Emission inventory and projections in residential sector

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Introduction

- Overview of household heating emissions
- Methodology of household emission estimation
- New data - structure of household equipment's
- Emission projections from residential sector

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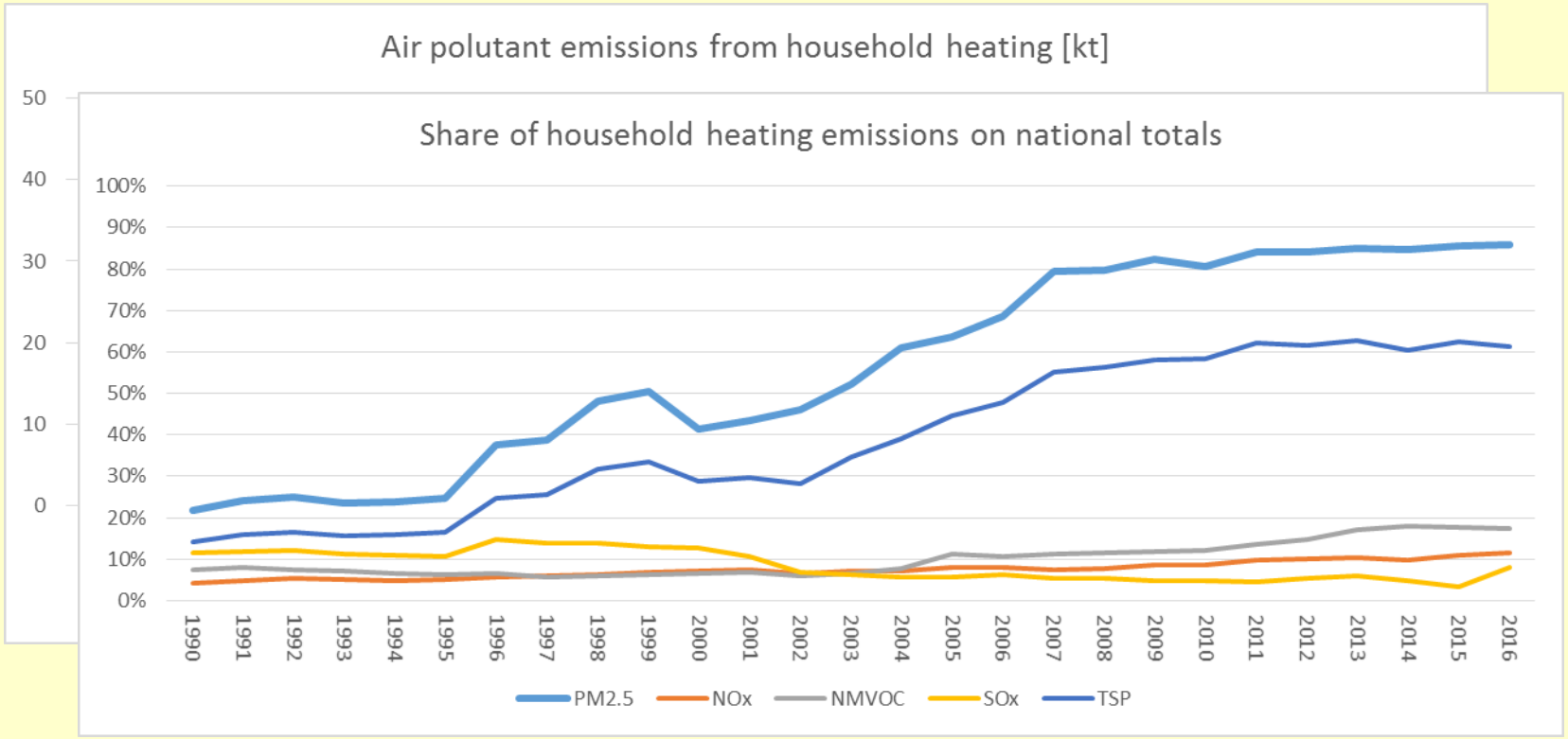
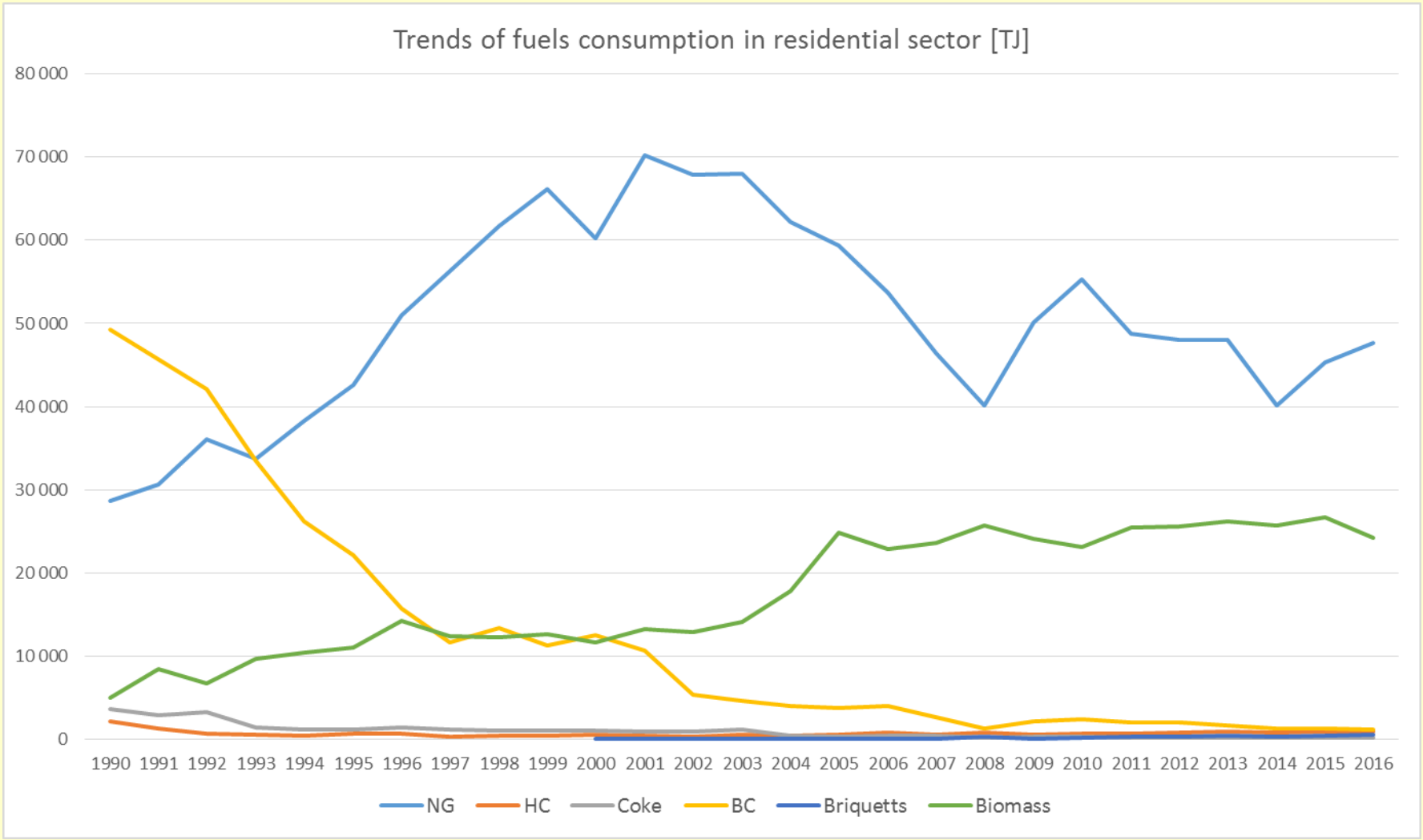
Household heating emissions

