IOŚ-PIB
Instytut Ochrony Środowiska
Państwowy Instytut Badawczy

CT5 - Key Challenge: PMs and BaP

Contribution to CT5 „Key challenges"

Initially two different chapters:

- How to design measures on domestic heating, to reduce PM and benzo(a)pyrene
- How to implement actions to reduce PM

After some discussions combined into one (working title):

- **How to design measures (on domestic heating?) to reduce PM and benzo(a)pyrene**

Focus on residential sector

Species – PM10, PM2.5, B(a)P (?)

Contributors

- IEP-NRI – Poland – country scale (support to the National Air Quality Plan – simulations provided to the Ministry of Climate and Environment once a year; 2.5km resolution)
- Ekometria – Poland – regional AQP
- ENEA - Italy - country scale
- SHMU – Slovakia – country scale (4.7km) / local scale (250m) in the scope of NAPCP

Call for contributors – if any team would like to report their results related to the residential sector measures and the impact on PM10/PM2.5/B(a)P
→ please join us ☺

CT5 – residential sector challenges

- ”Local problem” – impact of individual source vs. „country-scale problem” – a vast number of small sources in different regions
- Problems with emission estimation
  - Fuel mix not known (BU)
  - Emission factors (installation dependent) not known (BU)
  - Temporal variability highly uncertain and variable in time (BU/TD)
  - No good proxy to distribute total values (TD)
- Implementation is difficult (social habits, income level of individual household)

CT5 – residential sector challenges

- Problem increasing in the continental climate zone (cold winter); problem increasing in the areas with complex topography (inversions)
- Strongly dependent on meteorology
  - emission intensity (temperature variability from October to April)
  - dispersion conditions (near-surface inversions, calms)

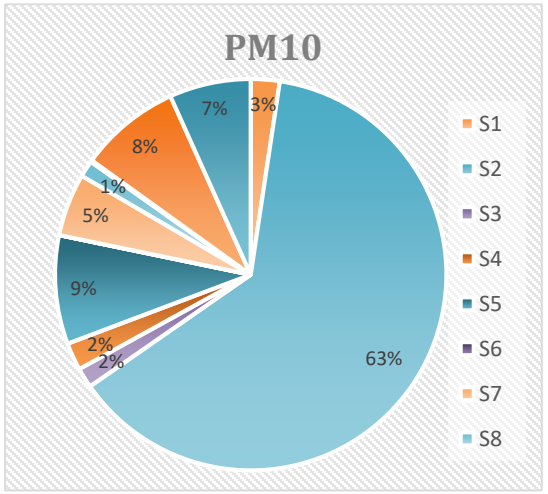
Chapter structure

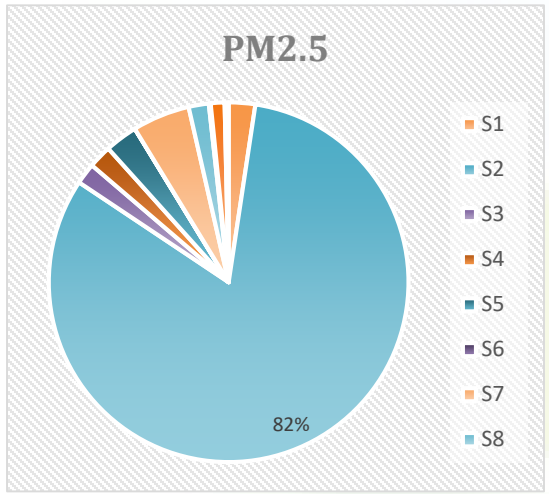
General description of the approach

- Measures
- Emissions
- Concentrations
- Exposure / impacts (voluntary)

