Small (residential) combustion in EDGAR: air pollutant emission estimation

Manjola Banja, Antoine Ebeling (trainee), EDGAR Group

Clean Air and Climate Unit, Joint Research Centre, Ispra, Italy

UNECE Task Force on Emission Inventories and Projections (TFEIP)

Combustion and Industry Panel, 14 May 2024

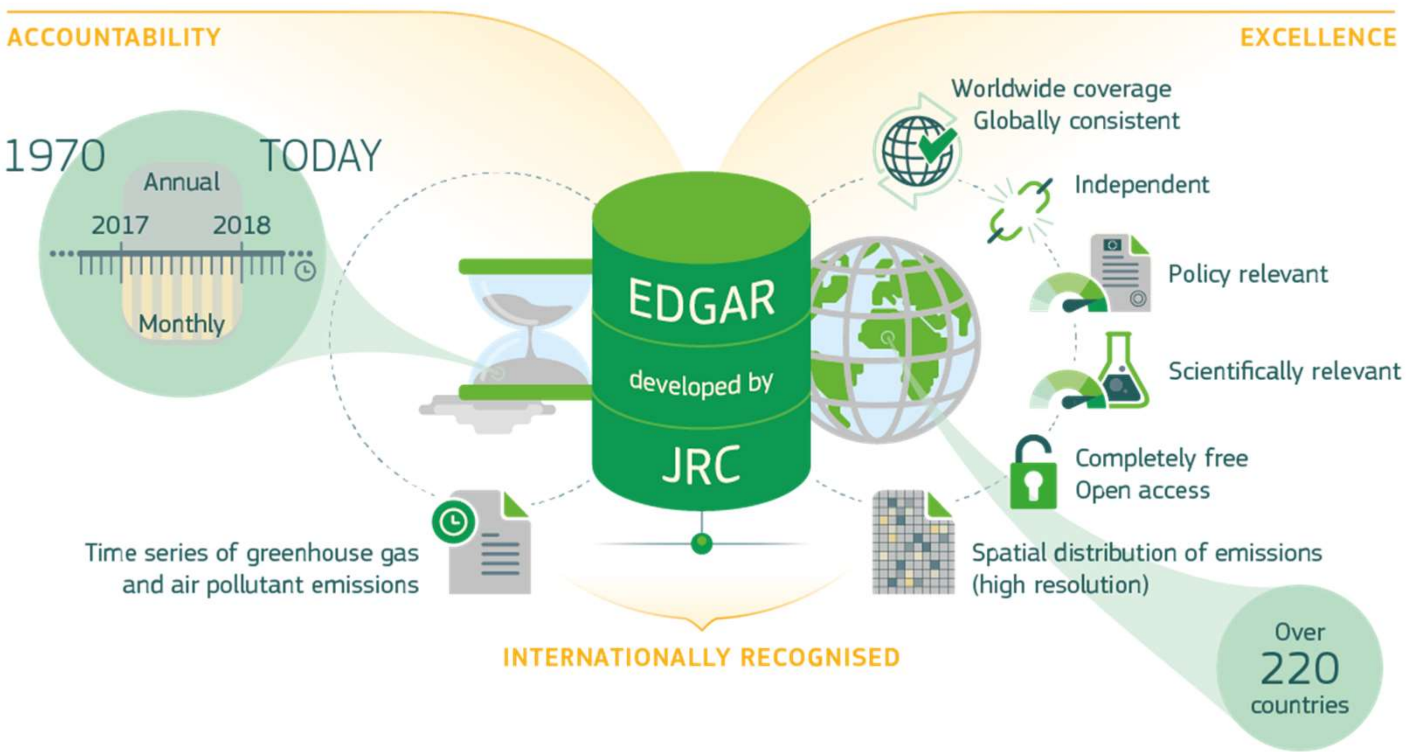
European Commission

Outline

- Emissions Database for Global Atmospheric Research (EDGAR)
- EU27 small combustion – short overview
- EU27 MS methodology overview
- EDGAR approach for small combustion sector
- EDGAR results for the EU27 residential sector
  - Emission factors & technology split
  - Comparison with official data
  - Role of fuels and technologies
- Key takeaways

European Commission

Emissions Database for Global Atmospheric Research (EDGAR)



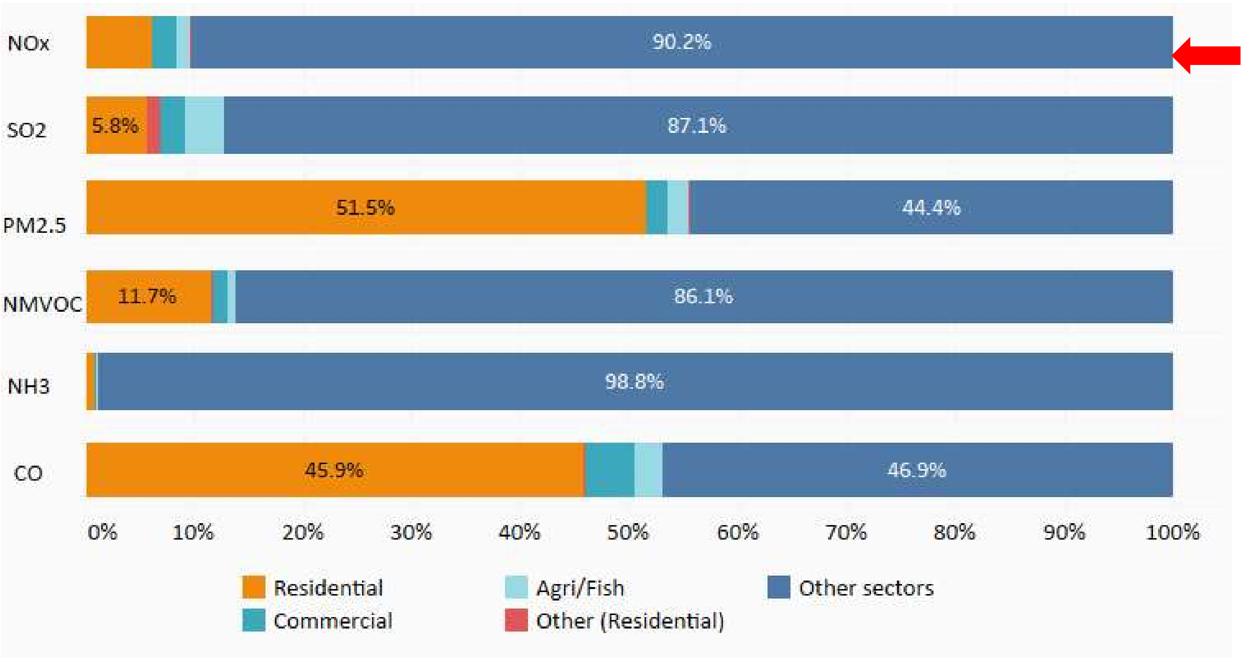
- Bottom-up inventory
- >50-year time series (t-1)
- 220 country
- IPCC & EMEP methodology
- GHG & Air Pollutant
- >95 subsectors
- >75 fuels
- >90 technologies
- Several abatement measures

