

Air pollution from residential combustion in Lithuania: share in national inventory

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Amounts of air pollutants: compiling methodology

- Sources of methodology: 1) Requirements of the Convention on Long Range Transport of Air Pollutants (CLRTAP)
2) EMEP/EEA Emission inventory Guidebook
- CLRTAP deals with 127 economy branches and 27 air pollutants
- Economic activities groups: 1) fuel combustion 2) industrial processes 3) agriculture 4) use of solvents 5) waste

Air pollutant groups

- Main pollutants (NO_x, NMVOC, SO_x, NH₃, CO)
- Particulate matter (TSP, PM₁₀, PM_{2.5}, BC (*Black Carbon -soot*))
- Heavy metals (priority :Hg (Mercury), Cd (*Cadmium*), Pb (Lead))
- Persistent organic pollutants (priority: dioxins-furans, benzo(a)pirene)

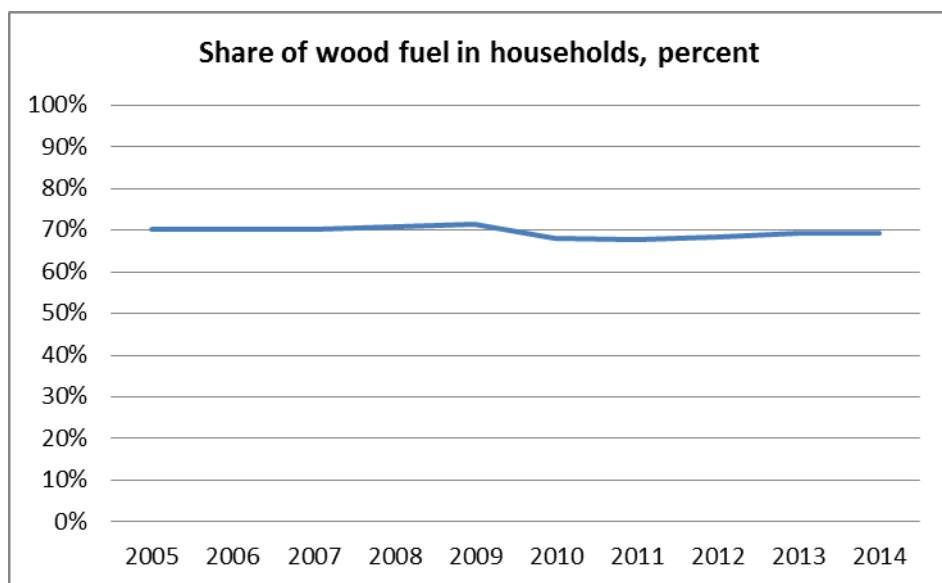
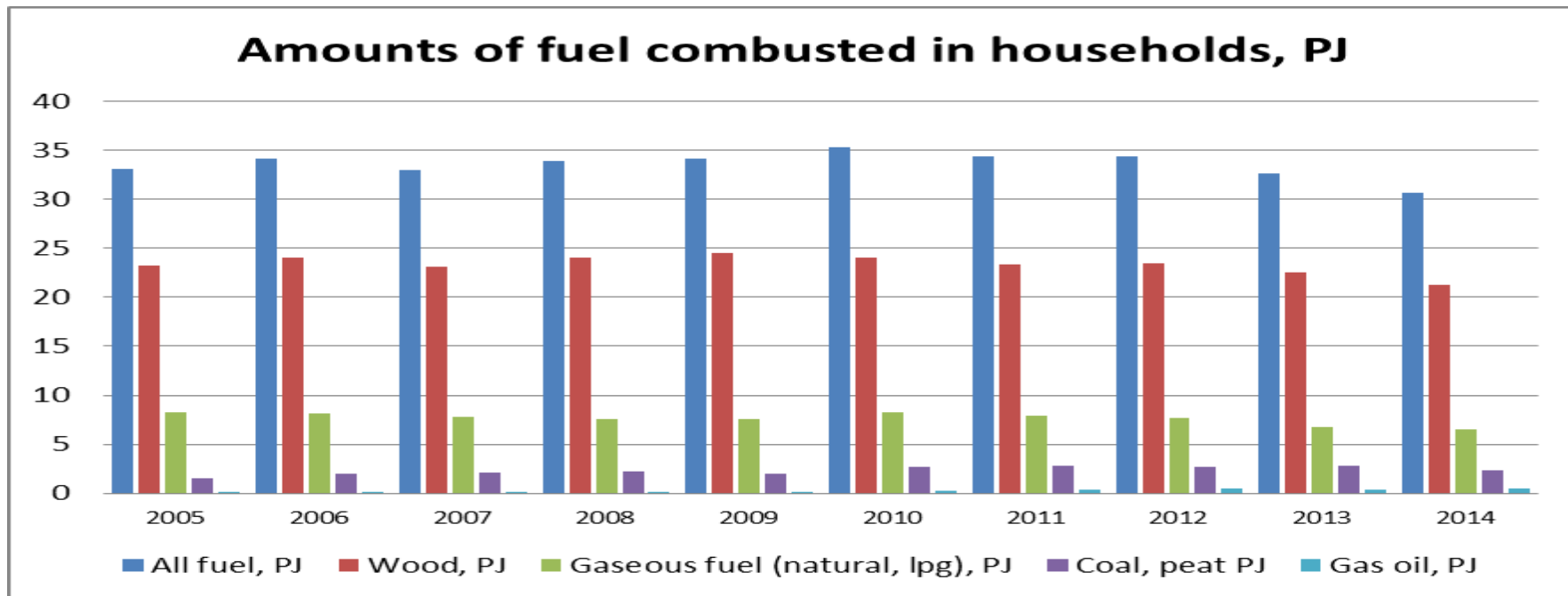
Definition of terms in fuel balance statistics

- **Household** – person living alone or a group of people who live together in the same private dwelling and sharing expenditures including the joint provision of the essentials of living.
- **In terms of energy consumption**, the household sector includes all energy-using activities related to private dwellings.
- Fuel used in all transport activities is reported in the transport sector and not in the household sector

Uncertainties of residential fuel balance data

- Statistics Lithuania performed statistical survey of fuel consumption in households at 2009.
- It was revealed that uncertainty of hard coal amount is about 10 percent.
- According to the expert estimates, uncertainty of wood amount can be about 15 percent.
- Fuel data uncertainties at the beginning of 90's are estimated to be about 20-25 percent

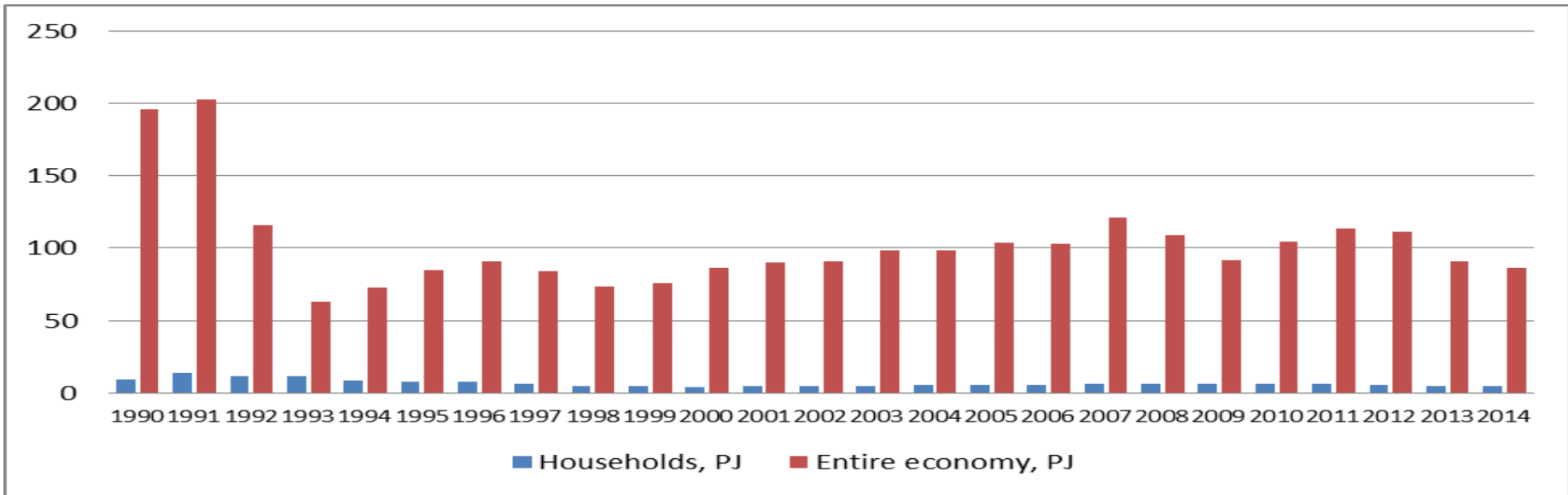
Types and amounts of fuel combusted in households



Data source: Statistics Lithuania

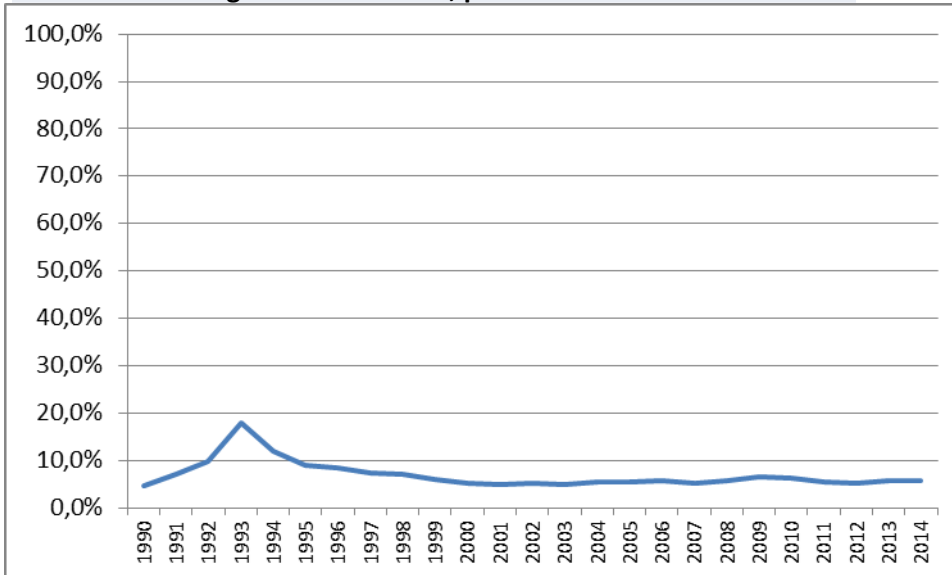
Combustion of Natural Gas in Lithuania

Combustion of natural gas in households and entire economy, PJ

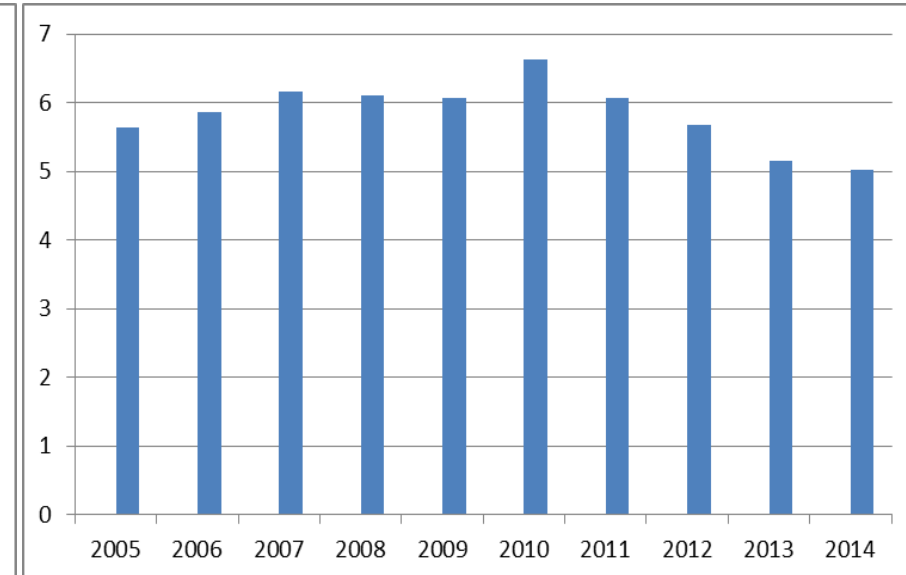


Data source: Statistics Lithuania

Share of natural gas in households, percent



Combustion of natural gas in households since 2005, PJ

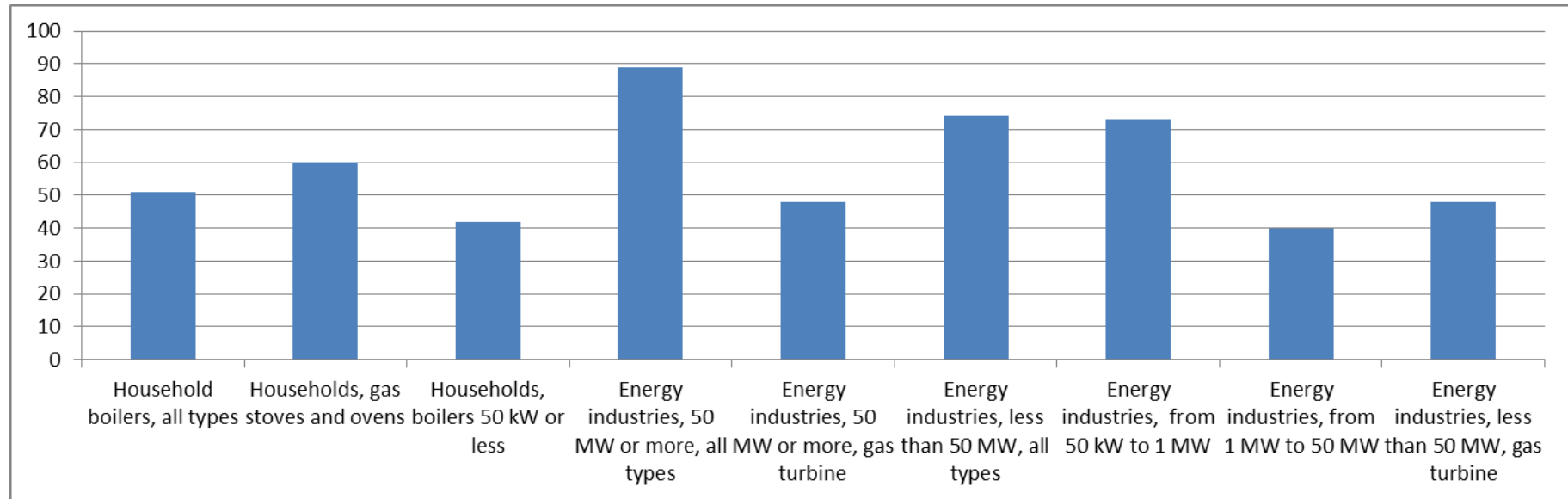


Combustion of Natural Gas : NOx emission factors

NOx emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of NOx (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



