Residential combustion air pollutant emissions in 2030: insights from NECPs and EU Green Deal scenarios

Manjola Banja, EDGAR group, JRC C7 H&C group
Joint Research Centre, Ispra, Italy

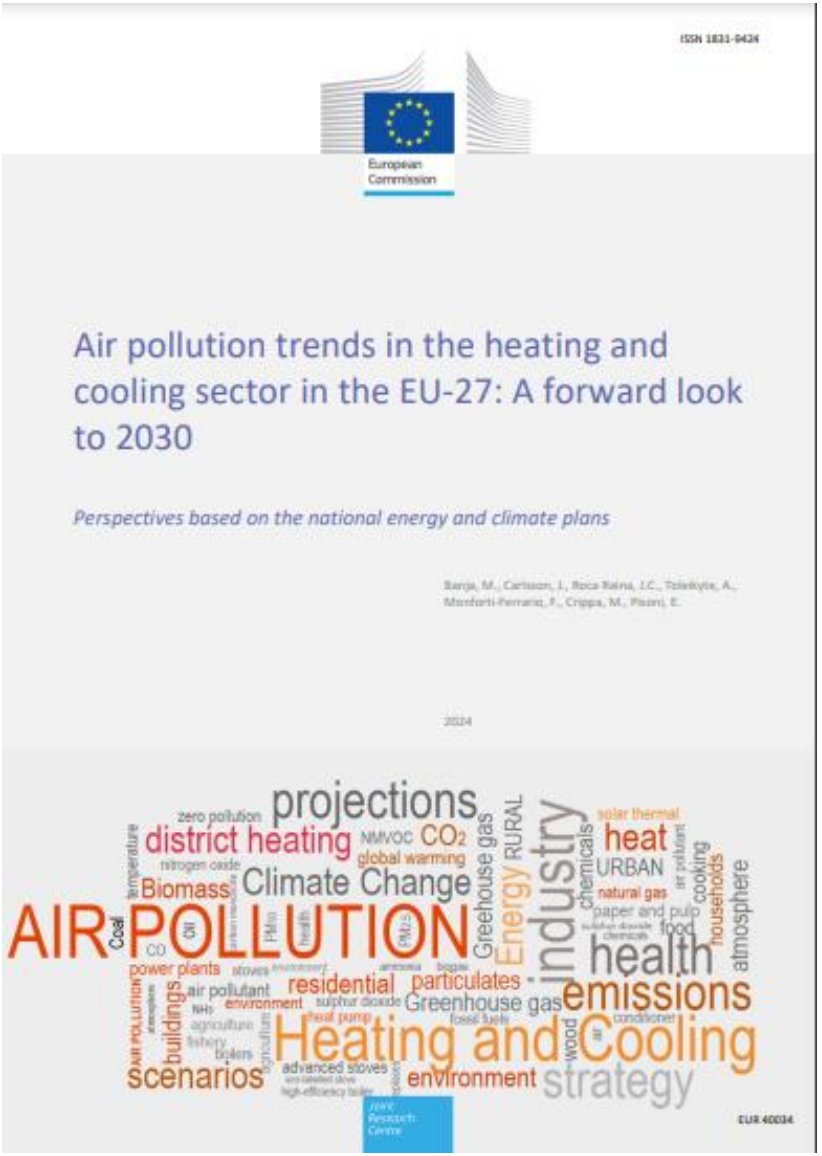
UNECE Task Force on Emission Inventories and Projections (TFEIP)
Combustion and Industry Expert Panel, 14 May 2025

Outline

- Links between energy and air pollution reporting
- EDGAR on residental air pollutant emissions
- Insights from the JRC 2024 report

“Air pollution trends in the heating and cooling sector in the EU27: A forward look to 2030 – Perspectives based on the National Energy and Climate Plans”

https://publications.jrc.ec.europa.eu/repository/handle/JRC138715



Links between energy and air pollution reporting

Commitments in emissions reduction

- UNFCCC/Paris agreement
- Convention of Long Range Transport (CLRTAP),
- Directive 2016/2284 (EU) – National Emissions reduction Commitments Directive (NECD)

National Energy and Climate Plans under the Governance Regulation (Green Deal)

Point 5.1.1 of the NECPs is aligned with the request for reporting referred to the emissions of air pollutants in accordance with NEC Directive (NECD)

The EU Green Deal for Heating & Cooling and air pollution

Renewable Energy Directive

New mandatory target: by 0.8 pp annually to 2025 and 1.1 pp from 2026 to 2030

EU Heating and Cooling Strategy

REPowerEU

Double rate of deployment of heat pumps until 2030

Energy Efficiency Directive

Reduction of FEC by at least 11.7% compared to 2030 projections

Energy Performance of Buildings Directive (revised)

EU ETS

Extending the EU ETS systems to buildings from 2027/2028

"Fit for 55" package scenarios

8th Environment action programme (EAP)

Climate Neutrality by 2050

Zero Pollution Ambition

Zero Pollution Action Plan

Reduce premature deaths by air pollution by 55% (likely by 66% in 2030)