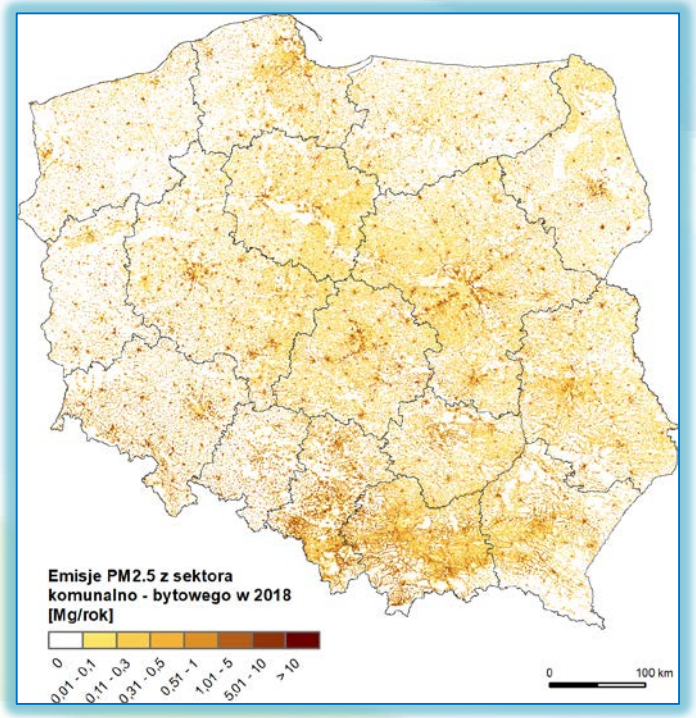
PM emission structure in Poland

PM_{10} and $PM_{2.5}$: contribution from the residential sector is dominant
Highest emission in urban areas (in the case of biggest cities – in suburban zones)





S2 (SNAP2) – household heating



$PM_{2.5}$ emission load in 2018

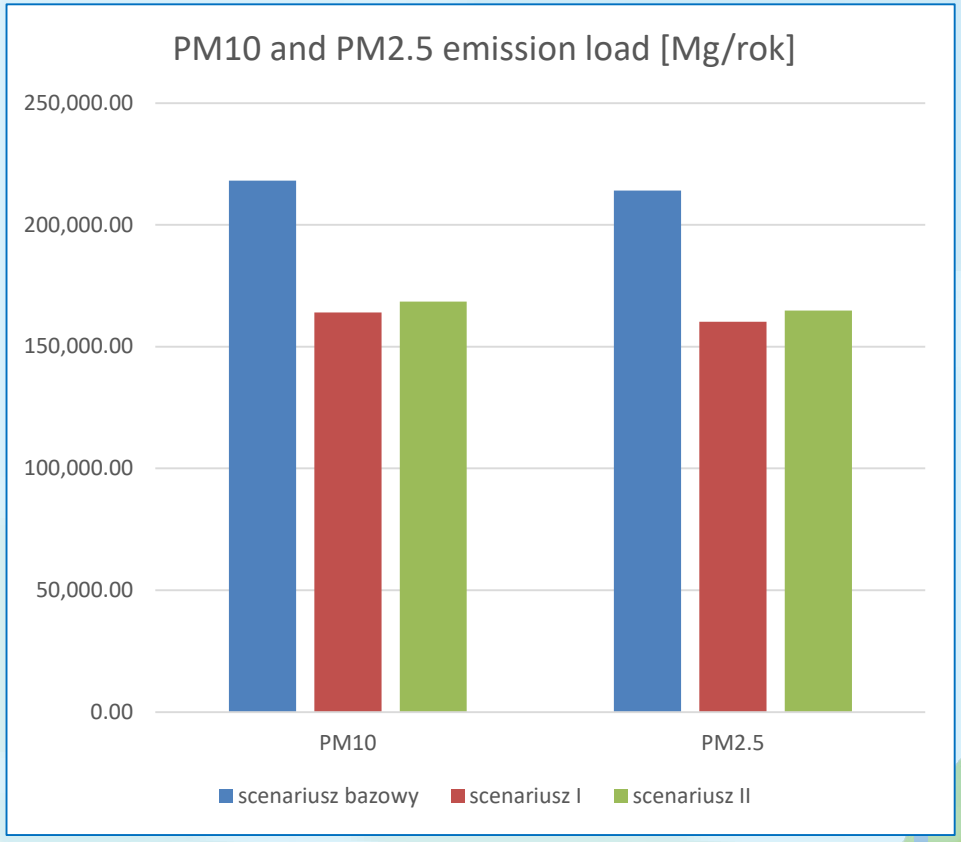
Poland: Assessment of ”Clean air” programme – scenario assumptions

„Clean Air programme” aims to provide support for **heating system modernisation** and better insulation for homes. The *Clean Air* Programme is designed to reach 4.5 million households in Poland over the next ten years.

