Ricardo Energy & Environment

Industrial emissions policy country profile – Poland

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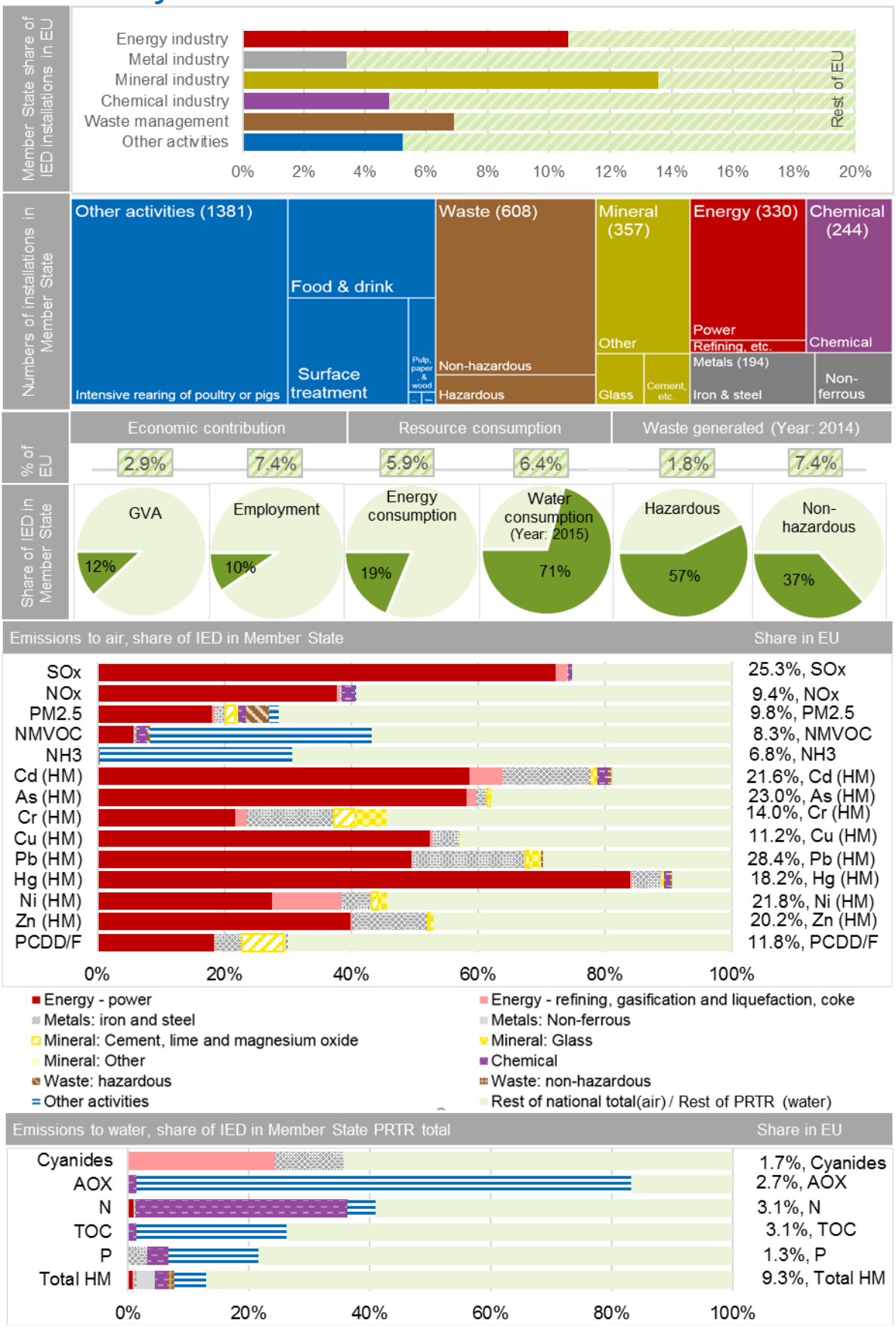
Abbreviations and units

AOX	Adsorbable Organic Halides
As	Arsenic
Cd	Cadmium
CLRTAP	Convention on Long-range Transboundary Air Pollution
CO_2	Carbon Dioxide
Cr	Chromium
Cu	Copper
DG	Directorate-General
EEA	European Environment Agency
E-PRTR	European Pollutant Release and Transfer Register
EU	European Union
EUR	Euros
GVA	Gross Value Added
HCBs	Hexachlorobenzenes
Hg	Mercury
HM	Heavy Metals
IED	Industrial Emissions Directive
IPPCD	Integrated Pollution Prevention and Control Directive
kg	Kilogram
ktoe	Kilotonne of oil equivalent
MW	Megawatts
N	Nitrogen
NACE	General Classification of Economic Activities within the European Communities
NH_3	Ammonia
Ni	Nickel
NMVOC	Non-Methane Volatile Organic Compound
NO_x	Oxides of Nitrogen
P	Phosphorus
PAH	Polycyclic Aromatic Hydrocarbon
Pb	Lead
PCBs	Polychlorinated Biphenyls
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PJ	Petajoules
PM	Particulate Matter
SO_x	Oxides of Sulphur
TOC	Total Organic Carbon
Zn	Zinc

Summary of industrial statistics for Poland



1 Introduction and summary of methodology

1.1 The industrial emissions policy country profiles

Industrial activities play an important role in the economic welfare and development of countries contributing to their economic growth. They can also have a significant impact on their environment. Directive 2010/75/EC on Industrial Emissions (IED) aims to prevent and reduce harmful industrial emissions across the EU while promoting the use of techniques that reduce pollutant emissions and that are energy and resource efficient.

This document is part of a series of industrial emissions policy profiles that provide an overview of industrial activities regulated by the IED for each Member State. This profile covers Poland.

The profiles show the economic significance of activities regulated by the IED in terms of the number of IED installations, their economic contribution (measured by gross value added and employment), and resources consumed (measured by energy and water consumed) – sections 2 and 3 respectively. The profiles also show the environmental impacts in terms of emissions to air and water (section 4) and waste generated (section 5).

The significance is shown both for the latest year of available data (typically 2015), as well as assessing the trends over time of key metrics. The data shown in the profiles is accompanied by descriptive analysis to bring together the various assessments made and draw out the salient messages. EU data sources used for each metric are described in a separate methodology paper together with their data limitations. The specific data sources used in this profile are summarised in Appendix 1. Each of the sections 2, 3, 4 and 5 consider the gaps in these data sources specific for Poland and how they have been addressed.

The profile also identifies the impact of industrial sectors or activities in Poland, within the scope of the IED policy, and the importance and political attention paid to this (section 6).

1.2 Definition of industrial sectors

The approach taken in the country profiles identifies data and trends wherever possible for a set of industrial sectors. However, in the data sources used to develop the profiles, there are several different approaches to sectoral classification. Since the definition of an 'industrial sector' differs across data sources, an approach has been taken to try to consistently report 'sectors' as much as possible. This has been aligned with the grouping of activities in Annex I of the IED where possible, but in practice the available datasets limit this.

The sectors defined in these profiles are referred to as 'industrial sectors'. Together these industrial sectors represent activity regulated by the IED, albeit subject to certain limitations as described here. The grouping for the industrial sectors has been chosen to reflect the level of granularity most commonly reported from EU data sources across the different metrics assessed while trying not to lose detail where it is available. The industrial sectors used in the profiles are shown in Table 1. A consistent colour scheme– also illustrated in Table 1 – is used throughout the profile.

Where available, the industrial sectors split out the energy, metal, mineral and waste management sectors into subsectors. Where this split is not possible, we refer to the respective IED sector group, e.g. metal in the case of the IED activities iron and steel and non-ferrous metals. Due to the large number and wide variety of activity within the IED sector 'other activities', these have also been grouped as 'other activities' in this profile, but split out into constituent industries when they are important sectors in the Member State in their own right, and where data are available.

Table 1: Industrial sectors used in the profiles with their corresponding IED Annex I activities

Industrial sectors used in the profiles		Corresponding IED Annex I activities
Energy industries, split where possible into:	Energy: power	Combustion of fuels (activity 1.1)
	Energy: refining, gasification and liquefaction, coke ovens	Refining, gasification and liquefaction, coke ovens (activities 1.2, 1.3, 1.4)
Production and processing of metals, split where possible into:	Metals: iron and steel	Iron and steel manufacturing (activities 2.1, 2.2, 2.3, 2.4)
	Metals: non-ferrous	Non-ferrous metal production (activity 2.5)
Mineral industry, split where possible into:	Mineral: Cement, lime and magnesium oxide	Production of cement, lime and magnesium oxide (activity 3.1)
	Mineral: Glass	Manufacture of glass (activity 3.3)
	Mineral: Other	Other mineral industries (activities 3.2, 3.4, 3.5)
Chemical industry	Chemical	Chemical industry (activities 4.1, 4.2, 4.3, 4.4, 4.5, 4.6)
Waste management, split where possible into:	Waste: hazardous	Hazardous waste (activities 5.1, 5.2(b), 5.5, 5.6)
	Waste: non-hazardous	Non-hazardous waste (activities 5.2(a), 5.3, 5.4, 6.5, 6.11)
Other activities, split when constituent activities are important:	Other activities	Pulp, paper and wood production (activity 6.1) Pre-treatment or dyeing of textile fibres or textiles (activity 6.2) Tanning of hides and skins (activity 6.3) Food and drink (activity 6.4) Intensive rearing of poultry and pigs (activity 6.6) Surface treatment (activities 2.6, 6.7) Production of carbon (activity 6.8)

Note: No installations operated with IED activity 6.9 in 2015 or before. The limited data available for activity 6.10 means it is excluded from the analysis.

2 Economic significance of industrial sectors

2.1 Economic contribution

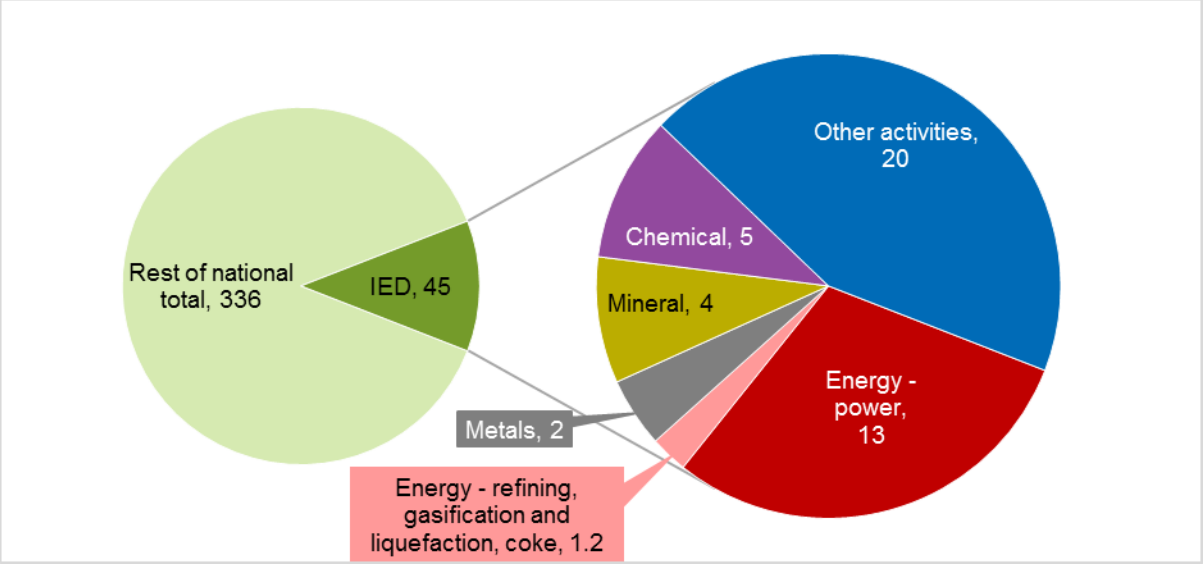
The economic contribution of industrial activities in Poland is assessed based on the indicators gross value added (GVA) and employment.

Industrial sectors in Poland account for a relatively small share of the total GVA of the country (12%) as evidenced in Figure 1. Within this sector, 'other activities' represent the largest contribution to GVA (44% of the GVA of industrial sectors). In particular, textiles, tanning [of leather], as well as pulp, paper and wood-based products are the largest economic activities in terms of GVA within this group in 2015. It is worth noting that no IED installations were reported to be permitted for the tanning industry (IED activity 6.3) in 2015 and therefore the inclusion of this economic activity has to led to overreporting of the GVA for the industrial sector 'other activities'. Note also that no GVA for the waste industrial sector could be included in the analysis due to lack of data. Energy – power is also a relevant industrial sector (representing 30% of the GVA of industrial sectors), followed by the chemical and mineral sectors which account for a similar contribution to the GVA of industrial sectors in Poland.

Industrial sectors also represent a relatively small share of the total employment across all economic activities in Poland (10% as illustrated in Figure 2). The relative contribution of each industry to the total employment in the industrial sector is similar to their contribution to GVA. 'Other activities' also accounts for the largest contribution to employment in 2015 (54% of total employment in the industrial sectors), mainly due to the food and drink and pulp, paper and wood-based products sectors. Energy – power is the second largest employer within the industrial sectors (12%), however its share of total employment is about half of its share of the total GVA for industrial activities. Note that there are 304 permitted IED installations reported for the energy - power sector in 2015 (Figure 5) which makes it one of the largest sectors in terms of IED installations in Poland. Other relevant industrial sectors to employment in Poland include the mineral (11%) and chemical (10%) industrial sectors.

Note that no GVA for intensive rearing of poultry or pigs could be included in the 'other activities', despite being the most relevant industry within 'other activities' in terms of permitted IED installations (Figure 5), owing to the difficulties discussed in the accompanying methodology report.

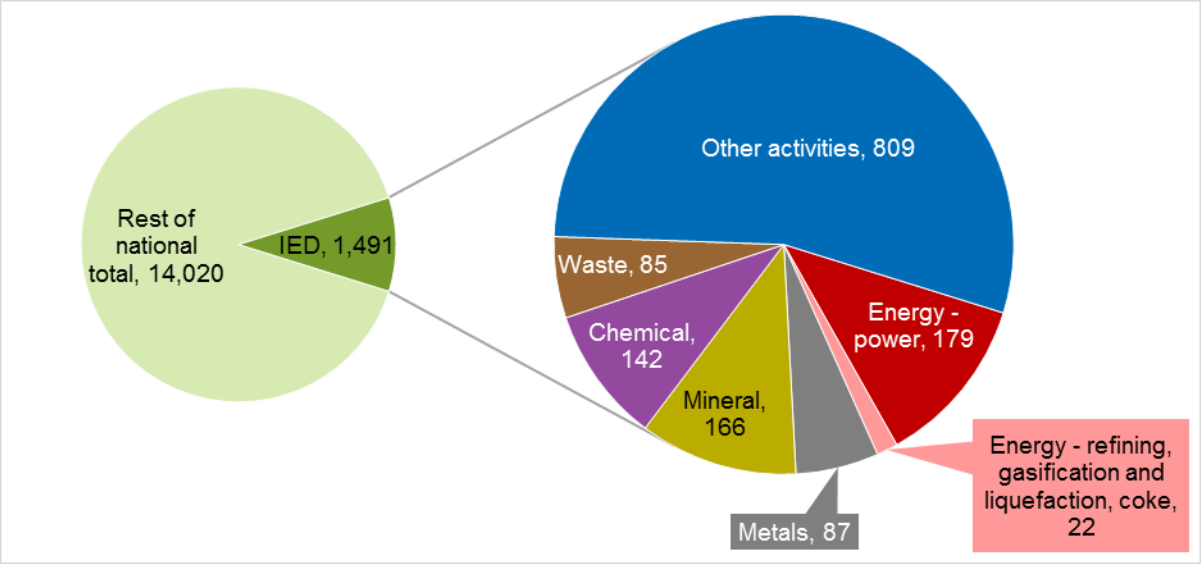
Figure 1: Gross value added of industrial sectors in 2015 (current prices, billion EUR)



Note: Rest of national total means all NACE activity minus industrial sectors shown here. GVA for all sectors except energy-power is extrapolated for the year 2015 based on data reported for 2012-2014. No GVA data for the waste management sector is reported. The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, the GVA cannot be excluded for this activity.

Source: Eurostat (2017a)

Figure 2: Employment within industrial sectors in 2015 (thousands, aged 15 to 64 years)



Note: Rest of national relates to all NACE activity minus industrial sectors shown here. Data within 'other activities' excludes tanning (NACE C15) to reflect the fact that no IED installations are reported against these activities (6.3) for Poland.