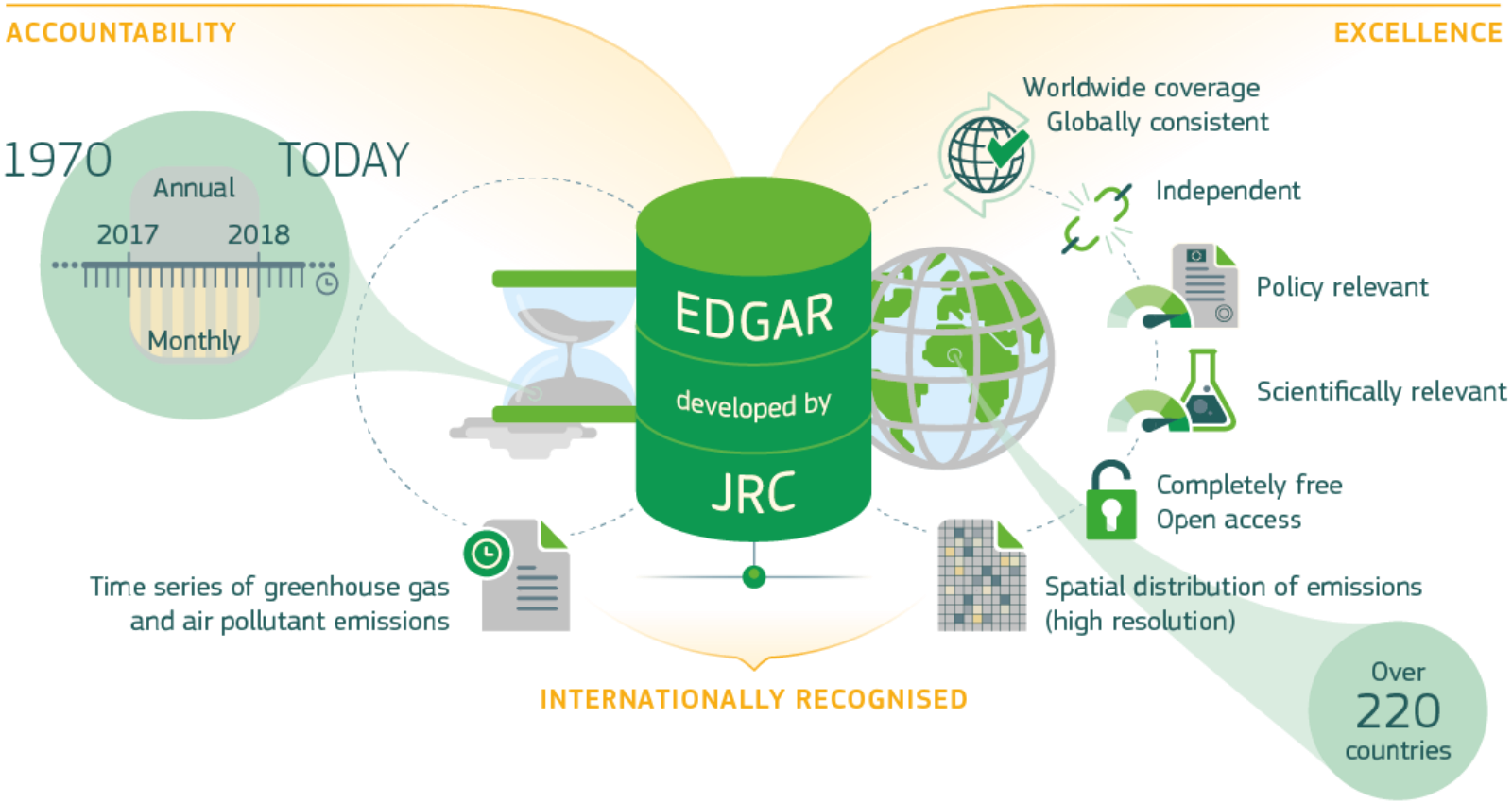
Reduce EU ecosystems threatened by air pollution by 25%

Industrial Emissions Directive (revised) (IED)

Ambient Air Quality Directive (revised) (AAQD)

New air quality limit values

The 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>

EDGAR approach for small (residential) combustion sector

Tier 2 method applied for NOx, SO2, PM2.5, PM10, NMVOC, NH3, CO, BC

Activity Data

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

IEA energy balances

Technology split

Fuel/Country

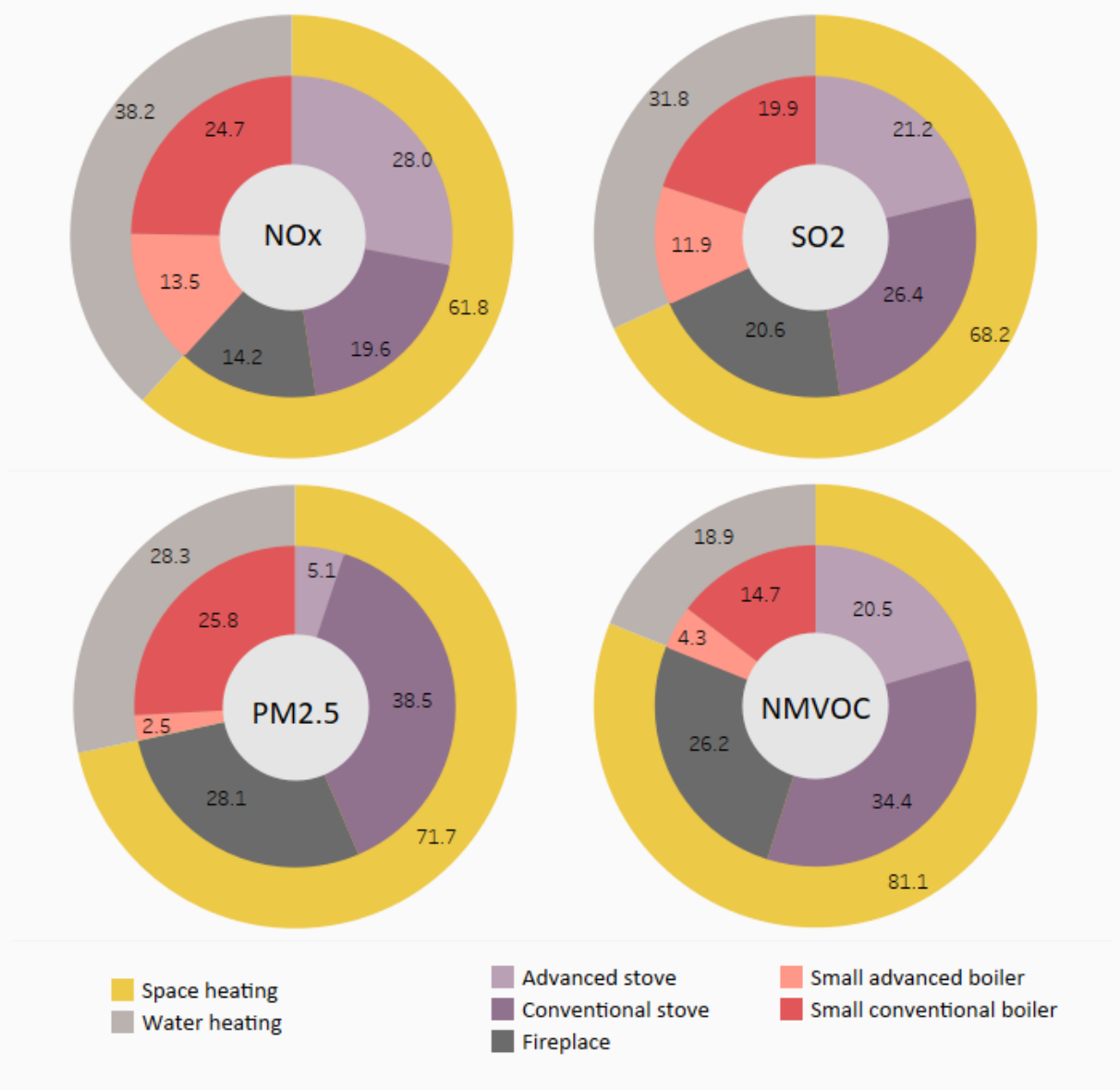
IIRs
GAINS model
Literature

Emission Factors

Fuel/Technology
Country

EMEP/EEA 2019
IIRs
Literature

EU27 residential air pollution by end-of-purpose and appliance type – solid biomass