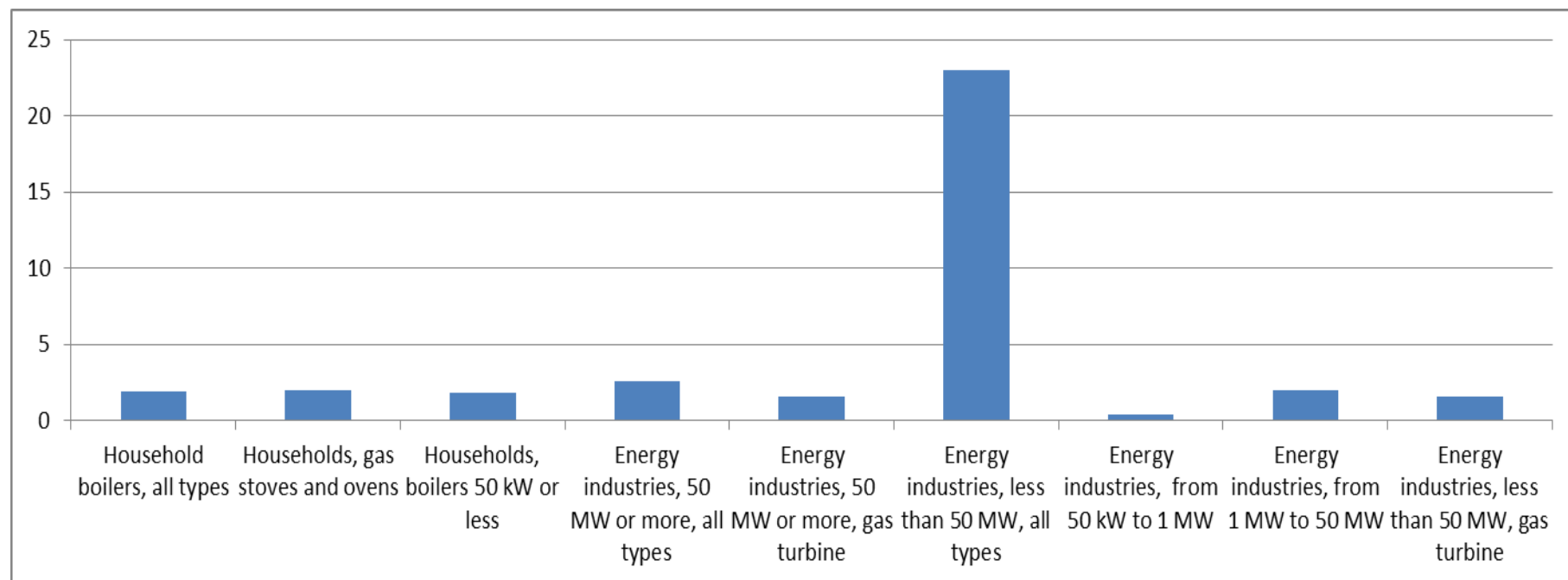
Conclusion: regarding to NOx, combustion of natural gas in households is not more polluting, than in other sectors

Combustion of Natural Gas: NMVOC emission factors

NMVOC emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of NMVOC (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



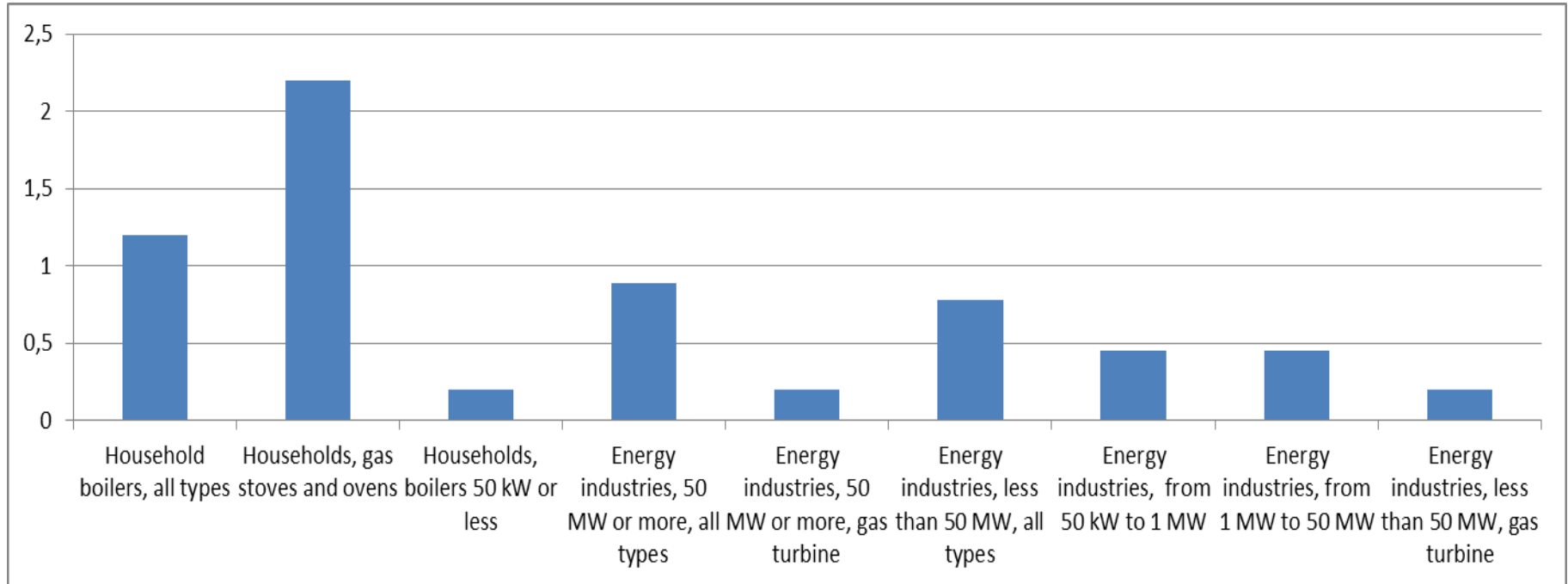
Conclusion: regarding to NMVOC, combustion of natural gas in households is not more polluting, than in other sectors. Stationary reciprocating engines used in energy industries generate especially significant amount of NMVOC: 89 tonnes /PJ

Combustion of Natural Gas: PM2.5 emission factors

PM2.5 emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of PM2.5 (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



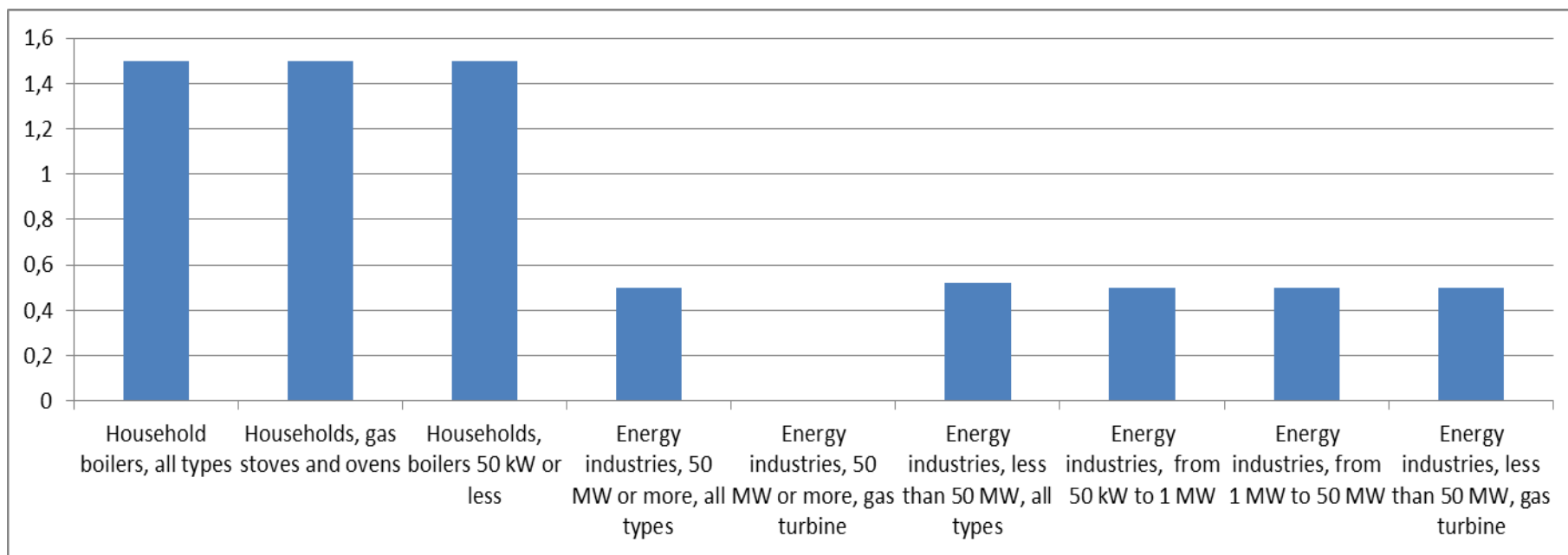
Conclusion: regarding PM2.5, combustion of natural gas in stoves and ovens of households is more polluting, than in other sectors.

Combustion of Natural Gas: dioxins and furans emission factors

Dioxins and furans emission factors (milligrams/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of dioxins and furans (in milligrams) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



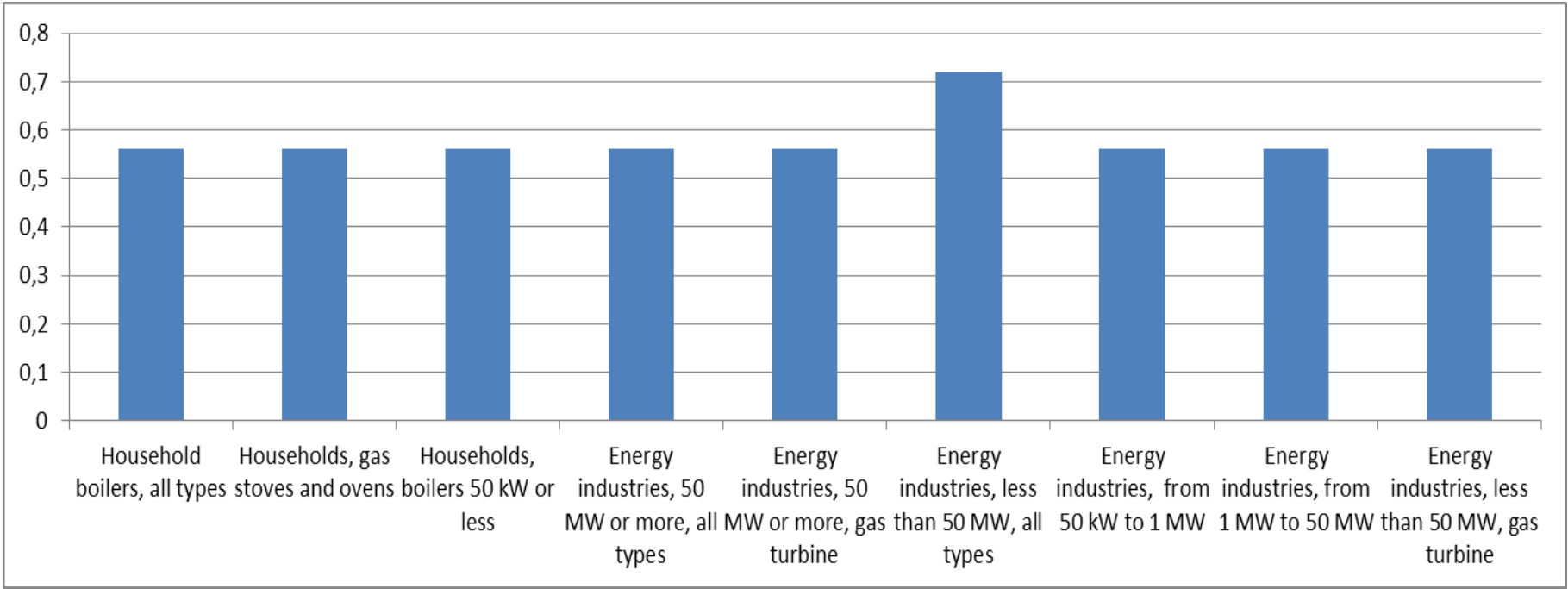
Conclusion: Regarding dioxins and furans, combustion of natural gas in households is more polluting, than in other sectors.