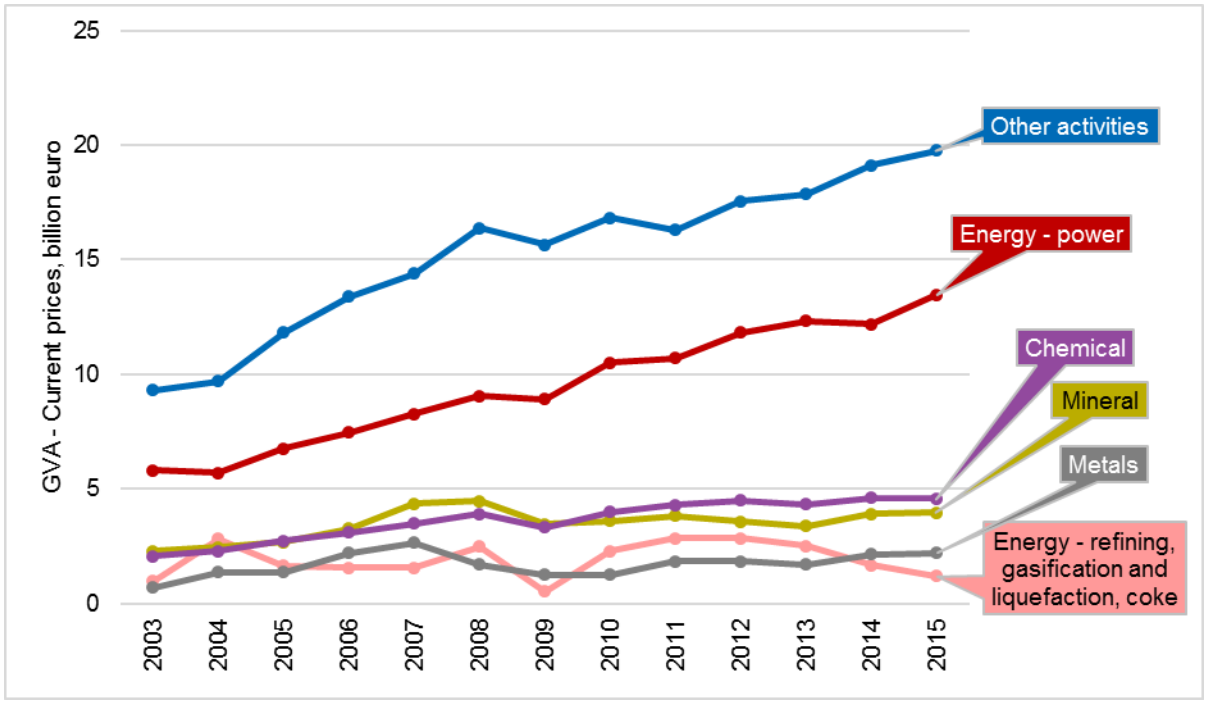
Source: Eurostat (2017b)

Economic growth in the industrial sector in Poland is particularly evident in 'other activities' and energy – power sectors as illustrated by Figure 3. Both industrial sectors have been growing steadily for the last 12 years, apart from a small drop in GVA observed in 2009 which could be linked to the economic crisis that hit Europe during this period although Poland was not severely affected (McKinsey, 2015).

The contribution to GVA of the other industrial sectors presented in Figure 3 has also been growing, although at a slower pace (excluding the small drop in 2009 previously discussed). This trend is not observed for the energy – refining, gasification and liquefaction, coke sector GVA which has been in decline since 2012.

In contrast, it can be observed that employment has remained relatively static between 2008 and 2015 (Figure 4), even in the industrial sectors for which significant growth in GVA is observed (i.e. 'other activities' and energy – power sectors).

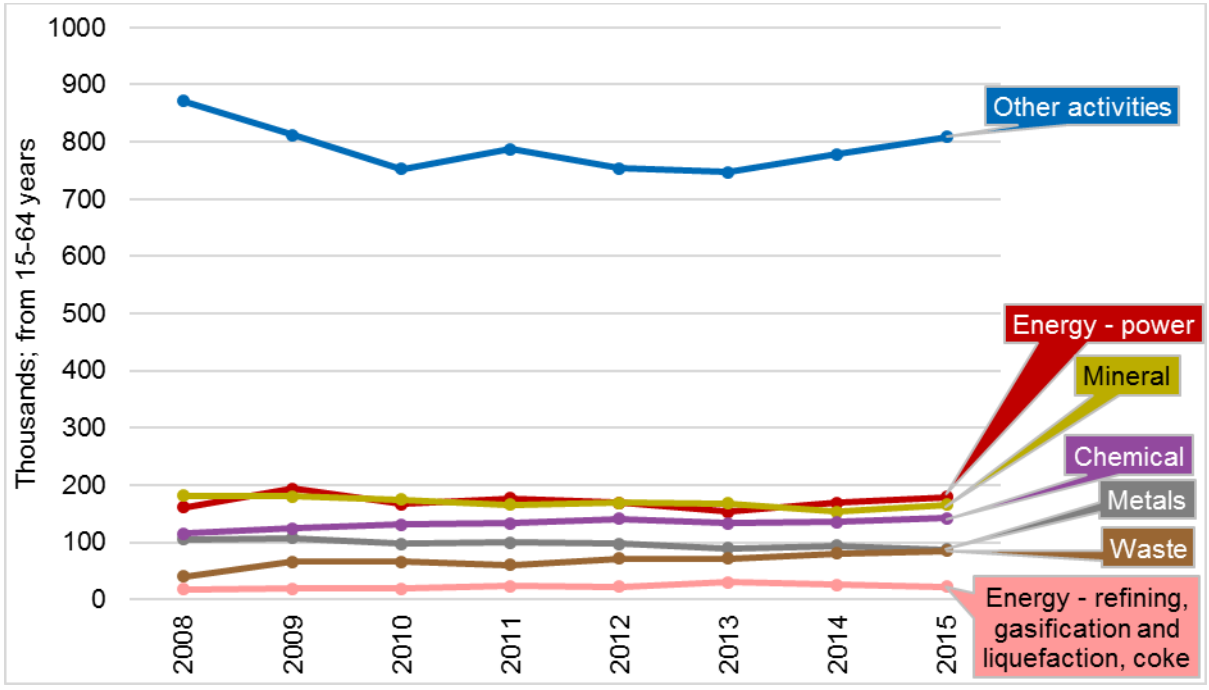
Figure 3: Gross value added of industrial sectors (2003-2015)



Note: GVA for all sectors except energy - power is extrapolated for the year 2015 based on data reported for 2012-2014. No GVA data for the waste management sector is reported. No GVA data is reported for 2000-2002. The data shown for 'other activities' includes, among others, the sub sectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, the GVA cannot be excluded for this activity.

Source: Eurostat (2017a)

Figure 4: Employment in industrial sectors (2008-2015)



Note: Data within 'other activities' excludes tanning (NACE C15) to reflect the fact that no IED installations are reported against these activities (6.3) for Poland.

Source: Eurostat (2017b)

Limitations

The use of NACE classifications for reporting has generally led to overreporting for both GVA and employment data against each industrial sector compared to a scope strictly limited to the IED. Underreporting was not found to be an issue except for the IED activity intensive rearing of poultry or pigs under 'other activity' as it was not covered within the available datasets.

Table 2: Gaps in GVA data for Poland

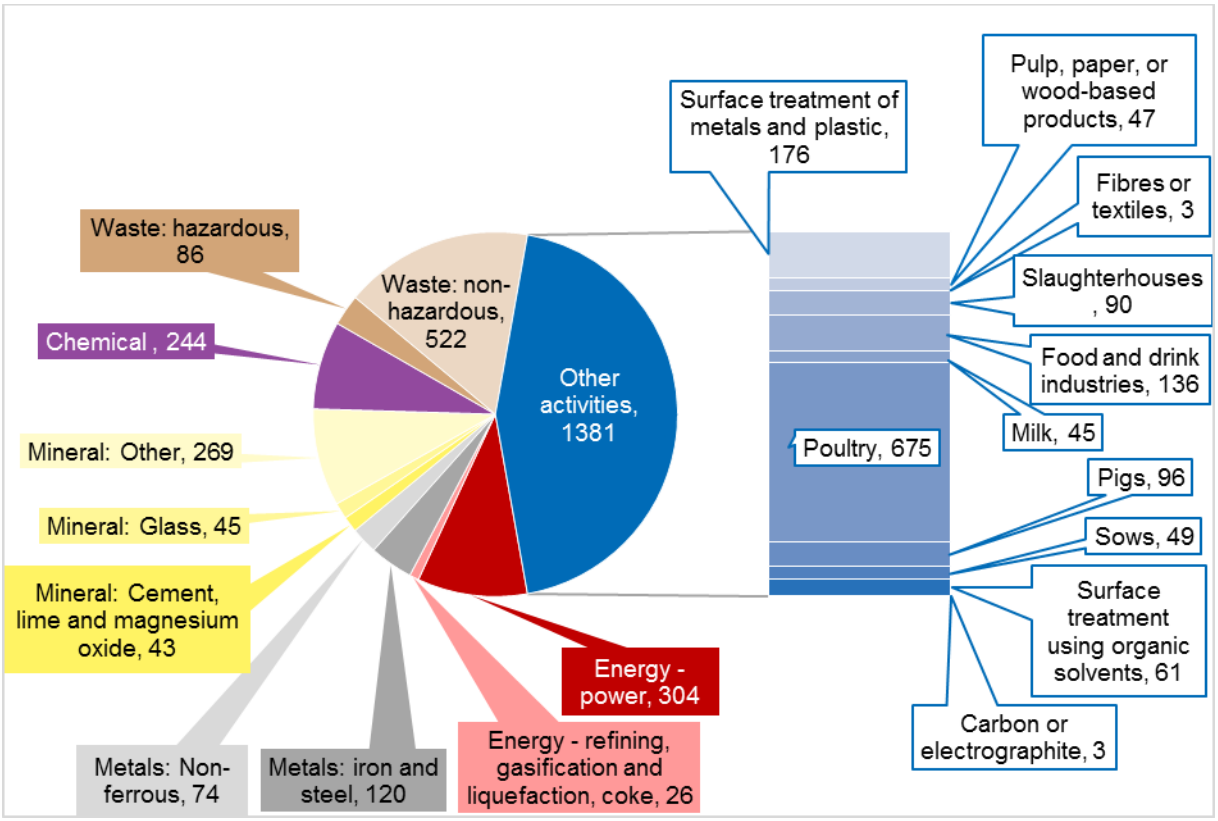
Missing data	Description	Conclusion and actions taken
No IED installations reported for tanning [of leather] IED activity	The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, the GVA cannot be excluded for this activity.	No action.
Data gaps in timeseries	No 2015 GVA data available for all industrial sectors, except energy – power. No GVA data available for 2000-2002.	Estimates were produced for these sectors for 2015.
Data gaps for sector	No GVA data available for the waste industrial sector for the whole period analysed	No action.

2.2 Number of IED installations

According to the reported number of IED installations, the most significant IED activity in Poland is intensive rearing of poultry or pigs (IED activity 6.6), which accounts for 26% of all IED permitted installations (Figure 5 and Table 3). This is followed by non-hazardous waste management (IED activities 5.2 – 5.4 and 6.5) and energy - power (IED activity 1.1).

Permits are reported for the majority of IED activities in Poland, except for temporary storage of hazardous waste (IED activity 5.5), underground storage of hazardous waste (IED activity 5.6) and tanning (IED activity 6.3).

Figure 5: Number of installations by industrial sector in 2015, with 'other activities' split by IED activity



Source: IPPCD and IED reporting / DG Environment, Personal Communication

Table 3: Number of installations in 2015 by industrial sector, with IED activity detail

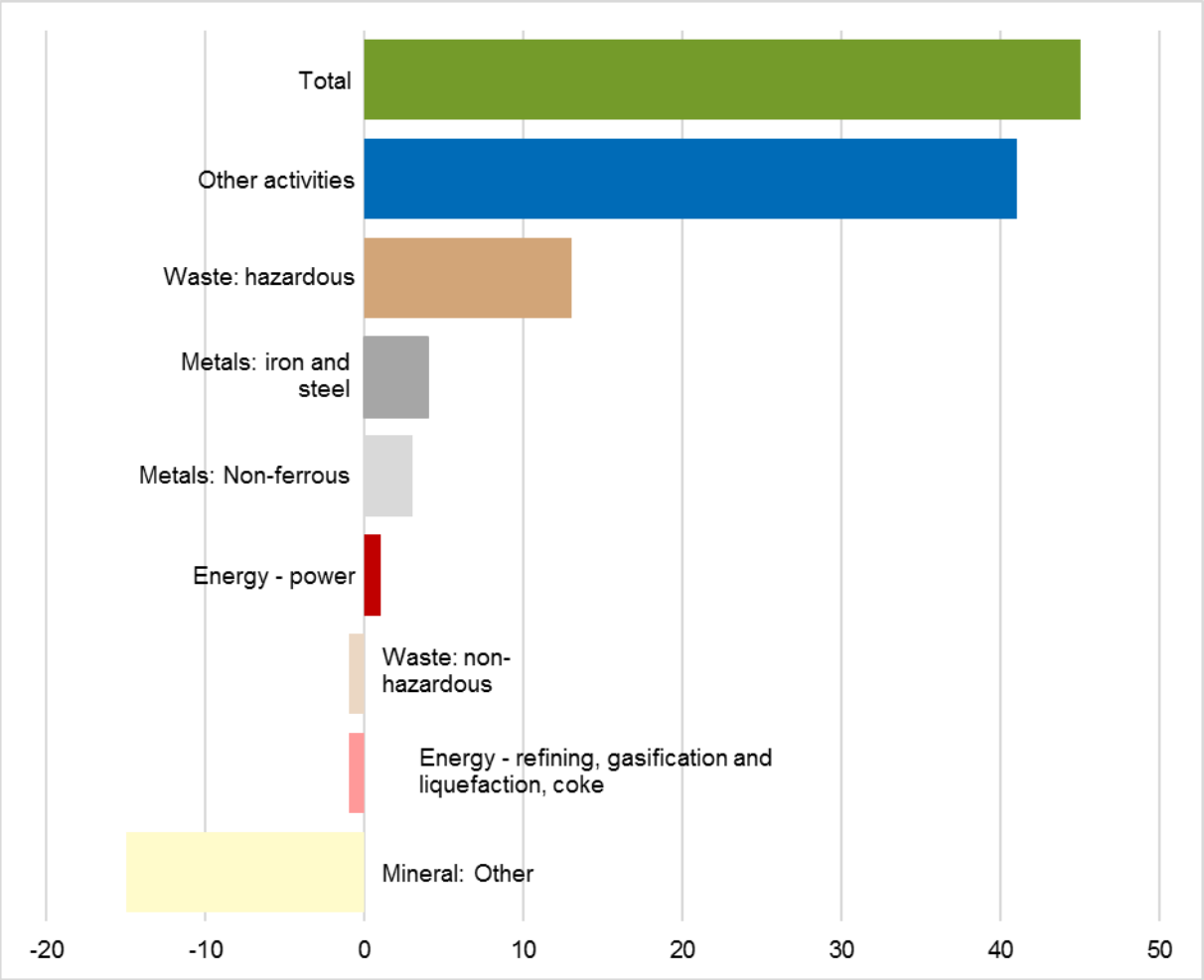
Industrial sector, with IED activity detail	2011	2015	Change in number of IED installations 2011 to 2015
Energy: power *(1.1 Combustion)*	**303**	**304**	**1**
Energy: refining, gasification and liquefaction, coke	**27**	**26**	**-1**
1.2 Refining	*14*	*13*	*-1*
1.3 Production of coke	*10*	*10*	*0*
1.4 Gasification or liquefaction	*3*	*3*	*0*
Metal: iron and steel	**116**	**120**	**4**
2.1 Metal ore	*3*	*3*	*0*
2.2 Pig iron or steel	*11*	*12*	*1*
2.3 Processing of ferrous metals	*47*	*51*	*4*
2.4 Ferrous metal foundries	*55*	*54*	*-1*
Metals: Non-ferrous *(2.5 Processing non-ferrous metals)*	**71**	**74**	**3**
Mineral: Cement, lime and magnesium oxide *(3.1)*	**43**	**43**	**0**
Mineral: Glass *(3.3 Glass production)*	**45**	**45**	**0**
Mineral: other	**284**	**269**	**-15**
3.4 Mineral fibres	*6*	*6*	*0*
3.5 Ceramic	*278*	*263*	*-15*
Chemical	**244**	**244**	**0**
4.1 Organic	*144*	*142*	*-2*
4.2 Inorganic	*49*	*50*	*1*
4.3 Phosphorus-, nitrogen- or potassium-based fertilisers	*17*	*18*	*1*
4.4 Plant protection products	*5*	*5*	*0*
4.5 Pharmaceutical products	*24*	*24*	*0*
4.6 Explosives	*5*	*5*	*0*
Waste management: hazardous (*5.1 Disposal / recovery*)	**73**	**86**	**13**
Waste management: non-hazardous	**523**	**522**	**-1**
5.2 Co-/incineration (a &b)	*1*	*2*	*1*
5.3 Disposal of non-hazardous waste	*14*	*18*	*4*
5.4 Landfills	*461*	*455*	*-6*
6.5 Disposal of animal carcasses	*47*	*47*	*0*
Other activities	**1337**	**1381**	**44**
6.1 Pulp, paper, or wood-based products	*46*	*47*	*1*
6.2 Textiles	*4*	*3*	*-1*
6.7 Surface treatment using organic solvents	*60*	*61*	*1*
2.6 Surface treatment of metals and plastic	*174*	*176*	*2*
6.4 (a) Slaughterhouses	*84*	*90*	*6*
6.4 (b) Food and drink	*128*	*136*	*8*
6.4 (c) Milk	*44*	*45*	*1*
6.6 (a) Poultry	*612*	*675*	*63*
6.6 (b)/(b)1 Pigs	*140*	*96*	*-44*
6.6 (c)/(b)2 Sows	*45*	*49*	*4*
6.8 Production of carbon	*3*	*3*	*0*
Total	**3066**	**3114**	**48**

Note: IED activities are in italics. The IED activity 5.2 (Disposal or recovery of waste in waste incineration plants or in waste co-incineration plants) relates to non-hazardous waste (5.2(a)) and hazardous waste (5.2(b)). Owing to the generally small number of installations reported within this category across the EU, these installations have been categorised as non-hazardous waste management. Data for permitted installations carrying out IED activity 6.11 is not included in the reported data and therefore not included in this table.