Space heating main contributors especially for PM2.5 and PM10

Most of the biomass in the EU27 residential sector is still being used in traditional appliances

Source: EDGAR 2024

Forward look to 2030

NECD targets for 2030 with 2005 as reference year

SO2 (-79%), NOx (-63%), PM2.5 (-49%), NMVOC (-40%), NH3 (-19%)

Scenarios selected

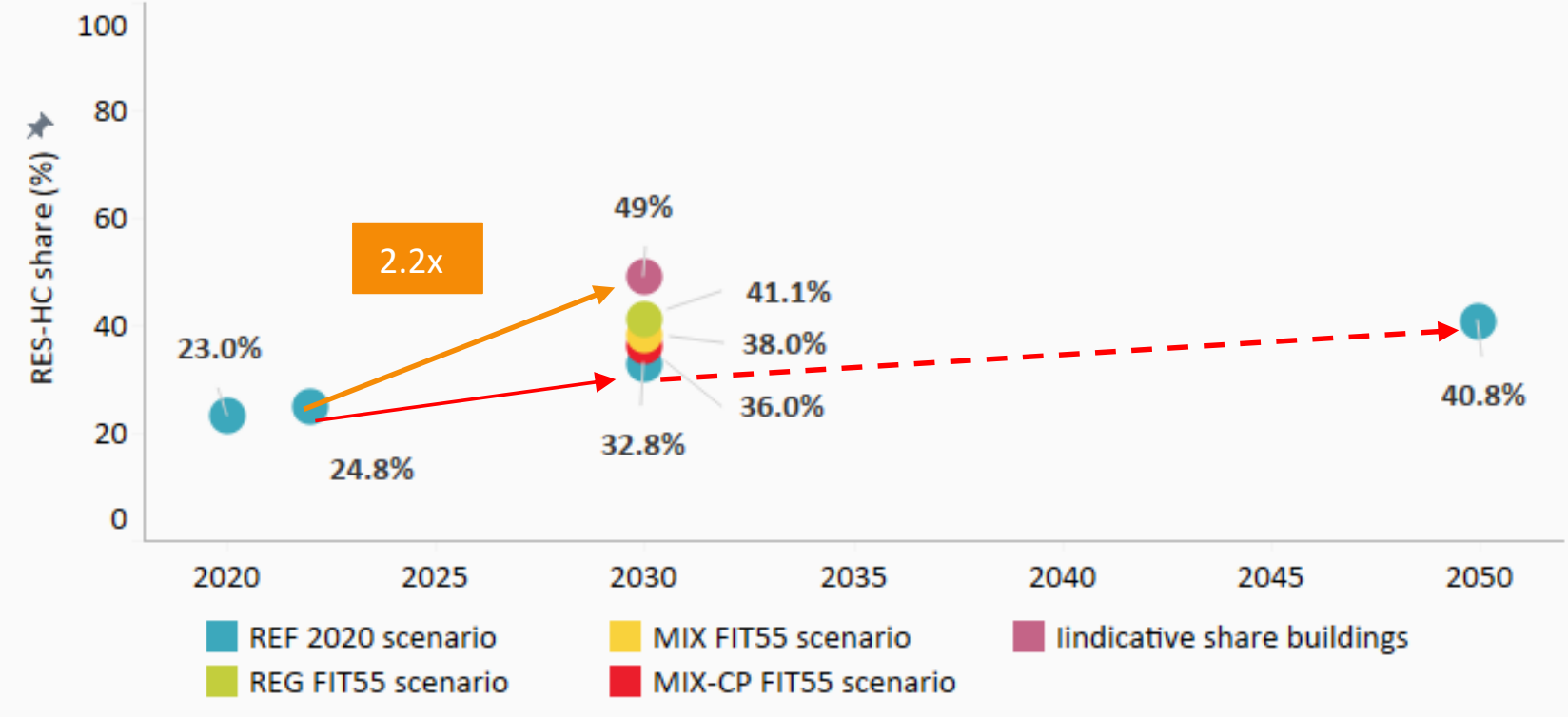
- MS projections under NECD — every 2 years
- Reference scenario 2020
- REG scenario
- MIX scenario — Delivering the Green Deal (“Fit for 55” scenarios)
- MIX CP scenario
- Clean Air Outlook 2 — GAINS (Baseline & MTFR)
- Clean Air Outlook 3 (only for internal evaluation)
- POLES JRC — 1.5 degree

