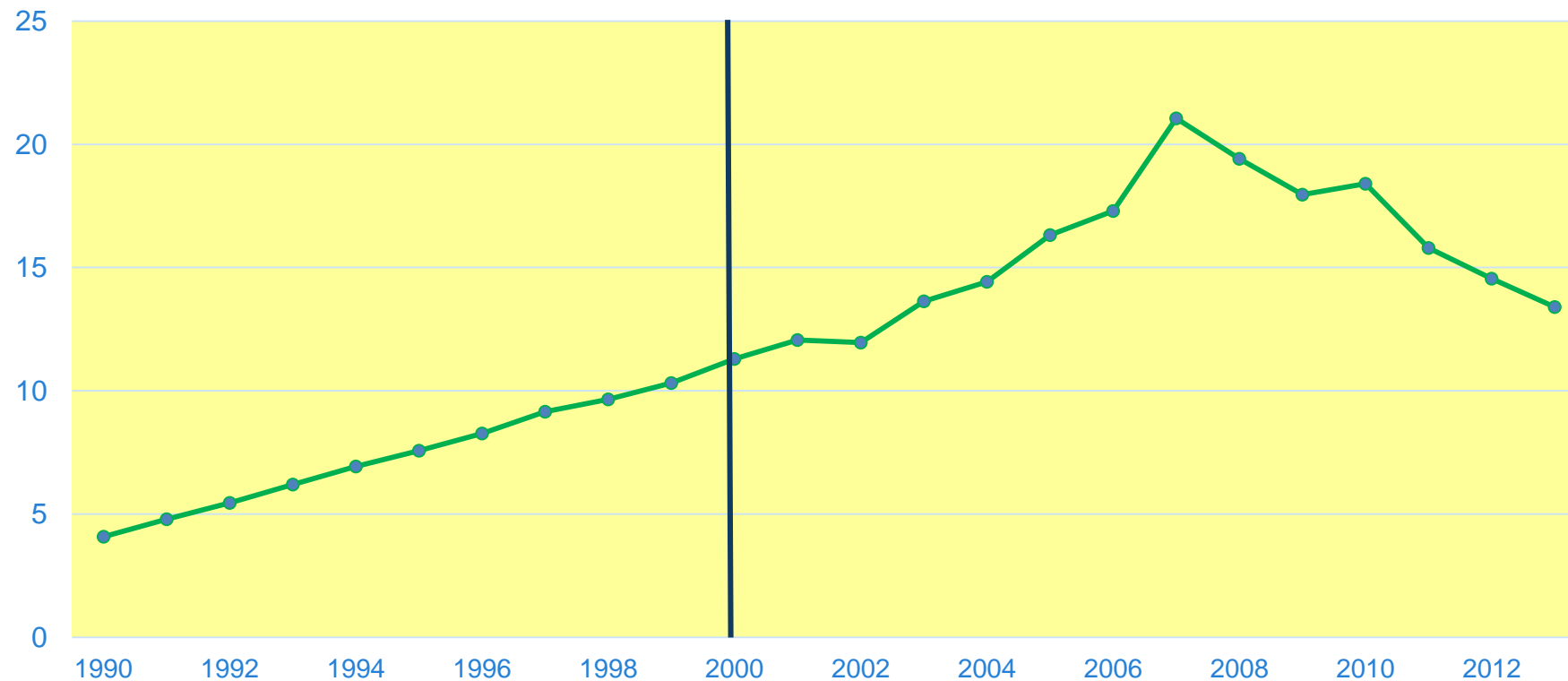
PM_{2.5}
58% households
13% road transport

PM_{2.5} emissions over time, example (1)

