Janusz Cofala
International Institute for Applied Systems Analysis (IIASA)

Reduction of emissions from household sector and its role in achieving of emission ceilings from the NEC Directive(*)

(*) Household sector – small combustion sources in the residential, commercial and agricultural sectors

Based on a study for European Commission DG Environment

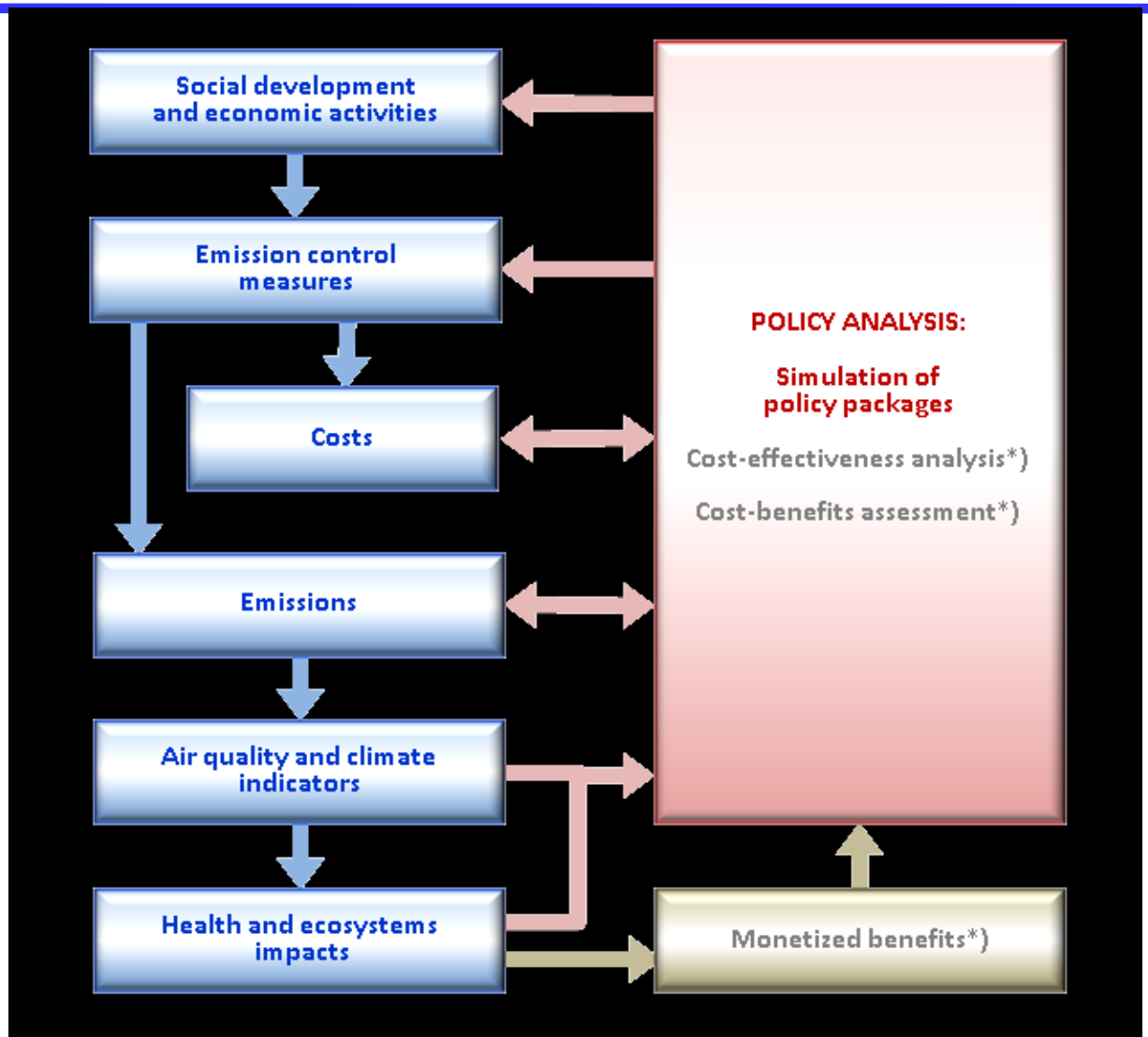
Progress towards the achievement of the EU's air quality and emissions objective

- New projections of economic activities
- Recent emission inventories and emission control legislation
- Prospects of achieving the WHO guideline values to protect human health
- Policy objectives on the protection of ecosystems

Scope of the study

- Calculated emissions of SO2, NOx, PM2.5, NH3, and VOC up to 2030
- Activity pathways: PRIMES/CAPRI 2016 Reference (REF) and Low Carbon Policies (LCP)
- Emission control legislation: includes ERR from the NEC Directive; two variants for source-specific legislation:
  - pre-2014
  - post-2014 (MCPD, BAT conclusions for LCPs, standards for non-road mobile machinery, Eco-directive measures)
- GAINS calculated how to achieve the NEC ERRs in a cost-optimal way
- Included emissions from power plants, industry, households, transport, agriculture and solvents

