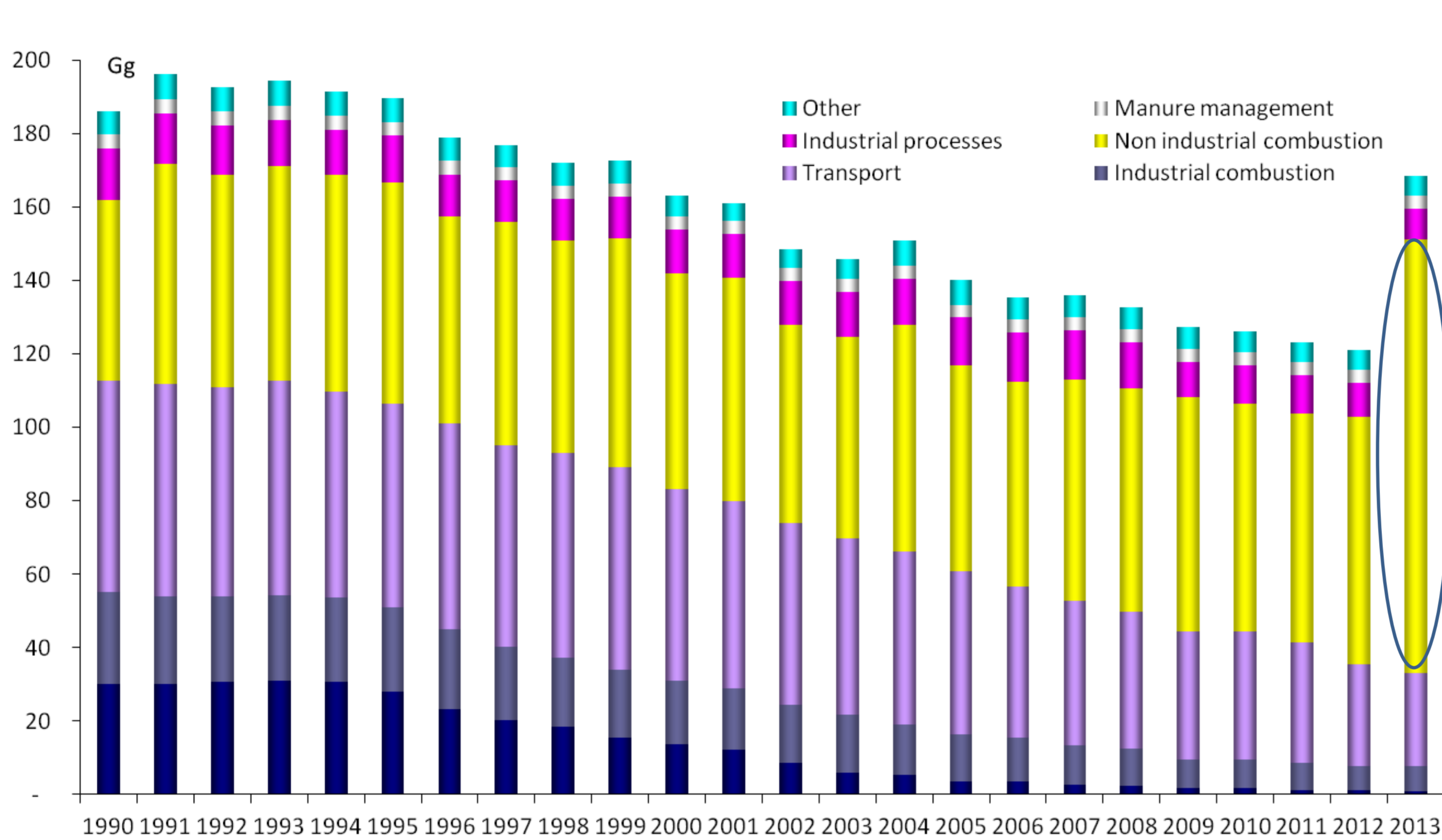


# PM2.5 emissions from biomass combustion in residential heating

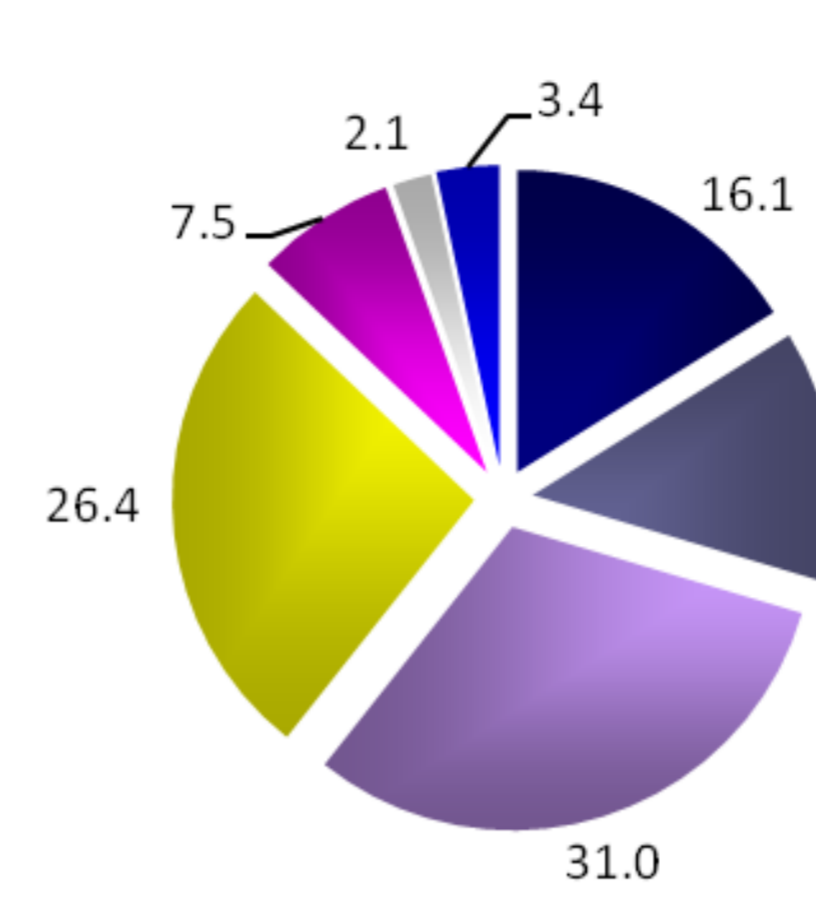
## Past – Present – Future

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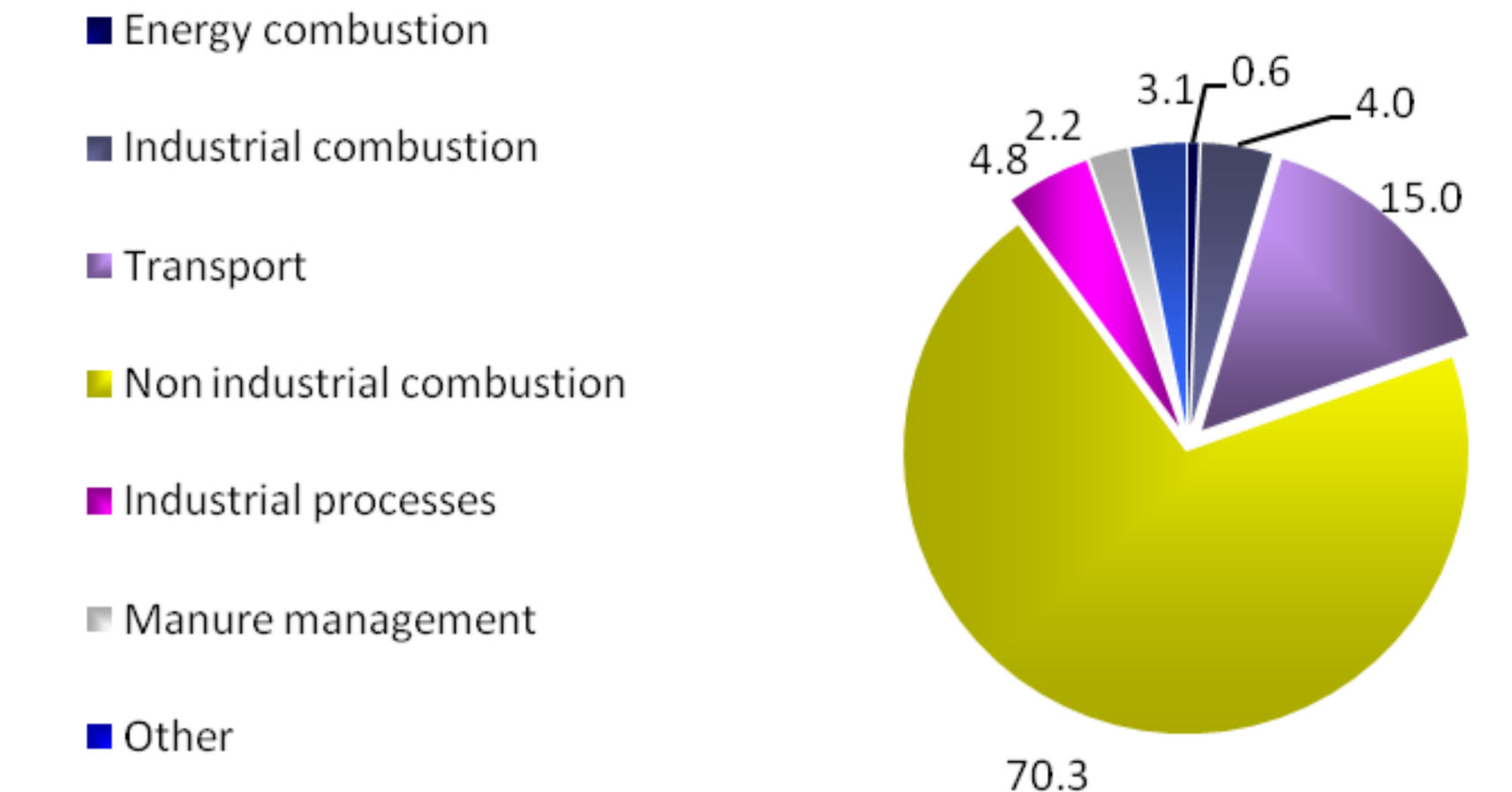
Biomass is playing a major role in Italian energy consumption. Most of the biomass is consumed in the residential sector for heating purposes. In particular, in recent years, the consumption of fuel-wood and pellets show a relevant increase, due to climate policies and lower costs compared to fossil fuels. In 2014 the national Institute of Statistics (ISTAT) carried out a survey on the final energy consumption of households for residential heating which include the fuel consumption of solid biomass, as wood and pellets. The survey resulted in an official statistics for 2012 and 2013 of wood and pellet consumption at national and regional level. The resulting figure for 2013 doubled the value reported in the National Energy Balance for previous years which asked for the need to update the whole time series. An ad hoc working group has been established to reconstruct the complete time series of wood and pellet fuel consumption and results will be available in summer 2015.