Gg

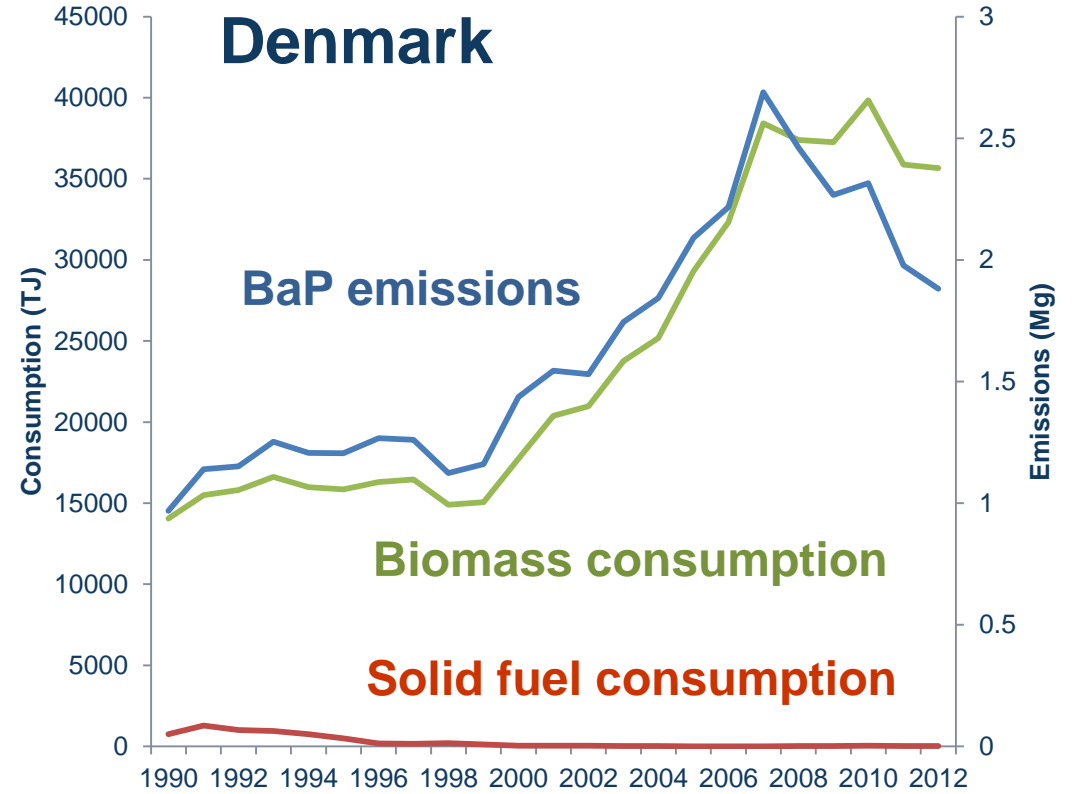
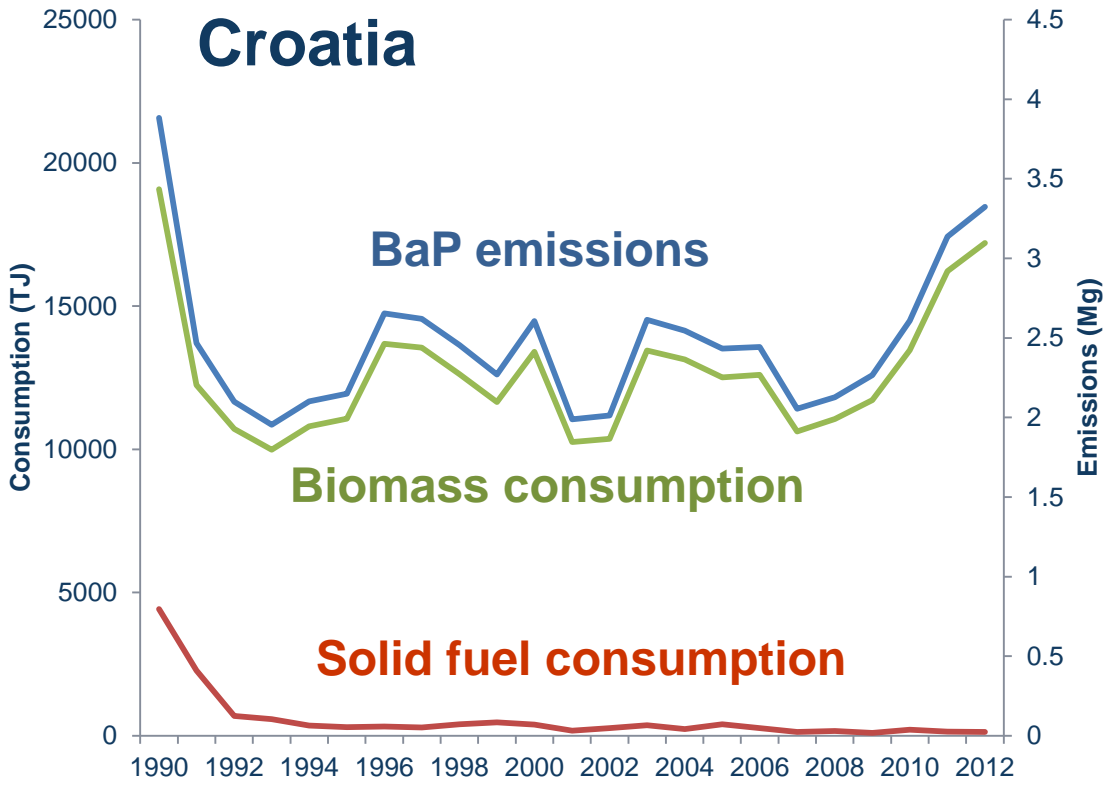
Denmark