Integrated assessment tool: the GAINS model

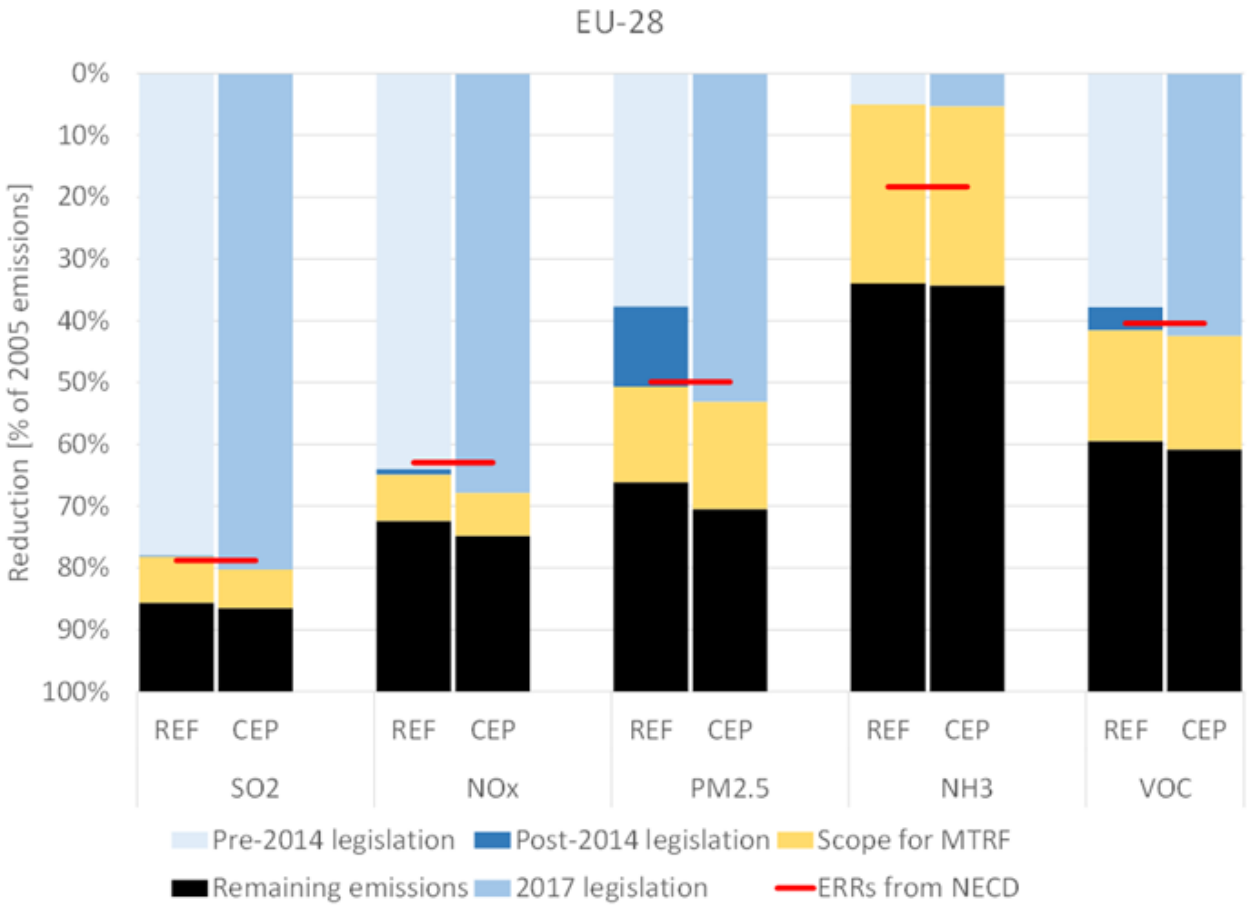


EU-28 emissions

10^6 tons	2005		2030		% reduction	
		CLE *)	NEC EER	REF	From 2005	To reach ERR
SO2	7.6	1.7	1.6	1.5	-80%	2%
NOx	11.4	4.0	4.2	3.8	-66%	1%
PM2.5	1.8	0.9	0.9	0.8	-57%	6%
NH3	4.2	4.0	3.5	3.4	-19%	14%
VOC	8.6	5.0	5.1	4.7	-45%	4%
*) post-2014 legislation						