Renewable energy in H&C - 2030

Acceleration needed to reach the 2030 shares as in REG, MIX and MIX CP

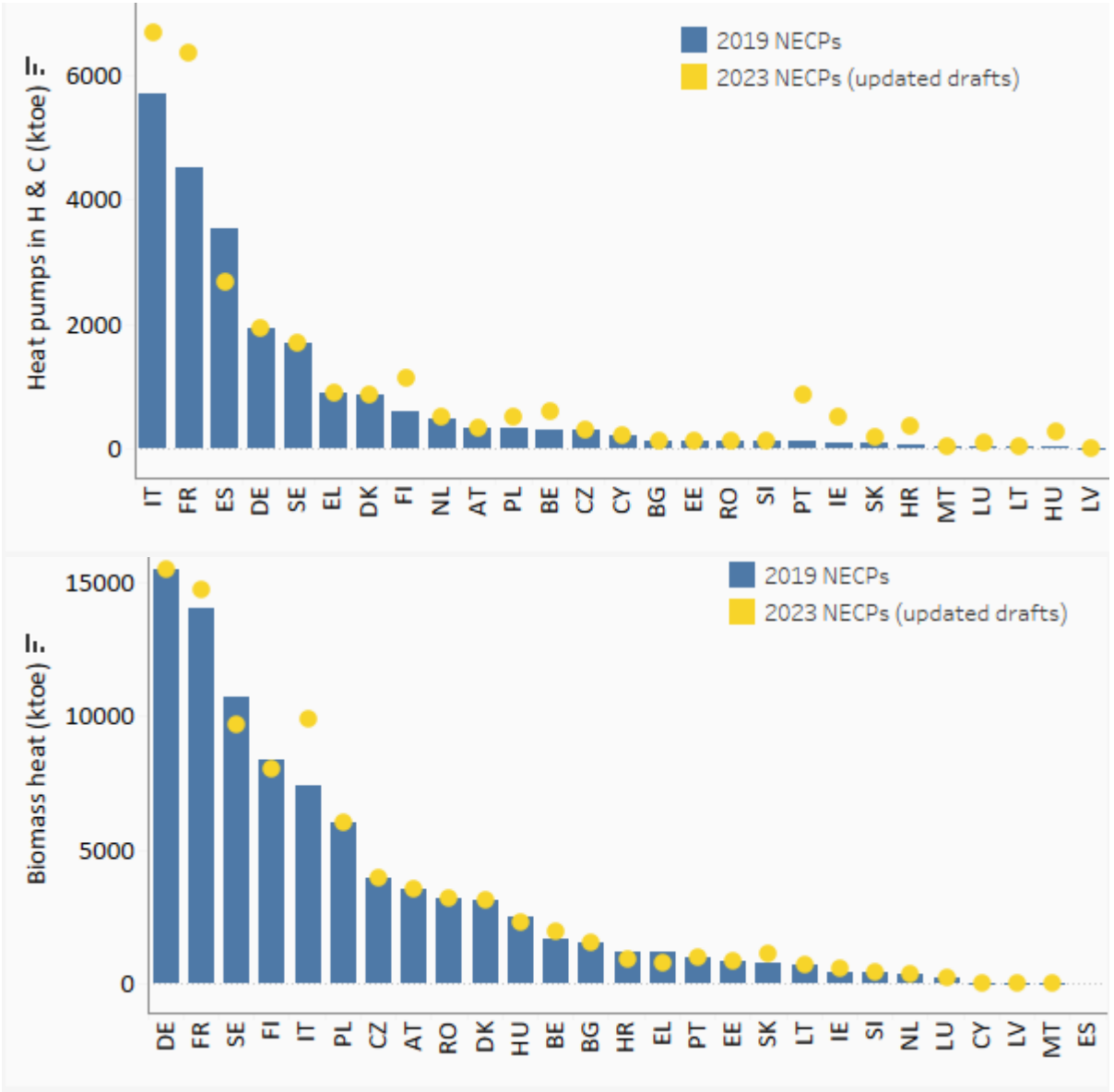
32.8% share in Reference scenario 2020 – 8 pp increase (1 pp annually)

RES Directive – new target 1.1 pp increase annually 2026 to 2030



Source: EC

Technologies in H&C – insights from NECPs



Changes between 2019 NECPs and 2023 NECPs (updated drafts)

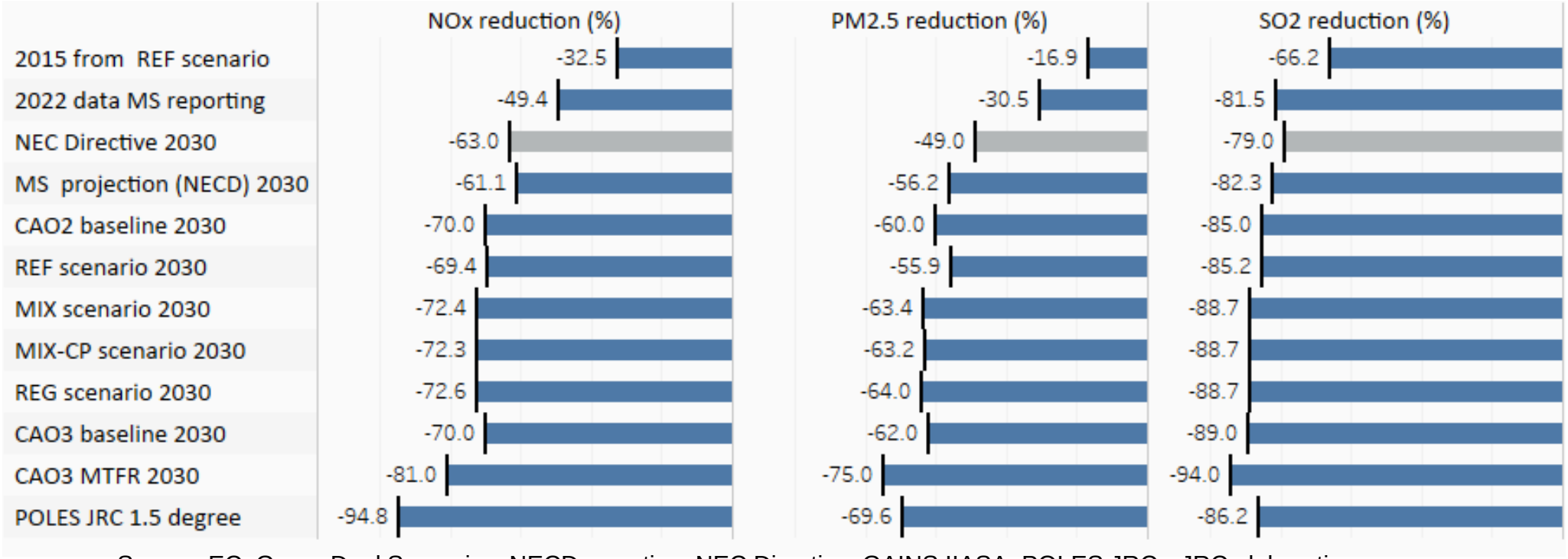
22% increase in heat pumps contribution

Biomass heat an increase by only 1.5 Mtoe mainly in Italy (biomethane) and France (biogas)

Decrease in some MS (Greece, Finland, Croatia, Sweden Hungary) related also to air pollution

2030 reduction vs 2005 in the EU Green Deal Scenarios – NOx, PM2.5, SO2 emissions

Scenarios provide projections only for NOx, PM2.5 and SO2. Baseline year 2015, No intermediary year available (e.g 2025)