1A4bi Residential: Stationary



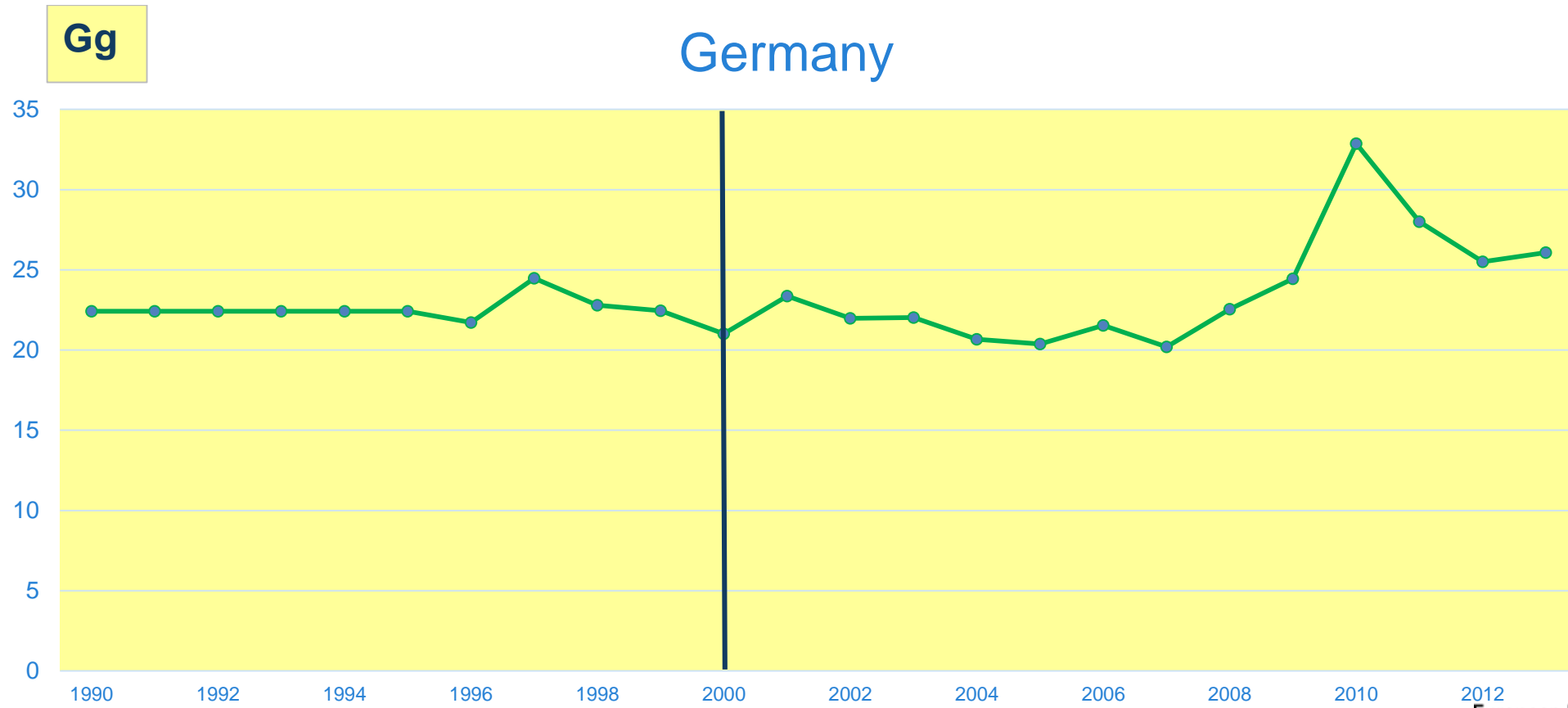
There are examples where an increasing trend in biomass consumption is reflected in air pollutant emissions.

- Residential sector -

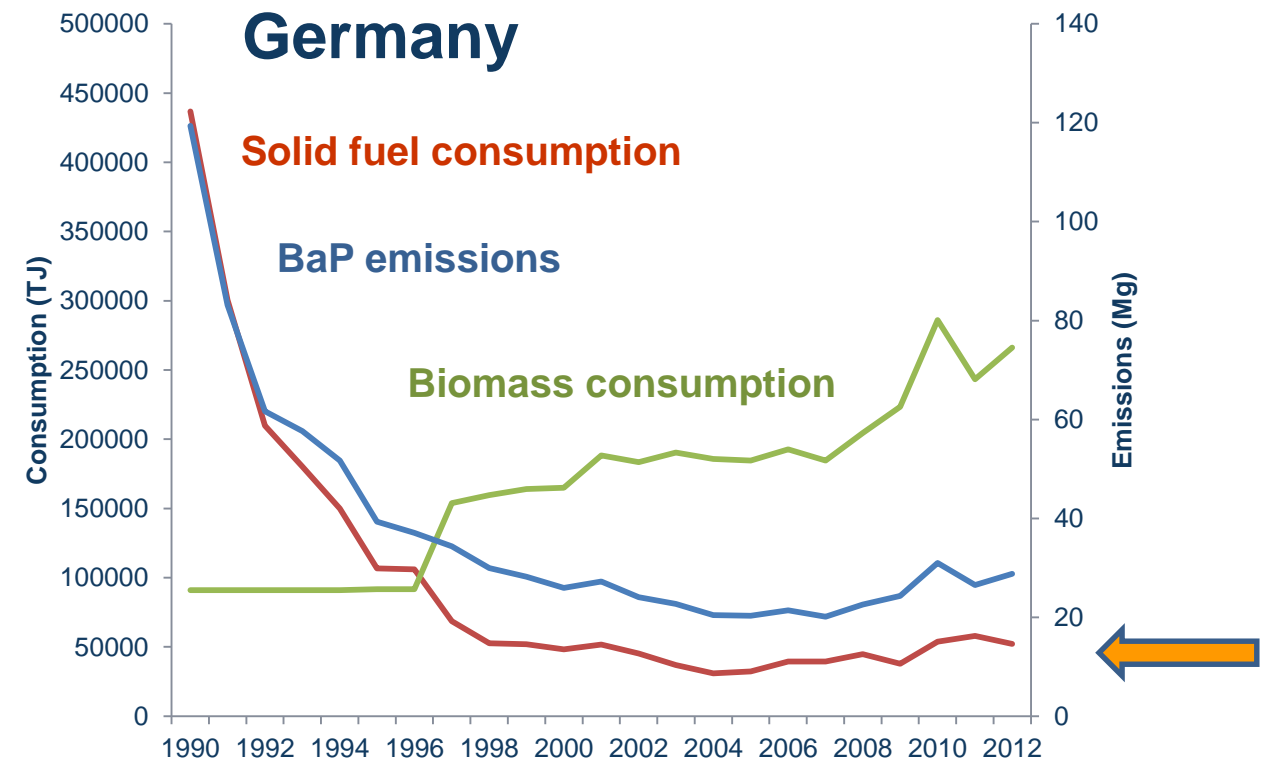
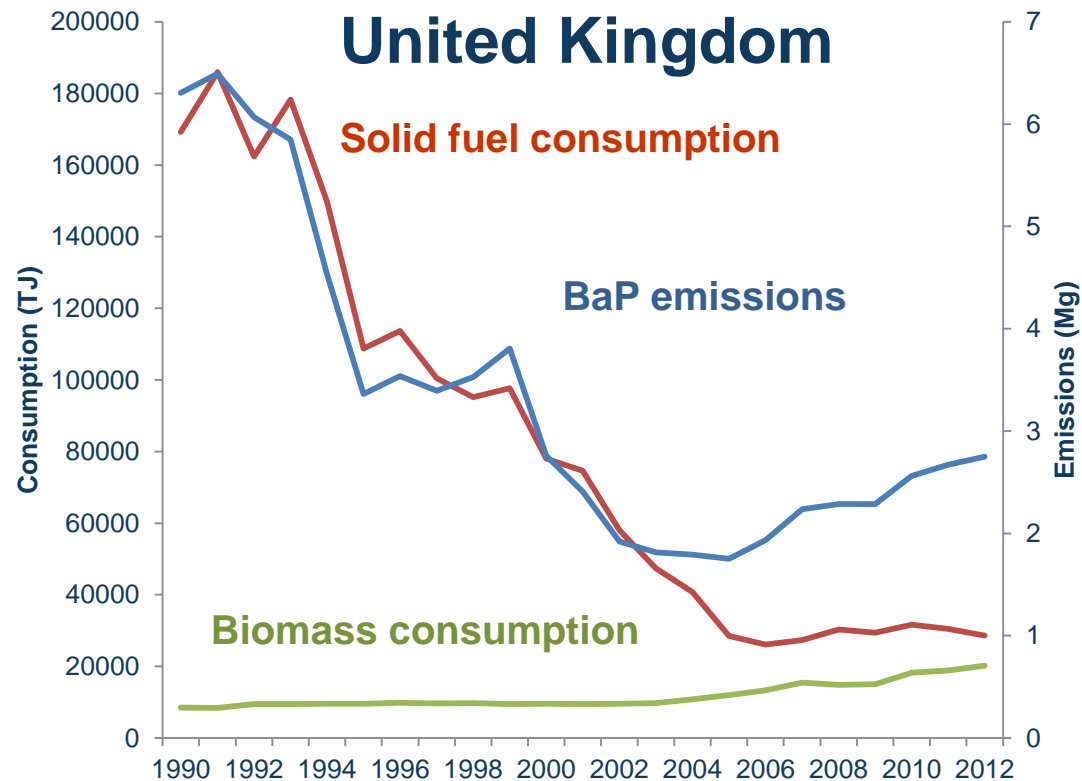