Combustion of Natural Gas: benzo(a)pyrene emission factors

Benzo(a)pyrene emission factors (grammes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of benzo(a)pyrene (in grammes) that is generated by combustion of 1 PJ of fuel

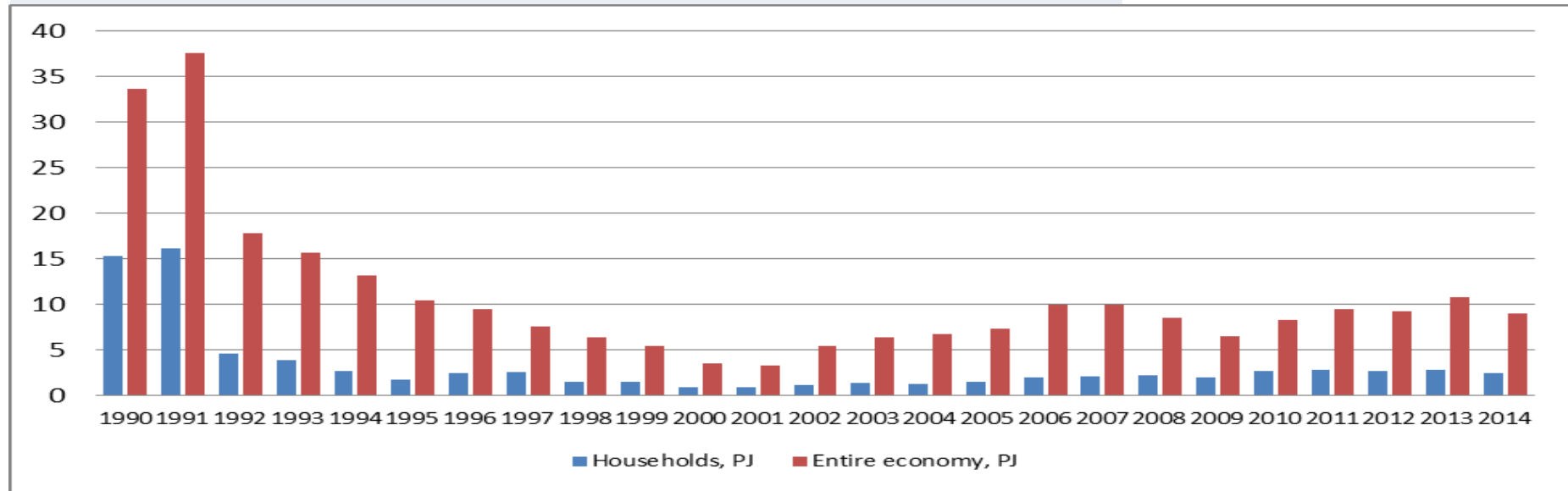
1 PJ=1000TJ



Conclusion: Regarding benzo(a)pyrene, combustion of natural gas in households is not more polluting, than in other sectors.

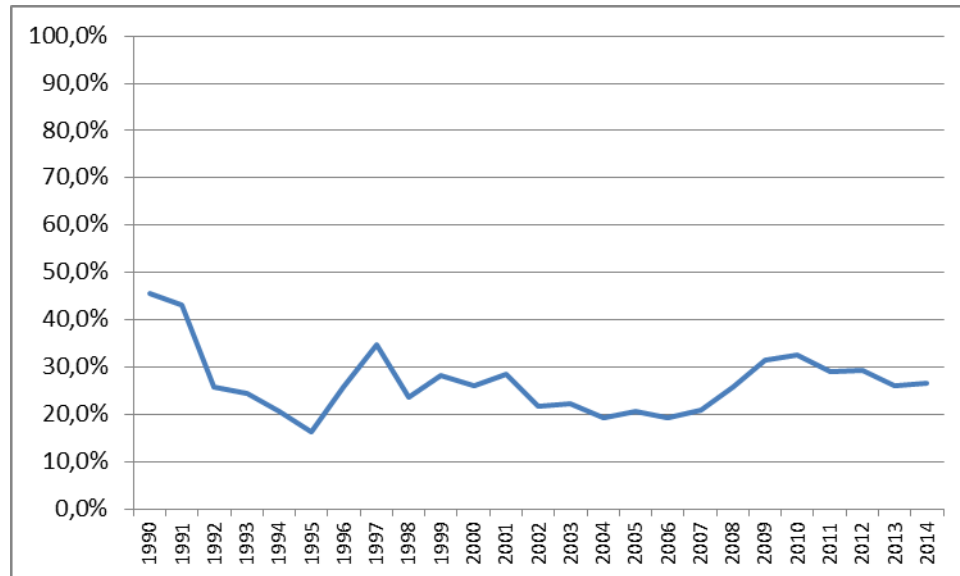
Combustion of Solid Fuel (Coal, Peat) in Lithuania

Combustion of solid fuel in households and entire economy, PJ

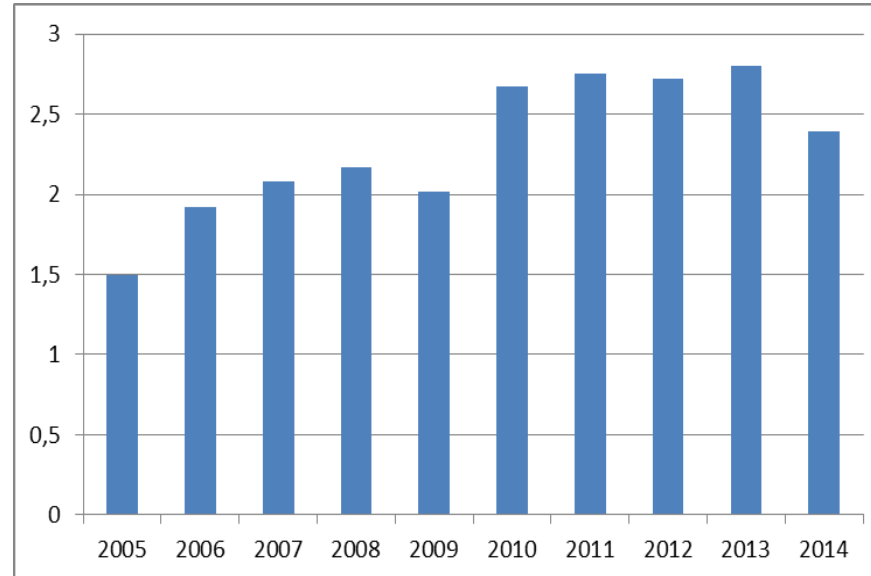


Data source: Statistics Lithuania

Share of solid fuel in households, percent



Combustion of solid fuel in households since 2005, PJ

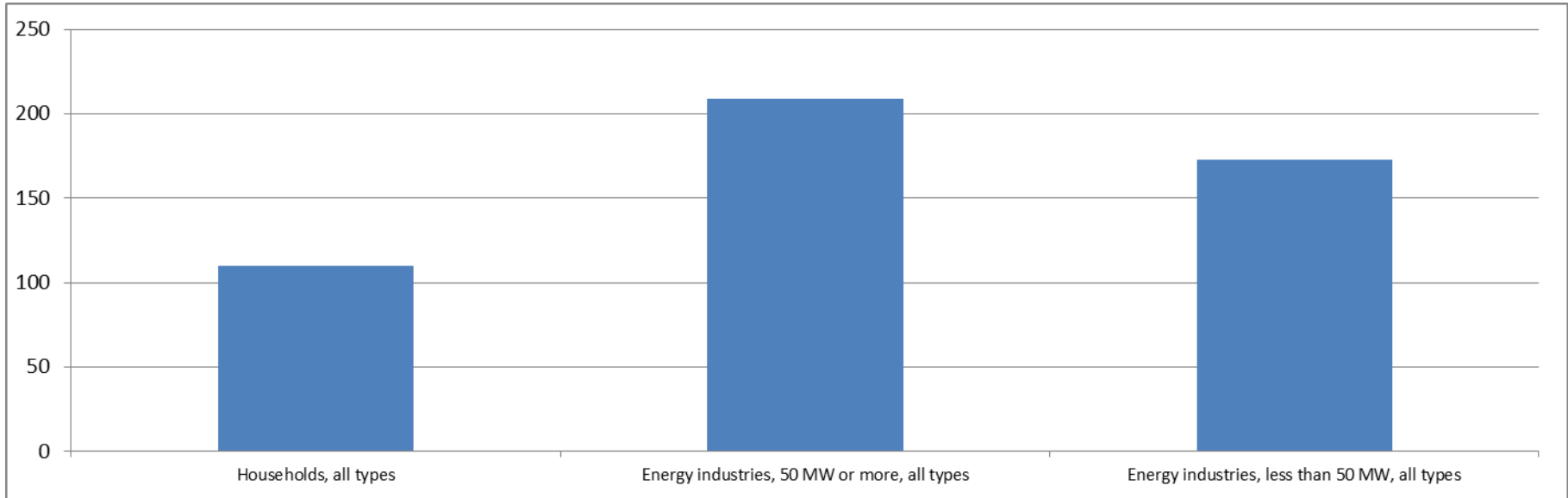


Combustion of Solid Fuel (Coal, Peat) : NOx emission factors

NOx emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of NOx (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



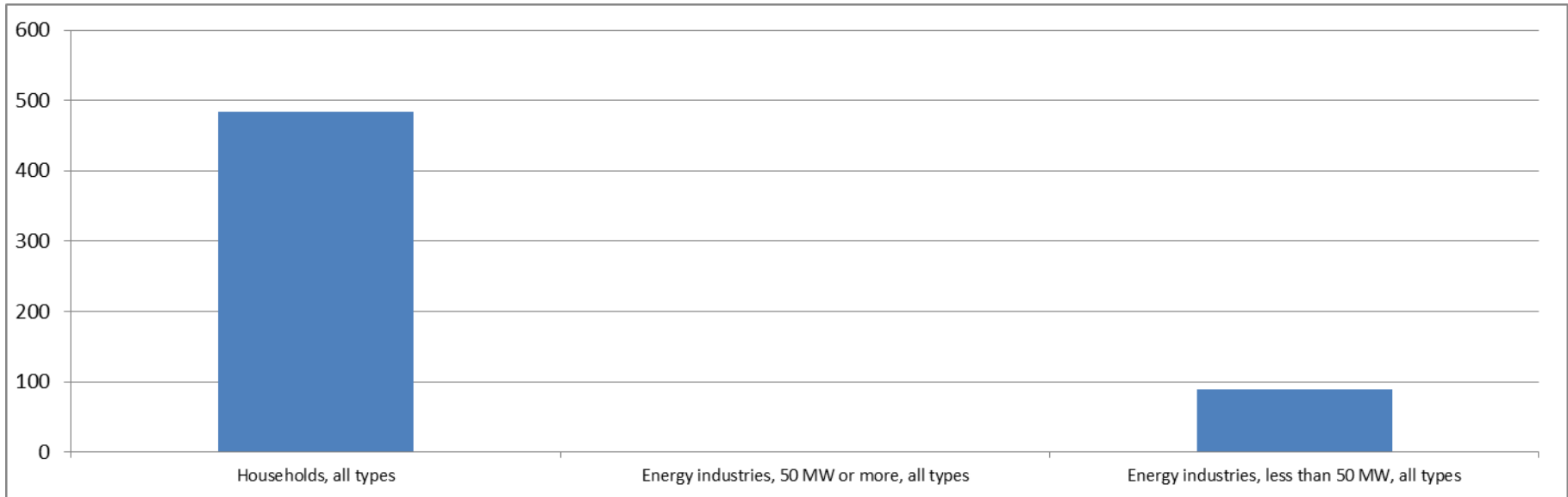
Conclusion: Regarding NOx, combustion of solid fuel in households is less polluting than in other sectors

Combustion of Solid Fuel (Coal, Peat): NMVOC emission factors

NMVOC emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of NMVOC (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