Source: IPPCD and IED reporting / DG Environment, Personal Communication

Between 2011 and 2015, an increase in the number of IED installations permitted in Poland is observed (Figure 6). This is largely driven by the increase in installations in 'other activities' (rising from 1337 installations in 2011 to 1381 in 2015 - Table 3) and hazardous waste industrial sector (rising from 73 to 86 installations between 2011 and 2015). For 'other activities', the most significant increases have been reported for poultry farms (IED activity 6.6(a)) whereas pig farms (IED activity 6.6(b)) have seen drops in the numbers of reported installations.

Figure 6: Change in number of installations per industrial sector 2011 to 2015 (%)



Note: No change reported for cement, lime and magnesium oxide and glass production (mineral sector) and the chemical sector; removed from the chart.

Source: IED reporting / DG Environment, Personal Communication

Limitations

The dataset used to reflect IED activity in Member States has a limited timeseries inherent to the reporting requirement and thus the number of permitted installations is only reported for the years 2011, 2013 and 2015.

3 Resource use in industrial sectors

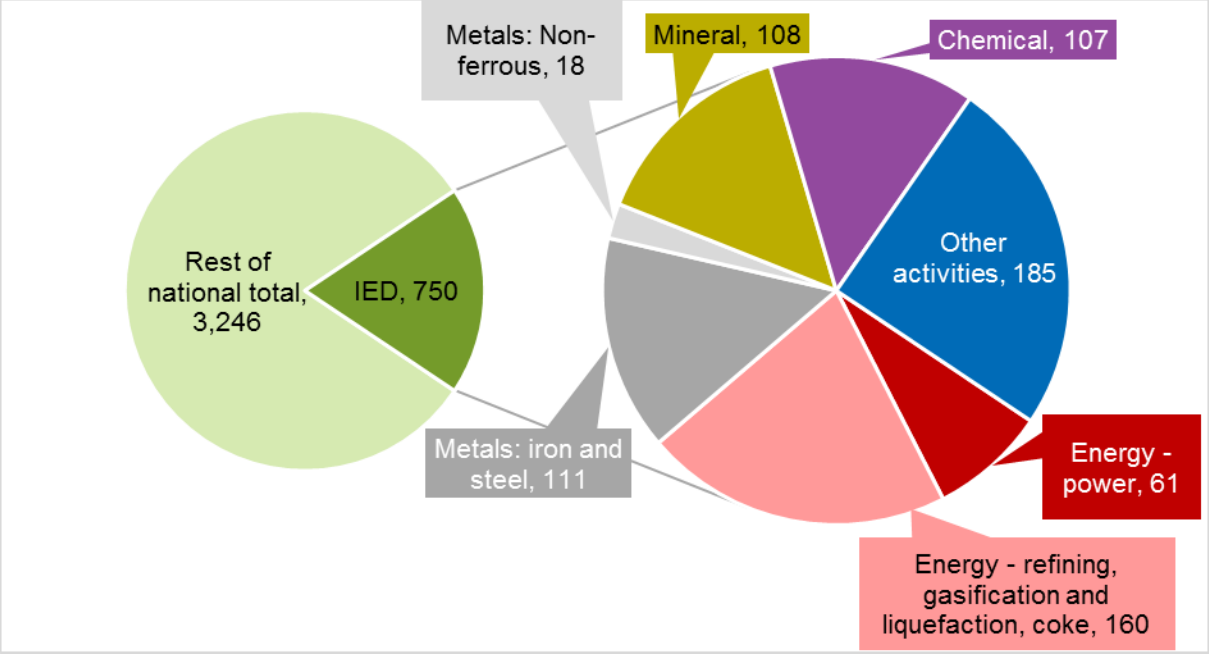
3.1 Energy consumption

In line with the analysis on the economic significance of industrial sectors (section 2), the industrial sector in Poland represents a small share of the total energy consumption in the country (19% as illustrated in Figure 7). However, important differences in the relative weight of the specific sectors within the industrial sector are observed. 'Other activities' is the largest consumer of energy within the industrial sectors, together with the energy – refining, gasification and liquefaction, coke sector. However, on average, 'other activities' consumes the least energy when considering the total reported number of permitted installations within this sector, whilst the average energy consumption per permitted installations is greatest for the energy – refining, gasification and liquefaction, coke sector.

The metals industrial sector (including production of iron and steel as well as non-ferrous metals) also accounts for an important share of energy consumption in Poland despite having a relatively low number of IED installations. Similarly energy consumption in the energy - power sector is relatively small compared to the number of IED installations.

Note that no data was reported for the waste management sector, which constitutes a major data gap given the importance of this sector in terms of IED installations permitted in Poland. This is also the case for the intensive rearing of poultry or pigs which is not included within 'other activities' due to a lack of data.

Figure 7: Energy consumption by industrial sector in 2015 (PJ)



Note: Rest of national total relates to Gross inland consumption minus industrial sectors shown here. No data is reported for the waste management sector or intensive rearing of poultry and pigs. The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, the energy consumption cannot be excluded for this activity.

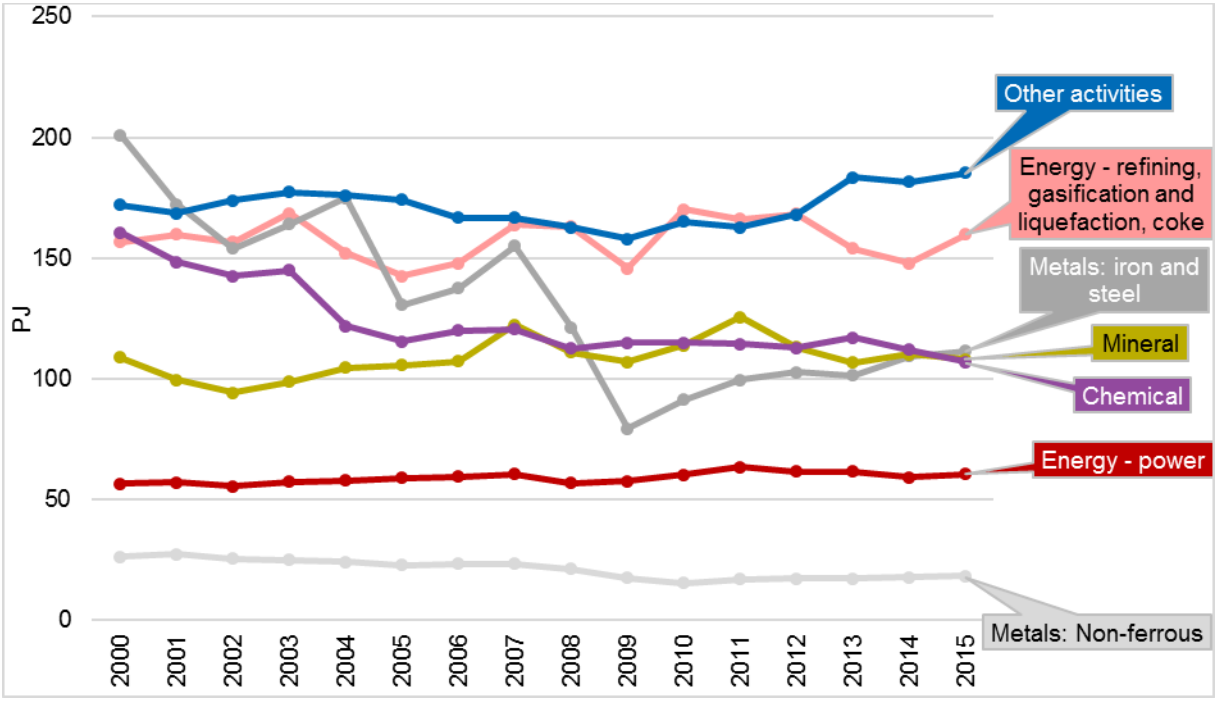
Source: Eurostat (2017c)

Energy consumption has remained relatively stable for the majority of the industrial sectors (Figure 8). One exception is the consumption of energy in the production of iron and steel which has declined substantially between 2000 and 2015, following a volatile trajectory. Energy consumption in this sector seems to fall and rise in a cycle of three to four years which could be linked to changes in activity levels as reported by Katarzynat and Slusaczyk (2010). The most significant drop occurred between 2007 and 2009 potentially associated with the economic crisis since iron and steel are important global

commodities. Since 2009, energy consumption in this sector has been increasing gradually, reflecting the increase in IED installations between 2011 and 2015 (from 116 installations in 2011 to 120 in 2015). The energy – refining, gasification and liquefaction, coke sector shows a similarly volatile trend albeit less extreme than those observed for the iron and steel sector. Overall it appears to have remained relatively constant despite year on year fluctuations.

It is worth noting that energy consumption by the chemical sector has been decreasing over time which seems to indicate a decoupling from economic growth (as GVA has increased slightly for the same period).

Figure 8: Energy consumption (in PJ) of industrial sectors (2000-2015)



Note: No data is reported for the waste management sector. The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, the energy consumption cannot be excluded for this activity.

Source: Eurostat (2017c)

Limitations

Generally, the use of energy balance indicators is expected to lead to overreporting against IED activities as no thresholds apply to the economic activities reported against (similar to NACE classifications). The energy consumption data that have been used has only limited coverage of the waste management sector. Data for this sector is therefore expected to be underreported as only one energy balance indicator was identified as relevant to this industrial sector: the energy consumed by gasification plants for biogas. Thus, where no data for the waste management sector is identified, this is rather a limitation that the energy consumption dataset has poor representation of the waste management sector.

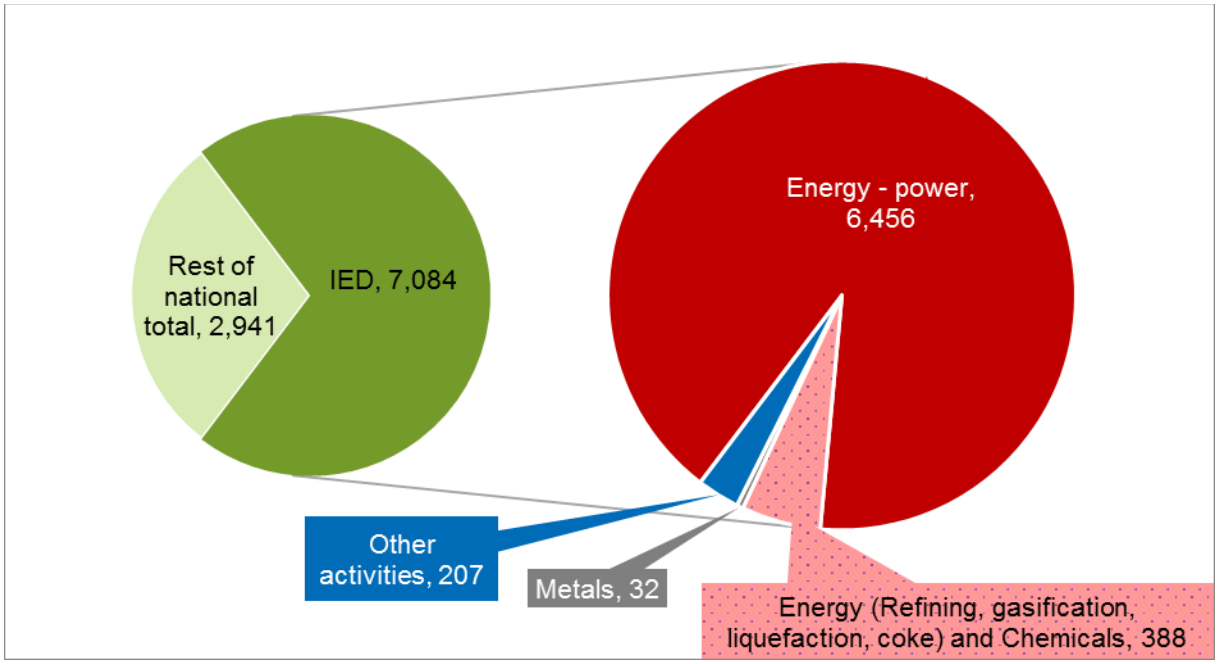
Table 4: Gaps in energy consumption data for Poland

Missing data	Description	Conclusion and actions
No data for waste management	No data reported for all waste management	No action
No IED installations reported for tanning [of leather] IED activity	The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, the energy consumption cannot be excluded for this activity.	No action.

3.2 Water consumption

Water consumption data by industrial sector in Poland is obtained from Eurostat (2017d). Data is available for all relevant industrial sectors, except the mineral and waste management sectors, and within 'other activities' the intensive rearing of poultry or pigs. Figure 9 shows that the industrial sectors represent a significant share of reported total water consumption in Poland (71%), which is perhaps higher than expected. Of these, energy – power is the largest consumer of water, representing 91% of the water consumption by the industrial sectors. 'Other activities', on the other hand, only account for 3% of the total water consumption by industrial sectors, despite their relative importance for GVA, high number of IED installations and greater energy consumption. However, considering the analysis already presented in this profile, the lack of water consumption data for the waste management sector and the intensive rearing of poultry or pigs within 'other activities' is considered to be a major gap.

Figure 9: Water consumption (million m^3) for selected industrial sectors (2015)

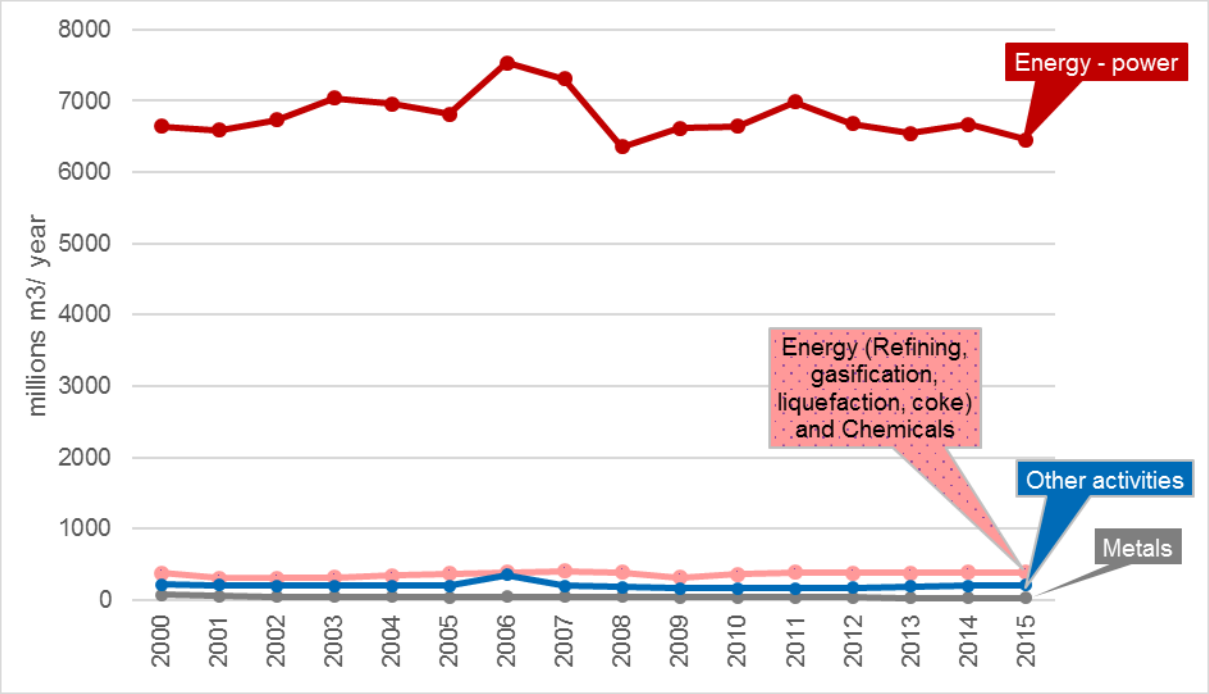


Note: Rest of national total relates to all NACE activity minus industrial sectors shown here (data for the year 2015). No data for the mineral and waste. The data shown for 'other activities' includes, among others, the sub sectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, water consumption cannot be excluded for this activity.