EDGAR provides a global independent picture of emission estimates compared to what reported by countries with <u>scientific and policy relevant purposes.</u>

European Commission

EU27 small combustion – short overview

- Commercial and public services (IPCC 1A4a)
- Residential (IPCC 1A4b)
- Agriculture, forestry, fisheries and other sectors (IPCC 1A4c and 1A5)



Contribution of sectors to the air pollutant emissions in EU27, 2022

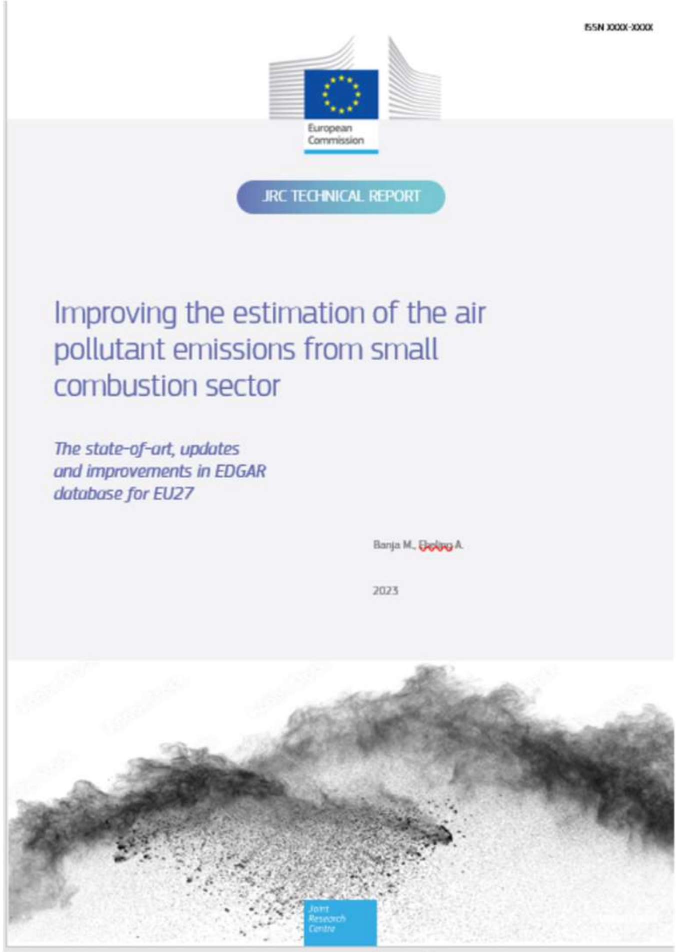
Residential sector - important for particulate matter and CO emissions

More than half of PM2.5 EU27 emissions and 40% of PM10 EU27 emissions

Data source: EDGAR v.8.0, 2024

EU27 MS methodology for small combustion

Countries	Emission Factor	Technology split by fuel	Method
Austria	CS, D	Yes	Tier 2
Belgium	D, CS	Yes	Tier 2, Tier 1
Bulgaria	D	Yes	Tier 2
Croatia	D	Yes	Tier 1, Tier 2
Cyprus	D	No	Tier 1
Czechia	CS	Yes	Tier 2
Denmark	CS, D	Yes (only for wood)	Tier 1, Tier 2
Estonia	D, CS	No	Tier 1, Tier 2
Finland	CS	Yes	Tier 2, Tier 3
France	CS, D	No	Tier 1, Tier 2
Germany	CS	Yes	Tier 2, Tier 3
Greece	D, CS	No	Tier 2, Tier 1
Hungary	D	Yes	Tier 1 , Tier 2
Ireland	CS	Yes (only for residential)	Tier 2
Italy	CS, D	Yes	Tier 2
Latvia	D	No	Tier 1, Tier 2
Lithuania	D	No	Tier 2
Luxembourg	D, CS	Yes	Tier 1, Tier 2, Tier 3
Malta	D	No	Tier 1
Netherlands	CS, D	No	Tier 2
Poland	CS, D	Yes	Tier 1, Tier 2
Portugal	D	Yes	Tier 1, Tier 2
Romania	D	Yes	Tier 1, Tier 2
Slovakia	CS, D	Yes	Tier 2
Slovenia	D	Yes	Tier 2, Tier 1
Spain	D	Yes (only by technology)	Tier 1, Tier 2
Sweden	D, CS	No	Tier 2, Tier 3 (mobile)



European Commission

EDGAR approach for small combustion sector

Main objectives

- Improve EDGAR air pollutant emissions estimation with focus in residential sector supporting the implementation of Clean Air Legislation in Europe
- Build coherent technology structure for the EU27 residential subsector