Share 1990



Share 2013



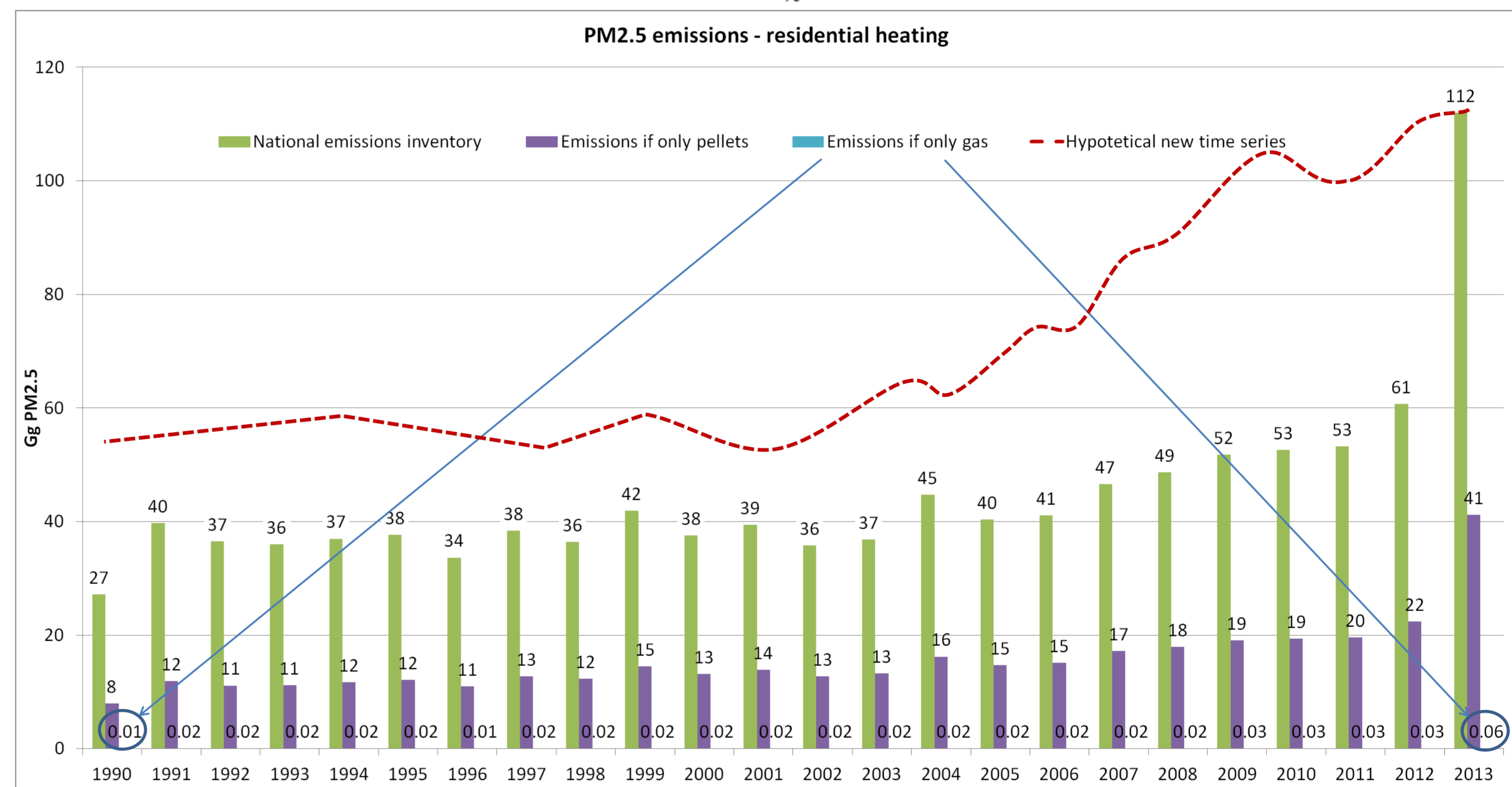
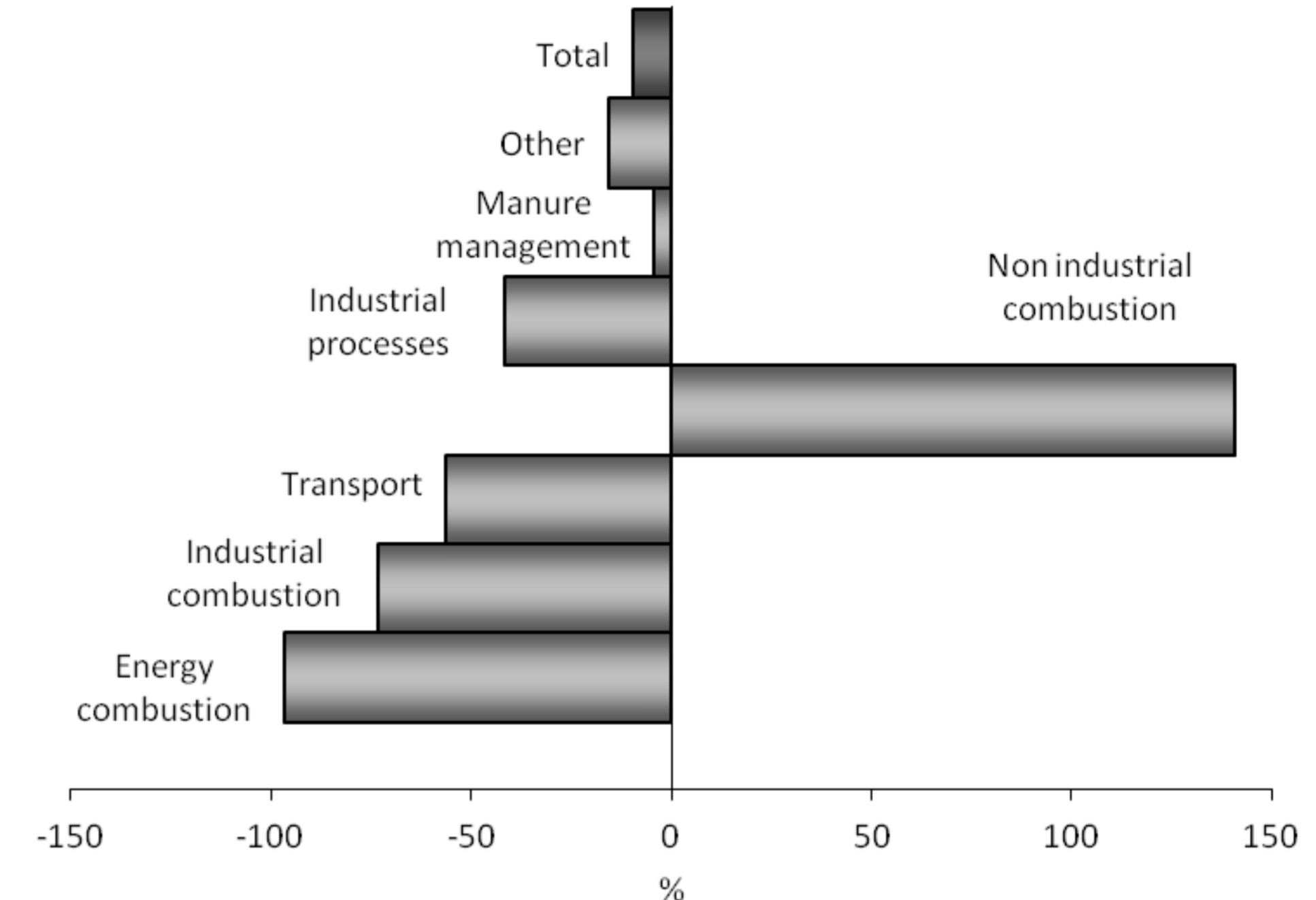
The peak of emissions in 2013 is due to the fuel consumption figure for biomass reported in the national energy balance, updated on the basis of the ISTAT survey and not consistent with the rest of the time series.