Source: Eurostat (2017d)

Reported water consumption since 2000 has been relatively unchanged over time as illustrated in Figure 10, apart from a brief increase in consumption in 2006 and 2007 especially in the energy – power sector and 'other activities' to a lesser extent.

Figure 10: Water consumption (million m³) for selected industrial sectors (2000-2015)



Note: No data for the mineral and waste management sectors. The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, water consumption cannot be excluded for this activity.

Source: Eurostat (2017d)

Limitations

Limitations have arisen from the mapping owing to combined reporting of NACE classifications for chemicals with energy – refining, gasification and liquefaction, coke. Water consumption by the mineral sector is combined with many other NACE activities and could not be used without significant overreporting. An additional category is reported by Eurostat to show water used for cooling; however, the data is also reported within other NACE classifications and so could not be included in the charts without double counting. No data could be included within 'other activities' to reflect the IED activity intensive rearing of poultry or pigs as reporting was not at the appropriate level of NACE classification.

Table 5: Data gaps in water consumption data for Poland

Missing data	Description	Conclusion and actions taken
No IED installations reported for tanning [of leather] IED activity	The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, water consumption cannot be excluded for this activity.	No action
Data gaps	No data available for the waste and mineral sector	Limitation reported

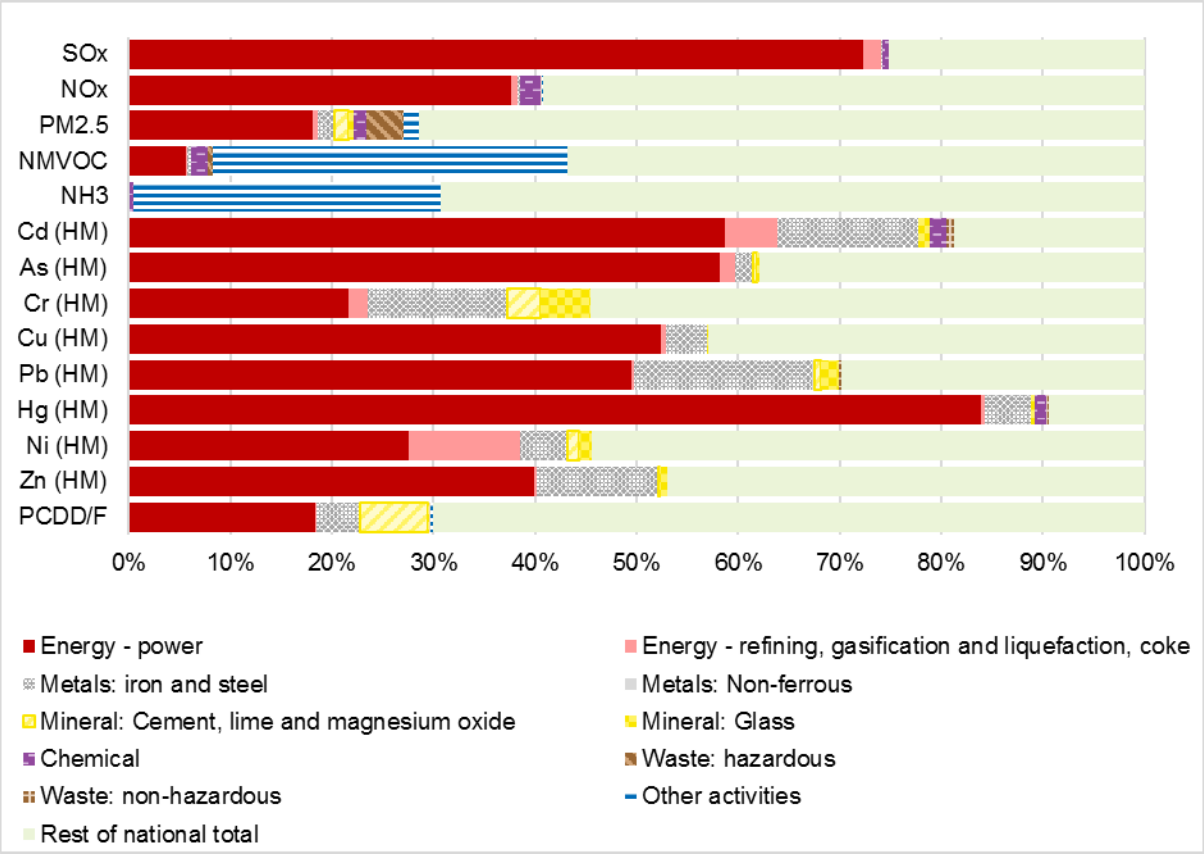
4 Emissions from industrial sectors

4.1 Emissions to air

Emissions to air data were sourced from inventories submitted by Member States under the CLRTAP (EEA, 2017a). It can be concluded from Figure 11 that industrial sectors are responsible for less than half of emissions of non-heavy metal pollutants emitted to air in Poland, except emissions of SO_x for which industrial sectors (and in particular energy - power) account for about 75% of the total. The contribution of industrial sectors to emissions of heavy metals is higher compared to the rest of the national total, representing more than 50% of emissions to air of Cd, As, Cu, Pb, Hg and Zn.

Within the industrial sector, the greatest share of emissions to air comes primarily from energy – power sector for most pollutants, the iron and steel sector and 'other activities' (Figure 12) also contribute significant amounts for some pollutants. There is no data available for the other minerals sector.

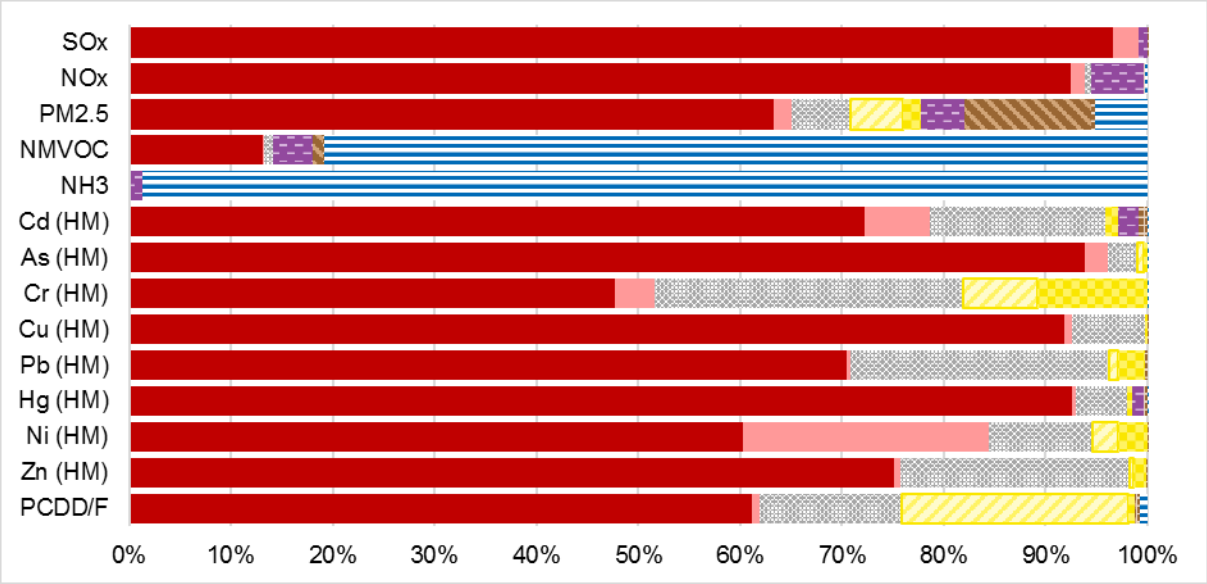
Figure 11: Emissions to air from industrial sectors and rest of national total (2015)



Note: Rest of national total relates to the national total for the entire territory (based on fuel sold) minus the industrial sector emissions shown here. No data available for the other minerals sector.

Source: EEA (2017a)

Figure 12: Emissions to air from industrial sectors (2015)



Note: The key for this chart is shown in Figure 11. *No data available for the other minerals sector.*

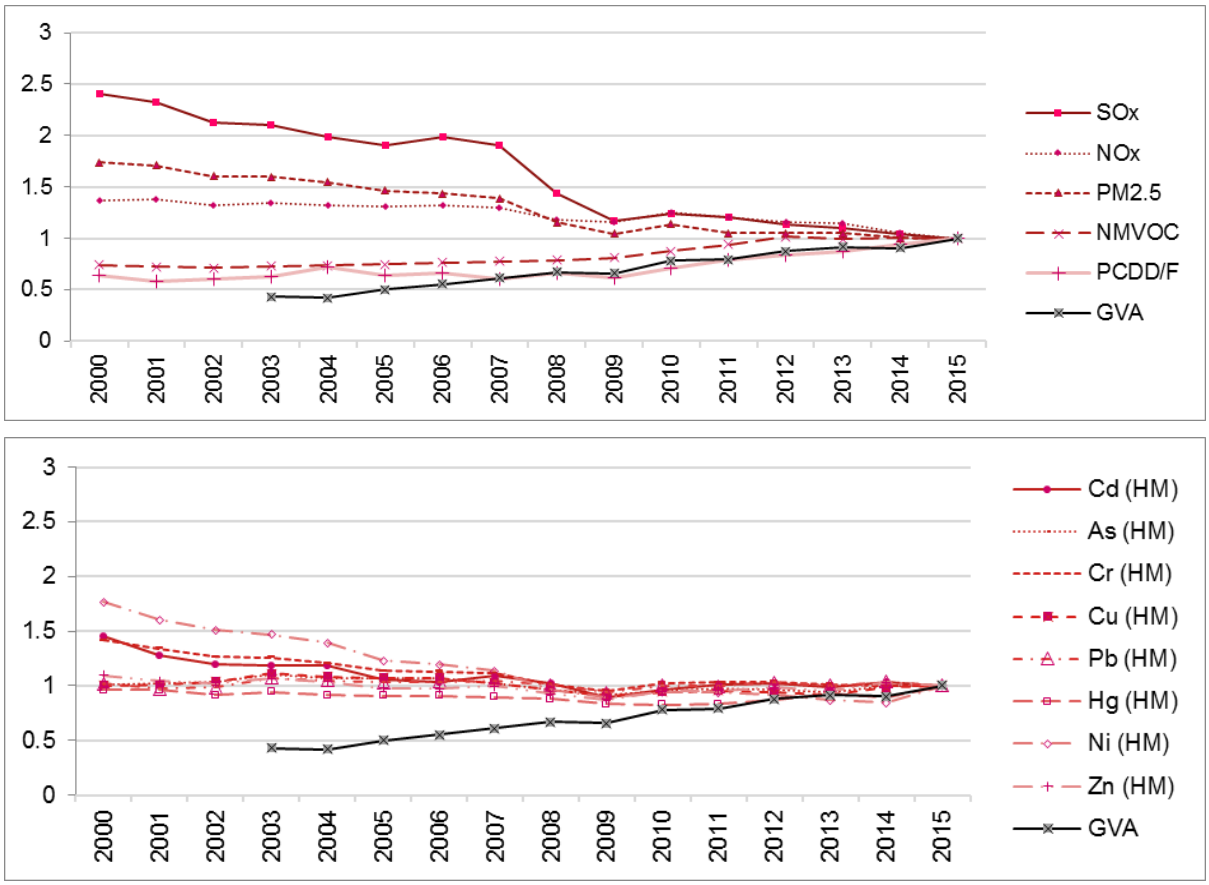
Source: EEA (2017a)

In the following subsections, emissions data are shown in indexed charts by sector. This was done to compare the development of pollutant emissions with the GVA in specific sectors in the period 2000 to 2015. GVA data are however only available from 2003. Appendix 2 includes full details on the emissions reported by pollutant, industrial sector and year.

Energy industry

For the energy – power sector, different trends are observed for the non-heavy metal pollutants reported (Figure 13). Between 2000 and 2015, emissions of SO_x, $PM_{2.5}$ and NO_x have decreased, whilst emissions of NMVOC and PCDD/F have increased, together with GVA. Emissions of NH_3 are not reported. Despite the different trends, changes are small for all of these pollutants. Concerning heavy metal emissions, these have been fairly static over time. A small decrease in emissions (mainly emissions of Ni, Cr and Cd) is observed for 2000-2009.

Figure 13: Indexed emissions to air from the energy - power industrial sector (indexed to 2015=1)

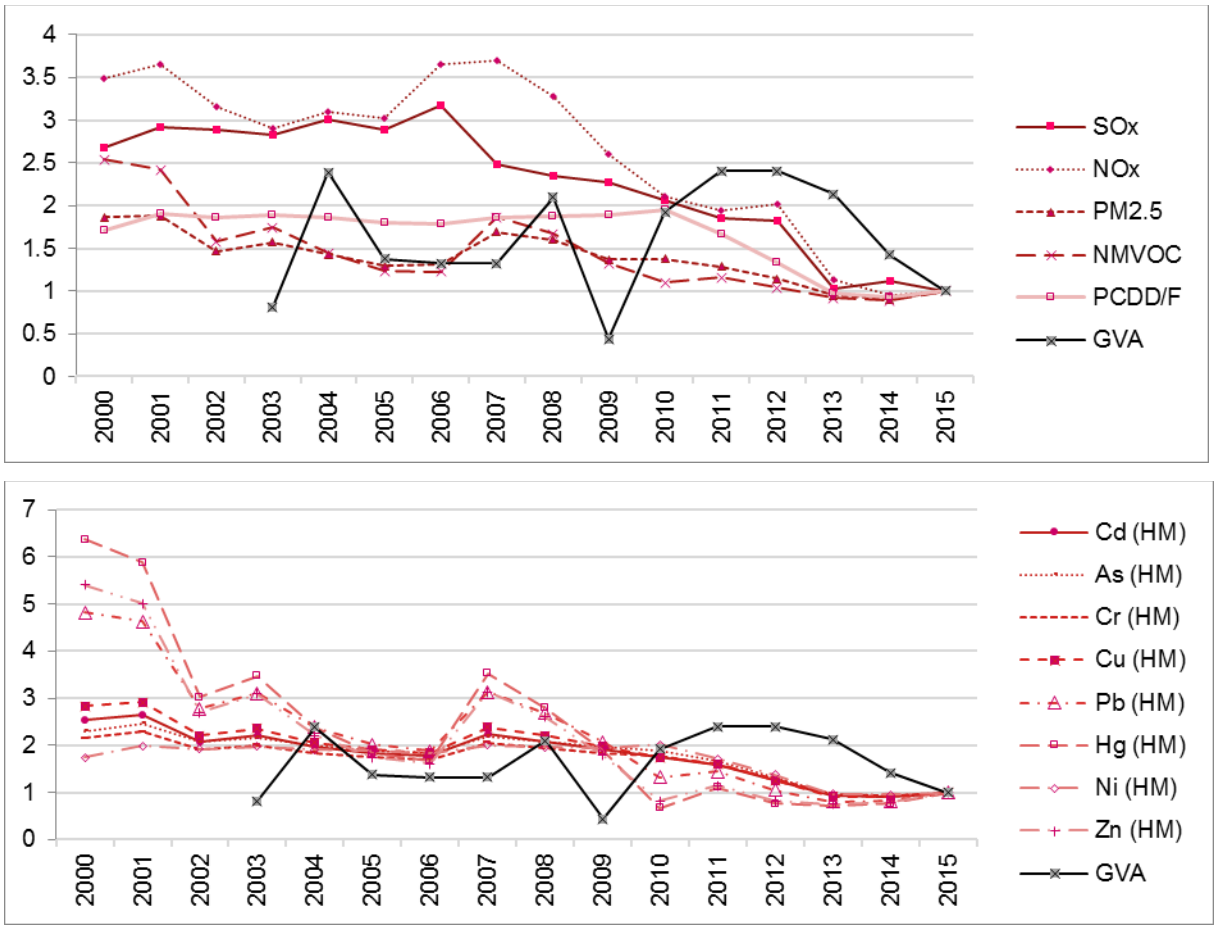


Note: Data is not reported for NH_3 emissions. No GVA data is available for 2000-2002.

Source: EEA (2017a), Eurostat (2017a)

Emissions to air from the energy – refining, gasification and liquefaction, coke sector have generally decreased between 2000 and 2015 (Figure 14). Emissions for all pollutants are reported, except for NH_3. It is worth noting that certain heavy metals tend to follow the same trajectory over time. These heavy metals can be divided into two groups: the first including Hg, Zn and Pb observe more extreme changes compared to the second group comprising Cu, Cd, As, Cr and Ni. GVA in this sector is also characterised by a volatile trend, similar to the trend observed for the first group of heavy metals.