PM_{2.5} emissions over time, example (2)

1A4bi Residential: Stationary



In general for the EU-28 (residential sector): Coal consumption in the residential sector is decreasing.

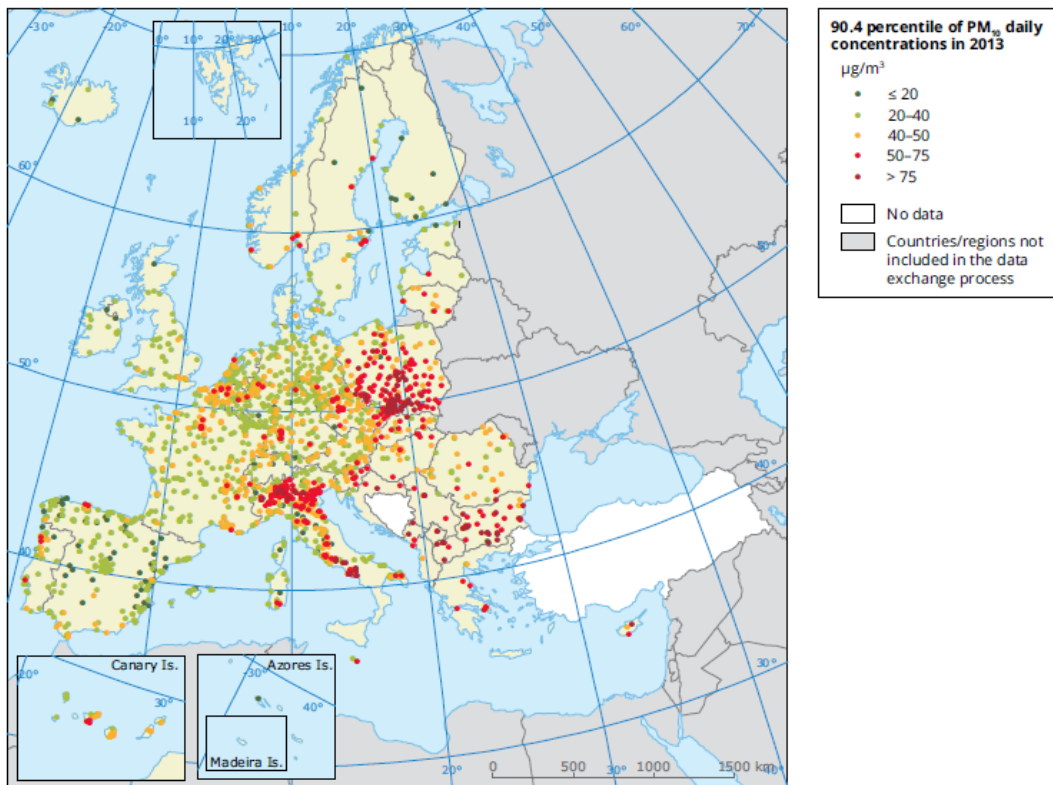


Source:
EEA, GHG database

Links between AirBase measurement results and the contribution of residential combustion to air pollution.