- Hot spot and key sector in National inventory
- $PM_{2.5}$ emissions – 85% share in national totals
- Hard to find relevant data – big uncertainty



Fuels consumption in residential sector



Methodology - assess of residential Total Energy Demand

- Emission estimation – based on fuel balance
- Fuel data sources:
  - NEIS – National emission information system – data from operators (HC, BC, Coke, Briquettes
  - NG consumption from operator of NG network
  - Consumption of Electricity for Heating and Hot Water from electricity network operators
  - **Relevant biomass data missing** – need for estimation
- Fuel consumption based on Total Energy Demand (TED) needed for Heating and Hot Water in households of 1m^2 flat area.
  - Number of households (flats, family houses) – SO SR (Census)
  - Average area of households – SO SR (Census)
  - Average heat demand for Heating and Hot Water
  - Share of non-inhabited houses and holiday houses (assessment 15%)
  - Share of flats with individual heating

Average heat demand	unit	up to 2004	after 2004
Flats	*kWh/m2.r*	102.3	102.3
Family Houses	*kWh/m2.r*	210	180

Calculation of Biomass consumption

- Poor availability of Biomass consumption data (BM)
- Calculation based on Total Energy Demand of households (TED), consumption of NG and other solid fuels from NEIS
- Electricity for Heating and Hot Water is deducted from Total Energy Demand needed for Heating and Hot Water in households with 99% efficiency.
- Base formula:

$$BM_E = TED - NG_E - HC_E - BC_E - BCB_E - Ck_E$$

Index E mean energy from fuels

$$BM_{amount} = BM_E / 0,72$$

Effectivity of energy production – 72%

Net calorific value – 14,27 MJ/kg

- Other fuels are neglected (Liquid)

Parameters for emission estimation

- Emission factors and net calorific value
- Missing structure of equipment in households

EF solid fuels	*unit*	Brown coal	Briquettes	Hard coal	Coke	Firewood	Natural gas
calorific value	*MJ/kg*	15.3	22.8	23	24.7	**14.6**	34.2
combustion efficiency		72%	72%	72%	72%	**72%**	88%
EF - TSP	*kg/t*	**8.33**	**10.98**	**11.25**	**10.93**	**15**	**0.08**
PM_{10} / TSP ratio		95%	95%	95%	95%	**95%**	100%
$PM_{2.5}$ / TSP ratio		90%	90%	90%	90%	**90%**	100%
EF - SO_X	*kg/t*	18.88	13.5	10.08	9.61	**0**	0.10
EF - NO_X	*kg/t*	3	3	5.5	5.5	**3**	1.56
EF - NMVOC	*kg/t*	3	3	4.6	0.11	**6.17**	0.17
EF - TSP	*g/GJ*	545.5	481.6	477.7	442.0	**1051.2**	2.3
EF - PM_{10}	*g/GJ*	409.1	361.2	358.3	176.8	**998.6**	2.3
EF - $PM_{2.5}$	*g/GJ*	136.4	120.4	119.4	88.4	**946.0**	2.3
EF - SO_X	*g/GJ*	659.8	592.1	801.5	388.6	**0**	2.8
EF - NO_X	*g/GJ*	360.2	131.6	127.4	222.4	**210.2**	45.6
EF - NMVOC	*g/GJ*	196.5	131.6	195.3	4.6	**432.6**	5.0

Statistical survey

- Cooperation with Statistical office of SR – questionnaire
- Sample of survey from Census 2011 - Family houses heating with **solid fuel**
- 1566 completed questionnaire (weight scaling)
- Focus of the survey:
  - A – Information about flats and houses – age, energy parameters
  - B – Overall use of energy, types of equipment, fuels use
  - C – Specific technical information about equipment an fuels consumption
- Main output – structure of appliances burned solid fuels to improve EF's