Activity Data

Fuel (coal, oil, gas, biomass)
Technology
Country

IEA energy balances

Technology split

Fuel/Country

IIRs
GAINS model
Literature

Emission Factors

Fuel/Technology
Country

EMEP/EEA 2019
IIRs
Literature

Tier 2 method

NO_x, SO_2, PM2.5, PM10, NMVOC, NH_3, CO, BC

European Commission

EDGAR approach for small combustion sector (2)

Technology split and Emission Factors database

Identification of data sources (IIRs, other literature)	Extraction of data (Elaboration of "pdf" documents)	Data entries consistency evaluation	Creation of the database

Period 1990 - 2021

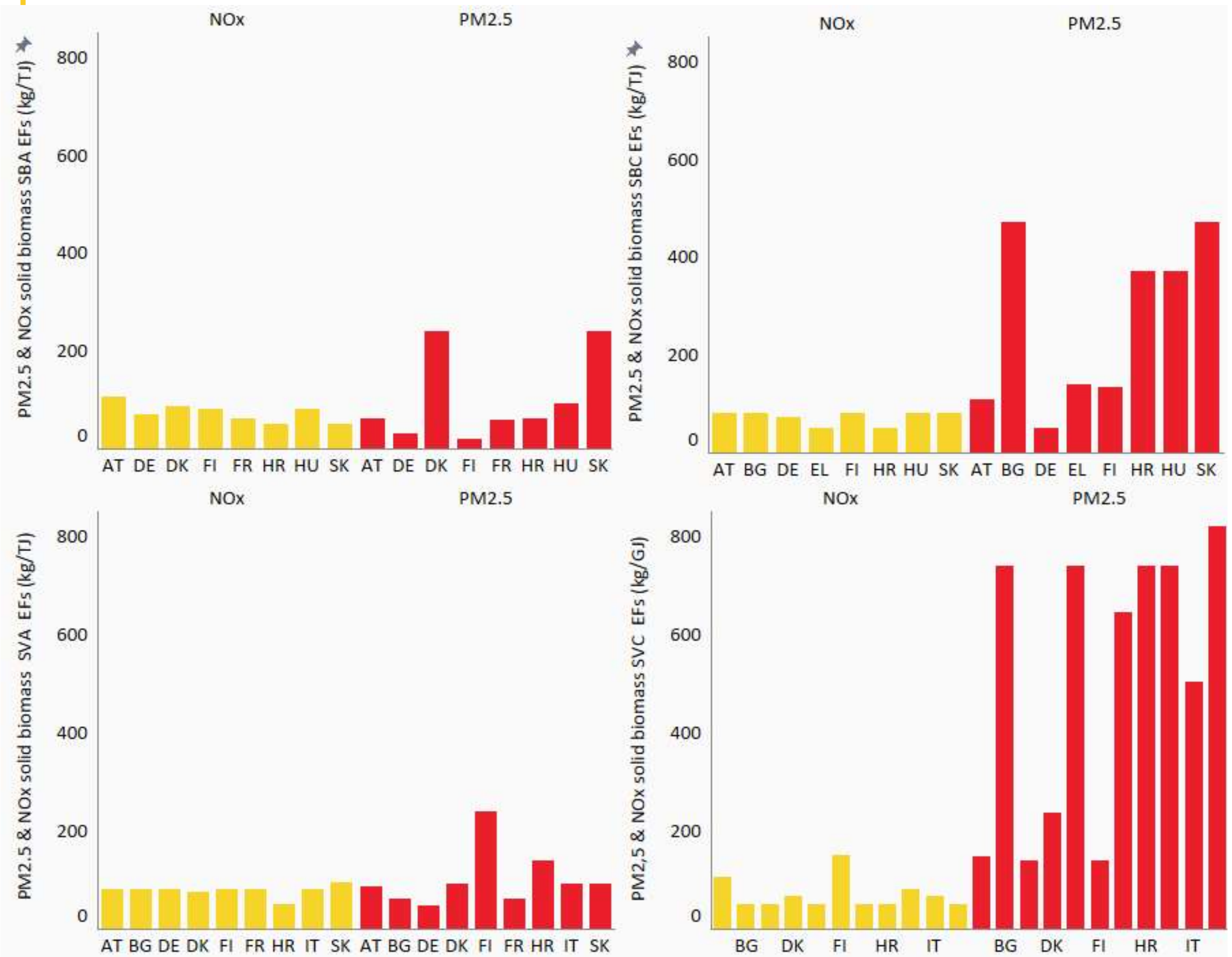
- Emission Factors (nearly 18000 entries)– 16 EU27 MS with country specific values or combination with default values
- Technology split (nearly 4000 entries) – 18 EU27 MS especially for woody biomass