PM₁₀ levels at AirBase measurement stations - 2013

Map 3.1 Concentrations of PM₁₀ in 2013



Notes: The map shows the 90.4 percentile of the data records in one year, representing the 36th highest value in a complete series. It is related to the PM₁₀ daily limit value, allowing 35 exceedances over 1 year of the 50 µg/m³ threshold. The red and dark-red dots indicate stations with exceedances of this daily limit value. Only stations with > 75% of valid data have been included in the map.

Source: Based on Air Quality e-reporting database (EEA, 2015a).

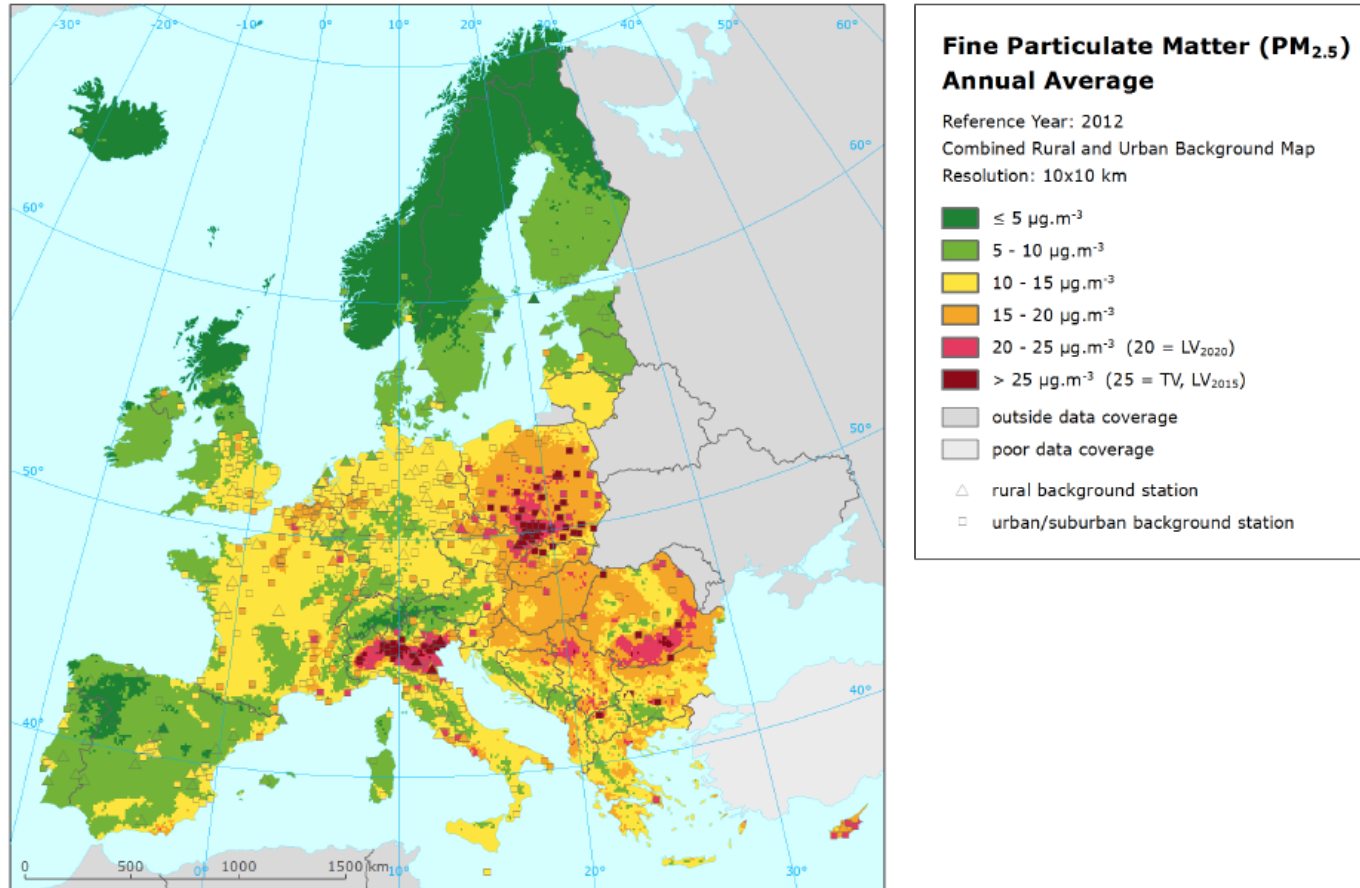
AirBase measurement data show that we have issues with high particulate matter levels, particularly in some parts of Europe.