Figure 14: Indexed emissions to air from energy - refining, gasification and liquefaction, coke industrial sector (indexed to 2015=1)



Note: Data is not reported for NH_3 emissions. No GVA data is available for 2000-2002. GVA is extrapolated for the year 2015 based on data reported for 2012-2014. The y-axes in the charts have different scales.

Source: EEA (2017a), Eurostat (2017a)

Metal industry

Emissions to air originating from the metal industry are reported for the production of iron and steel as well as non-ferrous metals. Figure 15 shows that emissions to air from iron and steel production have varied in cycles, increasing and decreasing significantly over time, although the change between 2010 and 2015 is relatively small. It appears that this volatile trend in emission to air follows the trajectory of GVA, increasing and decreasing in the same years. The exception is emissions of PCDD/F which fell in 2007 as opposed to the rise in GVA. It is not clear why this has occurred. There is no information on E-PRTR which suggests that the installations are operating below the reporting thresholds.

Figure 15: Indexed emissions to air from iron and steel production (metal industrial sector) (indexed to 2015=1

Note: Data is not reported for NH_3 emissions. No GVA data is available for 2000-2002. GVA is extrapolated for the year 2015 based on data reported for 2012-2014.

Source: EEA (2017a), Eurostat (2017a)

Emissions to air from non-ferrous metal production are only available for $PM_{2.5}$ and Pb. Figure 16 demonstrates that $PM_{2.5}$ emissions have fallen substantially between 2007 and 2009 (by about a factor of 20). This is likely to be linked to the decrease in energy consumption observed for the same period. It could also reflect compliance with permitting requirements under the IPPC Directive by 2008. In contrast, emissions of Pb have been increasing over time, although only slightly in comparison, broadly following the trend in GVA (although changes in emissions are less extreme).

Figure 16: Indexed emissions to air from non-ferrous metal production (metal industrial sector) (indexed to 2015=1)

Note: Data is only reported for $PM_{2.5}$ and Pb. The y-axis in the charts have a different scale. No GVA data is available for 2000-2002. GVA is extrapolated for the year 2015 based on data reported for 2012-2014.

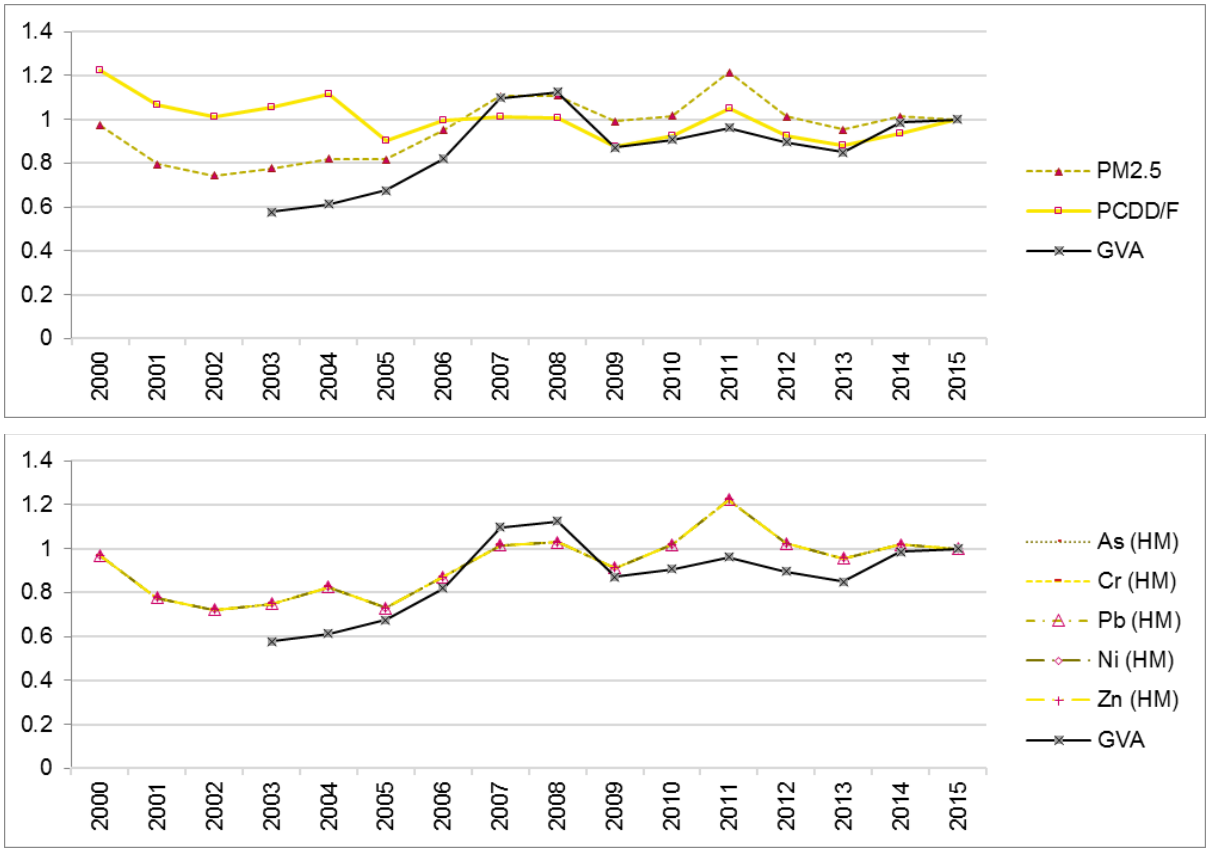
Source: EEA (2017a), Eurostat (2017a)

Mineral industry

Within the mineral sector, only emissions of $PM_{2.5}$ and PCDD/F are reported for both the production of cement, lime and magnesium oxide (Figure 17), and the production of glass (Figure 18). Heavy metal emissions are only reported for the production of glass. There is no data reported for the production of other minerals.

Emissions to air from the cement, lime and magnesium oxide production have remained fairly constant over time, broadly following changes in GVA (Figure 17). It is worth noting that the trajectory of the emissions of heavy metals are the same for the whole period analysed. This may indicate that the emission factors used for this sector are static over time, with changes in all pollutants driven by changes in activity levels.

Figure 17: Indexed emissions to air from cement, lime and magnesium oxide production (mineral industrial sector) (indexed to 2015=1)

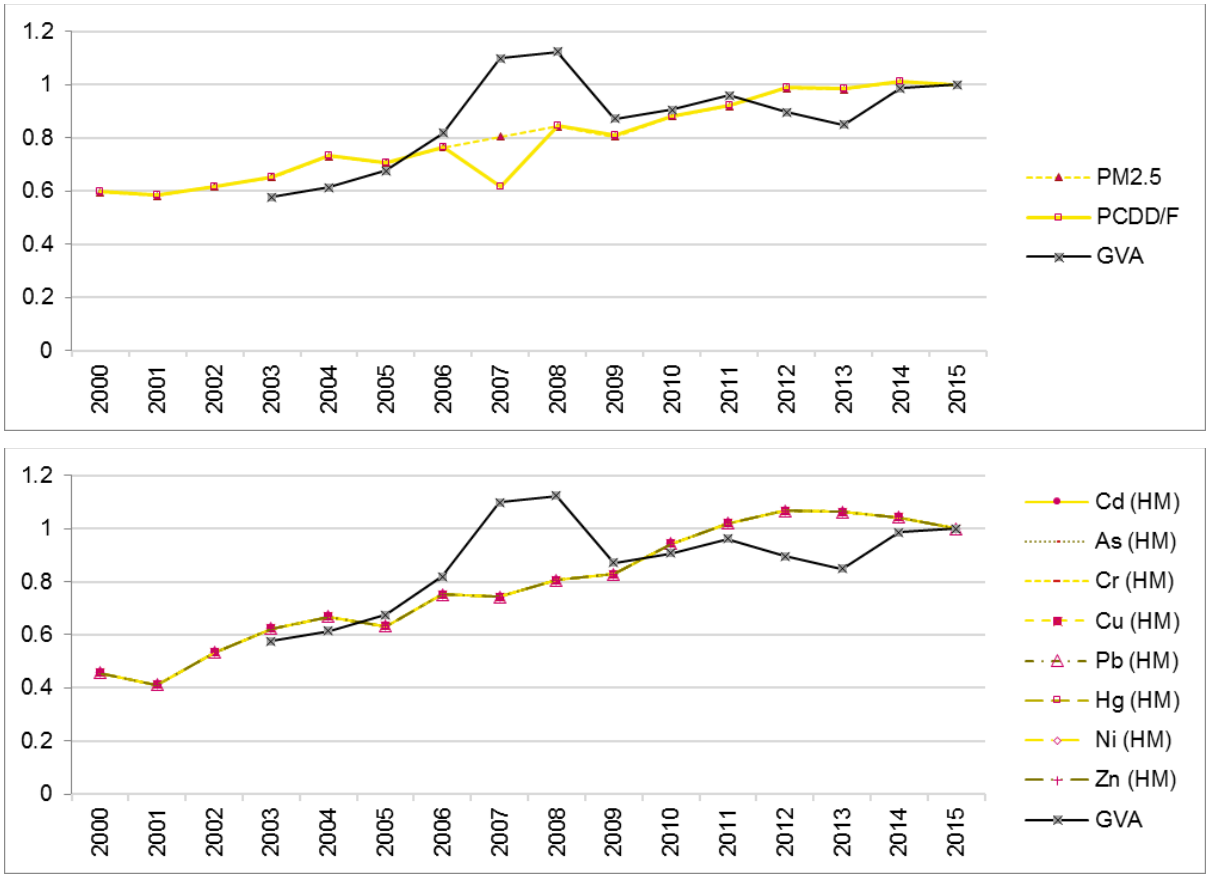


Note: For the non-heavy metal pollutants, only PM2.5 and PCDD/F emissions are reported. For the heavy metals, Cd, Cu, and Hg emissions are not reported. No GVA data is available for 2000-2002. GVA is extrapolated for the year 2015 based on data reported for 2012-2014.

Source: EEA (2017a), Eurostat (2017a)

Emissions to air originating from glass production have increased over time (Figure 18). Similar to what is observed in the cement, lime and magnesium oxide sector, they broadly follow the trend in GVA, except between 2006 and 2009 when the increase in GVA did not translate into substantially higher emissions. In contrast, emissions of PCDD/F decreased in 2007. Cross-checking with E-PRTR, it does not report any data for glass facilities in 2007 and 2008 which may reflect the fact that the installations were operating below the reporting thresholds and/or they ceased production for a limited period of time. Emissions of heavy metals also follow the exact same trend over time which also suggests that emissions factors for all heavy metals are constant over time.

Figure 18: Indexed emissions to air from glass production (mineral industrial sector) (indexed to 2015=1)



Note: For the non-heavy metal pollutants, only PM2.5 and PCDD/F emissions are reported. All heavy metals are reported. No GVA data is available for 2000-2002. GVA is extrapolated for the year 2015 based on data reported for 2012-2014.

Source: EEA (2017a), Eurostat (2017a)

Chemical industry

For the chemical industry, Figure 19 shows that the reported non-heavy metal pollutants have slightly increased over time, although a drop is observed in 2009. Their trends reflect the changes in GVA, which also increases over time. Only PCDD/F emissions are not reported.

The trends in emissions to air of the reported heavy metals (only Cd and Hg) are more volatile. The same drop is observed in 2009. Emissions of Hg have decreased over time, whilst emissions of Cd have slightly increased between 2000 and 2015, although both heavy metals demonstrate significant variations over time.

Figure 19: Indexed emissions to air from the chemical industrial sector (indexed to 2015=1)

Note: For the non-heavy metal pollutants, only PCDD/F emissions are not reported. For the heavy metals, only Hg and Cd are reported. No GVA data is available for 2000-2002. GVA is extrapolated for the year 2015 based on data reported for 2012-2014.

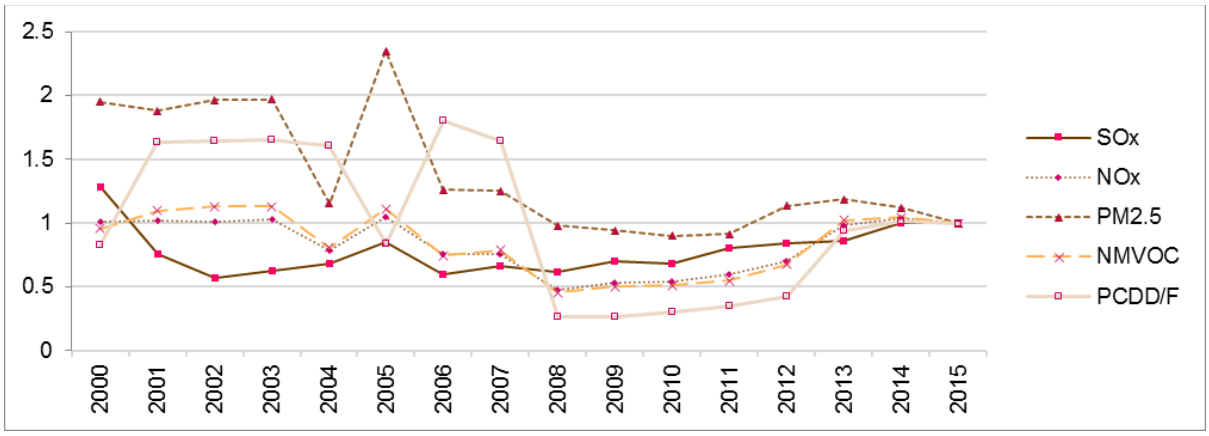
Source: EEA (2017a), Eurostat (2017a)

Waste management industry

No GVA data is available for the waste management industry. As a result, pollutant emissions are not shown with indexed GVA in Figure 20 and Figure 21. Emissions were reported for all non-heavy metal pollutants except NH_3 in both the hazardous and non-hazardous waste management sectors. Data on heavy metals emissions are also not available for the hazardous waste management sector.

For the hazardous waste management sector, reported emissions to air are characterised by significant variations over time. All the reported pollutants followed a similar trend, except for PCDD/F emissions which fell in 2005 whilst all other pollutants observed an increase. It is unclear why PCDD/F emissions have followed a different trend. Aside from the significant variations observed over time, the actual change in emissions between 2000 and 2015 is small for the majority of pollutants, except emissions of $PM_{2.5}$ which decreased slightly in this period.

Figure 20: Indexed emissions to air from hazardous waste (waste management industrial sector) (indexed to 2015=1)

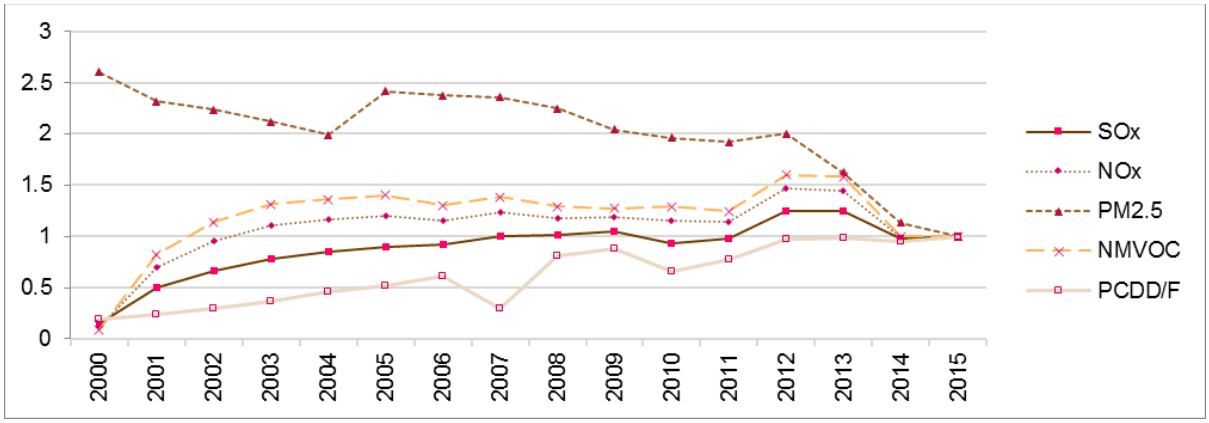


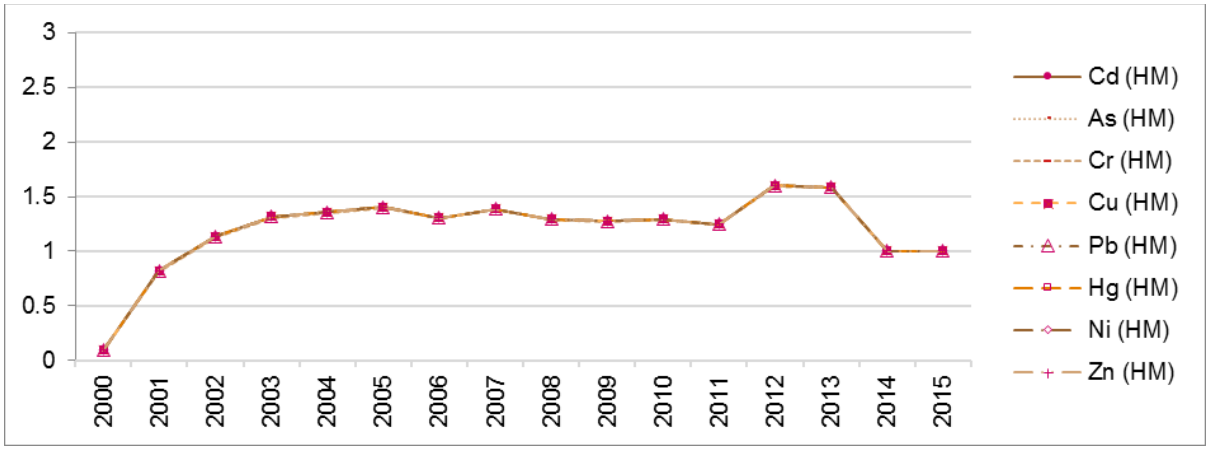
Note: Data is not reported for NH_3 emissions. No data is available for heavy metals. GVA data is also not reported.