Even ignoring the 2013 data, there has been a sharp increase in the use of biomass in the period 1990-2012. The considerable energy consumption and the higher values of EF for many pollutants, including in particular PM2.5, make it necessary to have more insights on domestic sources and in particular on technologies used and the related EF. The EFs used in the inventory (see table below) take into account both the EMEP/EEA Guidebook and the studies conducted at the national level. Focusing on PM, open fireplaces and traditional stoves have higher EFs while more advanced equipments are characterized by lower emission levels.

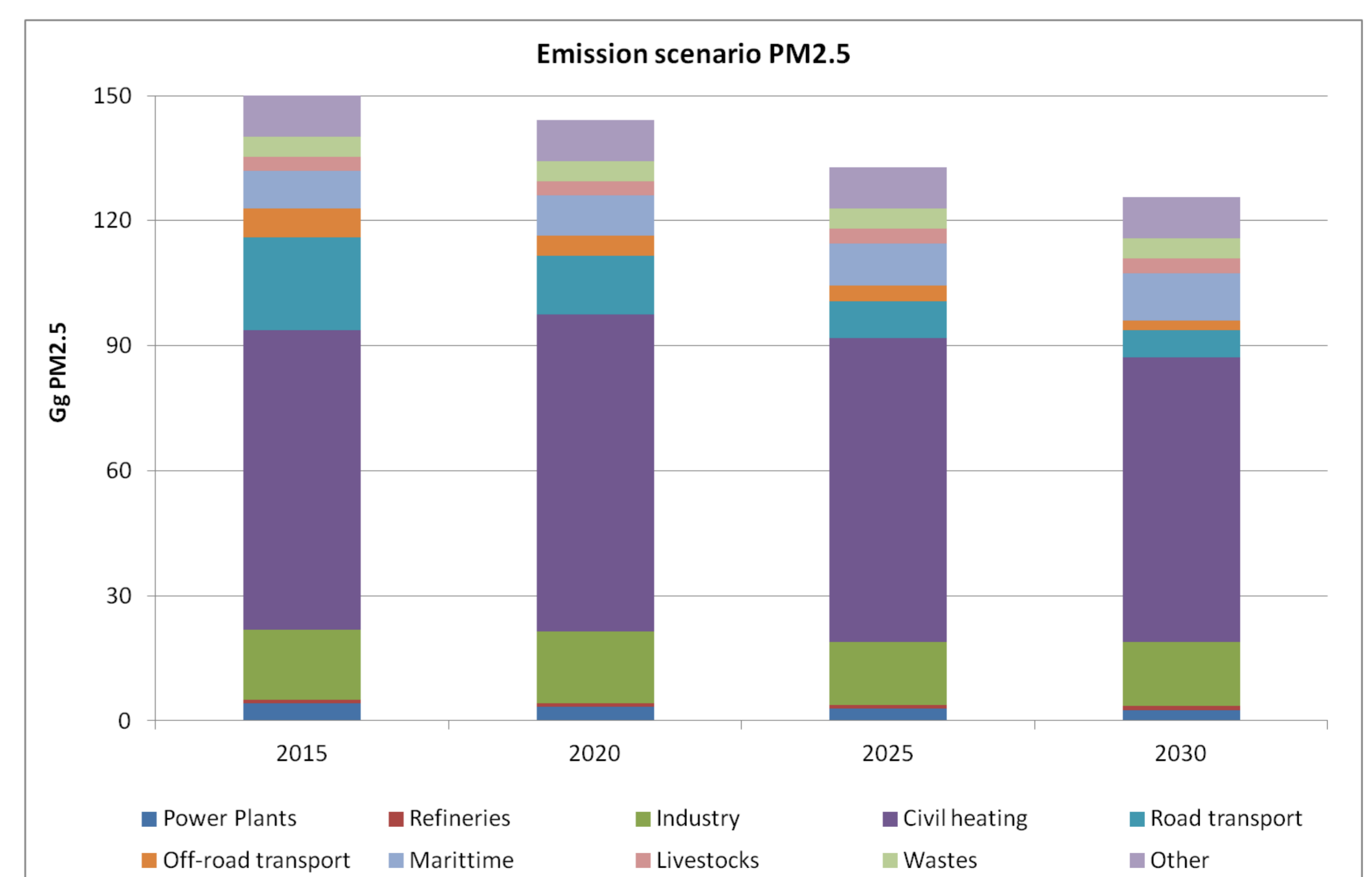
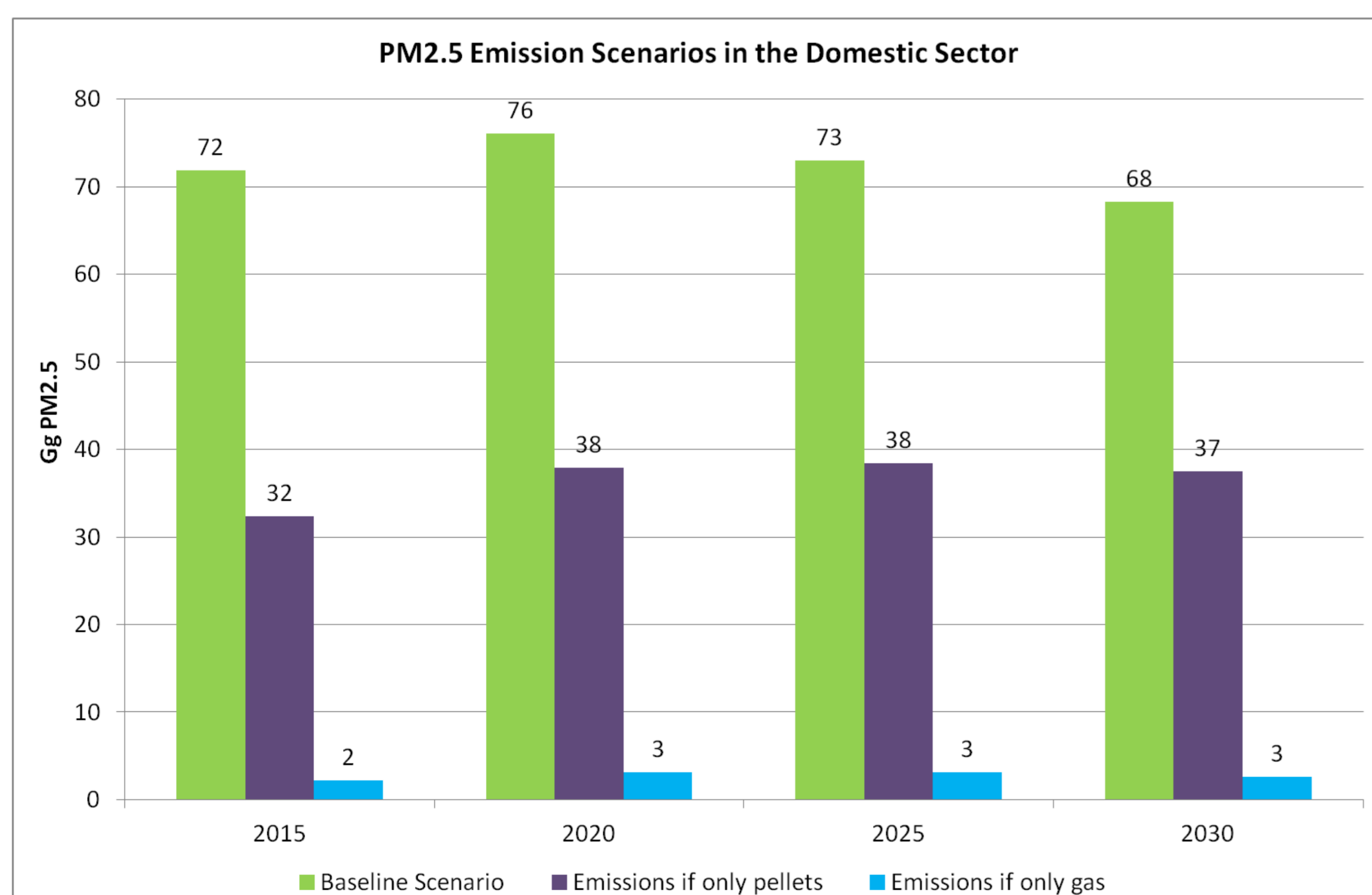
Anyhow, looking at the EFs, it take easily be seen that, even if biomass burning in domestic heating has a positive effect on CO<sub>2</sub> emissions, other fuels, and in particular methane, have a much lower impact on air quality, that is of great relevance considering where these emissions occur.