Base scenario – emissions reported in 2018

Future scenarios: exchange of furnaces in 2 million households (home insulation not considered)

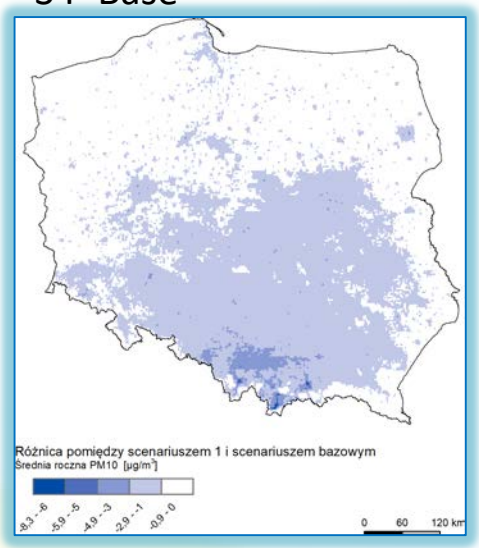
- Scenario I – uniform distribution over Poland, proportional in all administrative units (30% households)
- Scenario II – action focused on administrative units with $PM_{2,5}$ > 20 µg/m^3 (39% households)



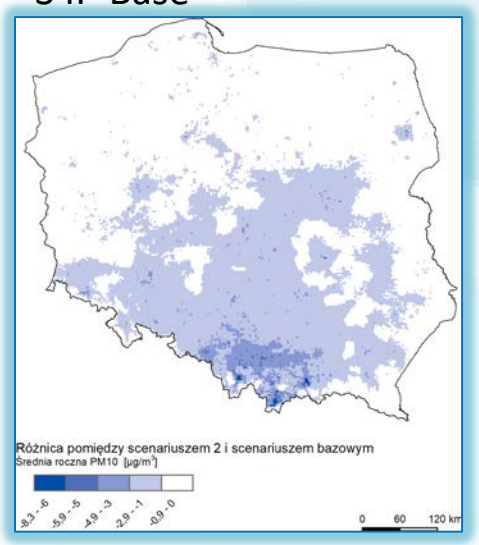
PM_{10} reduction in Poland (Clean air Programme)