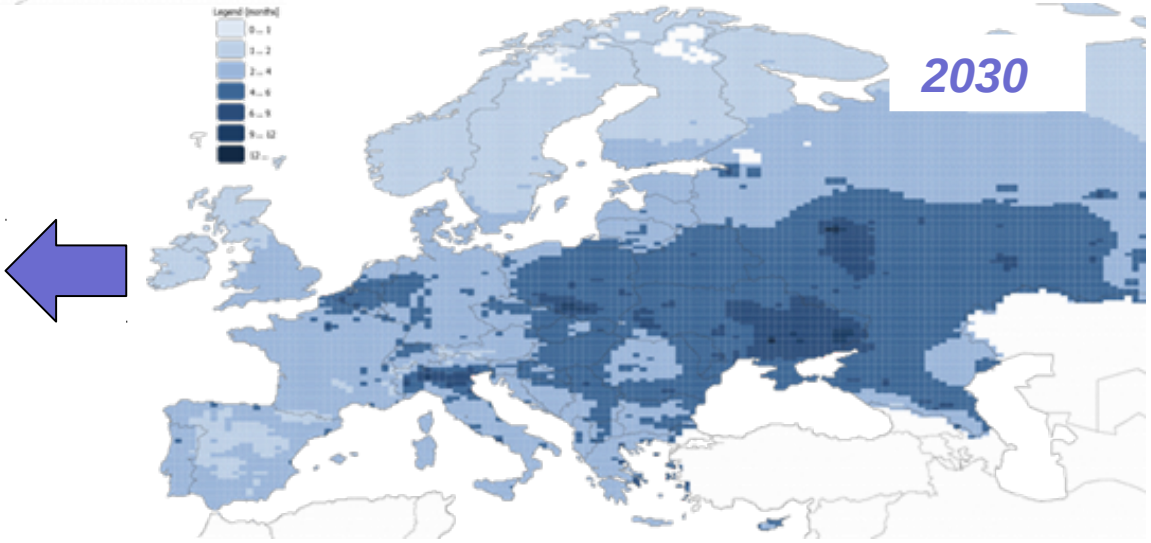
- With post-2014 legislation many national emissions are lower than the NEC ERR. Countries with overshooting:
  - SO2 12 NOx 18 PM2.5 19
  - NH3 2 VOC 16