Source: EEA (2017a), Eurostat (2017a)

Regarding emissions to air from the non-hazardous waste management sector, Figure 21 shows an increase in all the pollutants reported, following a similar trend, except emissions of $PM_{2.5}$ which have decreased more significantly over time. Note that emissions of PCDD/F decline significantly from 2007 to 2008, potentially reflecting the impact of the economic recession. The trend lines for emissions of all the heavy metal pollutants reported are the same over time, which suggests that the emission factors used for these pollutants are constant over time.

Figure 21: Indexed emissions to air from non-hazardous waste (waste management industrial sector) (indexed to 2015=1)





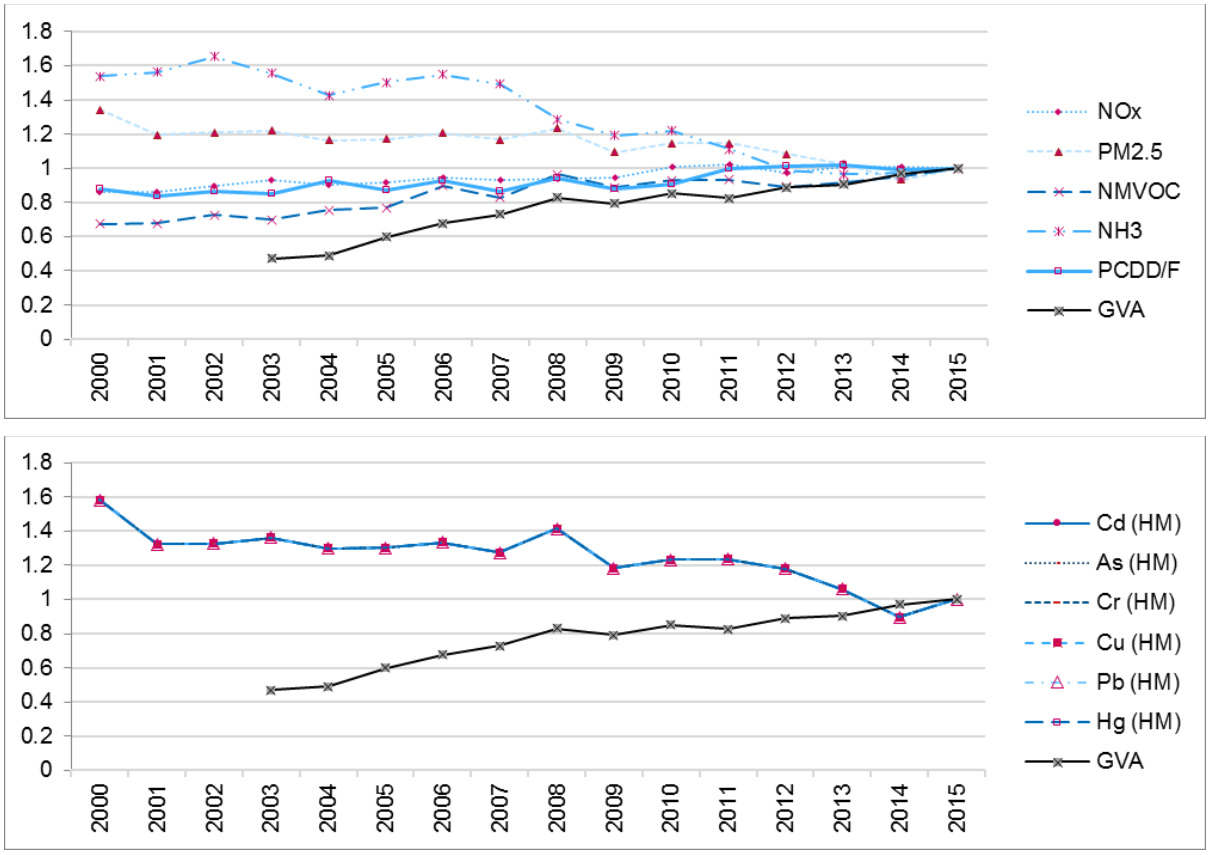
Note: Data is not reported for NH_3 emissions. GVA data is also not reported.

Source: EEA (2017a), Eurostat (2017a)

'Other activities'

Emissions to air from 'other activities' of non-heavy metal pollutants have followed different trends as illustrated in Figure 22. NH_3 and $PM_{2.5}$ emissions have declined slightly over time, whilst emissions of PCDD/F, NO_x and NMVOC have increased for the same period, following the growth in GVA. Note that data on SO_x emissions is not reported. Regarding emissions of heavy metals, the trend lines are exactly the same for all heavy metals reported (only data on emissions of Zn and Ni are not available) which also indicates that emission factors are the same over time and thus changes in emissions are driven by changes in activity level.

Figure 22: Indexed emissions to air from other activities (indexed to 2015=1)



Note: Data is not reported for SO_x, Zn or Ni emissions. No GVA data is available for 2000-2002. GVA is extrapolated for the year 2015 based on data reported for 2012-2014.

Source: EEA (2017a), Eurostat (2017a)

Limitations

The use of emissions data reported to LRTAP has generally led to overreporting against IED activities as emissions are reported by NFR classification and thus no activity thresholds apply as in the case of IED annex I activities.

Table 6: Gaps in emissions to air data for Poland

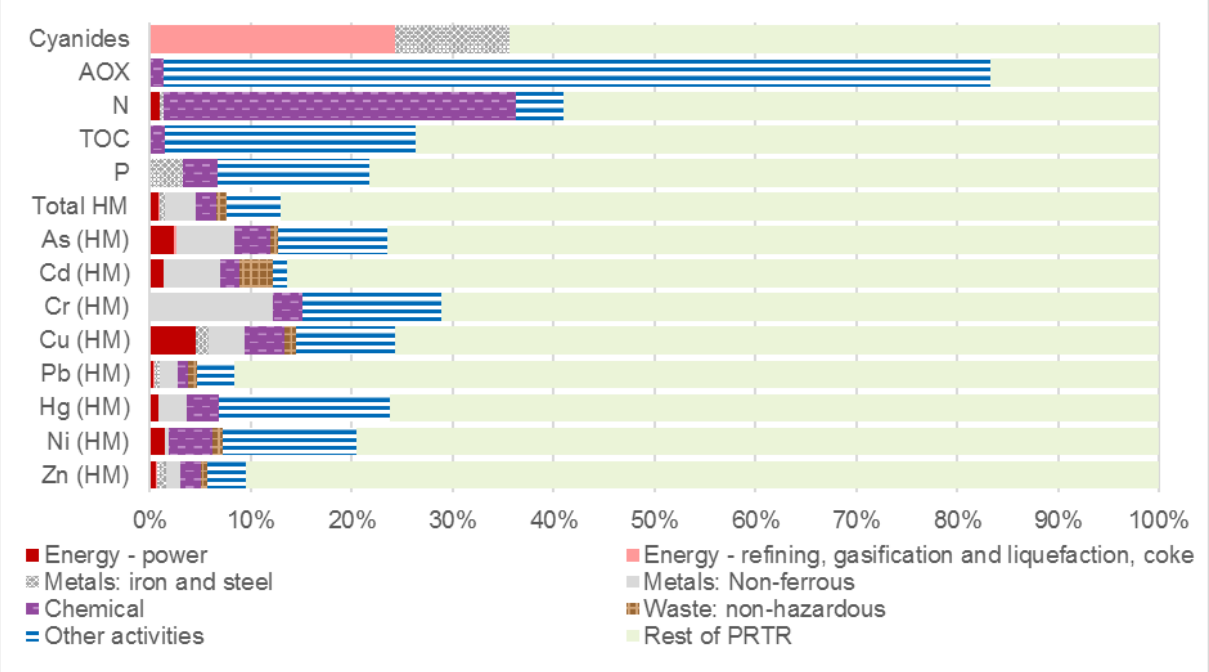
Missing data	Description	Conclusion and actions taken
Gaps in time series	No gap-filling for emissions data has been carried out	No action
Data gaps in CLRTAP	No data available for the other minerals sector for the whole period analysed	No action

4.2 Emissions to water

Emissions to water data were obtained from the E-PRTR (EEA, 2017b), which has a broader industrial scope than the IED but is not a national total. The figures in this section, apart from Figure 23 aggregate the separate metals into a single heavy metals metric based on their relative toxicity (predicted no effect concentrations).

Figure 23 shows that industrial sectors are responsible for less than half of the direct discharges to water in Poland (i.e. not via an urban wastewater treatment facility). The notable exception is emissions of AOX which mainly originate from the industrial sectors (and in particular, 'other activities' – representing about 83% of the total direct emissions to water of AOX in the country). Across the pollutants, 'other activities' generally contribute to a higher share of emissions to water. Note that data is not reported for the mineral sector.

Figure 23: Pollutant emissions to water from IED industrial sectors and rest of PRTR total (2015)



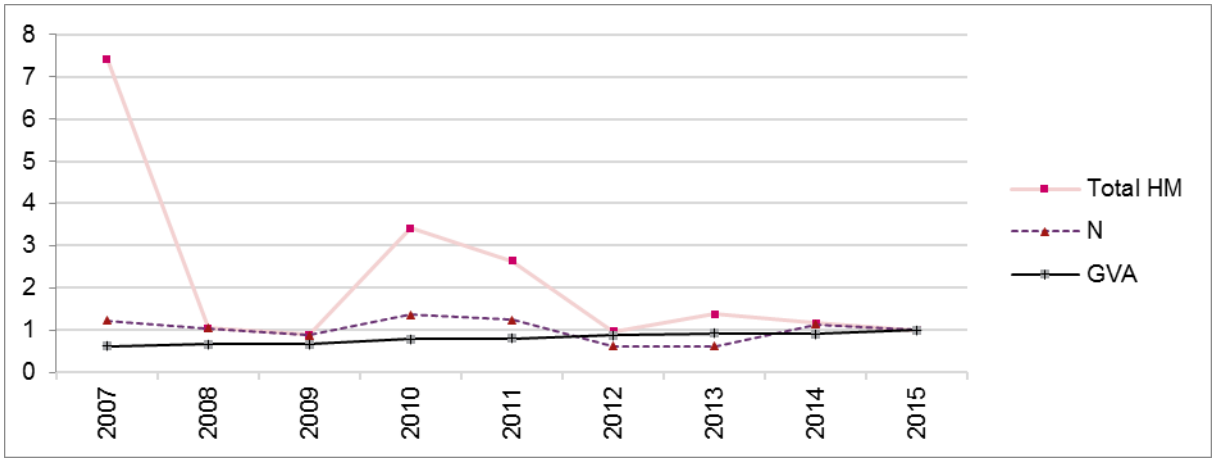
Notes: Rest of PRTR total relates to the total for E-PRTR reporting minus the industrial sectors shown here. No emissions data available in 2015 for Diuron, PCDD/F and PCBs. Data is not reported for the mineral sector.

Source: EEA (2017b)

Energy industry

Emissions to water from the energy industry are reported for the energy – power and energy - refining, gasification and liquefaction, coke sectors (Figure 24 and Figure 25, respectively). Emissions data for the energy – power sector are only available for total N and heavy metals. Figure 24 shows that the reported emissions to water follow a similar trend, although changes in emissions of heavy metals tend to be more extreme. The reported emissions first decreased between 2007 and 2009, more intensively for heavy metals driven by the decline in Cr, Pb, Hg and As in particular. This eight-fold decline in emissions of heavy metals could be associated with the reported reduction in the number of permitted installations. In 2010, emissions increased, once again more significantly for heavy metals (due to a considerable rise in Hg and Cr), after which they decline until 2012. After this year, changes in emissions are smaller.

Figure 24: Indexed emissions to water from the energy - power industrial sector (indexed to 2015=1)

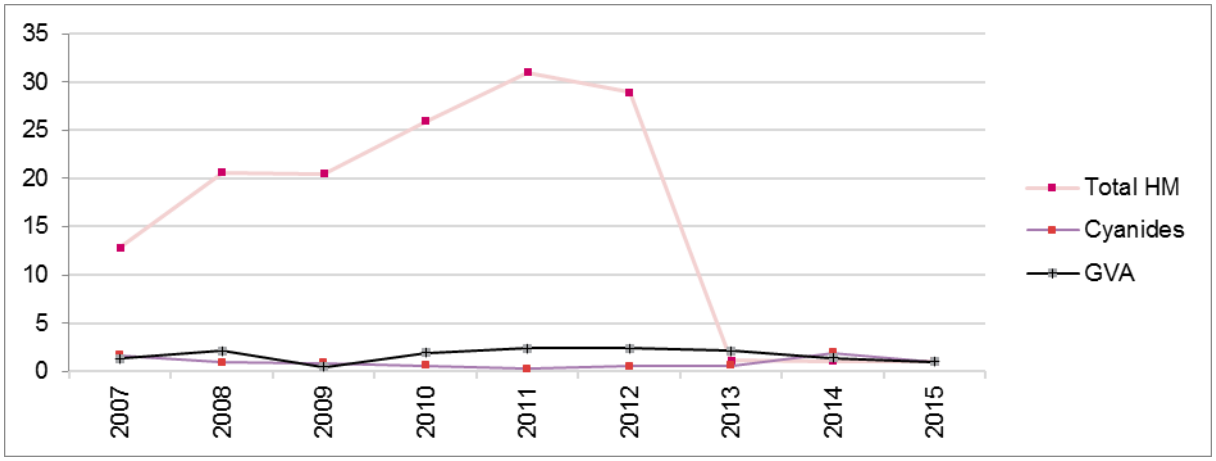


Note: Only heavy metals and total N emissions are reported.

Source: EEA (2017b), Eurostat (2017a)

Emissions to water from the energy - refining, gasification and liquefaction, coke sector are only available for heavy metals and cyanides. Figure 25 demonstrates that emissions of heavy metals increased significantly between 2007 and 2011 (by a factor of 20). Amongst all the heavy metals reported, their share in the total reported in Figure 25 varies widely over time. Pb, Cr and Zn appear to be the most relevant heavy metals emanating from this sector (taking also into account their level of toxicity). After 2011, emissions to water of heavy metals declined abruptly until 2013 (by a factor of 30). This is associated in lack of reporting of emissions of Hg, Pb, Cu, Cr and Cd. The fact that the reported number of installations permitted decreased between 2011 and 2013 (one fewer IED installations) could in part explain this decline. Furthermore, according to data from E-PRTR, one particular facility stopped reporting in 2013. The fact that some heavy metals have stopped being reported completely could point towards wider underlying data limitations of using the E-PRTR data (due to reporting thresholds– as discussed in the accompanying methodology report). In comparison, emissions of cyanides have only observed small changes for the same period.

Figure 25: Indexed emissions to water from the energy - refining, gasification and liquefaction, coke sector (indexed to 2015=1)



Note: Only heavy metals and cyanide emissions are reported. GVA is extrapolated for the year 2015 based on data reported for 2012-2014.