PM_{10} annual average reductions

S I -Base

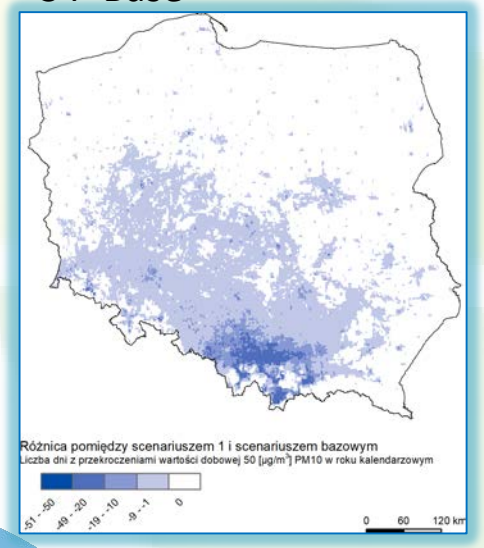


S II -Base

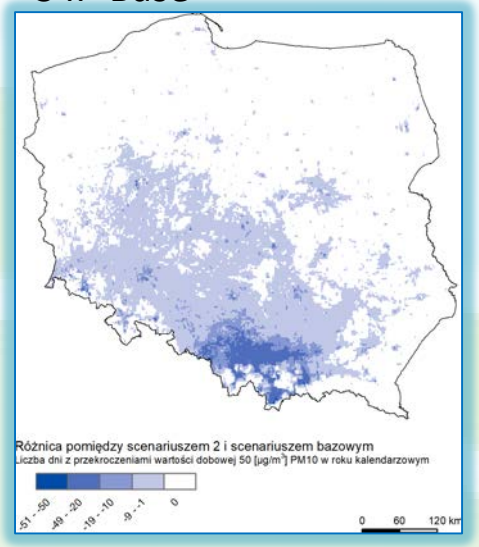


No of days
PM_{10} > 50 µg/m^3 reduction

S I -Base



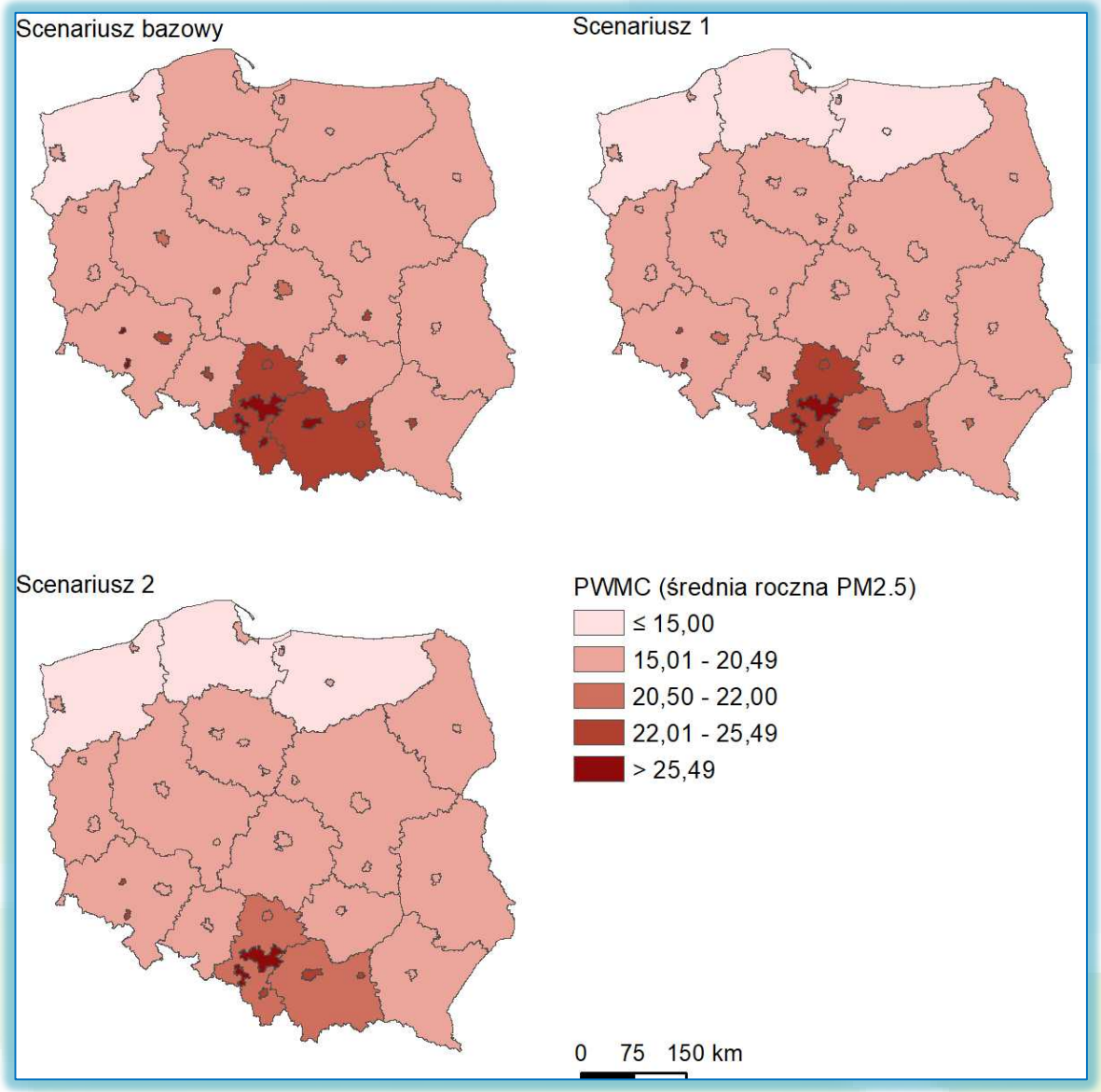
S II -Base



Health exposure

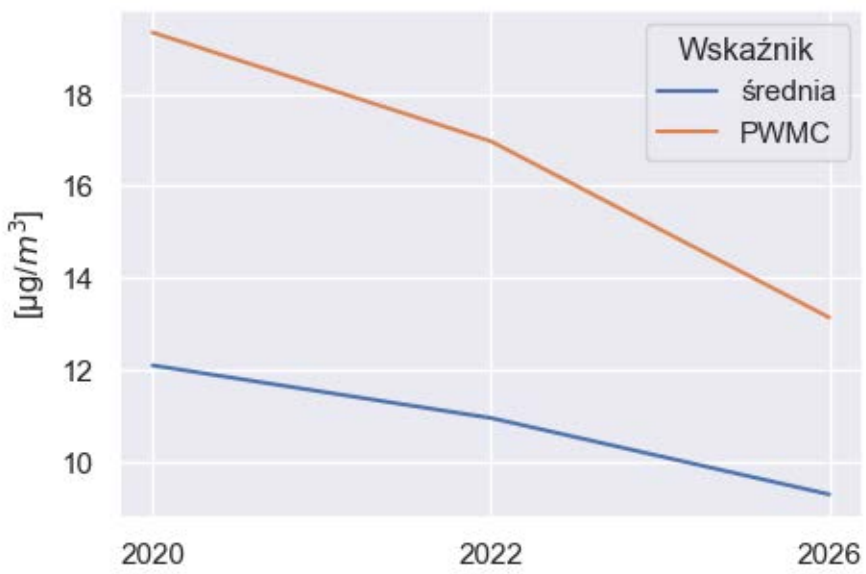
Population Weighted Mean Concentration (PMWC) shows significant improvement in the southern part of Poland and major cities