Emission reductions in EU-28 2030 vs. 2005



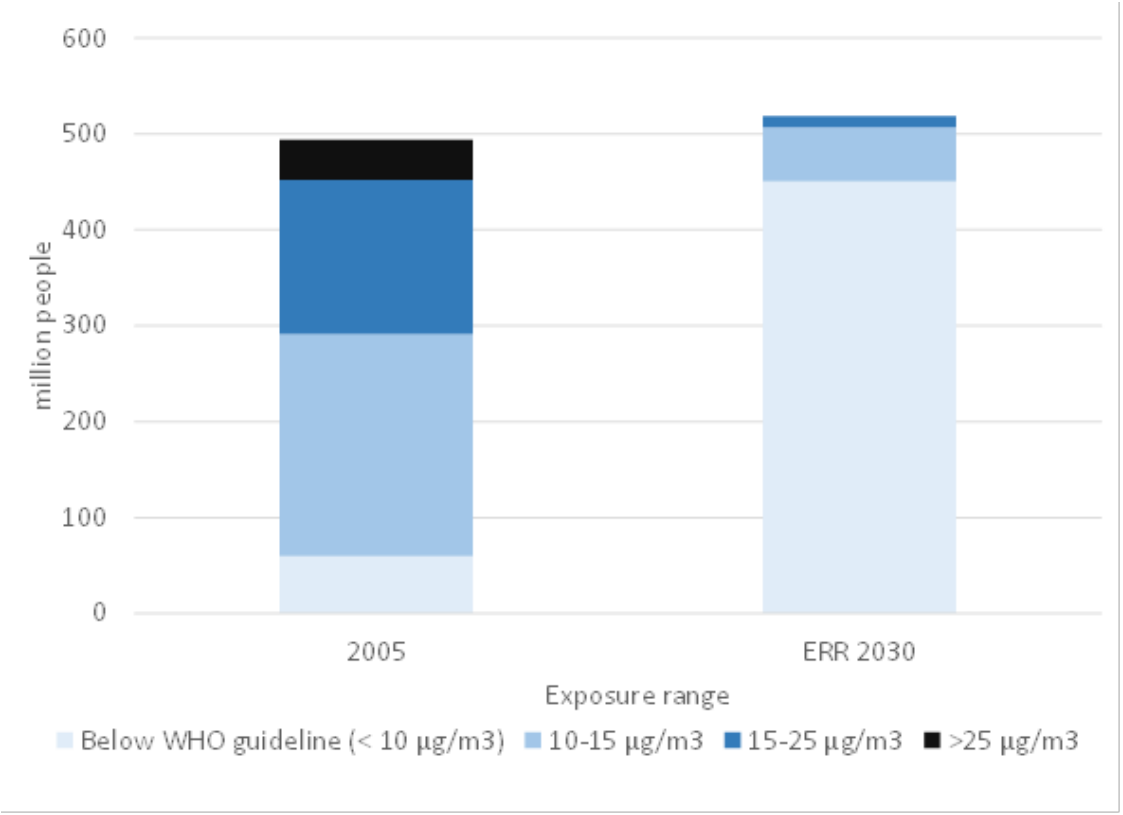
Health impacts from PM

Loss of life expectancy – 9.0 months
Premature deaths 418,000 cases



Loss of life expectancy – 4.1 months
Premature deaths – 194,000 cases

PM exposure


600
500
400
300
200
100
0
million people
2005
ERR 2030
Exposure range
Below WHO guideline (< 10 µg/m3)
10-15 µg/m3
15-25 µg/m3
>25 µg/m3

Air pollution from households

- Caused mainly by combustion of solid fuels
- EU-28: 2.6% of primary energy use but
  - 46% of total primary PM2.5 emissions
    - Biomass:36%
    - Coal: 10%
- High contribution to ambient PM2.5 concentrations
- Large differences across countries

Households sector in GAINS

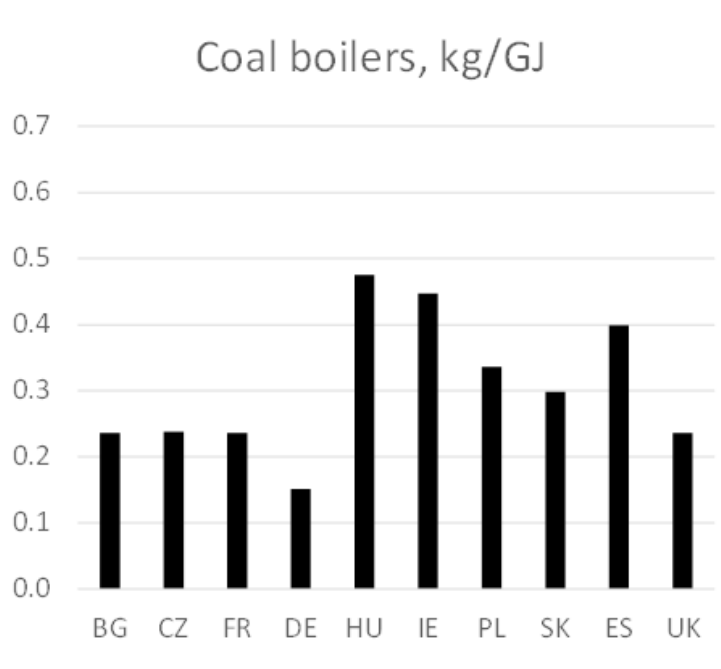
- Emissions from coal and solid biomass calculated for:
  - Boilers
    - medium size boilers (manually fed and automatic)
    - single family (manual, automatic)
  - Stoves for cooking and heating
  - Fireplaces

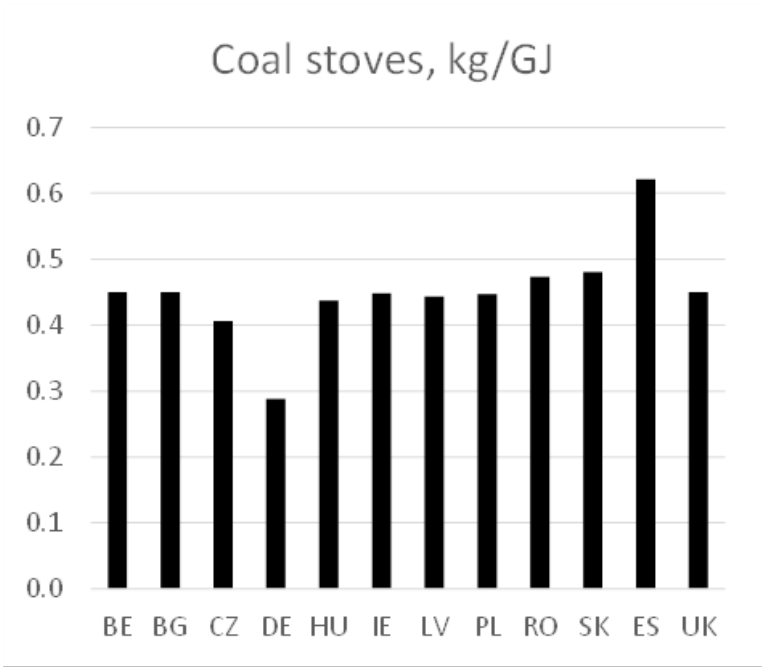
- For every combustion device three types available: traditional, improved, new, for biomass also pellets