European Commission

EDGAR results for the EU27 residential sector

Air pollutant emissions release expected mid-May 2024

NOx & PM2.5 EFs in the EU27 residential sector



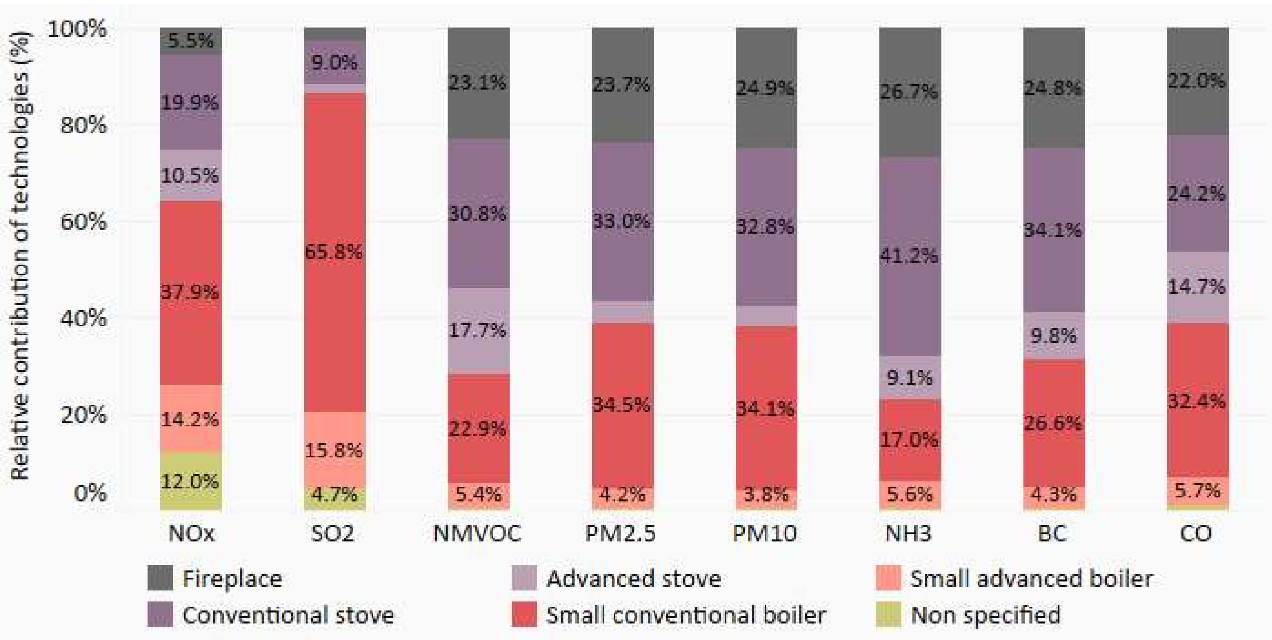
Example: Solid biomass

- Depending on emission control legislation in each MS and methodologies
- Large variations in the PM2.5 emission factor values by country and by technology
- Small advanced boilers – the lowest PM2.5 EFs values (Germany & Finland the lowest)

Source: EDGARv8.0

European Commission

Technology split – EU27 residential sector



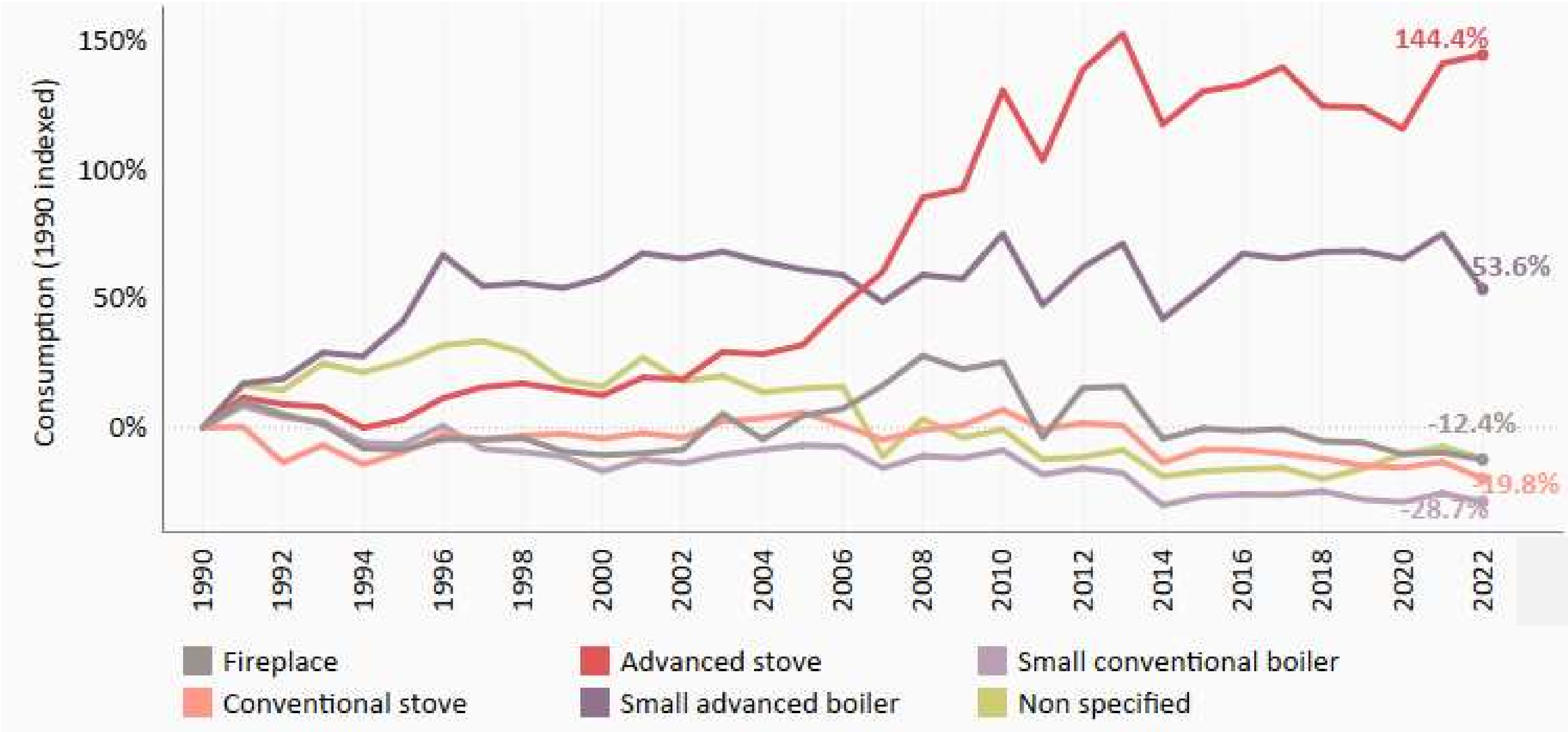
- Current structure of technologies for EU27 residential sector is still dominated by conventional technologies
- Non specified: mainly for oil
- Introduction of small advanced boilers and advanced stoves has taken place at a higher pace for solid biomass

Source: EDGARv8.0

European Commission

Technology split – EU27 residential sector (2)

Moving slowly towards advanced and more «clean» technologies
Advanced stoves largest increase after 2005