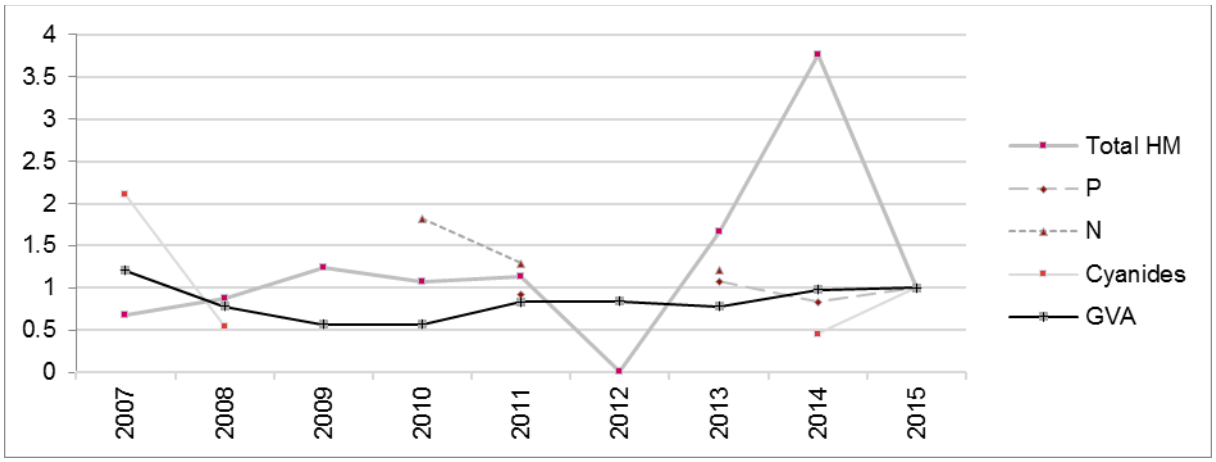
Source: EEA (2017b), Eurostat (2017a)

Metal industry

Emissions to water originating from the metal industry are analysed for the iron and steel sector as well as the production of non-ferrous metals (Figure 26 and Figure 27, respectively).

It is worth noting that data on emissions to water from iron and steel production has important limitations as evidenced in Figure 26. Data is not available for the whole time period in analysis for all the reported pollutants (only heavy metals, total P and total N and cyanides emissions are reported). Data on emissions of total P are only available for the years 2011, 2013, 2014 and 2015. In the available years, the trend in emissions has remained relatively stable. Emissions of total N are reported for the years 2010, 2011, 2013 and 2015 and appear to have decreased over time. Data on cyanide emissions are available for the years 2007, 2008, 2014 and 2015. During this period, emissions have first decreased between 2007 and 2008, but increased between 2014 and 2015. Emissions of heavy metals are reported for the whole period. The trend was relatively static until 2011 when emissions dropped significantly in 2012. Although the reported number of permitted IED installations increased by four installations between 2011 and 2013, E-PTR data shows that one facility stopped reporting emissions to water in 2012. This drop could be linked to the wider limitations of E-PRTR data as only facilities above a certain emissions threshold are required to report. Emissions of heavy metals increased after 2012, peaking in 2014, mainly due to the rise in emissions of Zn.

Figure 26: Indexed emissions to water from the iron and steel production (metal industrial sector) sector (indexed to 2015=1)

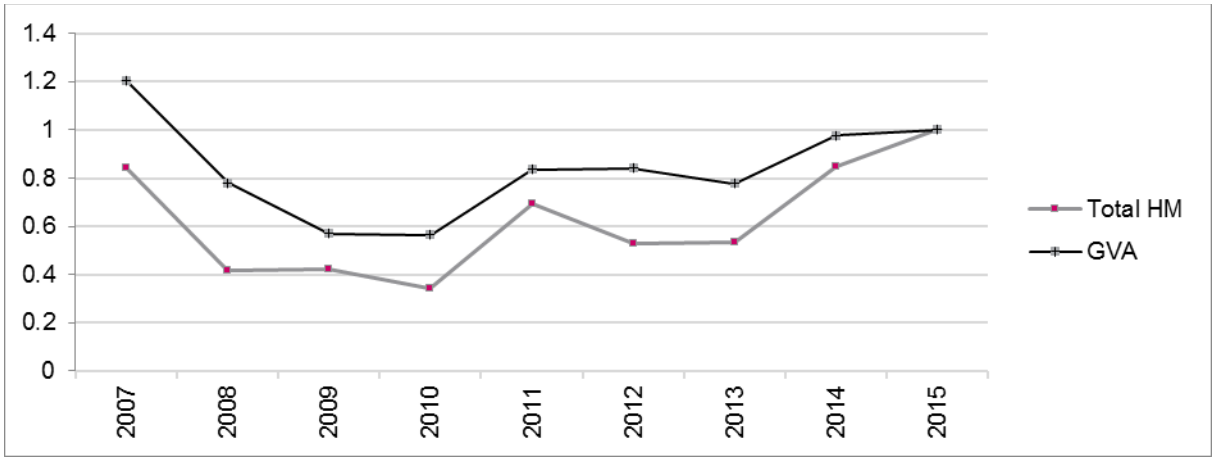


Note: Only heavy metals, total N, total P and cyanides emissions are reported. GVA is extrapolated for the year 2015 based on data reported for 2012-2014. Zero emissions reported for total P between 2007 and 2010 and in 2012, for total N between 2007 and 2009, in 2011 and in 2014, and for cyanides between 2009 and 2013. Values not plotted for these pollutants in these years to avoid misrepresenting trends.

Source: EEA (2017b), Eurostat (2017a)

Emissions to water from the production of non-ferrous metals are only reported for heavy metals. Figure 27 shows that heavy metals emissions have largely followed changes in GVA over time. Emissions of Cd, Cr and Zn are particularly significant for this sector. It is worth noting that Pb emissions have declined substantially in 2008, whilst Cd emissions have generally increased over time.

Figure 27: Indexed emissions to water from the non-ferrous metal production (metal industrial sector) sector (indexed to 2015=1)



Note : Only heavy metals emissions are reported. GVA is extrapolated for the year 2015 based on data reported for 2012-2014.

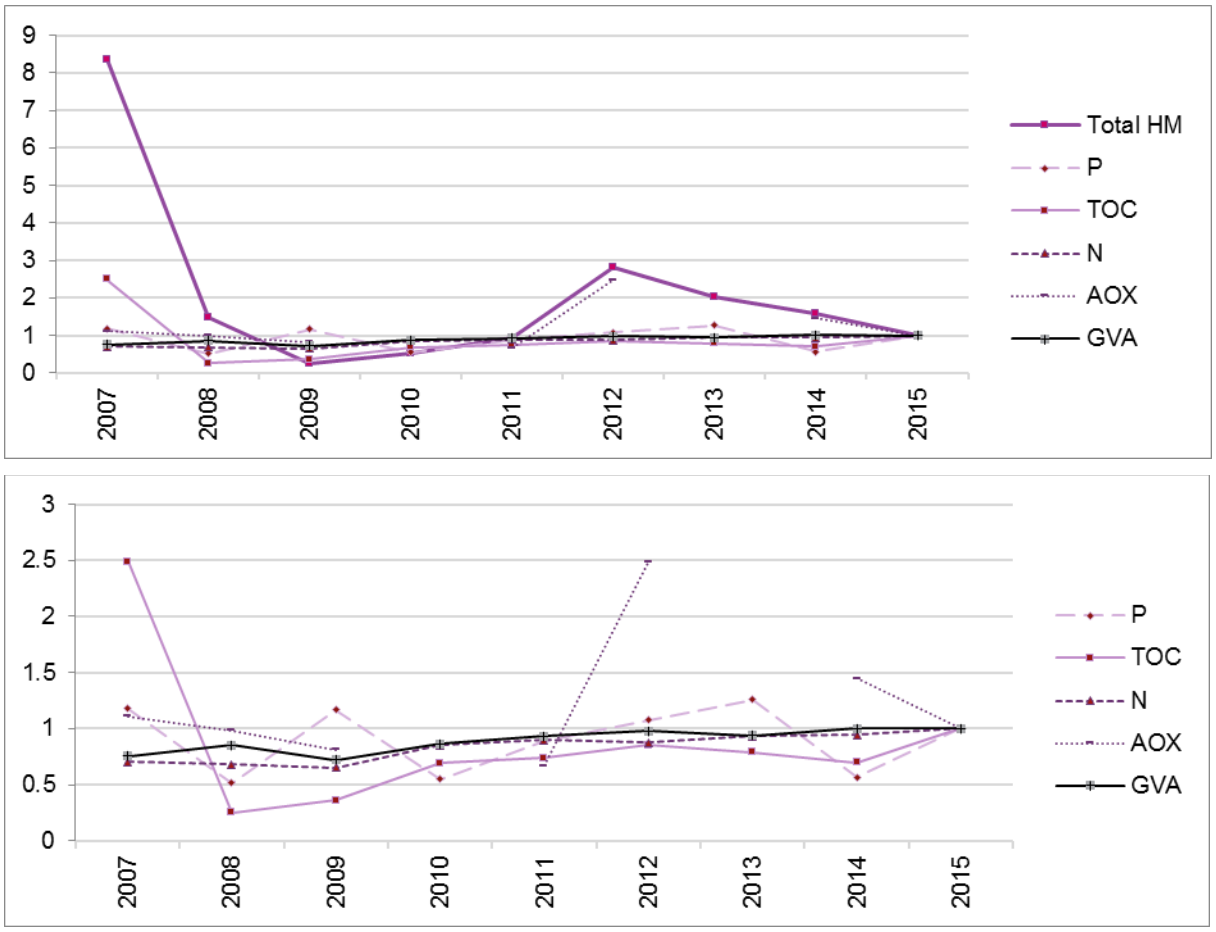
Source: EEA (2017b), Eurostat (2017a)

Chemical industry

Emissions to water from the chemical industry are reported for heavy metals, total P, TOC, total N and AOX (Figure 28) with different trends observed for the reported pollutants. Emissions of heavy metals decreased significantly between 2007 and 2009 mainly due a decline in emissions of Hg. According to E-PRTR, the number of facilities reporting Hg emissions increased from four to five in this period, however the total emissions reported by the existing facilities declined very significantly (especially for one facility, in particular). This could be associated with improvements in emissions control and/or changes in production. After 2009, emissions of heavy metals increased steadily until 2012, after which they declined until 2015. This is mainly driven by changes in emissions of Cr, Hg, Zn and As.

The trend of the other reported pollutant emissions is less extreme, varying relatively little over time. However, it should be noted that emissions of TOC declined more significantly between 2007 and 2008 and an increase in emissions of AOX is observed in 2012. Emissions of this pollutant are not reported for the years 2010 and 2013.

Figure 28: Indexed emissions to water from the chemical sector (indexed to 2015=1)



Note: No data on PCBs, PCDD/F, diuron and cyanides are reported. The bottom chart excludes heavy metals to provide more detail on the trends of the other reported pollutants. GVA is extrapolated for the year 2015 based on data reported for 2012-2014. Zero emissions reported for AOX in 2010 and in 2013. Values not plotted for this pollutant in these years to avoid misrepresenting the trend.

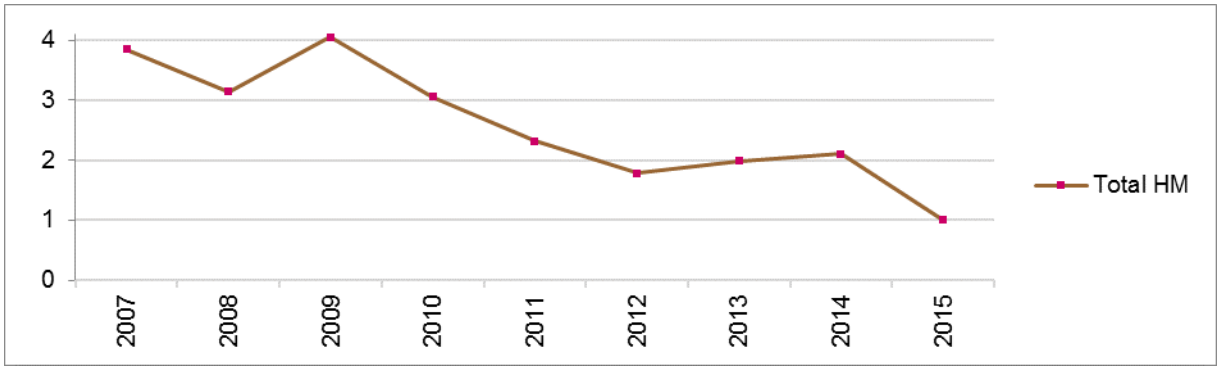
Source: EEA (2017b), Eurostat (2017a)

Waste management industry

Emissions to water from the waste management industry are only available for the non-hazardous waste management sector. Note that GVA data is not reported for the waste management industry and thus emissions to water are not shown with indexed GVA in Figure 29.

Figure 29 shows a downward trend for the emissions to water from the non-hazardous waste management sector. These can only be reported in a time series for heavy metals since only limited data points are available for the other pollutants and thereby their trend indexed to 2015 cannot be presented. Emissions of heavy metals have generally decreased over time, except in 2009 and between 2012 and 2014 when emissions slightly increased. The increases in heavy metal emissions are mainly due to the rise in Zn emissions in 2009 and the increase in As emissions between 2012 and 2014.

Figure 29: Indexed emissions to water from non-hazardous waste (waste management industrial sector) (indexed to 2015=1)

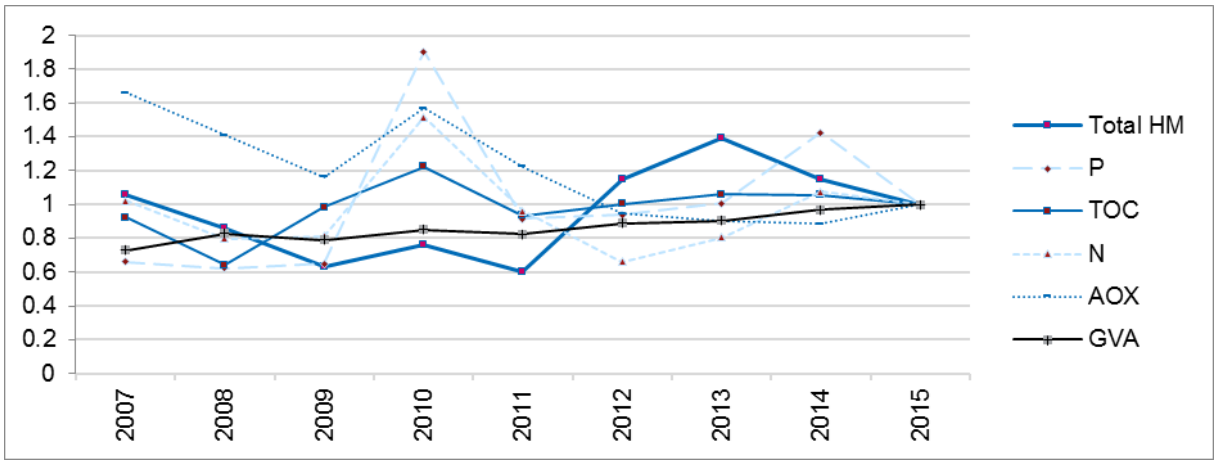


Note: Only heavy metals emissions are reported. GVA data is not available.
Source: EEA (2017b), Eurostat (2017a)

'Other activities'

Overall, emissions of the majority of pollutants from 'other activities' remained relatively unchanged (comparing the starting year of 2007 with the final year of 2015), despite significant variations in between (Figure 30). Only the emissions of AOX decreased for the same period, whilst emissions of total P increased slightly. Nonetheless, a similar trend is observed between 2007 and 2015. They first declined between 2007 and 2008 (and in the case of total heavy metals and AOX until 2009). They all indicate an increase in 2010, which is particularly pronounced for total P emissions. After 2012, the trend followed by the majority of the pollutants reported is more stable, except in the case of heavy metals which peaked in 2013, and total P emissions which reached a second peak in 2014.

Figure 30: Indexed emissions to water from other activities (indexed to 2015=1)



Note: No data on PCDD/F, diuron and cyanides are reported. GVA is extrapolated for the year 2015 based on data reported for 2012-2014.

Source: EEA (2017b), Eurostat (2017a)

Additional data for emissions to water

All data reported to E-PRTR for emissions to water are presented in Table 7 for relevant pollutants.