- For liquid and gaseous fuels two reduction stages available

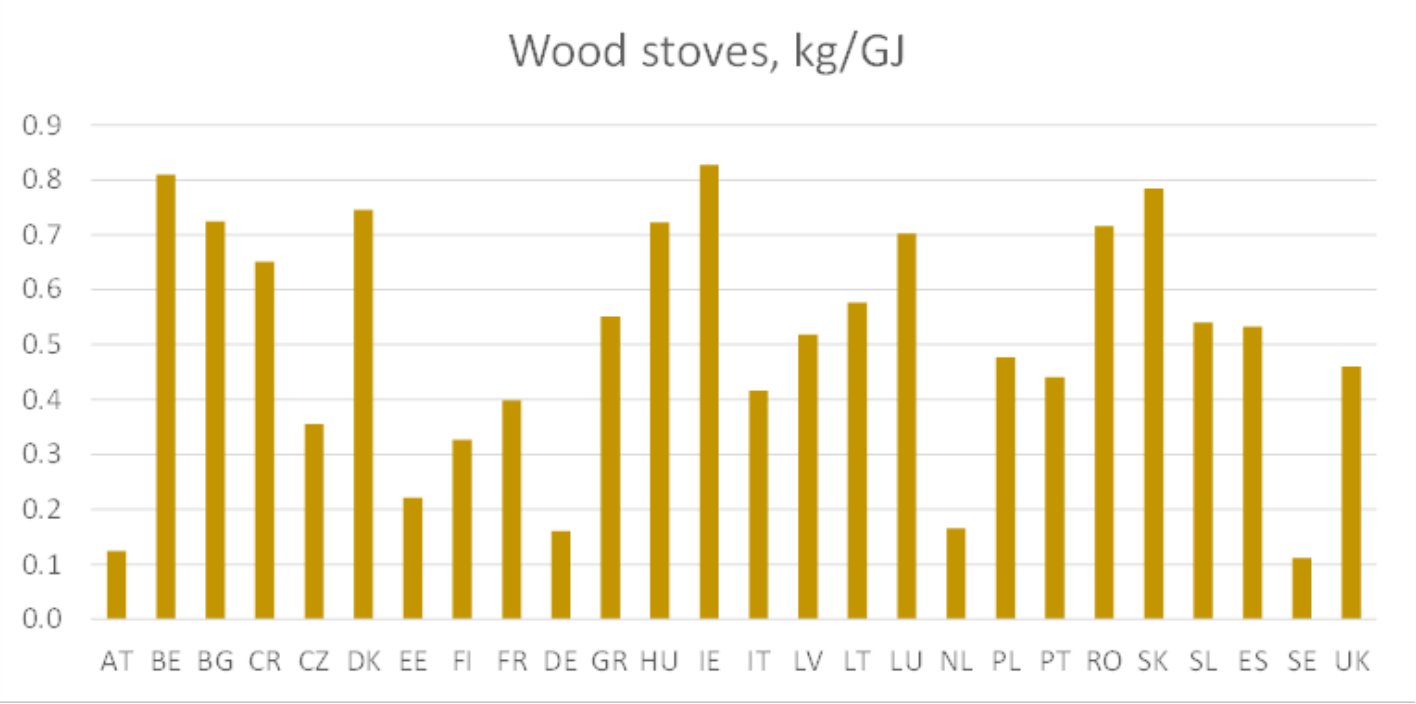
- Fuel demand from PRIMES, structure of combustion devices and emission factors from national studies