Source: EC, Green Deal Scenarios, NECD reporting, NEC Directive, GAINS IIASA, POLES JRC - JRC elaboration

Overall, all EU Green Deal scenarios show more ambitious reductions than the NECD targets

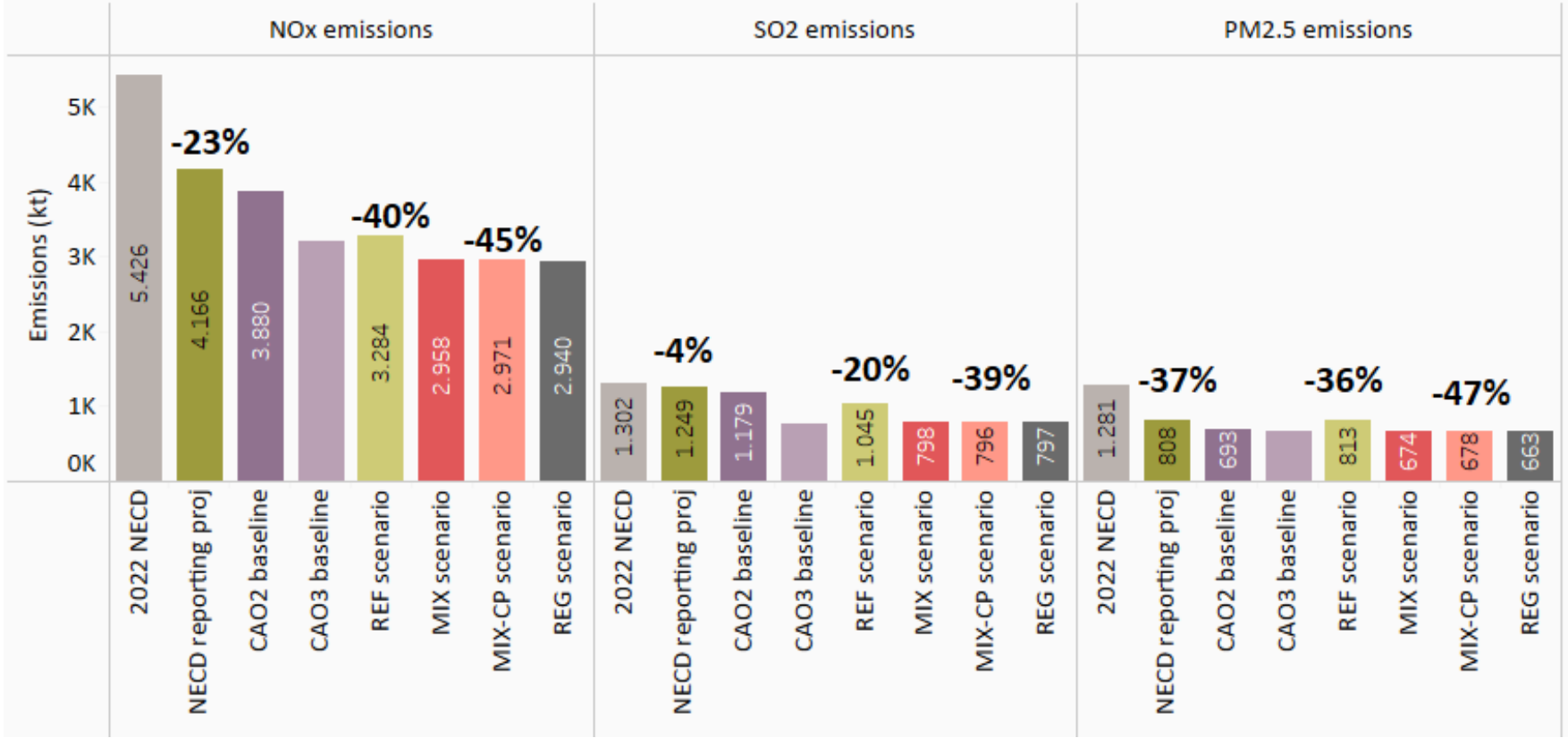
Air pollutant emissions – 2030

Road to 2030 more aligned for SO2 – 20% reduction as in REF 2020 scenario

In 2022 the SO2 reduction since 2005 above 80%

For NOx and PM2.5 respectivey 40% and 36% as in REF 2020 scenario

MS projections under NECD less pronounced



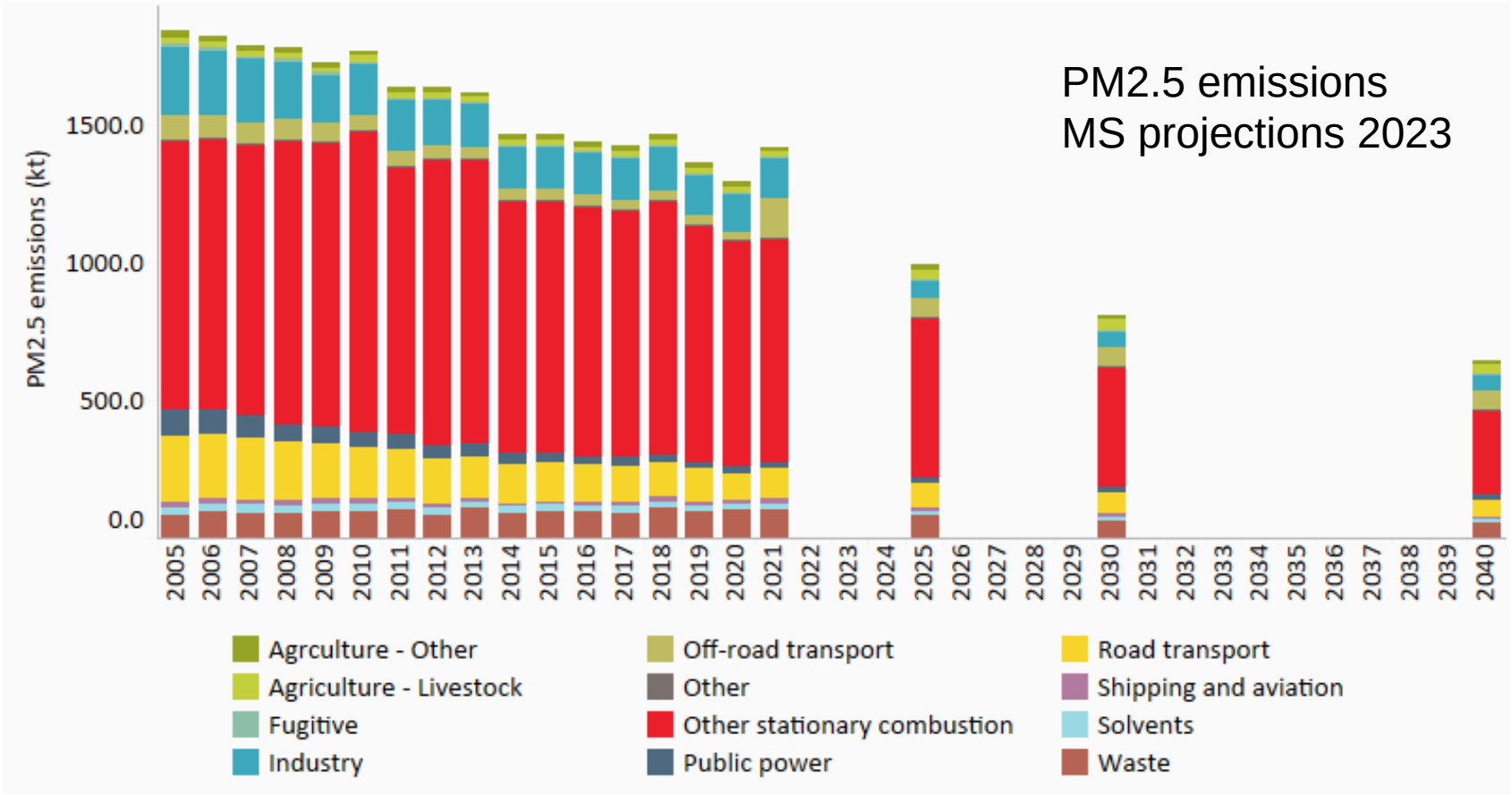
Source: EC, Green Deal Scenarios, NECD reporting, NEC Directive, GAINS IIASA, POLES JRC - JRC elaboration

Air pollutant emissions – 2030 (2)

Baseline year 2015, No intermediary year available (e.g 2025)