This indicator shows potentially higher impact of Scenario II

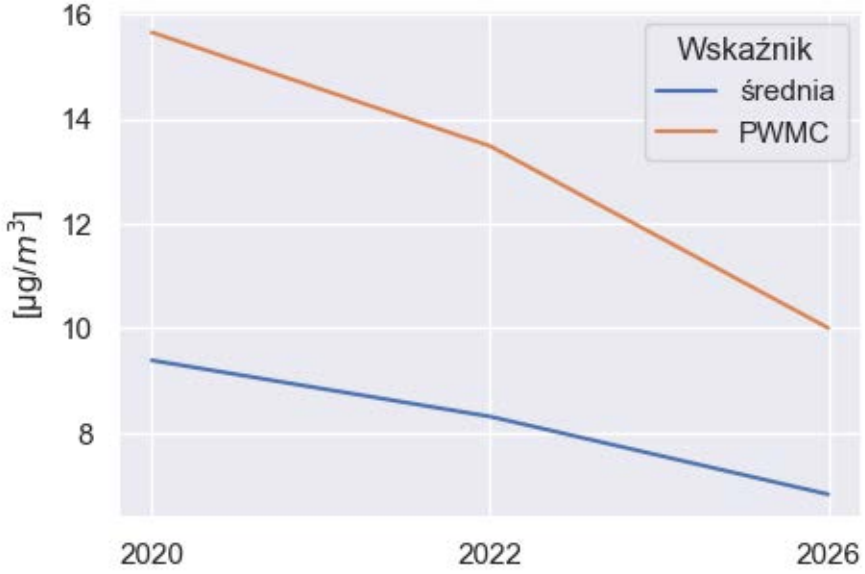


Trends of average PMs concentrations over Poland in 2022 and 2026 - joint effect of the implementation of regional AQP

PM10



PM2.5



* Red line – PMWC – Polpulation Weighted Mean Concentration

PM10 emission structure and measures in Slovakia

Emission projections for whole Slovakia based on NAPCP

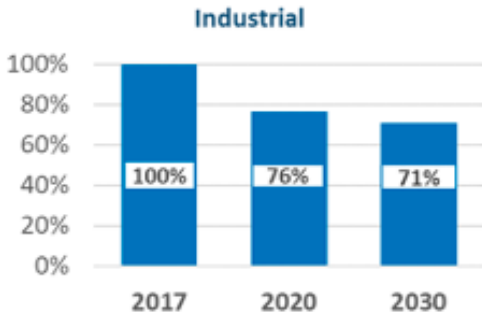
Emission sector	PM10 emissions (kT)		Emission reduction
	2017	2030	2030
Point sources	3.3	2.7	80%
Road transport	1.6	1.4	90%
Residential heating	25.9	17.5	67%
Other	3.5	25.1	
TOTAL	34.3	25.1	73%

Potential measures in the sector residential heating

- Incentives for replacement of unsuitable boilers: subsidy scheme
- Introduction of differentiated registration fees for different categories of heating devices to promote more environmentally friendly devices
- Connect households using wood or coal for heating to natural gas
- Fuel standards mandating the use of wood that has a moisture content of less than 25%
  Introduction a "control system" (based on the Czech model) – each household that uses solid fuel would have an obligation to have their device regularly inspected.
- Awareness raising campaigns and education