Source: EDGARv8.0

European Commission

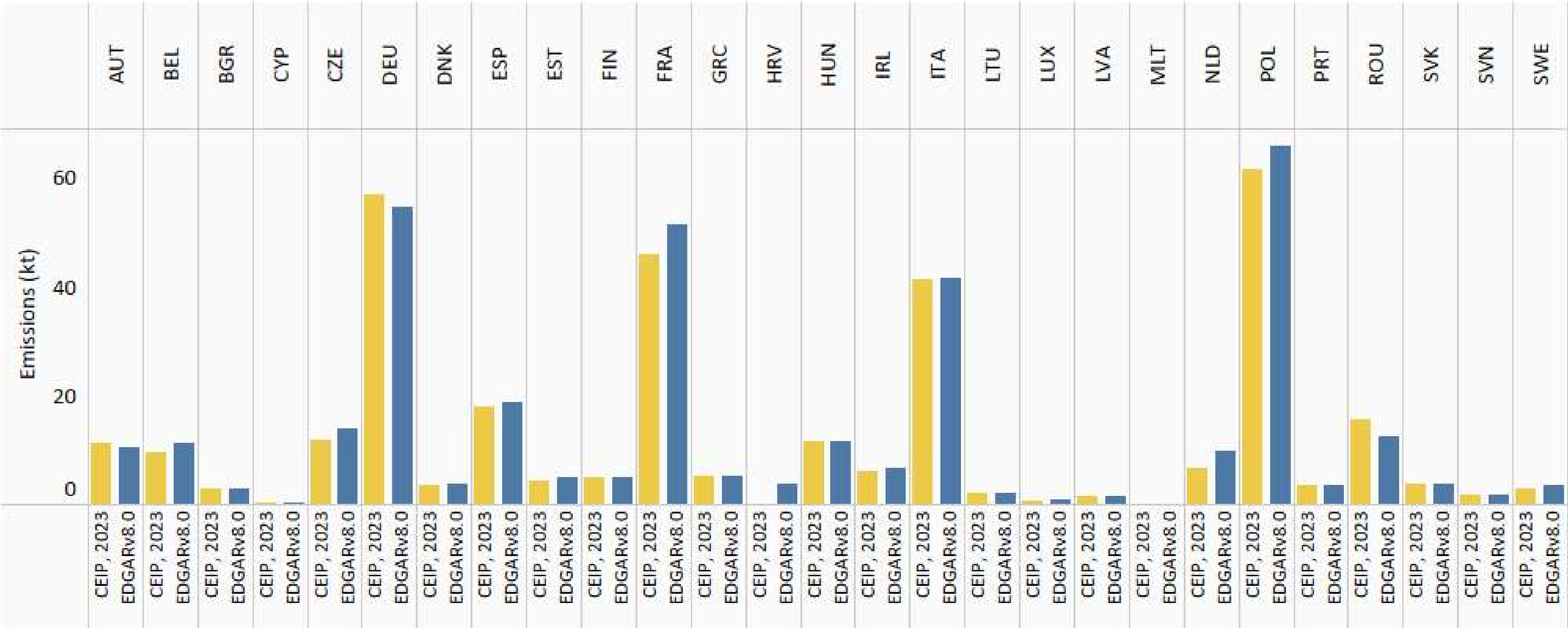
NOx emissions-comparison with official data (2021)

EDGARv6.1 was 31% higher

EDGARv8.0 is 5% higher

Fuel statistics reported to IEA might change from official statistics

Tendency to use EMEP/EEA Guidebook 2019 default emission factors

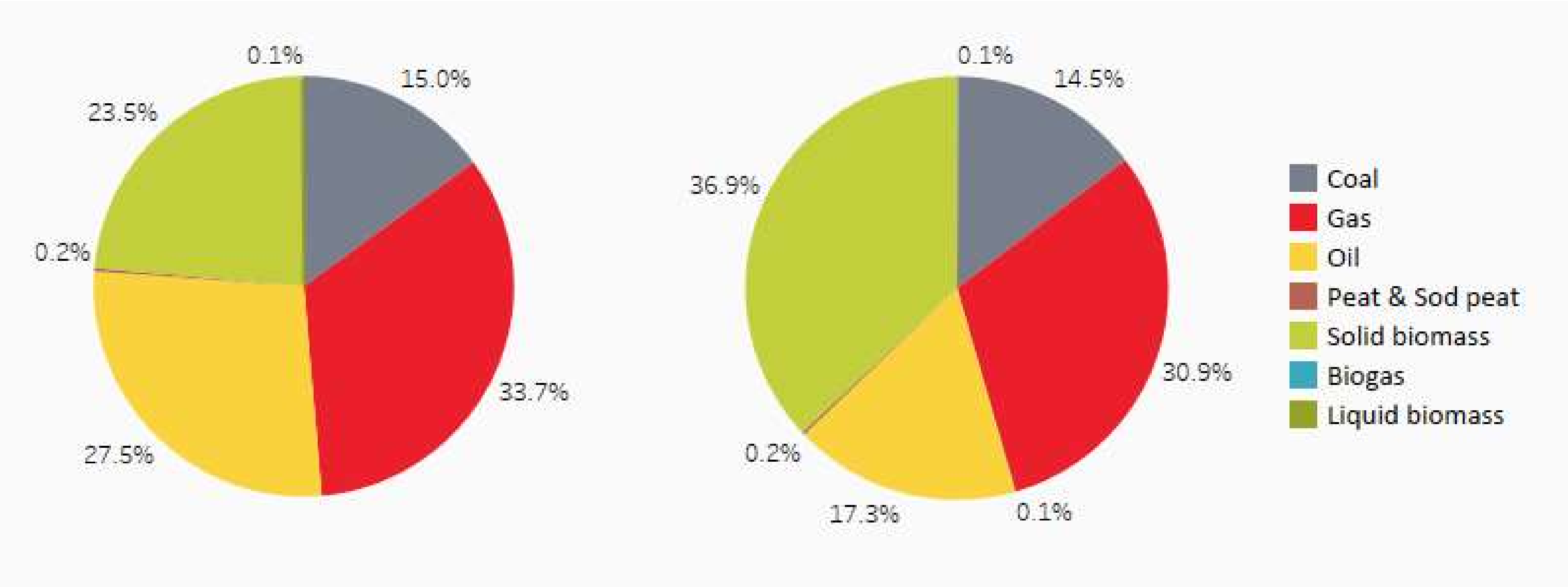


Source: EDGARv8.0 , CEIP 2023

European Commission

NOx emissions by fuel, 2005 (left)-2022 (right)