→ **Exceedance of daily limit values set in EU AQ Directive (50 µg/m³)**

17th joint EIONET and TFEIP meeting, Zagreb (Croatia), 17-18 May 2016



Interpolated AirBase measurement data for PM_{2.5} - 2012

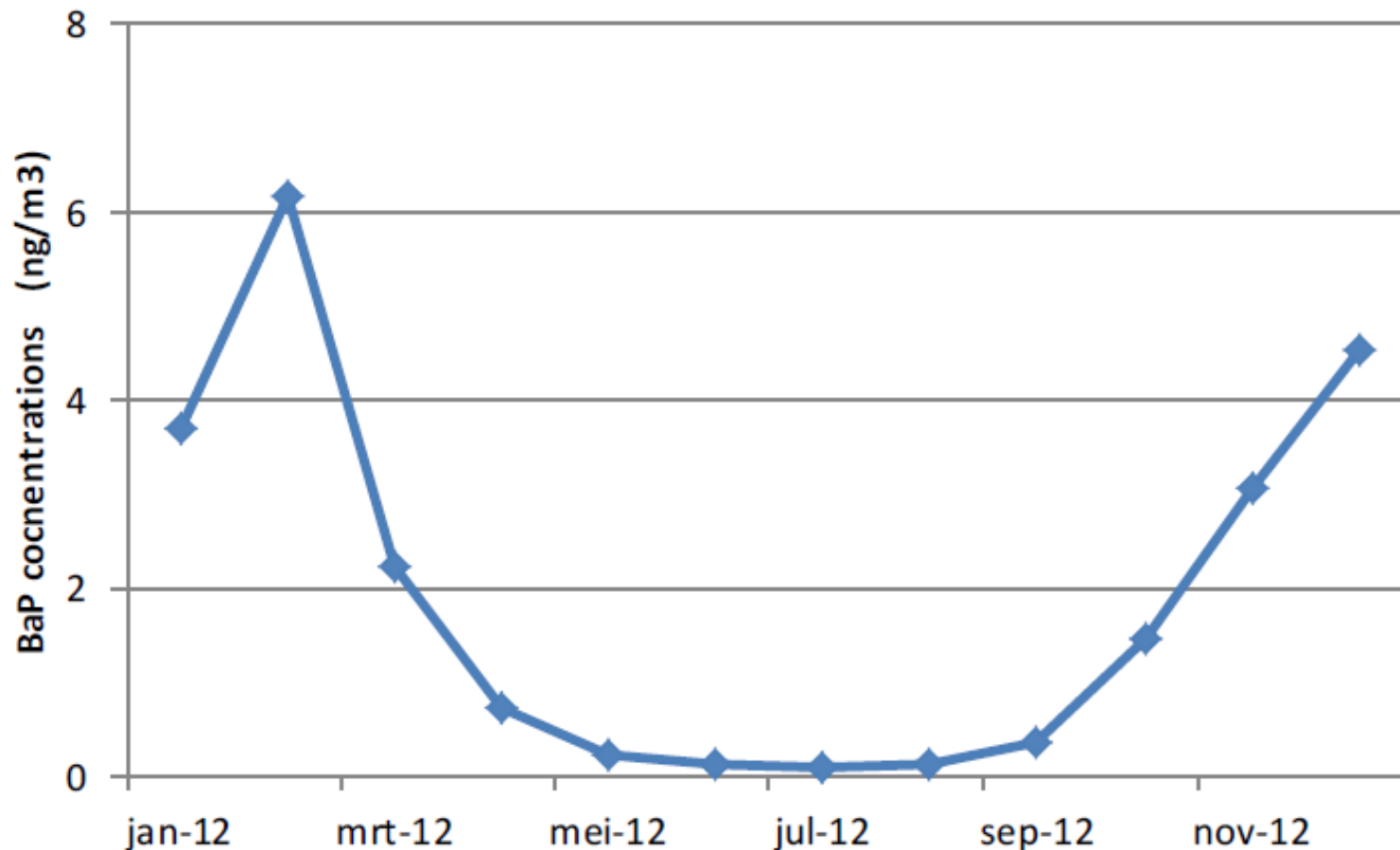


AirBase measurement data show that we have issues with high *fine* particulate matter levels...

Annual limit value of 25 µg/m³ to be met in 2015.

Underestimation!

Monthly variations of BaP (in ng/m³) - 2013



We do not have enough AirBase stations showing seasonal developments for the whole of Europe (usually annual means are reported).

Where we have results, we see high BaP concentrations during the winter heating season.

Averaged for all operational stations for which monthly data is available in AirBase, period 2013.

Umwelt Bundesamt

Das UBA Themen Presse Publikationen Daten

Themen > Gesundheit > Umwelteinflüsse auf den Menschen > Besondere Belastungssituationen > Emissionen aus Kleinfeuerungsanlagen in Wohngebieten

Emissionen aus Kleinfeuerungsanlagen in Wohngebieten



Die Luft kann besonders im Winter mit Feinstaub aus Kaminen und Öfen verunreinigt werden.
Quelle: Grzegorz Polak / Fotolia.com

Der Qualm aus Schornsteinen kann zu Geruchsbelästigung in der Nachbarschaft führen und gesundheitsschädlich sein.