Ref.:Slovak Republic Air Protection Strategy, June 2019

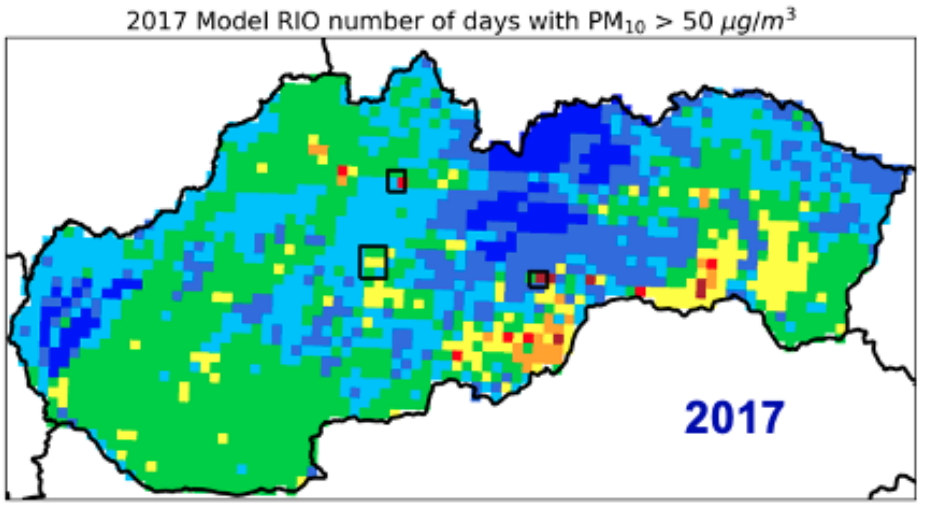
Emission after proposed reductions

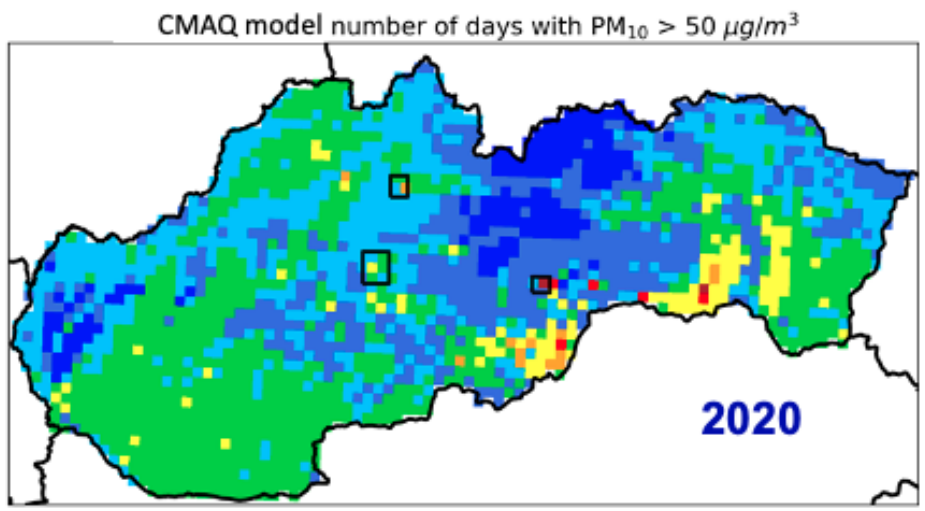


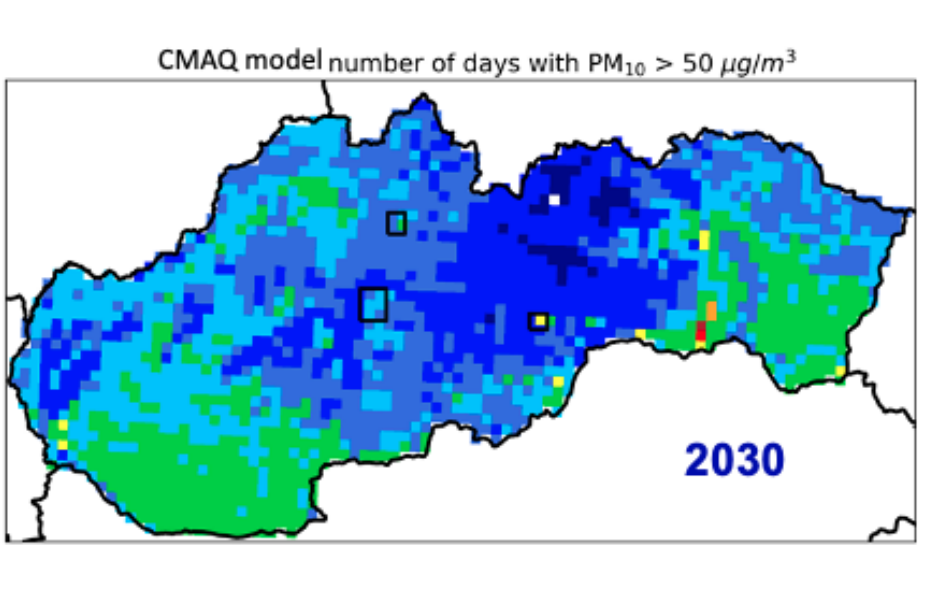
PM10 reduction in Slovakia due to NAPCP

National scale results (CMAQ, RIO)