Emission factors for coal boilers and stoves

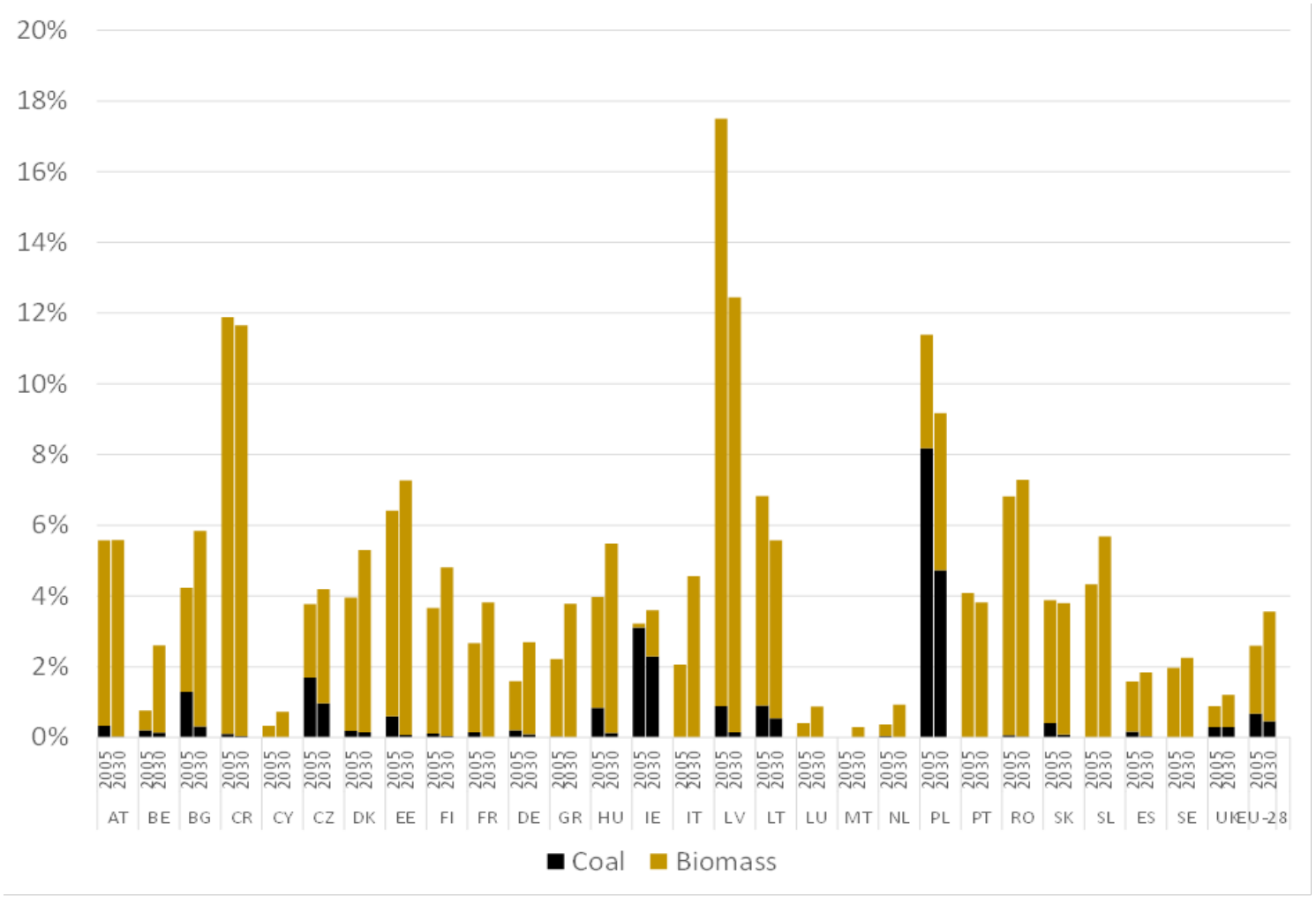




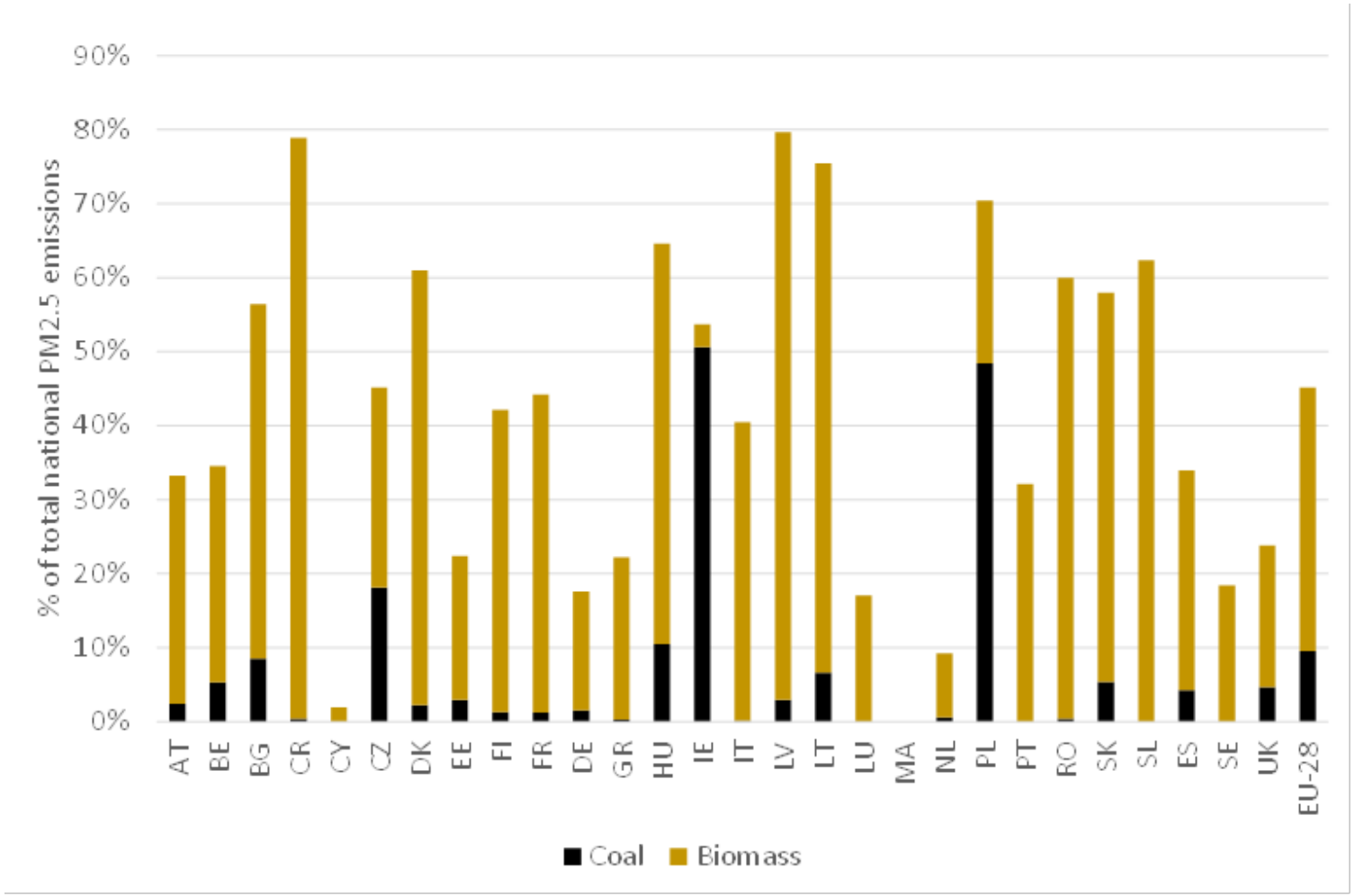
Aggregated emission factors for wood stoves