	EMISSION FACTORS (kg/Gj)			AGGREGATE EMISSION FACTORS (g/Gj)			
	NOx	CO	NMVOc	PM10	PM2.5	Diox (mg/Gj)	B(a)P
Open fireplace	0.050	6.000	0.780	516	510	0.478	0.039
Traditional stove	0.050	6.000	0.720	486	486	0.478	0.150
Closed fireplace	0.090	4.500	0.390	138.5	133.5	0.478	0.012
Pellet stove	0.090	0.500	0.014	149	148	-	0.012
Advanced stove	0.090	3.000	0.250	176.5	164.5	-	0.150
Average EF 1990	0.050	6.000	0.762	507.000	502.800	0.478	0.073
Average EF 1999	0.058	5.624	0.677	431.493	427.596	0.455	0.065
Average EF 2006	0.061	5.395	0.638	405.150	400.899	0.442	0.068
Average EF 2012	0.060	5.275	0.631	406.895	402.343	0.423	0.065

Increase and decrease in PM2.5 emissions (1990-2013)



These graphs show hypothetical emission levels that would be achieved if the actual and the projected consumptions of biomass for residential heating were all converted in pellets consumption or in natural gas consumption. It is evident the role played by the technology used and by the kind of fuel. The last graph show the emission projection calculated on the latest National Energy Strategy and considering a renewal rate of domestic heating equipments in line with the historic information.



1. ENEA, 2. ISPRA

Data sources: ISPRA 2015 "Informative Inventory Report" (in press), ISTAT 2014 "I consumi energetici delle famiglie", Ministry of economic development 2013 "Strategia energetica nazionale", "National energy balance 2013"