09.02.2016 ★ 32 mal als hilfreich bewertet

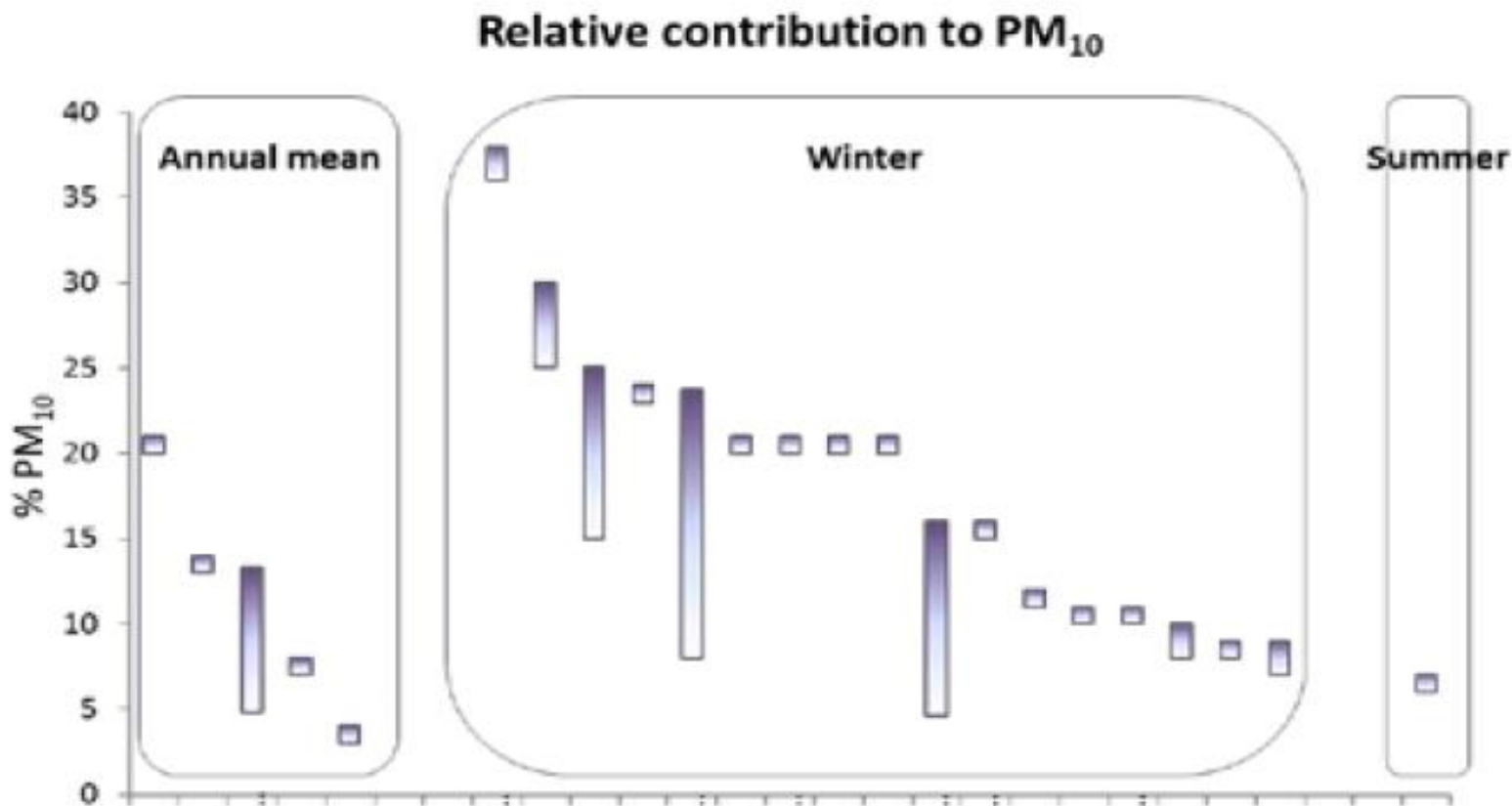
Einsatz von Kleinfeuerungsanlagen in Wohngebieten
Für viele Menschen ist es aus unterschiedlichen Gründen wieder attraktiv geworden, Öfen

Links
Themenseite Feinstaub

Publikationen

Source-apportionment studies to prove/quantify that there is a link between wood burning in homes and high air pollutant levels.

Contributions from residential sector emissions to ambient air quality... (1)