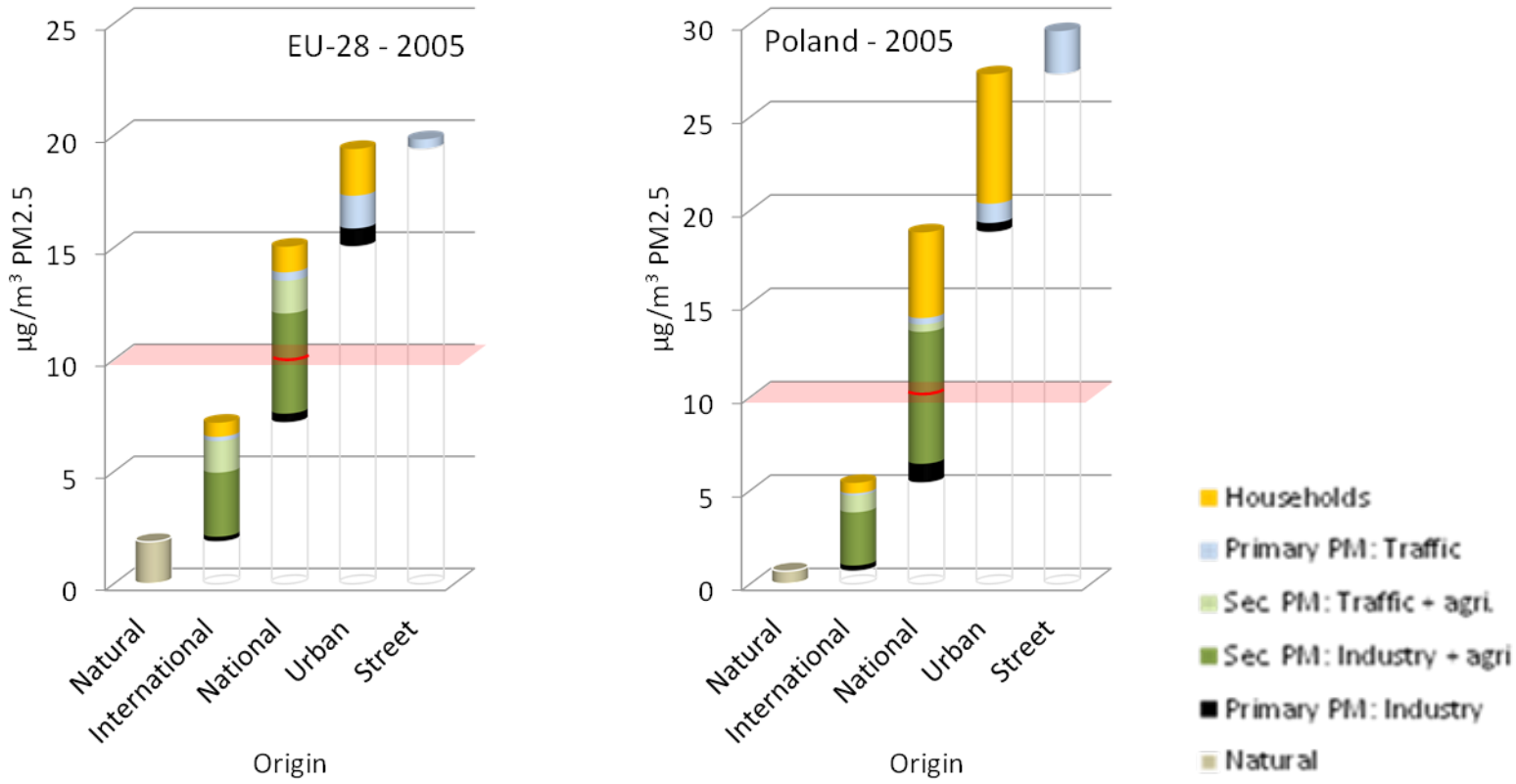
Share of households solid fuels consumption in total energy use (EU-28 in 2005 – 2.6%)