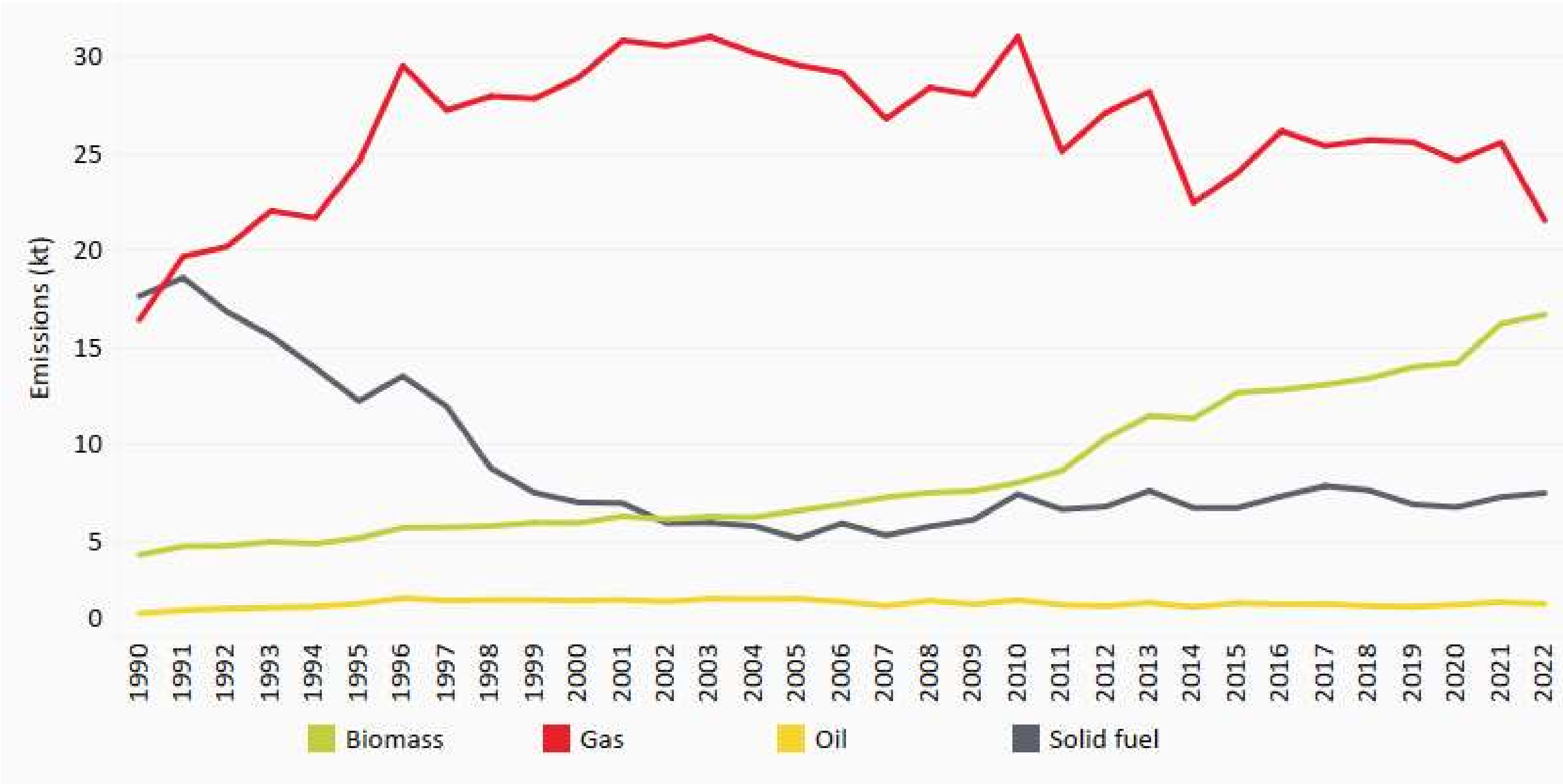
Shift mainly from oil to biomass



Source: EDGARv8.0

NOx emissions by fuel in small advanced boilers

- Strong variations in the fuel composition between MS
- Shift from coal to gas and solid biomass