No sector/subsector/fuel data available – only totals

Details only in NECD reporting projections and Clean Air Outlook

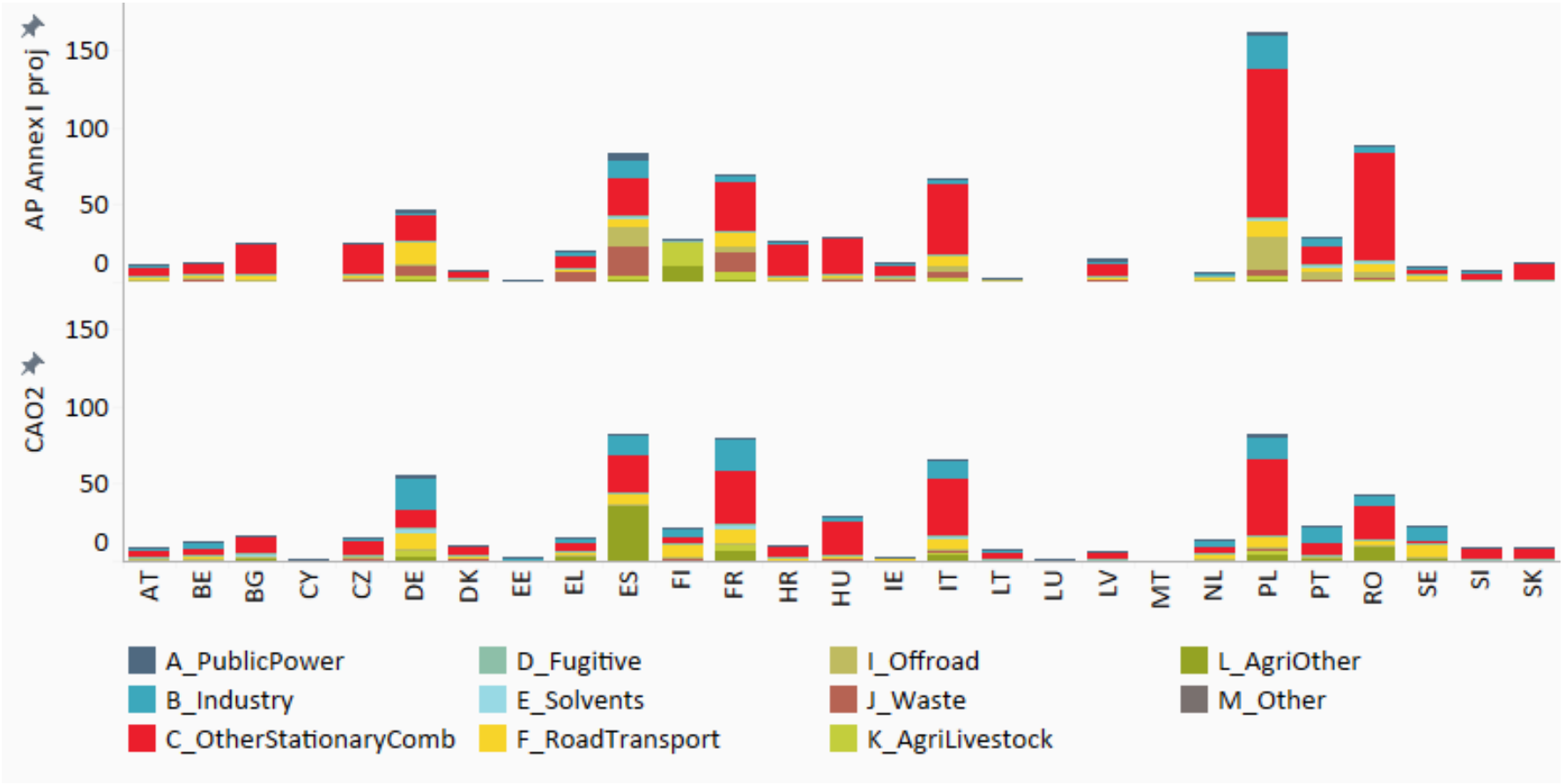


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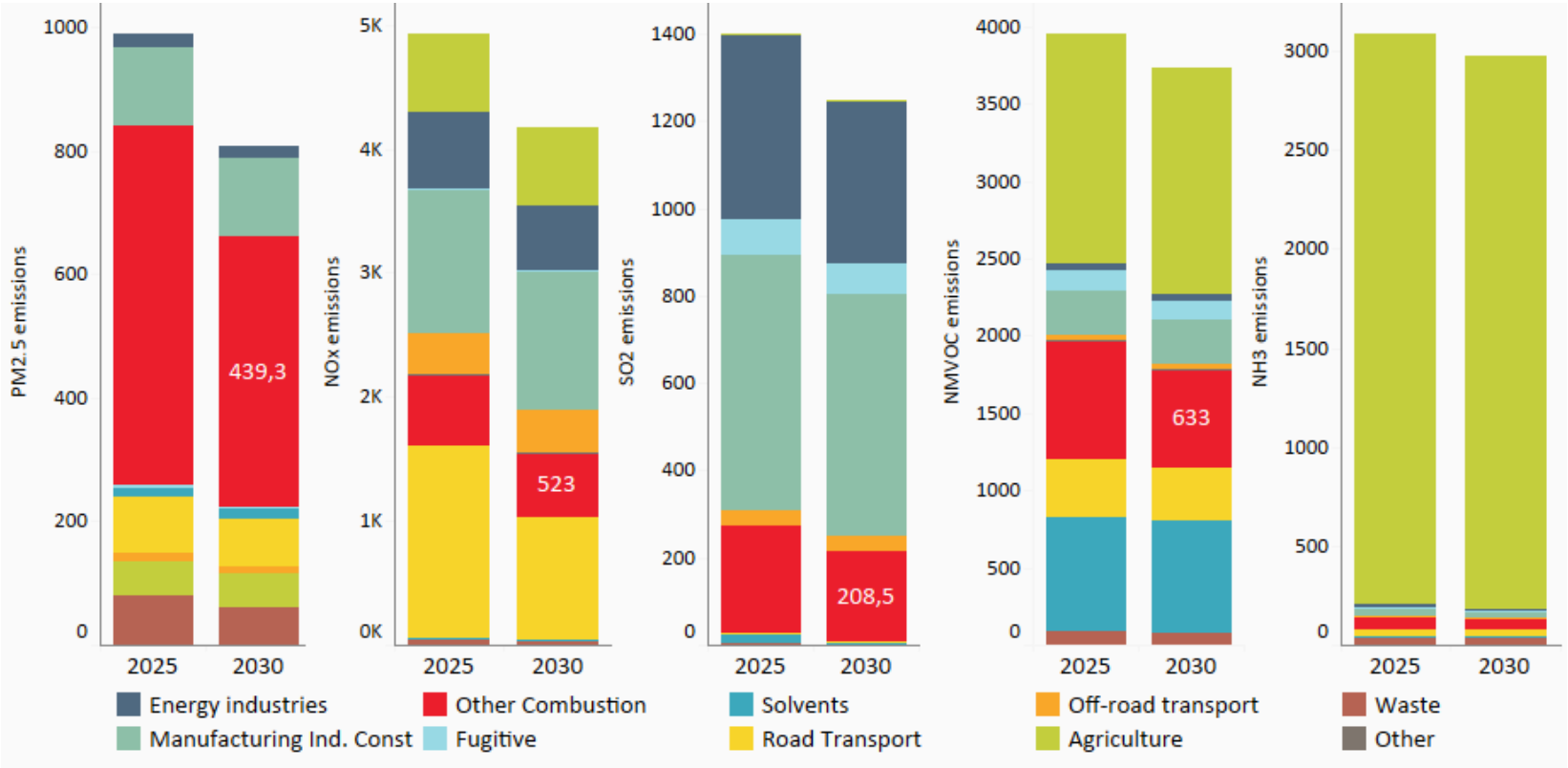


PM2.5 emissions 2030

Air pollutant emissions – 2030 (3)

Small combustion is projected to remain the main source of PM2.5 emissions in EU27with a share slightly lower from 2022 share (halved in absolute terms).

The relative contribution to NOx is projected to slightly increase, primarily due to the significant projected decline in the transport sector and a minor decrease in absolute terms