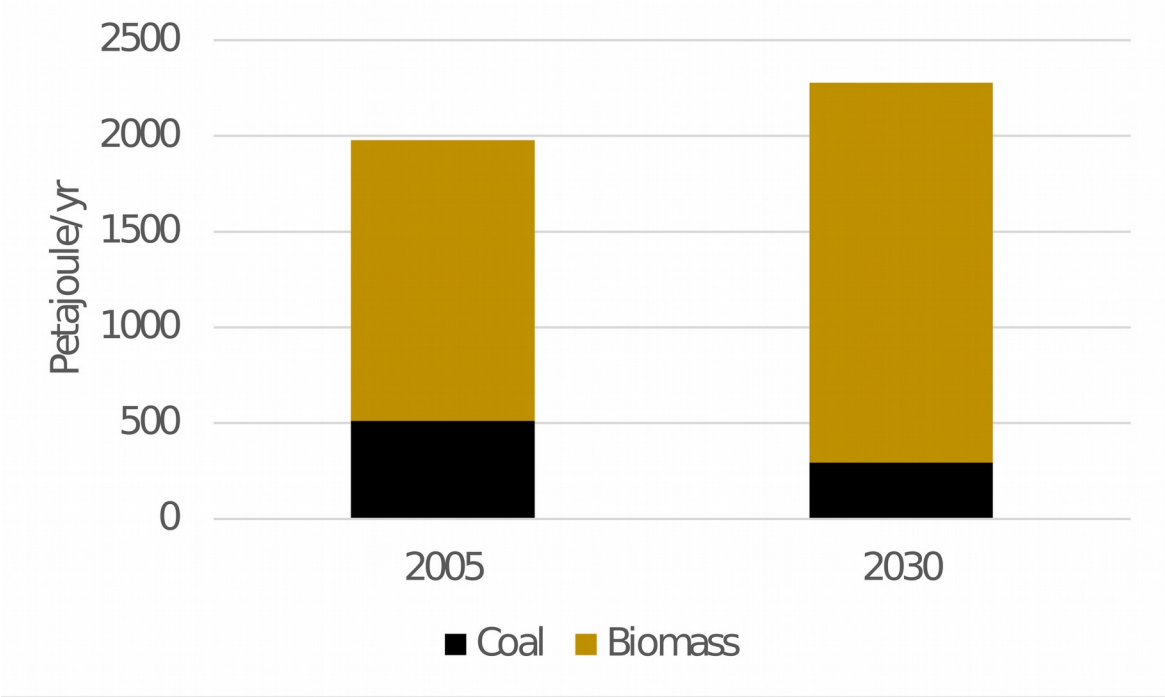
Households PM2.5 emissions in 2005 as % of national total (EU28 in 2005 – 46%)



Sources of PM2.5 at urban traffic stations in 2005



Solid fuels use in households



Source: PRIMES Reference scenario

PM2.5 emissions from households and their contribution to the achievement of NEC ERR in 2030 (REF scenario)

		Legislation		Red. to meet	Contr. of
	2005	pre-2014	post-2014	the ceiling	households
EU-28	**806**	**578**	**355**	**104**	**36%**
of which:					
- Belgium	13	19	19	9	87%
- Czech Rep	23	18	14	2	3%
- Germany	27	25	15	7	10%
- Hungary	68	78	50	13	83%
- Italy	2	4	4	2	73%
- Netherlands	174	128	80	25	20%
- Poland	19	6	5	4	44%
- Portugal	23	19	11	1	2%
- Slovenia	8	6	4	2	70%

Findings

- Despite a sharp decrease of energy-related emissions, human exposure to PM2.5 will remain a significant threat to human health

- Household sector is and will remain important contributor to air pollution

- Technologies exist that reduce emissions from households. Their implementation requires appropriate enforcement and policy interventions