PM10
Number of daily limit exceedances





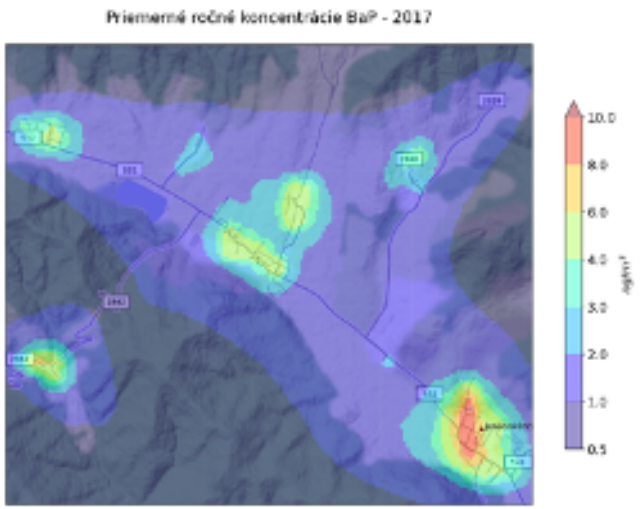


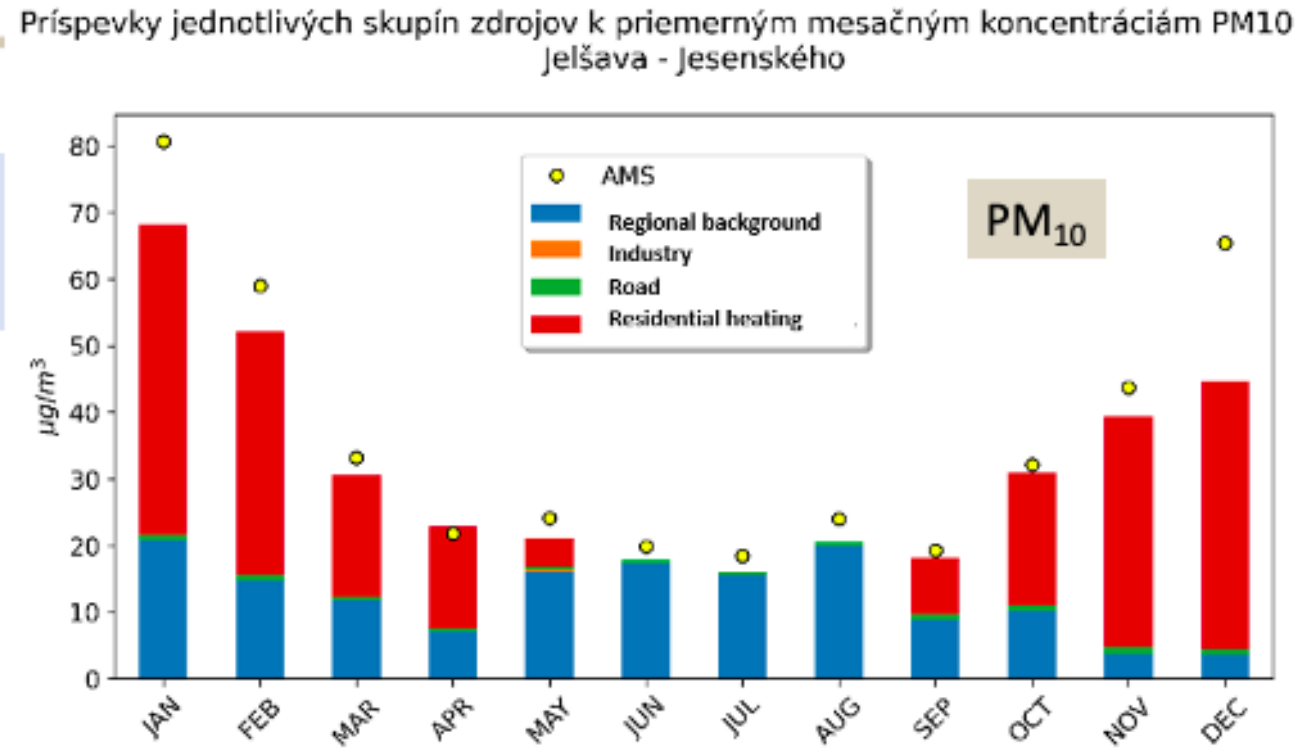
PM10 and B(a)P source attribution in Slovakia – local scale