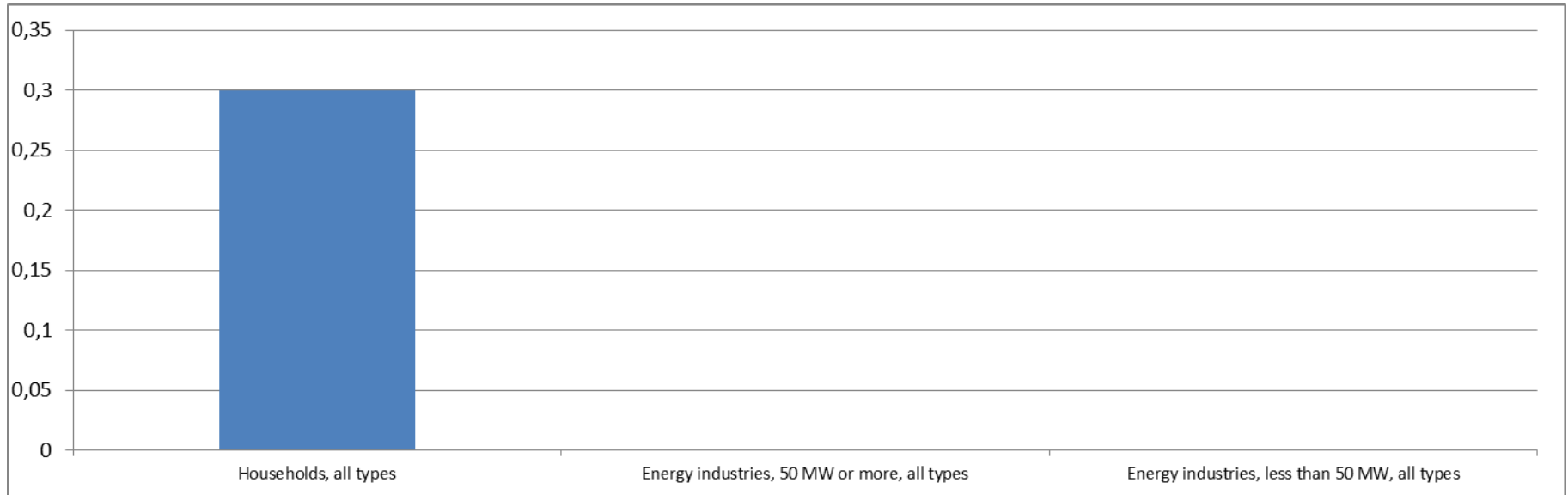
Conclusion: regarding NMVOC, combustion of solid fuel in households is very polluting

Combustion of Solid Fuel (Coal, Peat): NH₃ emission factors

NH₃ emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of NH₃ (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



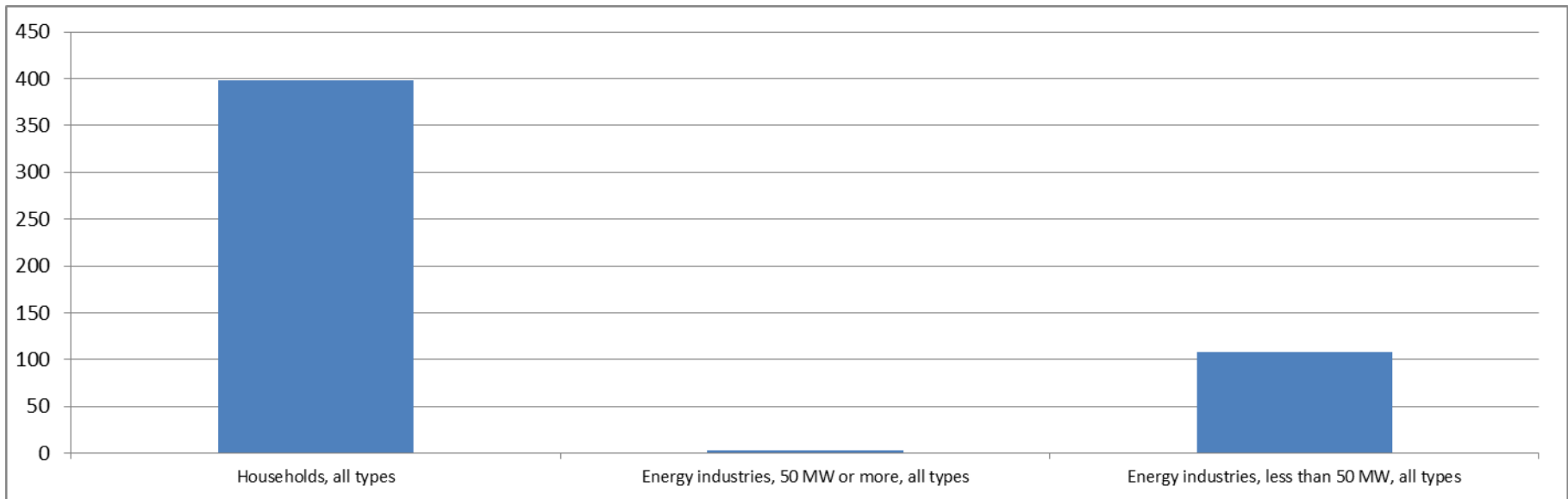
Combustion of solid fuel in households emits small amounts of ammonia

Combustion of Solid Fuel (Coal, Peat): PM2.5 emission factors

PM2.5 emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of PM2.5 (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



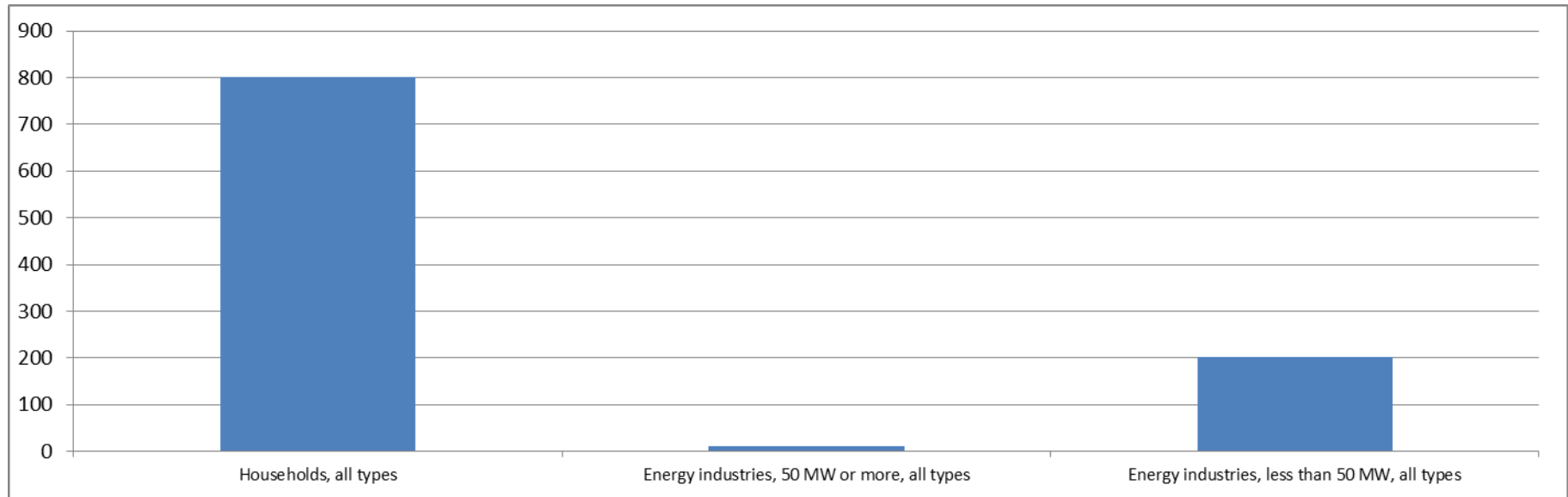
Conclusion: regarding PM2.5, combustion of solid fuel in households is much more polluting than in other sectors.

Combustion of Solid Fuel (Coal, Peat): dioxins and furans emission factors

Dioxins and furans emission factors (milligrams/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of dioxins and furans (in milligrams) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



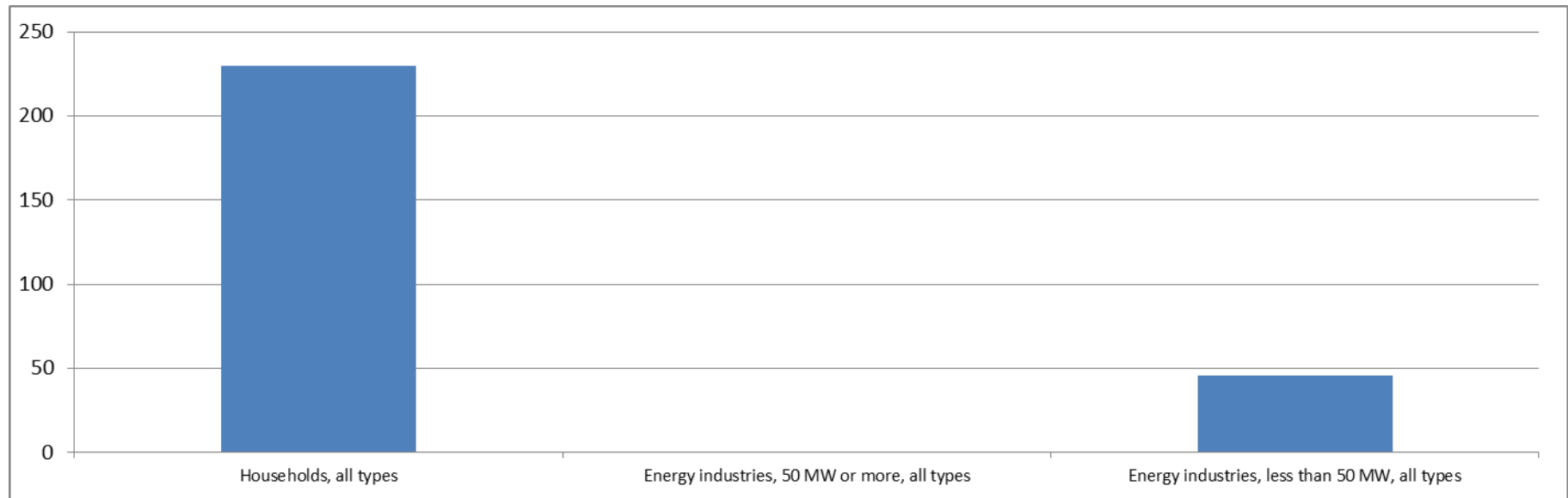
Conclusion: regarding dioxins and furans, combustion of solid fuel in households is much more polluting than in other sectors.

Combustion of Solid Fuel (Coal, Peat): benzo(a)pyrene emission factors

Benzo(a)pyrene emission factors (kilogrammes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of benzo(a)pyrene (in kilogrammes) that is generated by combustion of 1 PJ of fuel

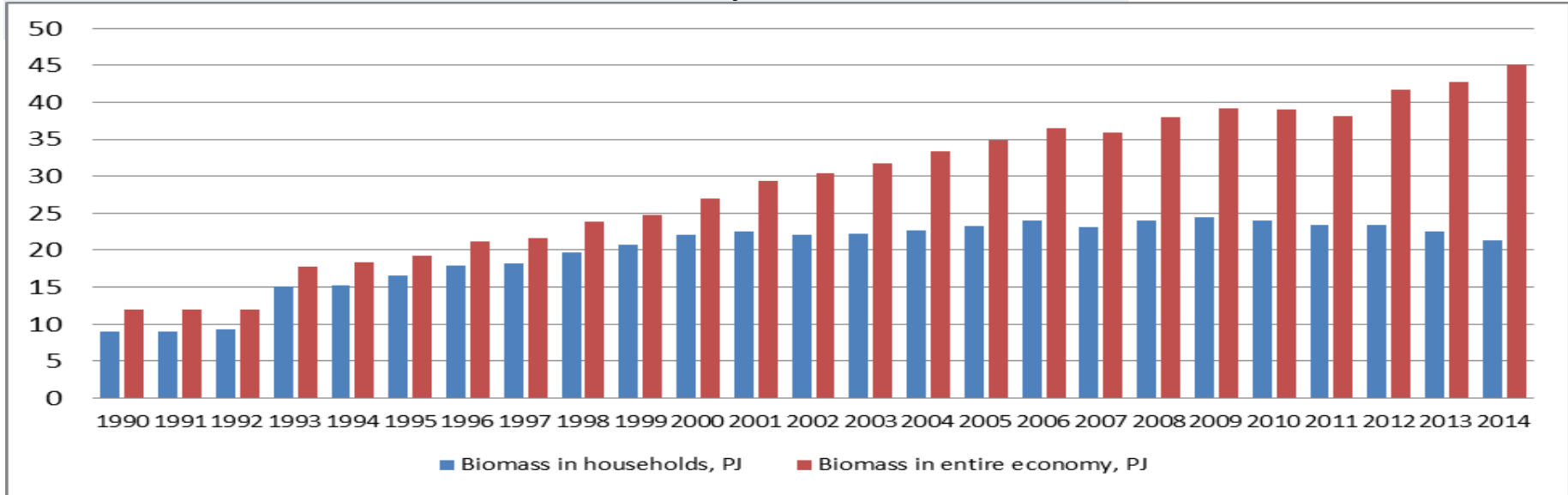
1 PJ=1000TJ



Conclusion: regarding benzo(a)pyrene, combustion of solid fuel in households is especially polluting. Emission factor for solid fuel is 2 times bigger than for biomass.