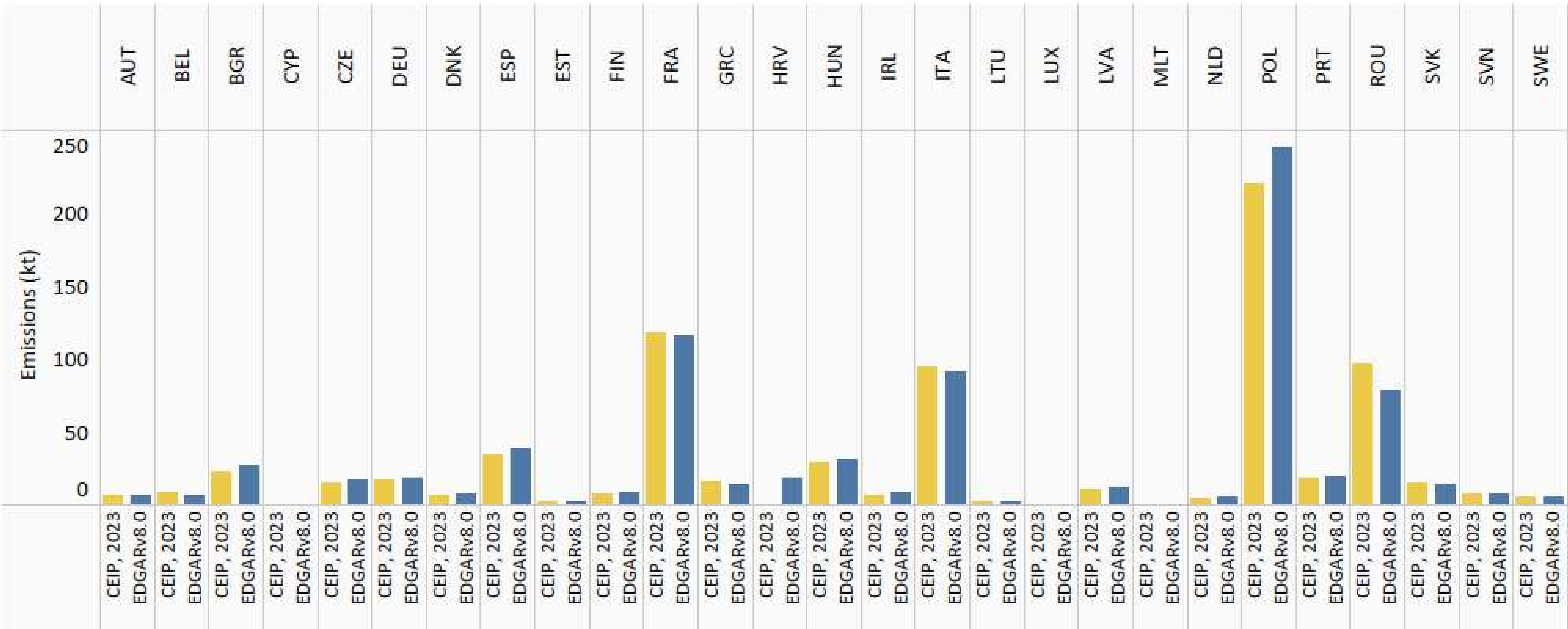
European Commission

PM2.5 emissions-comparison with official data (2021)

EDGARv6.1 was 35% lower

EDGARv8.0 is 4.5% higher

PM2.5 condensable important – mainly for biomass (only for 15 EU MS)
Tendency to use EMEP/EEA Guidebook 2019 default emission factors



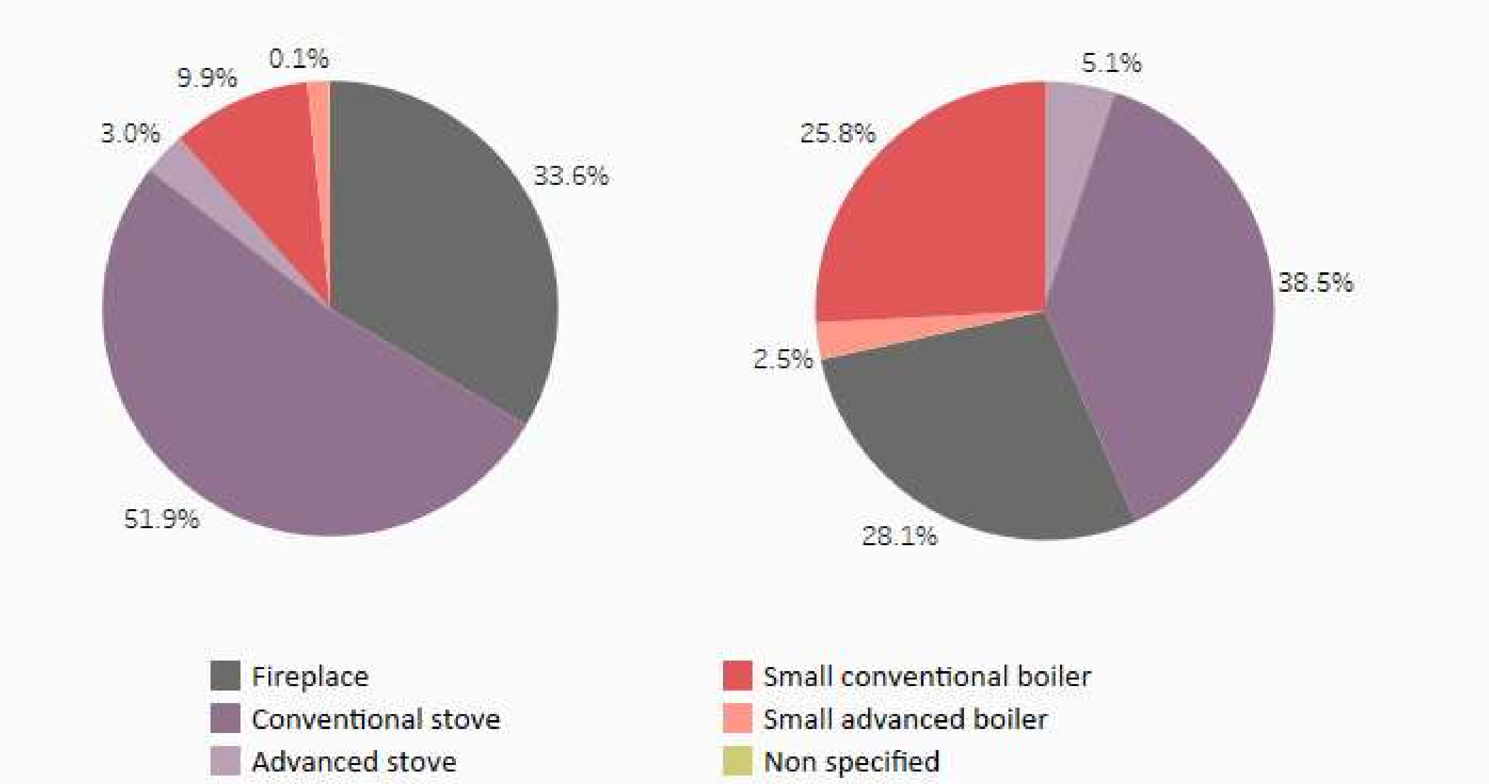
Source: EDGARv8.0 , CEIP 2023

European Commission

PM2.5 emissions by tech, 2005 (left) – 2022 (right)