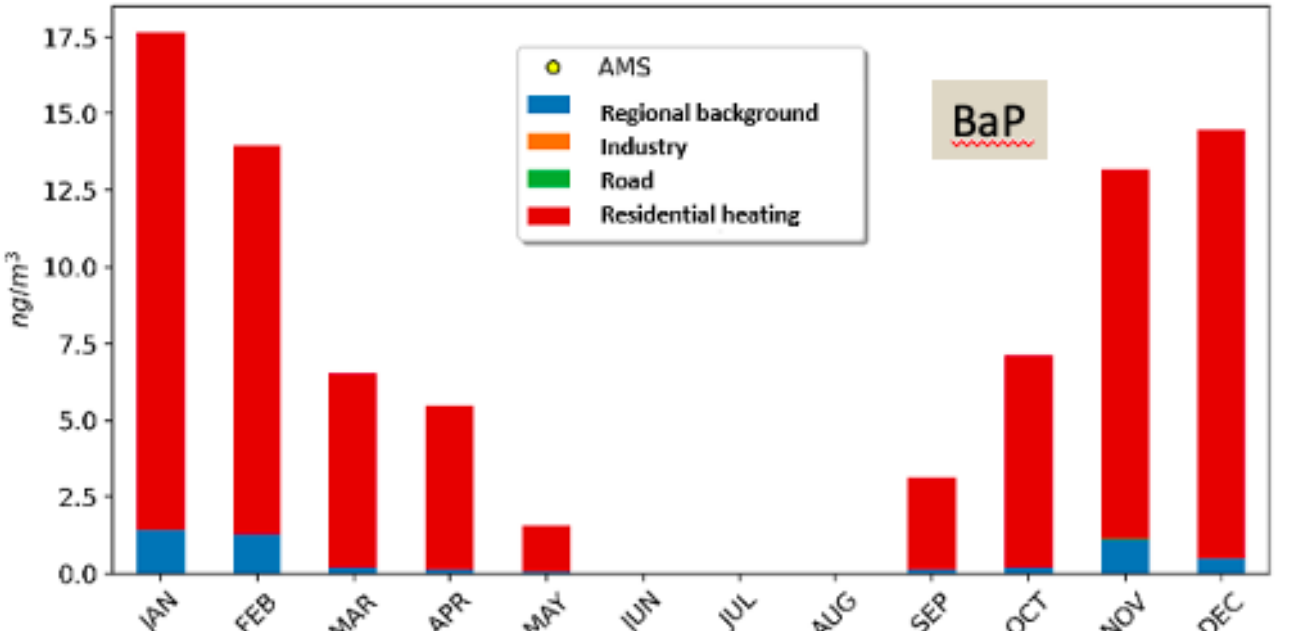
CALPUFF results Jelšava

Source apportionment

BaP annual mean







CALPUFF projections at monitoring stations (PM_{10})

Monitoring station	Mean annual concentration		Number of daily exceedances	
	2017	2030	2017	2030
Jelšava	39.0	31.2	93	61
Banská Bystrica	28.4	24.9	44	25

Summary

Draft conclusions:

- Importance of the residential sector emissions - different across Europe (linkages to CT1)
- Differences between TD and BU inventories (linkages to CT7)
- Results depends on the resolution and the domain size (linkages to CT9)
- A list of measures applied (to be applied) in different countries would be useful

Summary

Open questions:

- How to link actions/measures to emission processes (heat consumption → fuel used → fuel mix → emissions)
- Is the fuel mix temperature dependent ? → evidence from PM2.5 chemical composition measurements in PL
- How to select base year – "worst case scenario" ?
- Shall we consider other sectors?

Summary

Early stage of the chapter compilation

Foreseen contributions from ENEA and Ekometria

Other groups invited to contribute ☺

Potential inconsistencies between approaches

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Thank you

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