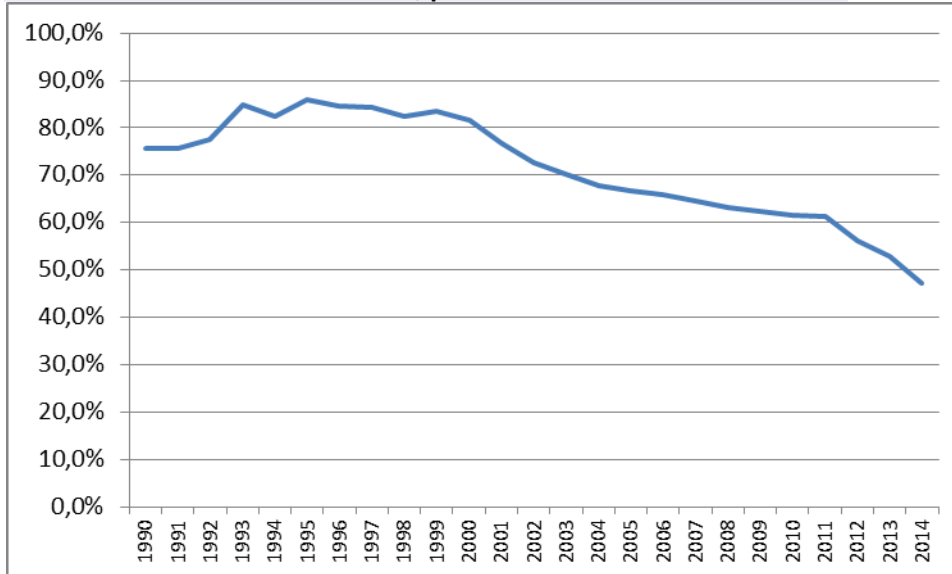
Combustion of wood in Lithuania

Combustion of wood in households and entire economy, PJ

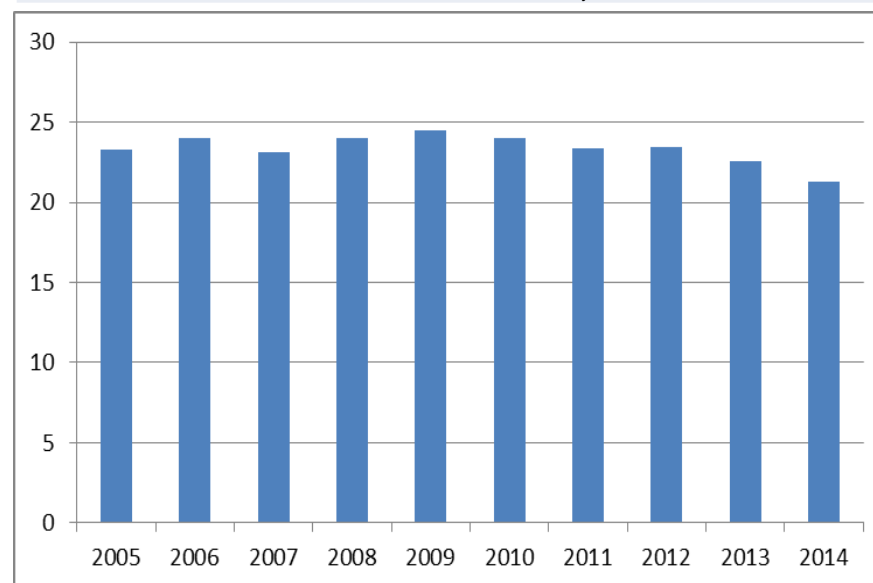


Data source: Statistics Lithuania

Share of wood fuel in households , percent

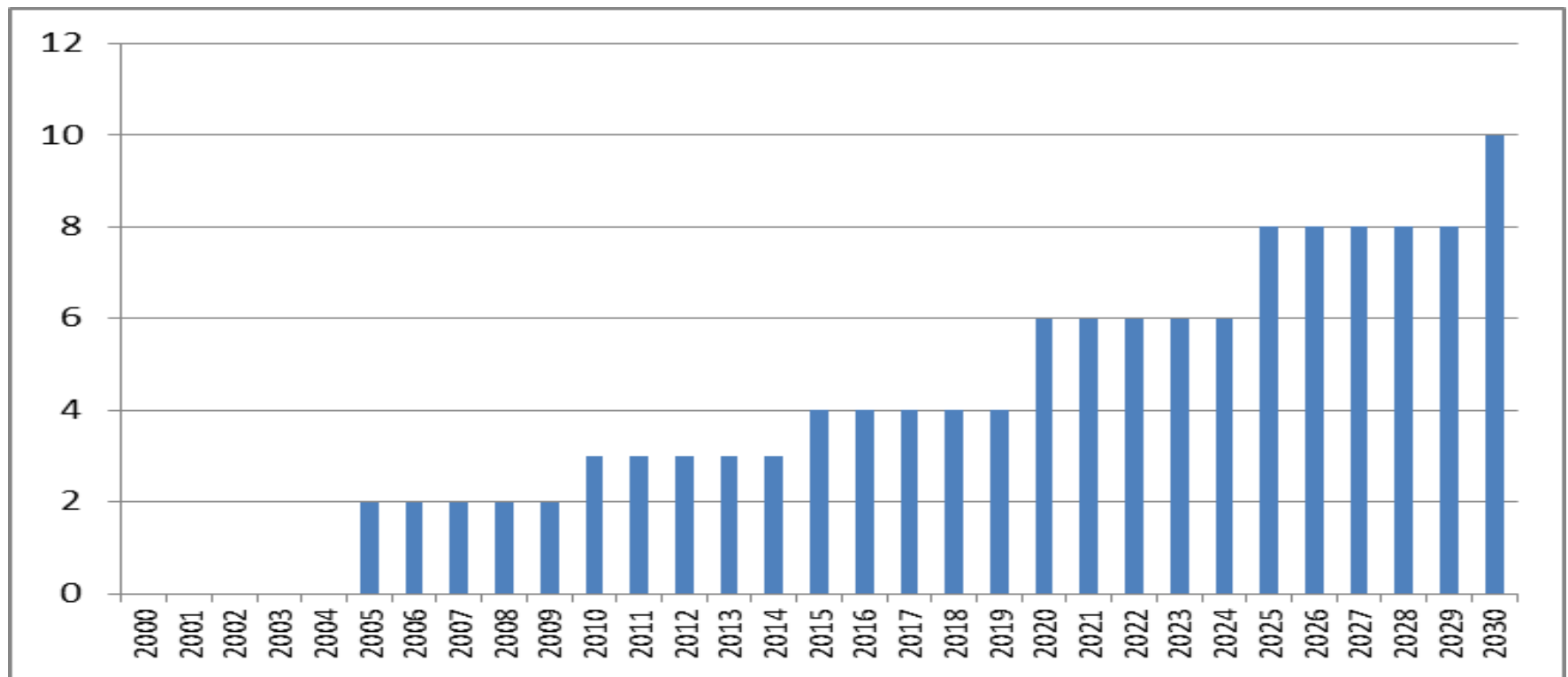


Combustion of wood in households since 2005, PJ



What is extent of usage of modern and ecological wood boilers in Lithuania? IIASA (International Institute of Applied System Analysis) provides such estimates:

Share of fuel consumption by Advanced / ecolabelled stoves and boilers and Pellet stoves and boilers in all fuel consumption by Wood combustion installations of Lithuanian households (percent)



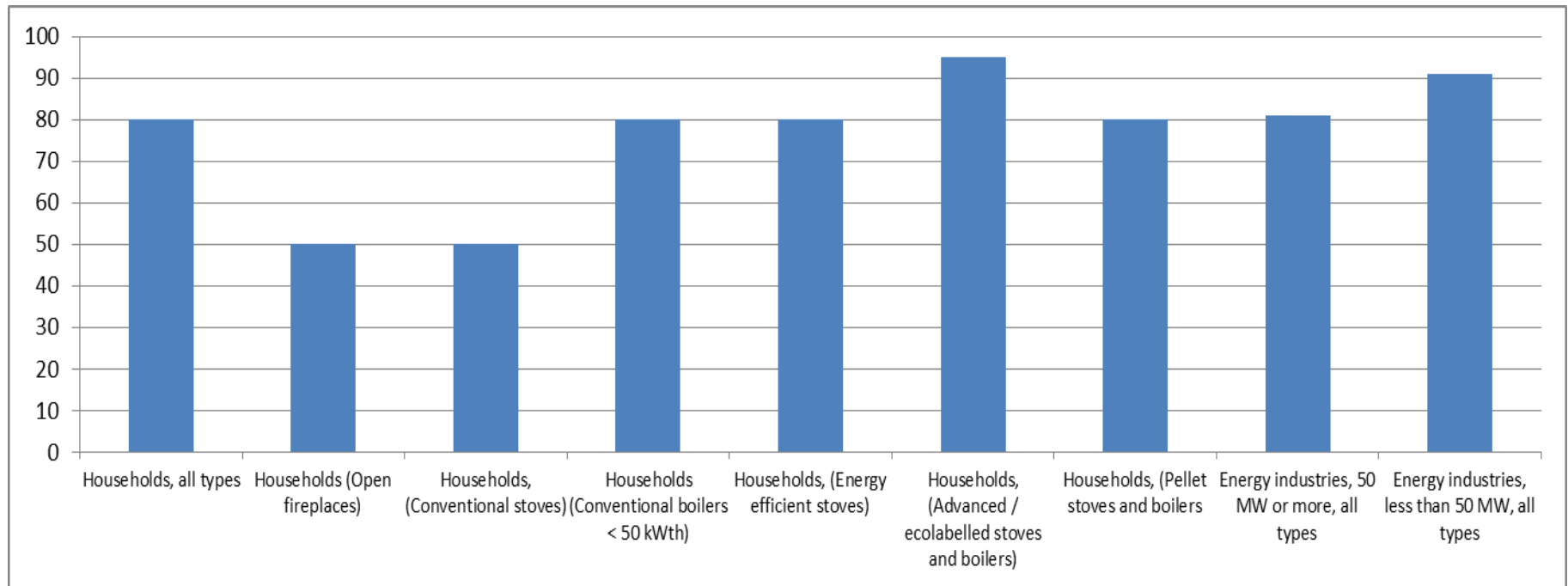
Source: IIASA (International Institute of Applied System Analysis)

Wood combustion: NOx emission factors

NOx emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of NOx (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



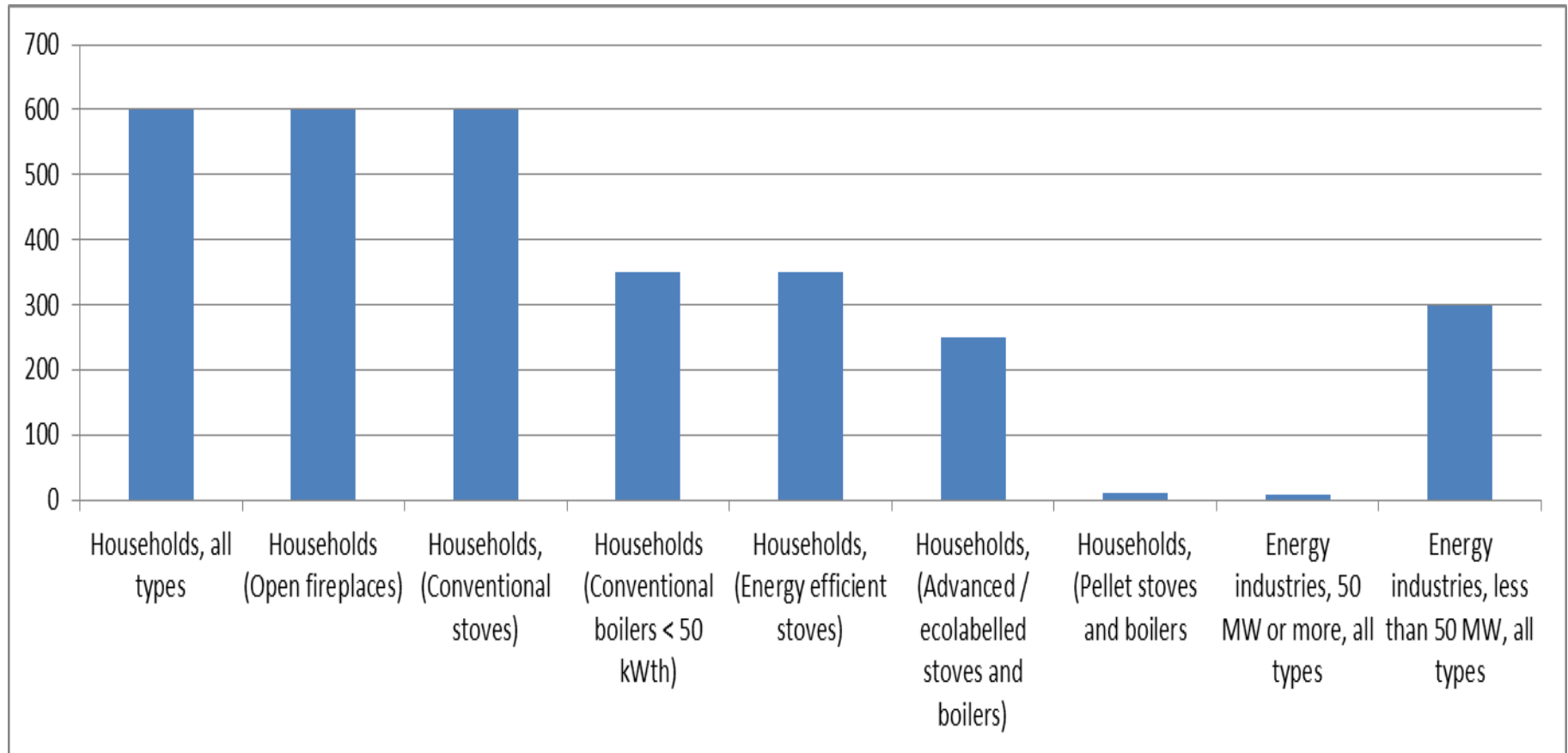
Conclusion: Regarding NOx, wood combustion in households is not more polluting than in other sectors