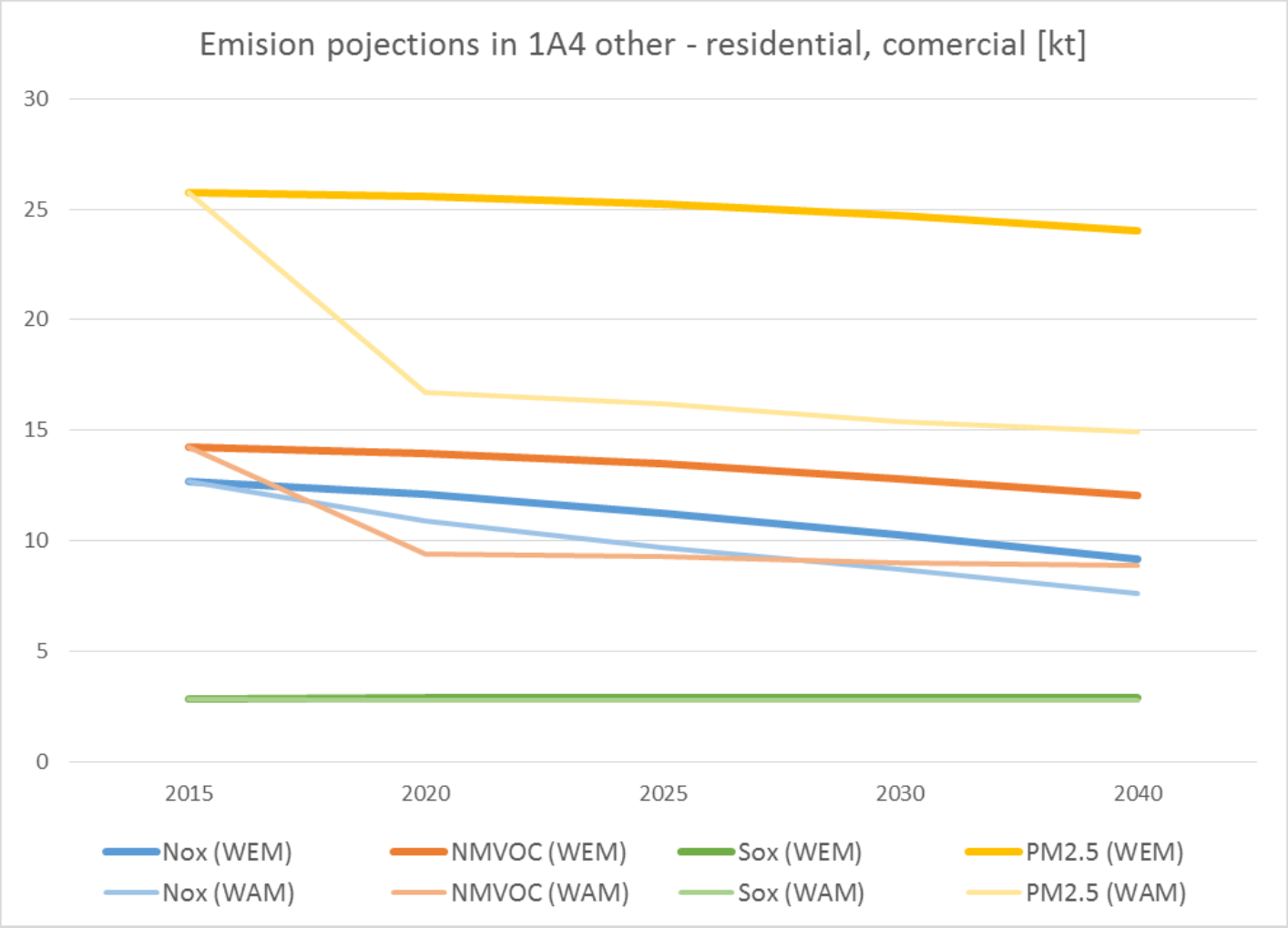
ID	Type of equipment	Share of equipment in households by type and fuels (TJ)							
		Brown coal	Hard coal / coke	Coal briquettes	*Wooden briq.*	*Pellets*	Wooden briq. & pellets	Firewood	Other
1	Underfired boiler	**52.8%**	**48.4%**	**73.6%**	50.9%	34.8%	**43.8%**	**47.4%**	**46.4%**
2	Overfired boiler	35.3%	27.3%	19.8%	24.7%	9.6%	18.0%	14.0%	50.3%
3	Gasification boilers	3.8%	4.3%	3.4%	6.3%	1.5%	4.2%	7.2%	
4	Automatic feed boilers	1.7%	6.3%		2.8%	37.8%	18.3%	2.2%	
5	Fireplaces, Stoves, Furnaces	6.5%	13.7%	3.3%	10.8%	12.7%	11.7%	26.9%	3.3%
6	Modern and pellet stoves				4.5%	3.6%	4.1%	1.7%	
7	Bathroom stoves							0.5%	
Sum		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Emission projections in Sector 1A4 – Other combustion

- The absolute majority of the emissions are from residential
- Trends of the projections are driven by trends of energy demand in EU Reference scenario 2016 for residential sector
- Measures:
  - Energy Efficiency Action Plan for the period 2014 - 2016 with the outlook for 2020
  - (WAM) Energy Efficiency Action Plan for the period **2017 - 2019** with the outlook for 2020
  - (WAM) Assessment of the future structure of appliances used for household heating

EF for Biomass comustion	unit	WEM	WAM
2015	*kg/t*	13.5	13.5
2020	*kg/t*	13.5	9.12
2025	*kg/t*	13.5	9.11
2030	*kg/t*	13.5	8.84

Emission projections in Sector 1A4 – Other combustion



Thank you for your attention

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