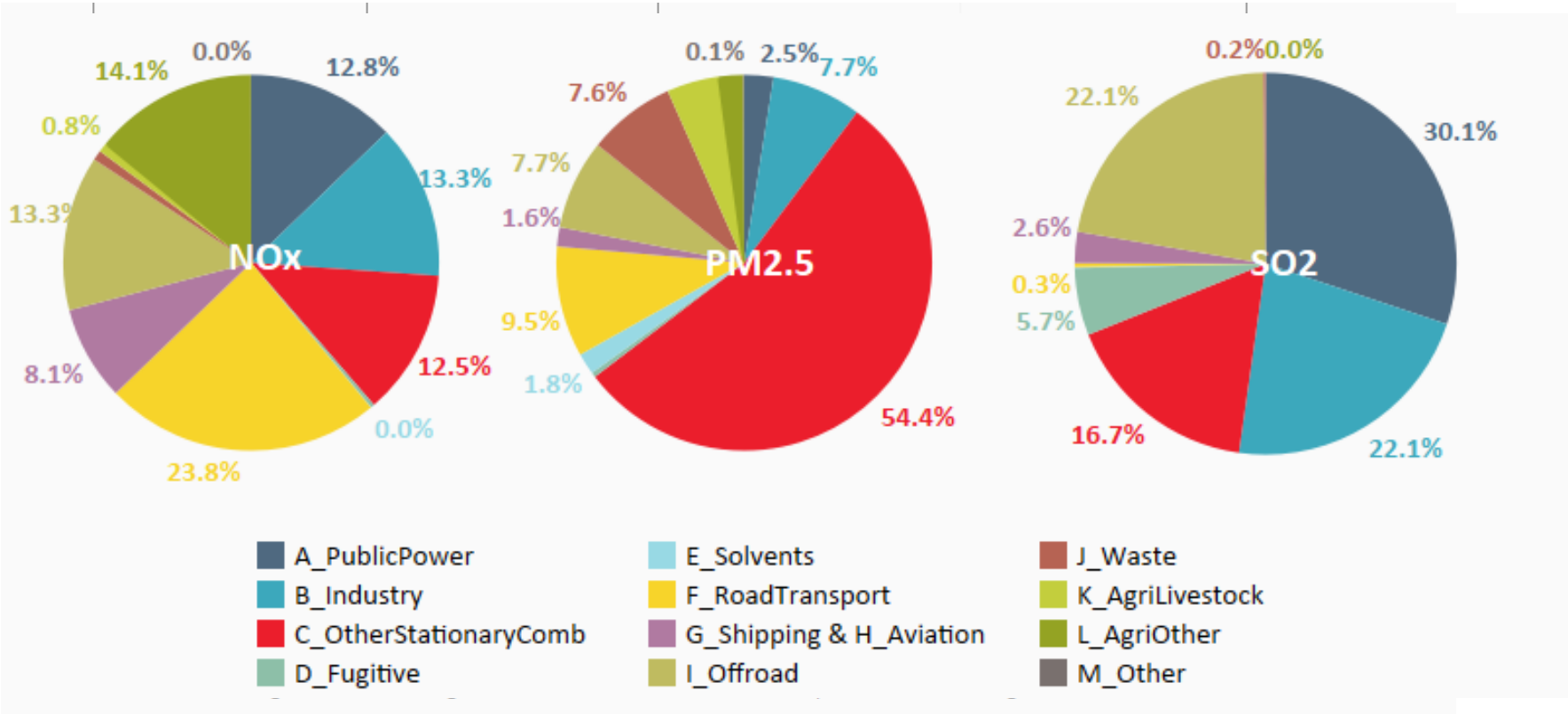


Source: MS projections under NECD, 2023

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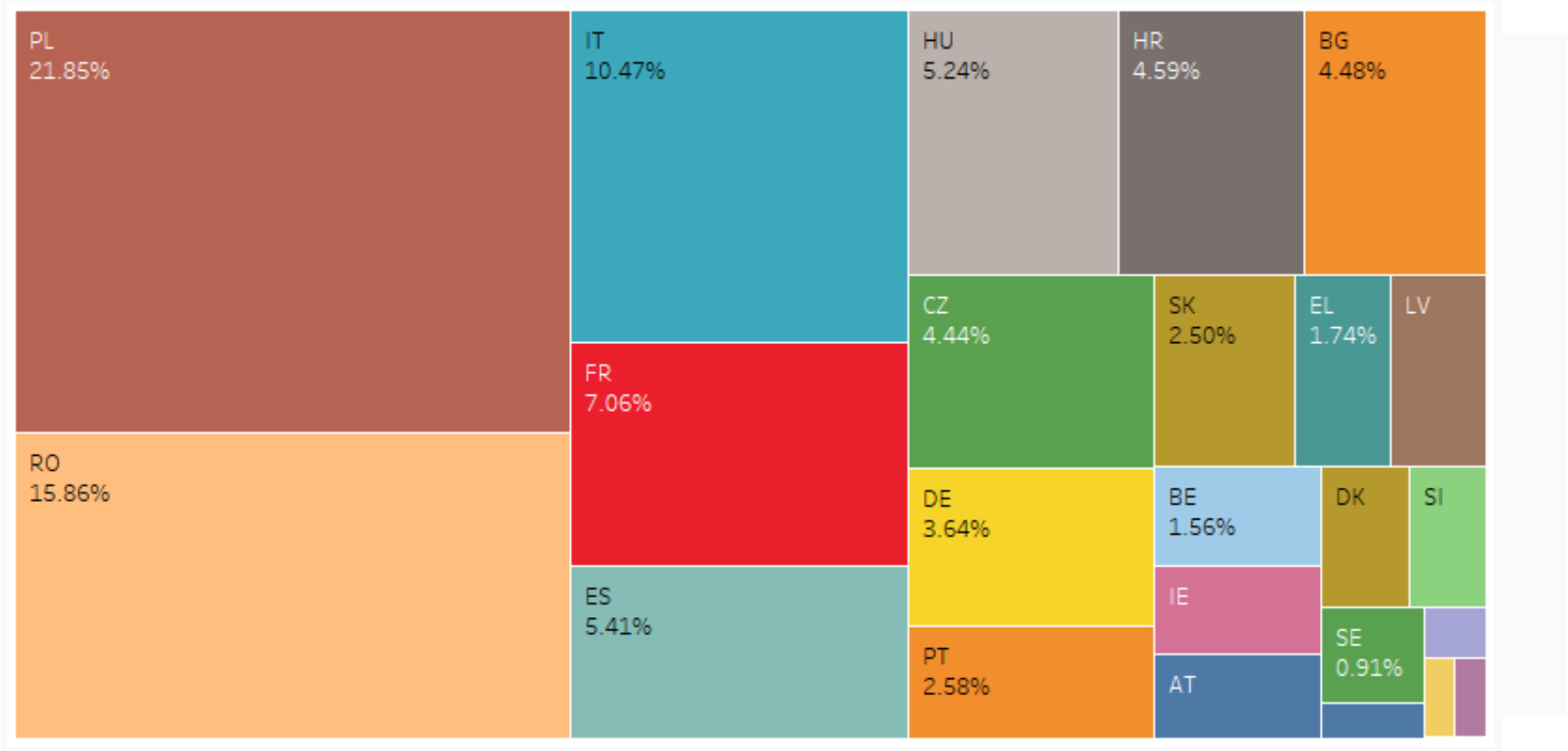


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Source: MS projections under NECD, 2023

Key take aways

- ✓ Acceleration is needed on further deployment of renewables in H&C sector
- ✓ Challenges in estimating the emissions related to the H&C sector
- ✓ Non uniformity in reporting projections under the NECD – scarse availability on activity data used for these projections
- ✓ MS NECPs impact assessment of policies in air pollution trends and projections in majority scarse. Only one MS includes air pollutant projections as part of NECP reporting
- ✓ Residential sectors still dominated from conventional technologies and moves slowly towards more «clean» technologies
- ✓ Moderate decrease of air pollutants in overall heat related

Key take aways (2)

✓ Limitations on scenario choices with detailed data used to evaluate the progress of air pollutant emissions from H&C towards 2030

✓ MS projections under NECD less pronounced compared with the «Fit for 55» scenarios

✓ In overall SO2 pace towards 2030 more aligned with the targets in place.

✓ NOx projections from MS reporting under NECD slightly below the reduction required by the Directive, 2.1 pp below

✓ Small combustion will remain the main source of PM2.5 emissions in 2030 halving its absolute contribution

✓ Poland projections on PM2.5 show the highest values in small combustion

Thank you



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