Wood combustion: NMVOC emission factors

NMVOC emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of NMVOC (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



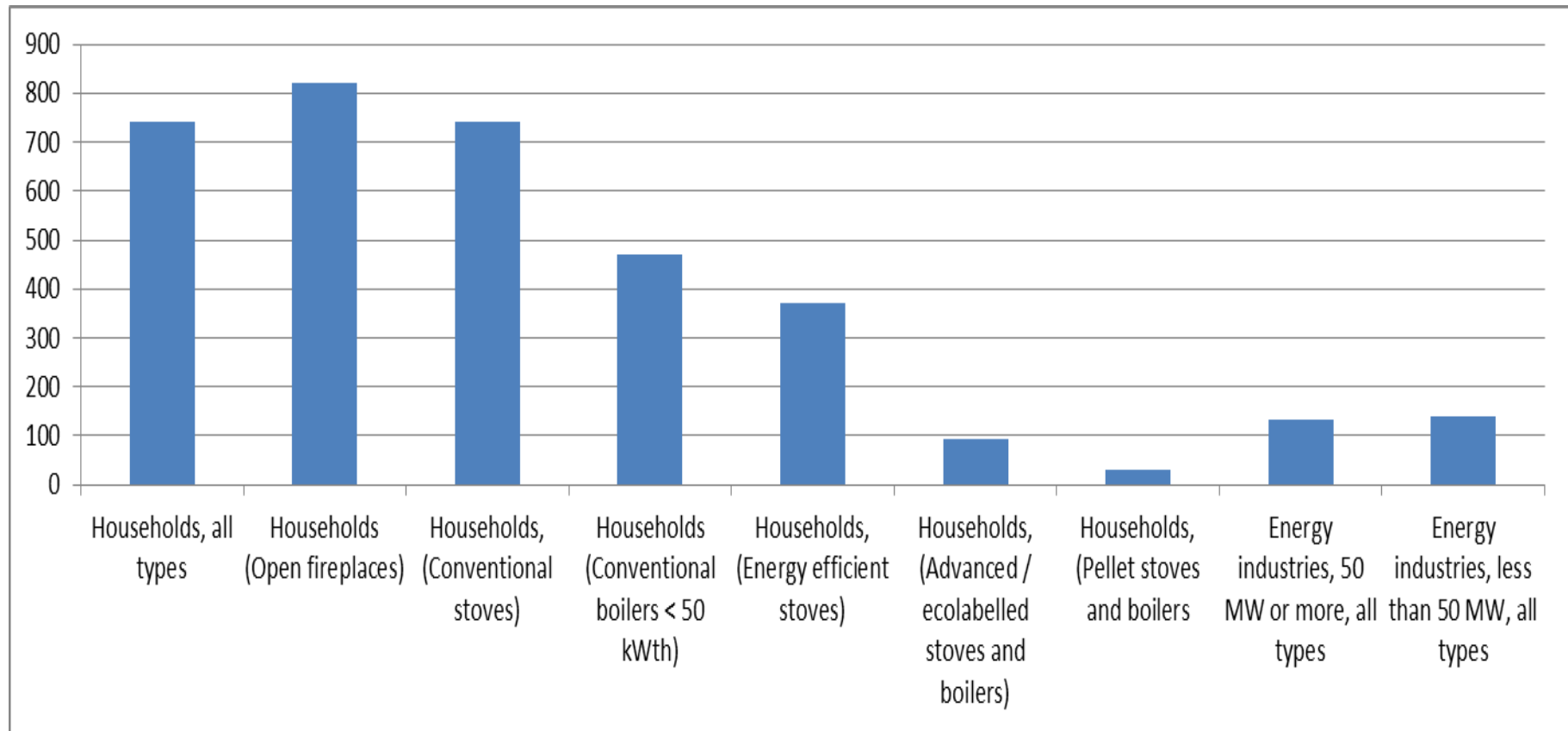
Conclusion: Regarding NMVOC, wood combustion in households is much more polluting than in other sectors

Wood combustion: PM2.5 emission factors

PM2.5 emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of PM2.5 (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



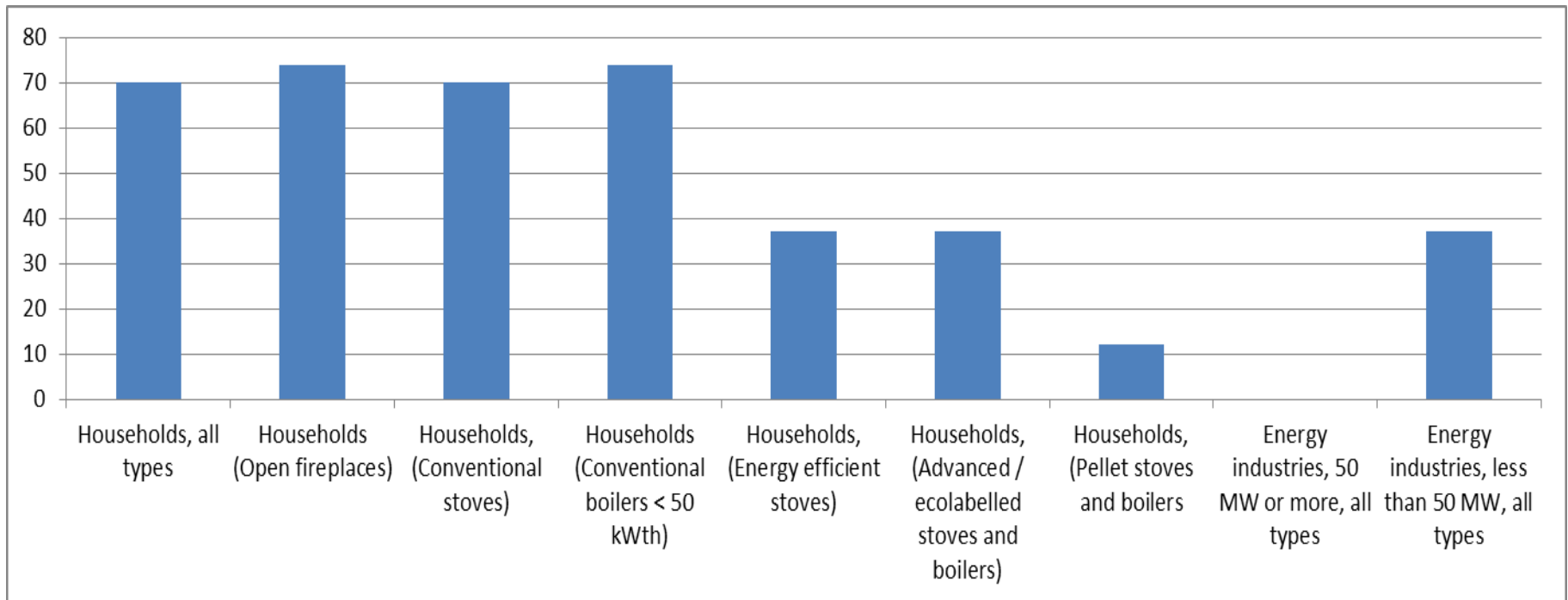
Conclusion: Regarding PM2.5, wood combustion in households is much more polluting than in other sectors. Combustion only in modern boilers generates small amounts, even less than energy industries

Wood combustion: NH₃ emission factors

NH₃ emission factors (tonnes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of NH₃ (in tonnes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



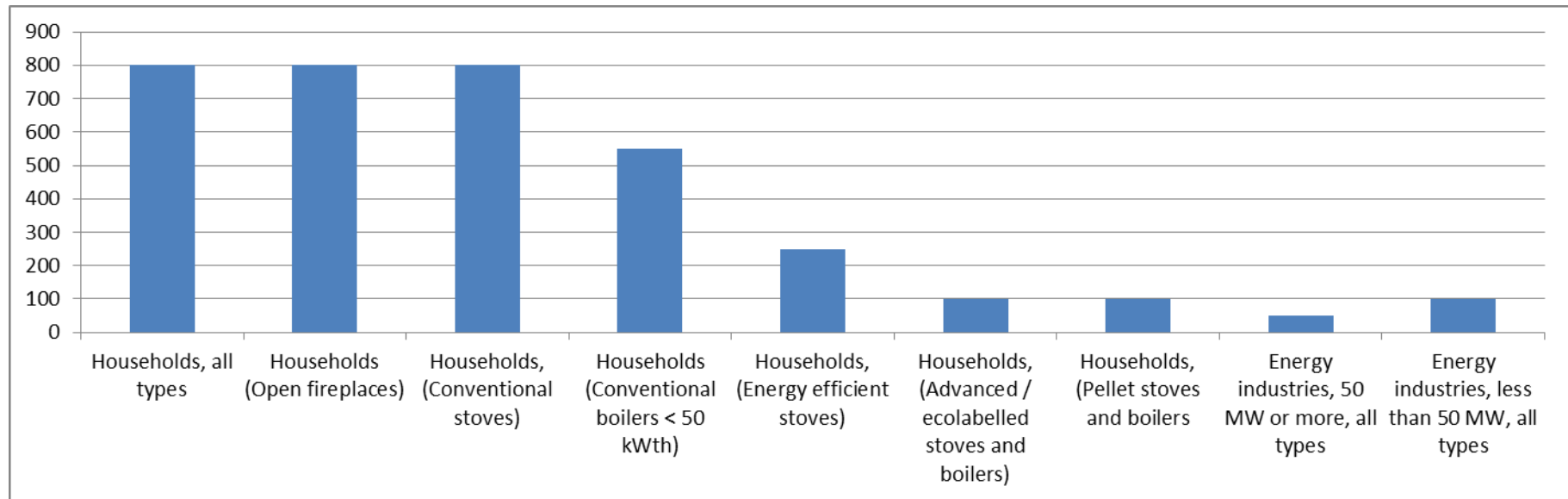
Conclusion: Regarding NH₃, wood combustion in households is more polluting than in other sectors. Combustion only in modern boilers generates small amounts.

Wood combustion: dioxins and furans emission factors

Dioxins and furans emission factors (milligrams/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

Amount of dioxins and furans (in milligrams) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



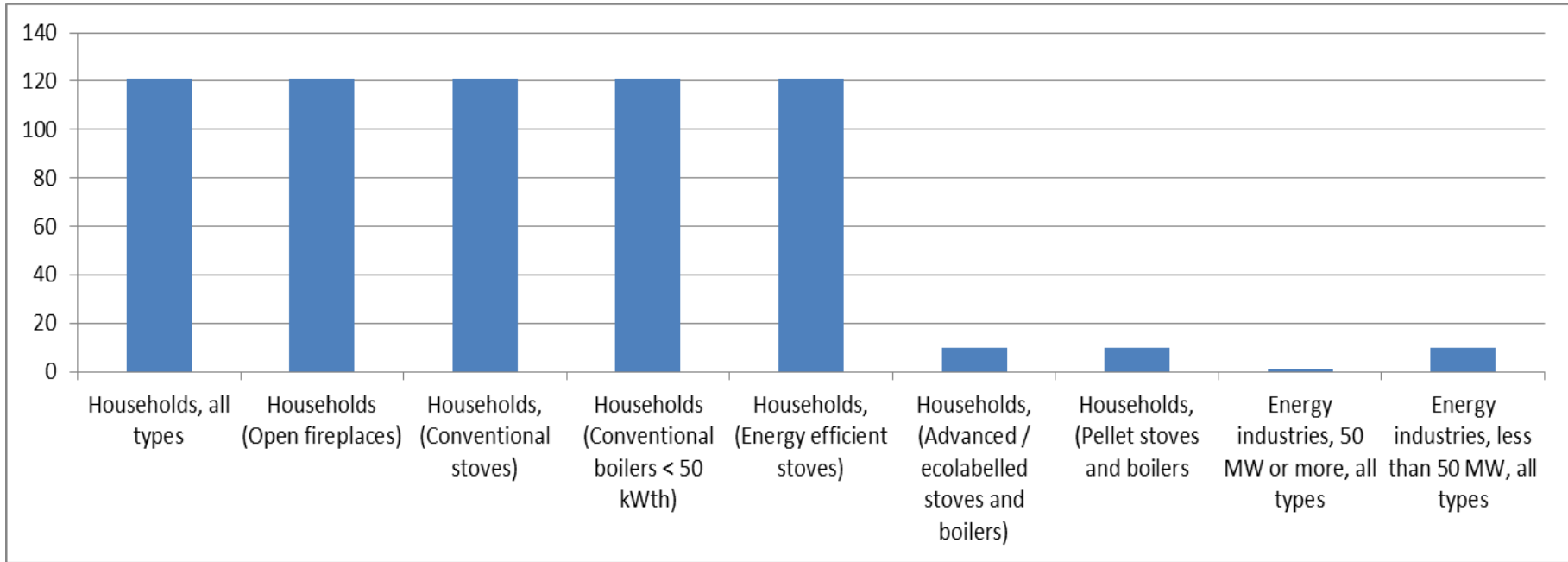
Conclusion: Regarding dioxins and furans, wood combustion in households is more polluting than in other sectors. Only modern boilers generates small amounts.