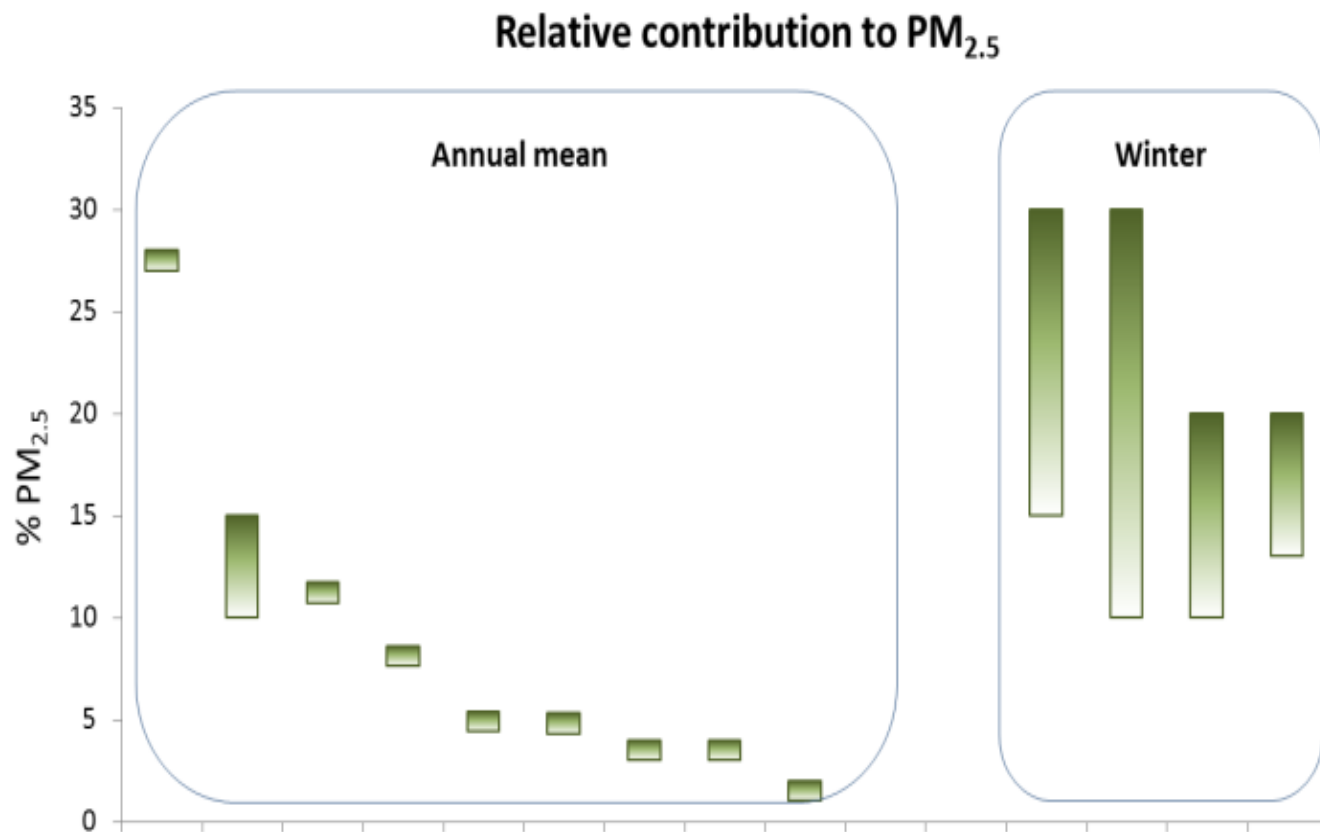


Contribution is <5% to 40% of PM₁₀ and PM_{2.5} during the heating season.

Source: ETC/ACM, 2015

Review of source apportionment studies

Contributions from residential sector emissions to ambient air quality... (2)



Contribution is <5% to 40% of PM₁₀ and PM_{2.5} during the heating season.

Source: ETC/ACM, 2015

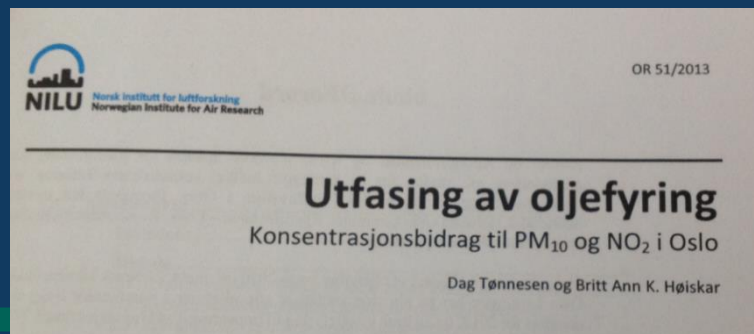
Review of source apportionment studies



NOVELLIERUNG DER VERORDNUNG ÜBER KLEINE UND MITTLERE FEUERUNGSANLAGEN

Neue Regelungen für Kaminöfen und Holzheizkessel

Mitigation of air pollutant emissions from wood burning in the residential sector.



Burning of wood in historic stoves is “dirty”.



- The use of old, non-regulated stoves
- The inadequate maintenance or handling of stoves and firewood
- The use of non-standardised fuels which hinder an efficient combustion or the use of polluted fuels

Burning of wood in modern stoves can be relatively “clean”.



Modern wood-burning stoves with a high efficiency and low emissions of (carbon containing) PM are becoming more and more available on the market.

Such stoves are rather expensive.

However, local emissions can also be mitigated by initiatives that use subsidies to replace old with modern stoves.

How can we mitigate emissions from wood burning stoves?



- Ecodesign Directive → Better stoves and boilers over the next decade (efficiency, emissions)
- Fuel quality → Promotion of wood pellet certification to ensure wood pellet quality
- National/regional/local level → Incentives to promote replacement of old stoves (for example)
- Local scale → e.g. guidance on how to use your stove; ban on solid fuel combustion in households (in certain areas)



Wood burning can be part of an environmentally sound mix. However, we have to evaluate/consider:

- ✓ If the use of wood burning stoves, also low emission stoves, is suitable for a certain (densely populated urban) area.
- ✓ Where the wood comes from and how it was harvested.
- ✓ Where the wood is burnt (modern/old small or bigger facilities).
- ✓ What kind of wood (logs, pellets) is burnt and how it is burnt.
- ✓ Who uses wood to warm his/her home and why people choose wood.
- ✓ What the draw backs might be if the use of wood burning stoves is encouraged (or banned).
- ✓ *Perception?*

Pros and cons of wood burning in residential homes, policy makers have to balance ...



- **Climate change issues**
- **Air pollution issues**
- **Social (inequality) issues**

'Residential combustion' and 'BaP' reports:

http://acm.eionet.europa.eu/reports/ETCACM_TP_2015_1_residential_combustion

http://acm.eionet.europa.eu/reports/ETCACM_TP_2014_6_BaP_HIA

Thank you!

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<http://www.eea.europa.eu/>