Solid biomass

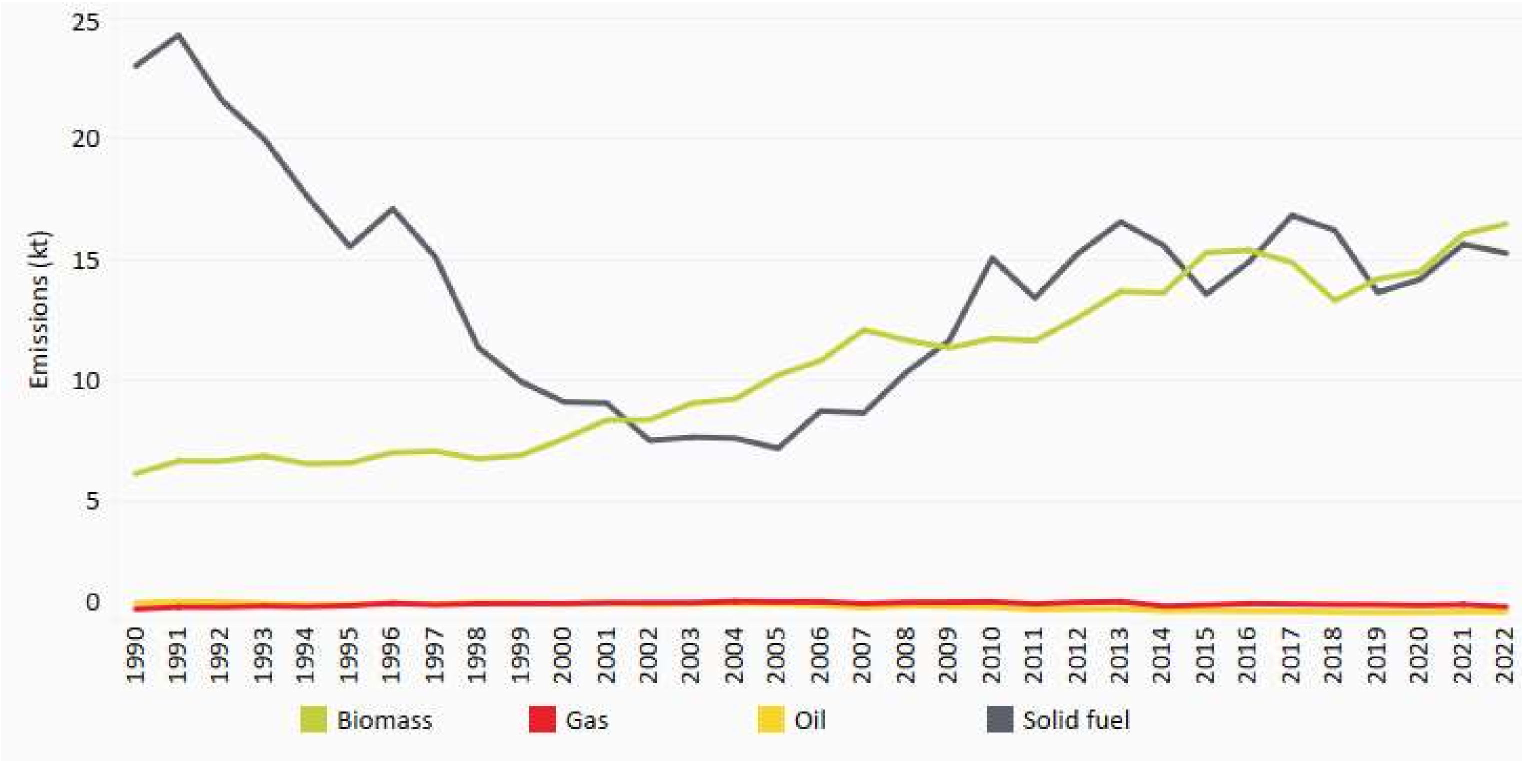
Shift from conventional stoves and fireplaces towards small boilers – both conventional and advanced



Source: EDGARv8.0

PM2.5 emissions by fuel in small advanced boilers

- Increase in the use of biomass
- Coal still dominant in Easter European countries (Poland)



Source: EDGARv8.0

Key takeaways – issues related to reporting

- Lack of a **unified template** of reporting on air pollutant emissions and methodology applied.

- No harmonization on how the emission factors / technology shares are reported (e.g variability in units of measurement : %of PM2.5, g/GJ, mg/MJ)

- Period of data coverage is different, not all countries report data since 1990

- In-depth comprehension of the methodology necessitates the search for additional documents, which may not always be translated.

- Unsystematic access to underlying databases

- 18 EU27 MS provides information about the technology split in small combustion sector

- 16 EU27 MS apply a country specific emission factor or a combination with default values

European Commission

Key takeaways (2)

- Residential sector remains important for particulate matter and CO emissions
- Broad range of technology types and fuels used in the EU27 residential sector
- Use of models as GAINS IIASA provide the possibility of gap filling
- Particulate matter emission factors for the inclusion or not of condensable fraction not available for all EU27 MS
- Biomass, gas and oil the main contributors in air pollutant emissions in the EU27 small combustion sector
- Coal still dominant is several Eastern European countries
- Residential sector still dominated from conventional technologies and moves slowly towards more “clean” technologies

Questions

Keep in touch

EU Science Hub
joint-research-centre.ec.europa.eu

@EU_ScienceHub

EU Science Hub – Joint Research Centre

EU Science, Research and Innovation

EU Science Hub

@eu_science

European Commission

Thank you

© European Union 2024

Unless otherwise noted the reuse of this presentation is authorised under the CC BY 4.0 license. For any use or reproduction of elements that are not owned by the EU, permission may need to be sought directly from the respective right holders.