Wood combustion: benzo(a)pyrene emission factors

Benzo(a)pyrene emission factors (kilogrammes/PJ) by boiler type (source: EMEP\EEA Emission Inventory Guidebook 2013)

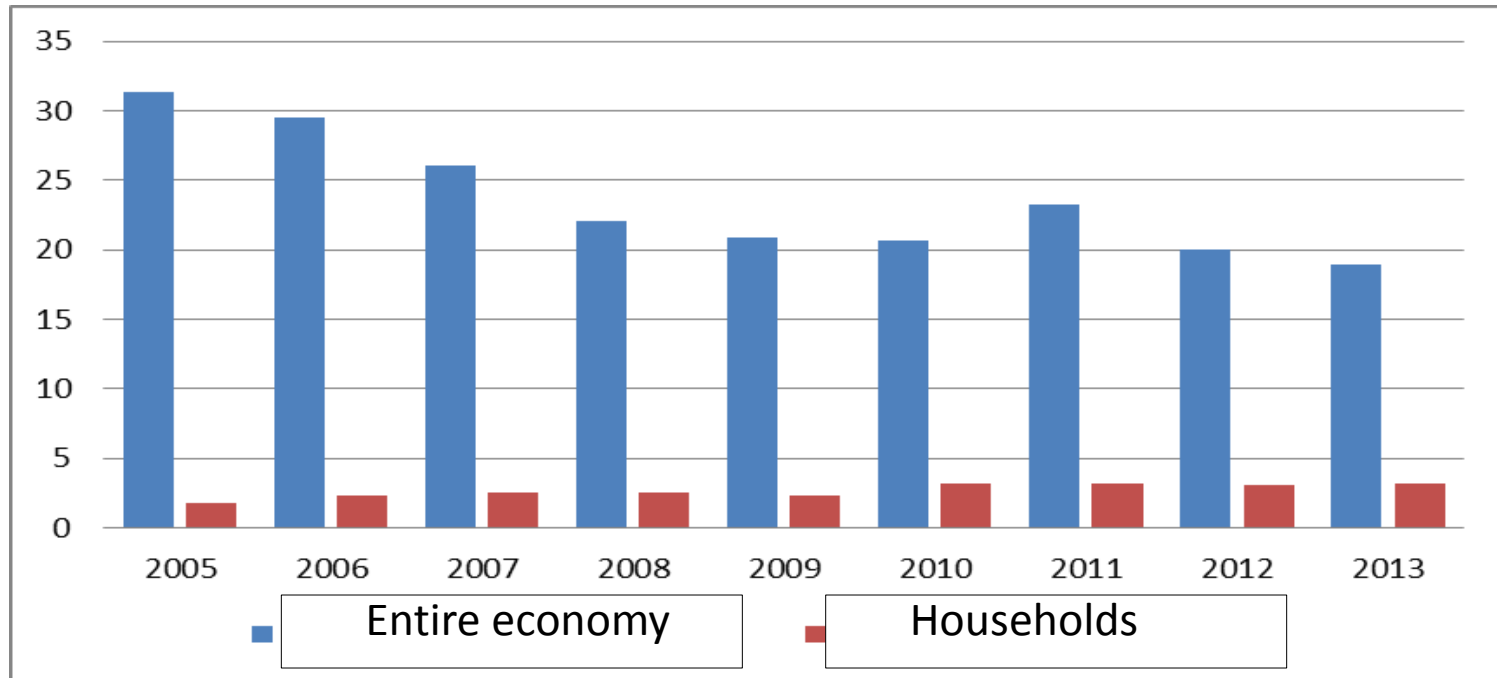
Amount of benzo(a)pyrene (in kilogrammes) that is generated by combustion of 1 PJ of fuel

1 PJ=1000TJ



Conclusion: Regarding benzo(a)pyrene, wood combustion in households is more polluting than in other sectors. Only modern boilers generates small amounts.

SOx emissions, 1000 tonnes

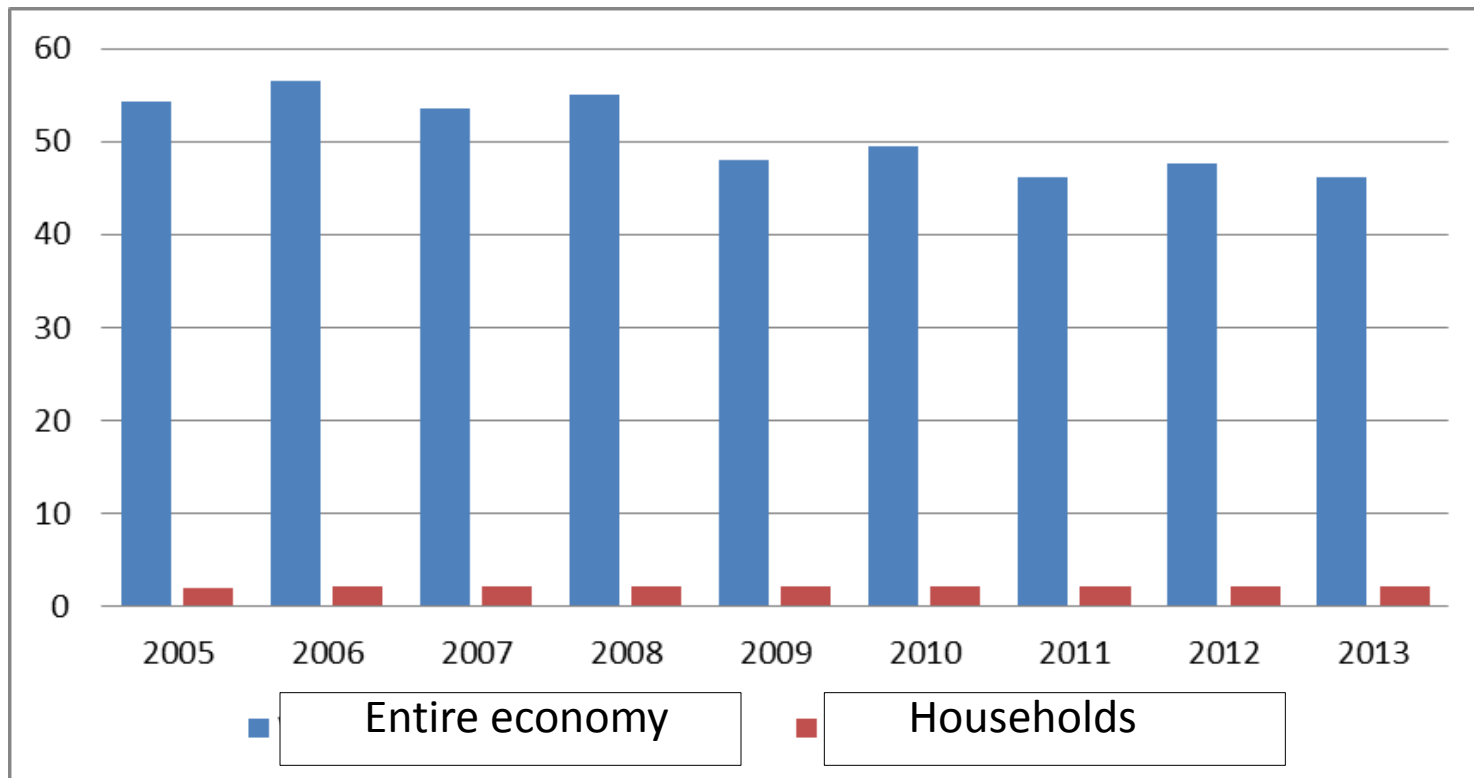


Share of SOx emissions from households

, percent

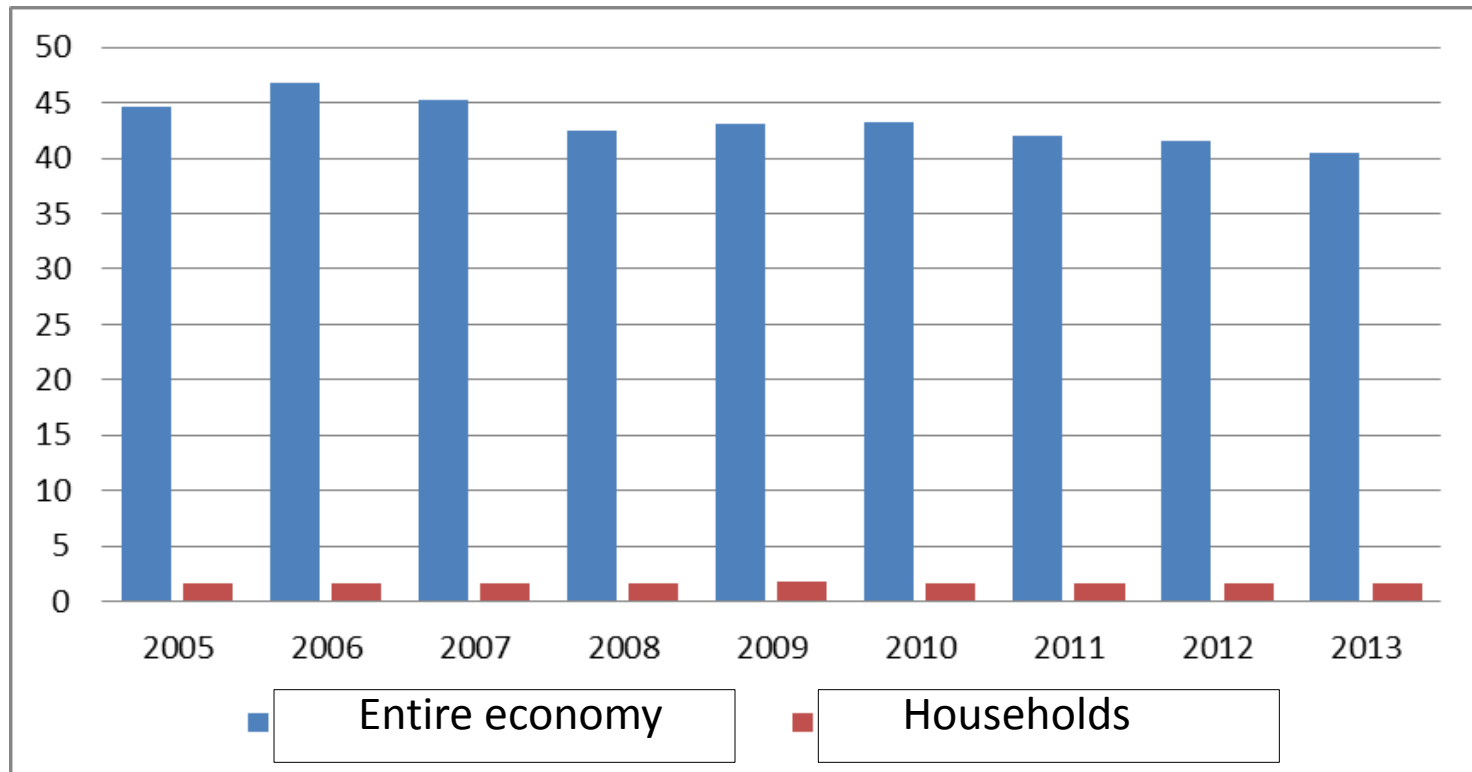
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Fuel combustion in households	6%	8%	10%	12%	11%	15%	14%	15%	17%

NOx emissions, 1000 tonnes

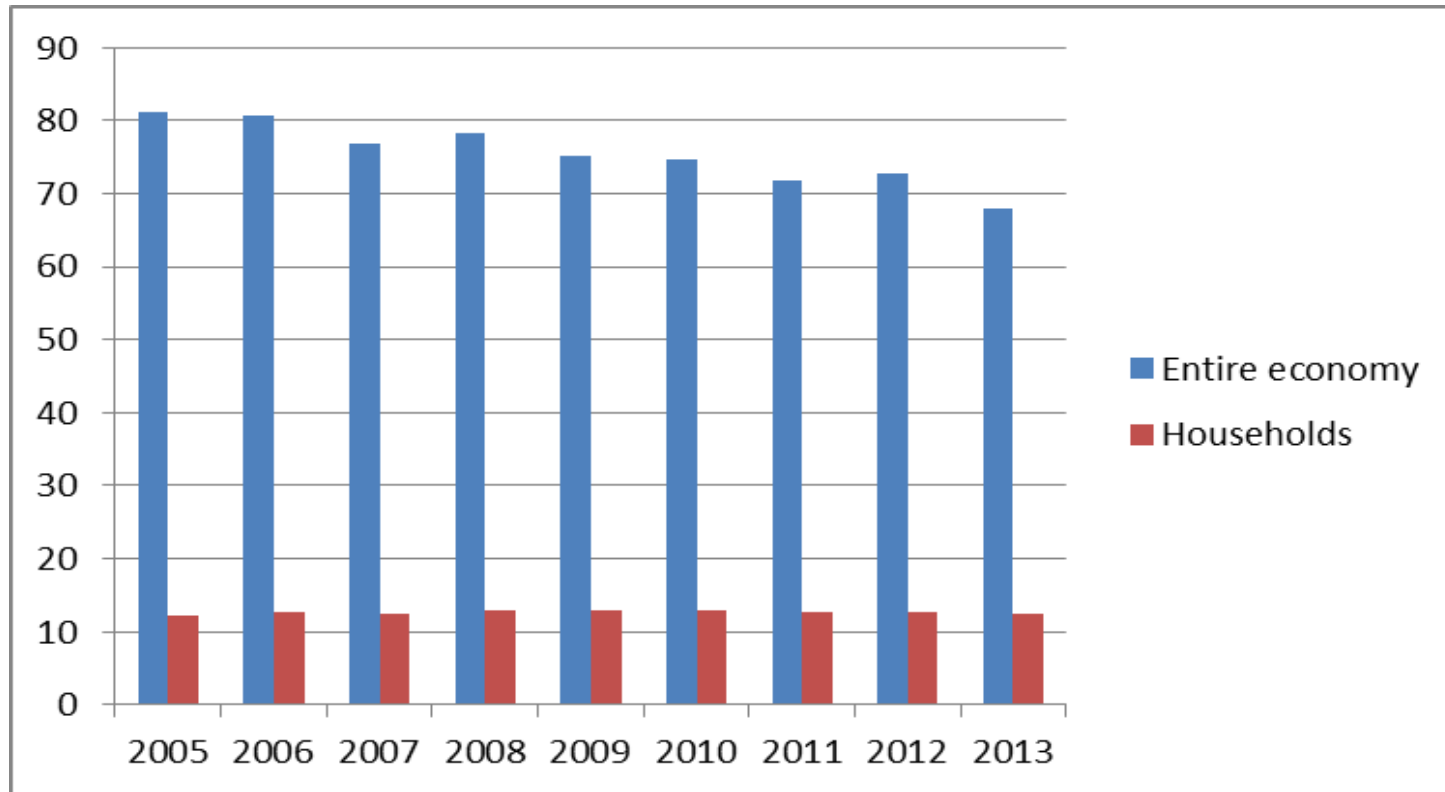


Share of NOx emissions from households , percent									
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Fuel combustion in households	4%	4%	4%	4%	4%	5%	5%	5%	5%

Ammonia emissions, 1000 tonnes

[illegible]

NMVOC emissions, 1000 tonnes

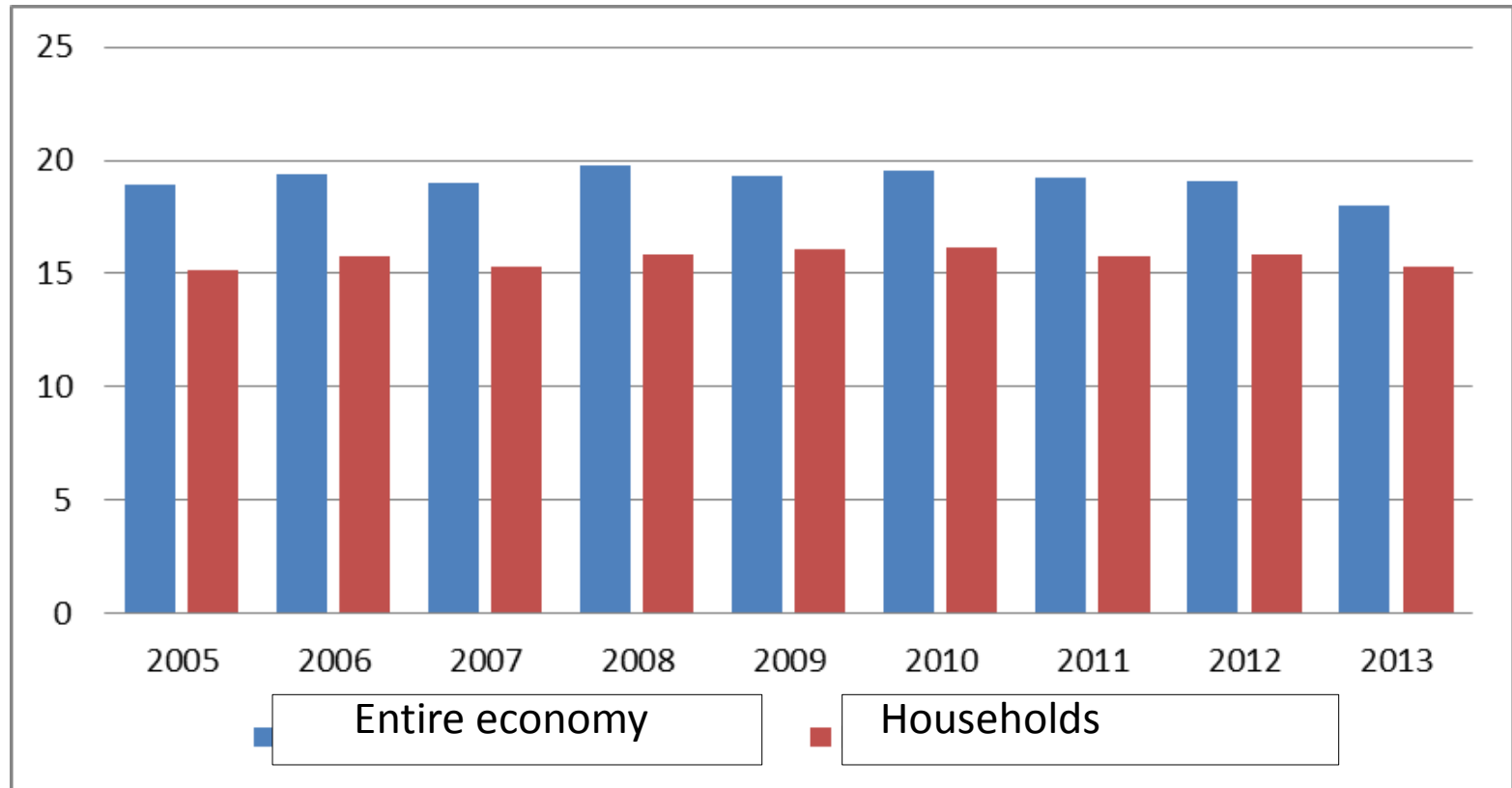


Share of NMVOC emissions from households

, percent

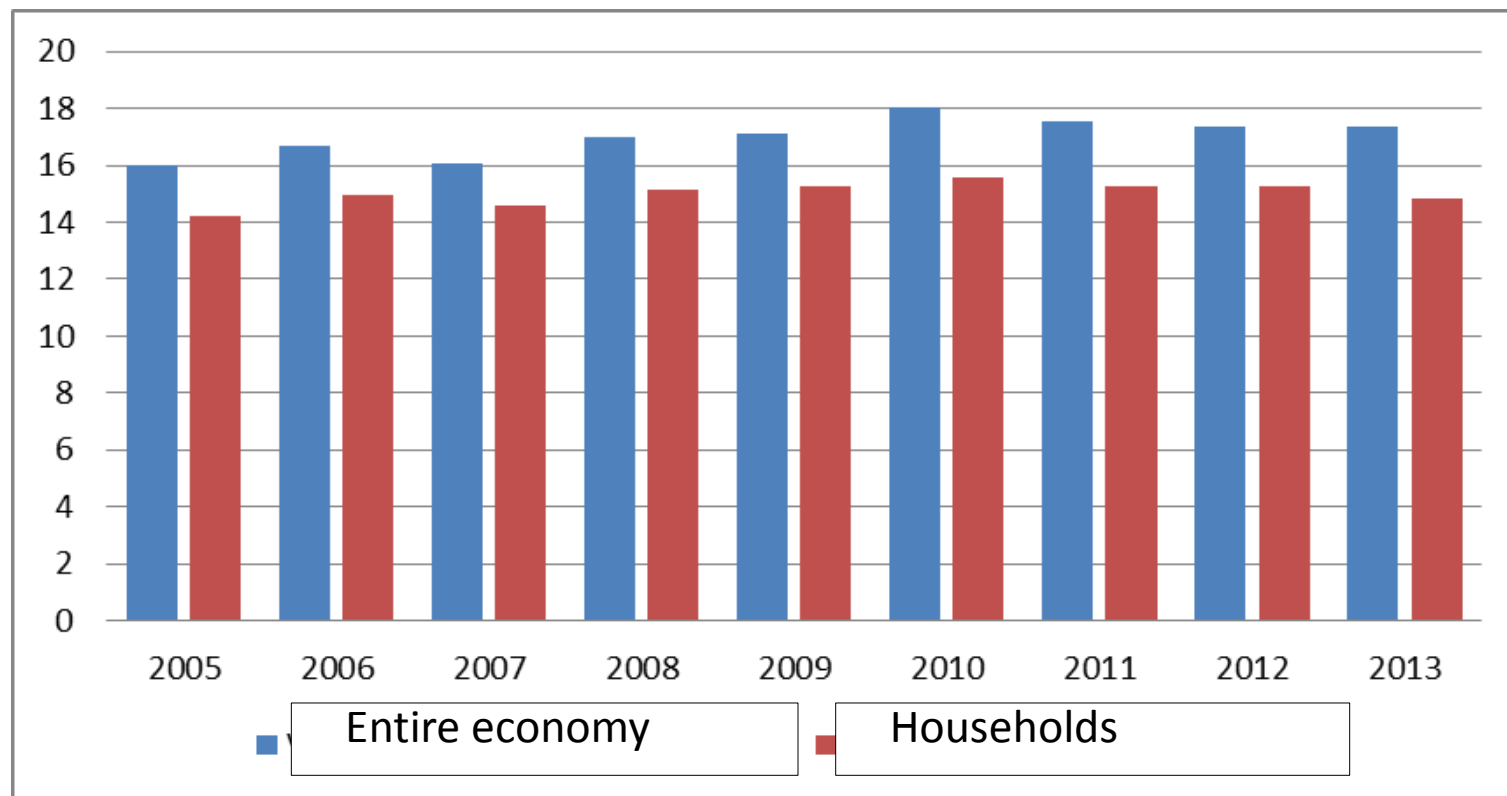
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Fuel combustion in households	15%	16%	16%	16%	17%	17%	18%	18%	18%

PM2.5 emissions, 1000 tonnes



Share of PM2.5 emissions from households									
, percent									
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Fuel combustion in households	80%	82%	80%	80%	83%	83%	82%	83%	85%

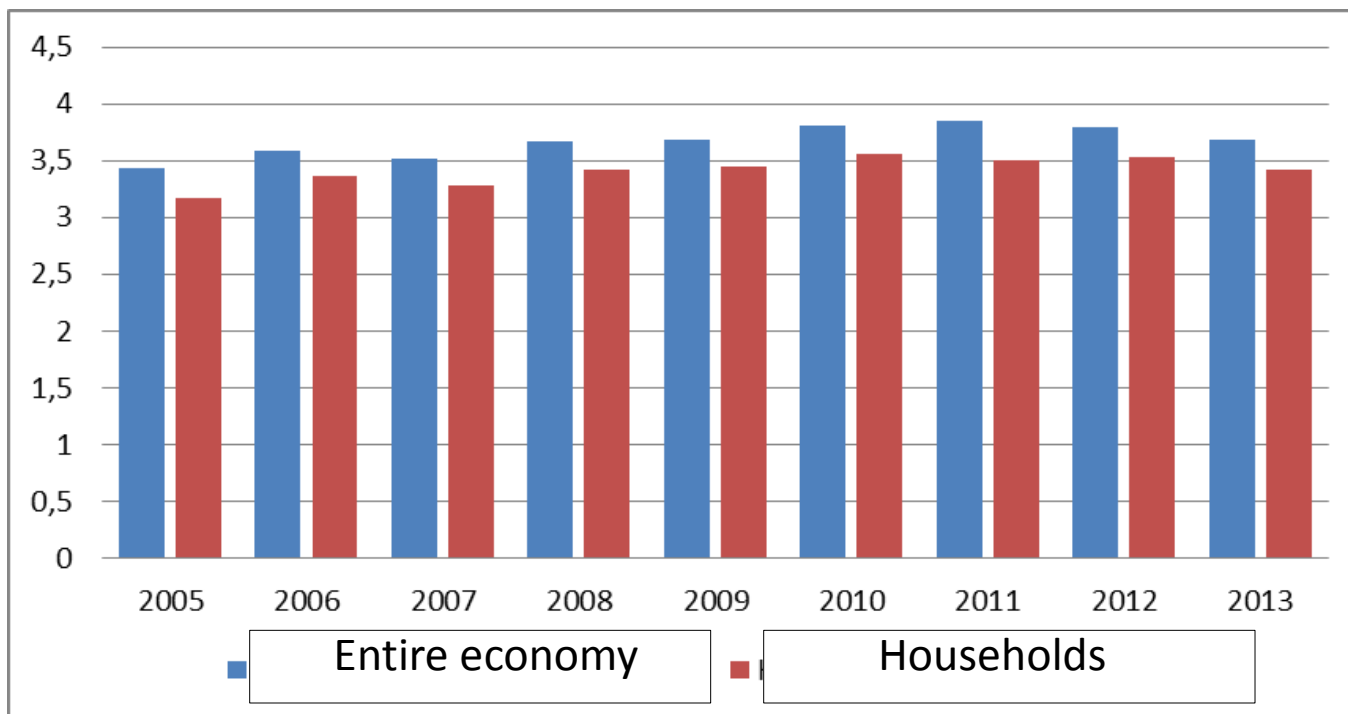
Dioxins and furans emissions, grammes



Share of dioxins and furans emissions from households
, percent

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Fuel combustion in households	89%	90%	91%	89%	89%	86%	87%	88%	85%

Benzo(a)pyrene emissions, tonnes



Share of benzo(a)pyrene emissions from households

, percent

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Fuel combustion in households	92%	94%	93%	93%	93%	94%	91%	93%	93%

Summary

Residential combustion contributes significantly to SO_x, NMVOC, PM_{2.5}, Dioxins and furans, Benzo(a)pyrene emissions

Thank you
for your attention.

Questions?

Remarks?