Table 7: Emissions to water by pollutant and industrial sector (all available data)

Pollutants	Units	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy - power										
Total HM	kg	454	64	54	209	161	59	85	72	61
N	t	131	112	94	147	134	67	67	123	108
PCDD/F	kg	0	0	0	0.0005	0	0	0	0	0
AOX	kg	0	0	0	0	0	1,650	3,550	0	0
Cyanides	kg	0	0	0	0	77	0	0	0	0
Energy - refining, gasification and liquefaction, coke										
Total HM	kg	46	74	74	93	112	104	4	4	4
TOC	t	134	105	101	133	240	204	90	89	0
N	t	0	0	0	59	69	81	0	0	0
Cyanides	kg	758	411	399	284	115	246	262	876	455
Metals: iron and steel										
Total HM	kg	27	34	49	42	45	0	65	147	39
P	t	0	0	0	0	15	0	17	13	16
N	t	0	0	0	93	66	0	62	0	51
Cyanides	kg	447	116	0	0	0	0	0	97	213
Metals: Non-ferrous										
Total HM	kg	185	92	93	76	152	117	117	187	220
Mineral: Cement, lime and magnesium oxide										
Total HM	kg	0	0	15	9	6	19	8	20	0
N	t	0	333	379	440	496	439	481	343	0
Mineral: Glass										
P	t	193	0	0	0	0	0	0	0	0
N	t	2,300	0	0	0	0	0	0	0	0
Chemical										
Total HM	kg	1,286	230	38	79	142	432	313	246	154
P	t	20	9	20	9	15	18	21	10	17
TOC	t	608	61	88	170	181	209	194	171	244
N	t	2,929	2,831	2,728	3,557	3,740	3,652	3,891	3,927	4,159
AOX	kg	1,810	1,610	1,330	0	1,090	4,050	0	2,360	1,630
Cyanides	kg	89	65	81	0	0	0	0	0	0
Waste: hazardous										
Total HM	kg	1	1	0	0	0	0	0	2	0
Waste: non-hazardous										
Total HM	kg	286	234	302	228	173	133	148	157	75
P	t	0	0	0	19	0	0	0	11	0
TOC	t	0	0	0	0	0	0	61	0	0
N	t	323	317	452	512	285	408	441	375	0
Other activities										
Total HM	kg	407	329	243	292	232	442	534	440	384
P	t	48	45	47	138	67	68	73	104	73
TOC	t	3,723	2,585	3,979	4,934	3,779	4,050	4,286	4,264	4,039
N	t	559	436	444	829	526	362	441	588	547
PCDD/F	kg	0.0005	0.0002	0.0001	0	0	0	0	0	0
AOX	kg	158,800	134,900	111,200	150,100	116,900	90,500	86,260	84,530	95,700
Cyanides	kg	0	0	0	0	75	0	0	0	0

Note: Total heavy metals in kg is expressed in Hg equivalents using reciprocal predicted no effect concentrations

Source: EEA (2017b)

Limitations

No limitations arise as a result of the mapping to IED activities as E-PRTR activities are well aligned in this respect. However, it is generally expected that emissions to water reported to E-PRTR will be underreporting against IED activities because of the activity thresholds which apply (as well as inconsistencies between years). E-PRTR also has a limited timeseries.

Table 8: Gaps in emissions to water data for Poland

Missing data	Description	Conclusion and actions taken
Gaps in time series	No gap-filling for emissions data has been carried out	No action
Missing activities	No data reported for several activities	No alternative data available
Data gaps	No data available for the minerals sector for the whole period analysed	No action.

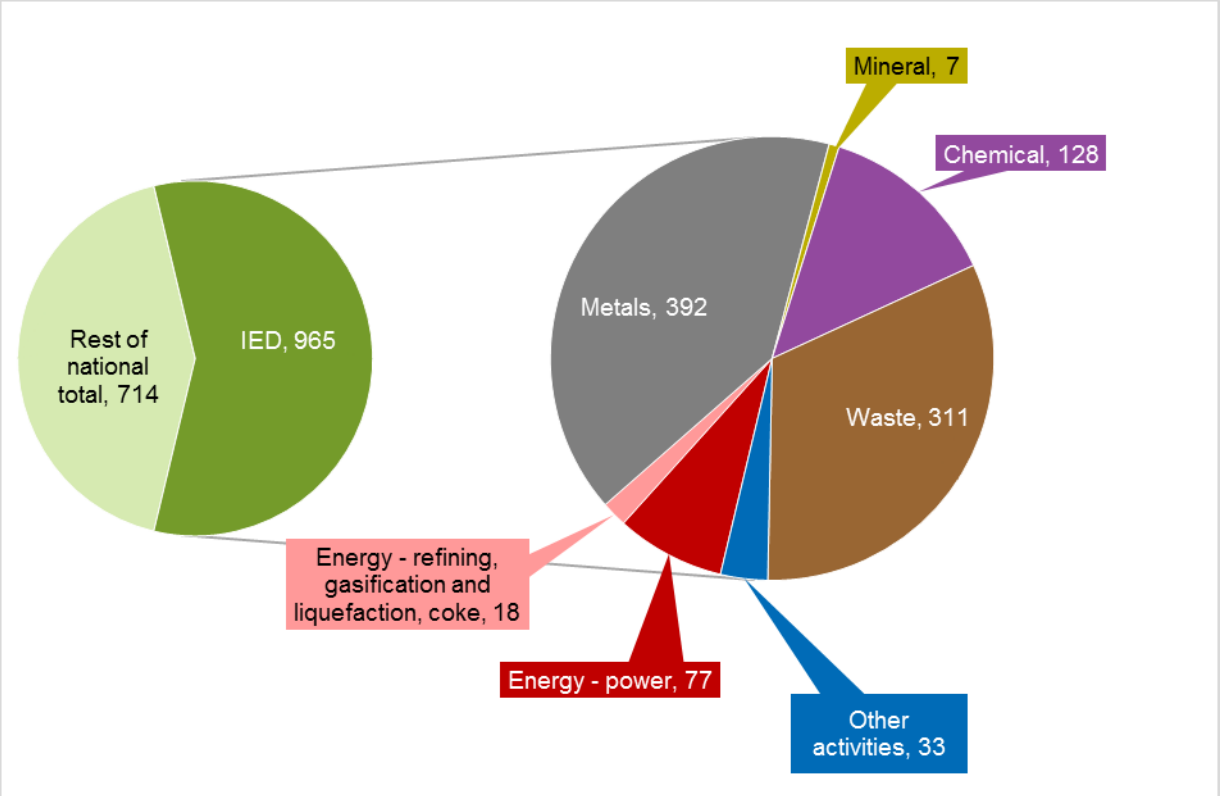
5 Waste generated by industrial sectors

The data presented in this section is the generation of waste by waste category (hazardous and non-hazardous) (Eurostat, 2017e). Data is reported by Member States biennially.

Industrial sectors in Poland represent a substantially share of total hazardous waste generated in the country (57%) as shown in Figure 31. Within the industrial sector, the metals sector is the most significant (41%), followed by the waste management sector (32%). Conversely, 'other activities' and energy – power sectors account for a relatively small share of waste generated despite their greater economic importance and high reported number of IED installations permitted in the country.

Taking into account the size of the sectors (in terms of number of installations), the metals industrial sector together with the energy – refining, gasification and liquefaction, coke sector are responsible for the generation of an important share of hazardous waste on average per installation. These industries are also characterised by high energy intensive production (as described in section 3).

Figure 31: Hazardous waste generation by industrial sector in 2014 (kt)

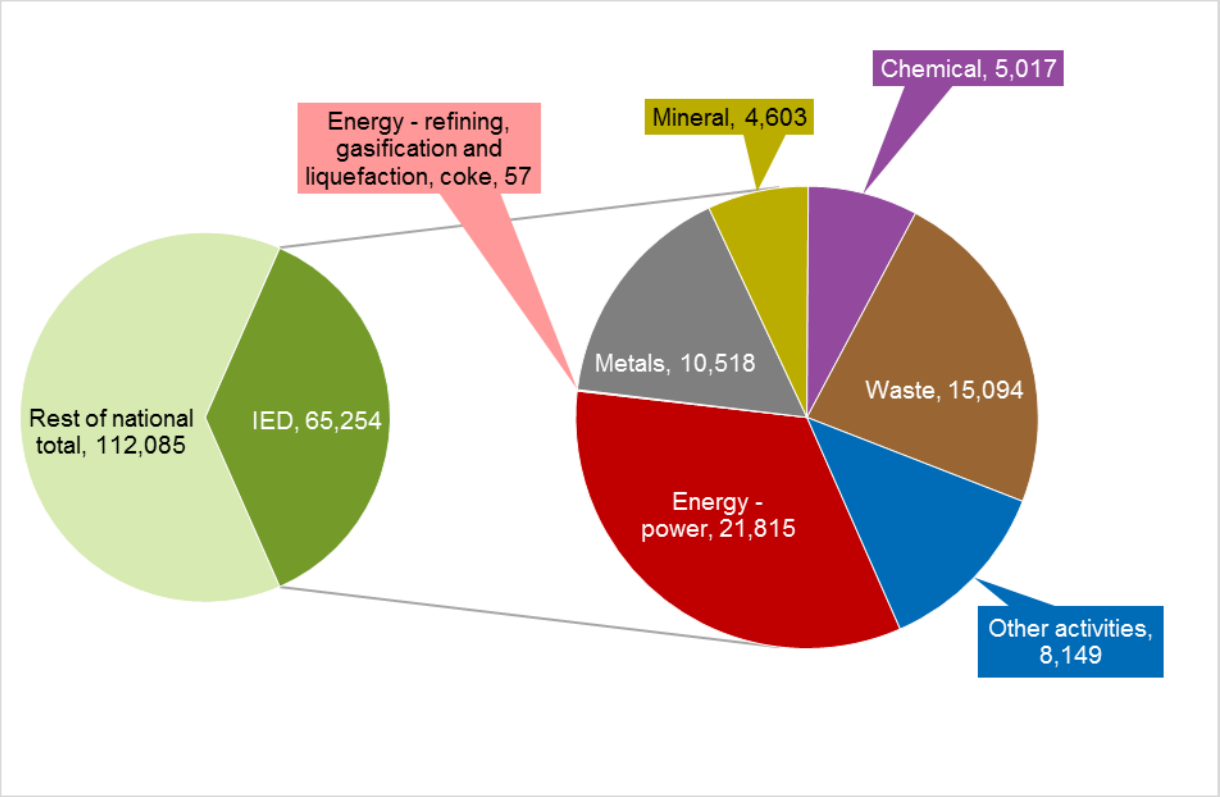


Note: Rest of national total relates to all NACE activity minus industrial sectors shown here. The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, waste generation cannot be excluded for this activity.

Source: Eurostat (2017e)

Industrial sectors represent a smaller share of the total non-hazardous waste generated in Poland (37%) as illustrated in Figure 32. In this case, the energy - power sector is responsible for a significant share of the non-hazardous waste generated by industrial sectors (33%), followed by the waste management sector (23%). Considering the reported number of installations permitted in Poland, the energy - power sector is also the largest contributor to non-hazardous waste generation on average per installation, followed by the metals industrial sector.

Figure 32: Non-hazardous waste generation by industrial sector in 2014 (kt)



Note: Rest of national total relates to all NACE activity minus industrial sectors shown here. The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, waste generation cannot be excluded for this activity.

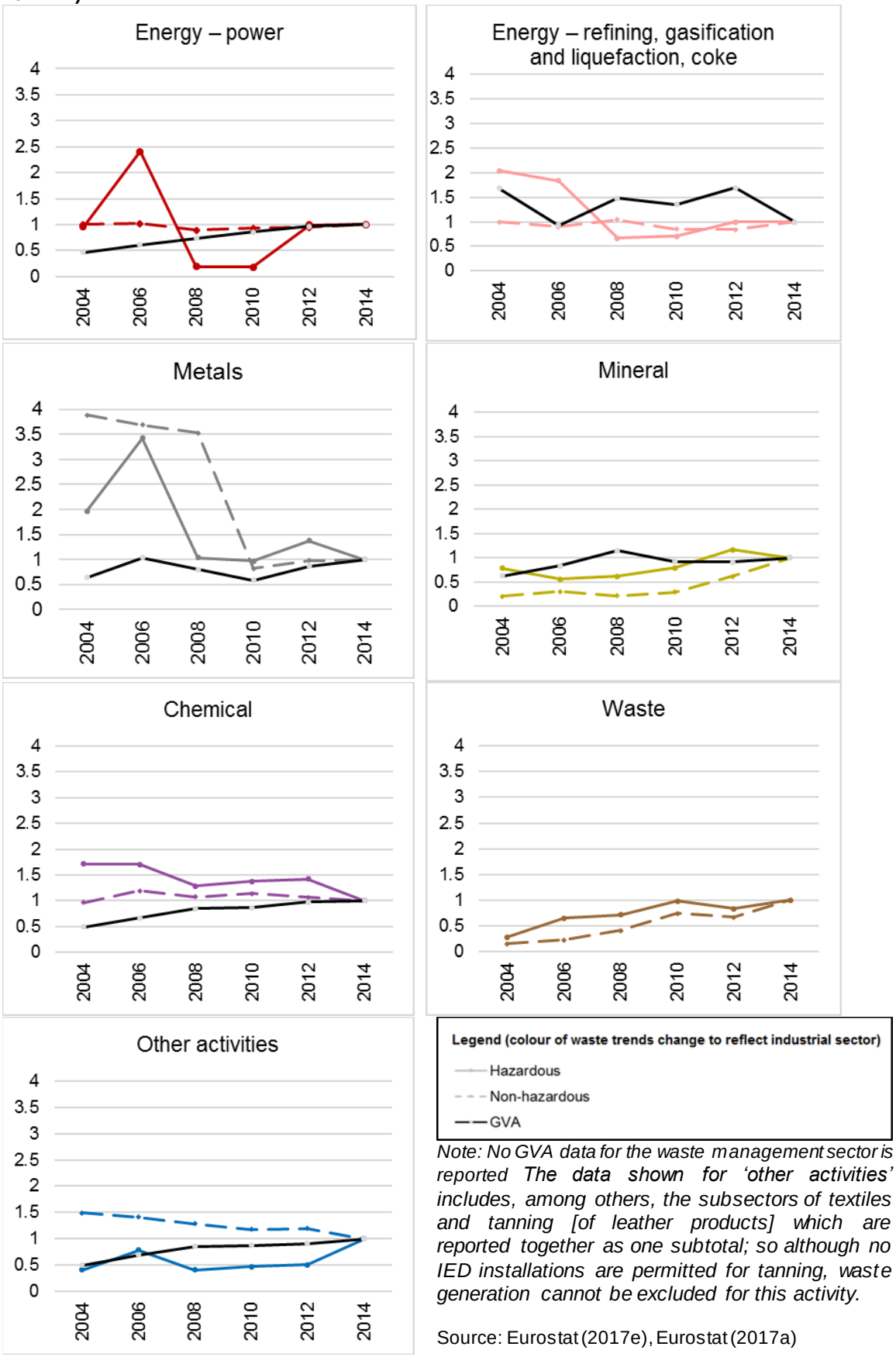
Source: Eurostat (2017e)

Between 2004 and 2014, different trends are observed regarding the generation of both hazardous and non-hazardous waste by the different industrial sectors (Figure 33).

The generation of hazardous waste largely declined between 2004 and 2014 in the energy – refining, gasification and liquefaction, coke, metals, and chemical industrial sectors, whilst it generally increased in the mineral and waste management sectors. In the energy – power sector, a spike is observed in 2006, followed by a decline until 2008 and subsequent increase in 2012. It is not clear why the trend in this sector is this volatile.

Regarding the generation of non-hazardous waste, the trend in some industrial sectors (including energy – power and energy – refining, gasification and liquefaction, coke and chemical) was relatively stable. Reductions were observed mainly in the metals sector and to a lesser extent in 'other activities'. In contrast, the quantity of non-hazardous waste generated by the mineral and waste management sectors increased slightly between 2004 and 2014.

Figure 33: Hazardous and non-hazardous waste generation by industrial sector relative to GVA (indexed; 2014 = 1)



Note: No GVA data for the waste management sector is reported The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, waste generation cannot be excluded for this activity.

Source: Eurostat (2017e), Eurostat (2017a)

Limitations

The use of NACE classifications for reporting has generally led to overreporting for waste generation data against each industrial sector and reporting is generally at IED sector level rather than by industrial sector. No data could be included within 'other activities' to reflect the IED activity intensive rearing of poultry or pigs as reporting was not at the appropriate level of NACE classification.

Table 9: Gaps in waste generation data for Poland

Missing data	Description	Conclusion and actions taken
No IED installations reported for tanning [of leather] IED activity	The data shown for 'other activities' includes, among others, the subsectors of textiles and tanning [of leather products] which are reported together as one subtotal; so although no IED installations are permitted for tanning, waste generation cannot be excluded for this activity.	No action

6 Challenges and Pressures

This section identifies the political and environmental challenges and pressures related to sectors or specific activities which are within the scope of the IED, and in particular whether the impact of these in a region or Member State is substantially above the EU average for that activity or sector. It is about the specific circumstances of the environmental impact of the industrial sectors or activities in that Member State which may have been indicated for example by public complaint, high profile media attention, political intervention, implementation of a specific national policy and/or which are evident from literature or analysis[1].

As shown elsewhere in this profile, key industries in Poland in terms of the reported number of IED installations are intensive rearing of poultry or pigs (26% of total in 2015), followed by non-hazardous waste management (17%), and energy – power (10%). The sectors identified as making the largest contribution to the Polish economy as measured by GVA are 'other activities' (5%) and energy – power (4%). These industrial sectors were also shown to contribute to the largest burden to the environment for emissions to air (in particular, energy – power) and emissions to water (in particular, 'other activities'). The significance of the energy – power sector (in terms of the limited progress towards reducing emissions to air and its importance to the national GVA) is particularly relevant context to one of the challenges identified here (PL-1 in Table 10).

Other challenges included in this section relate to the metals industrial sector. While the quantitative analysis shows that this sector is responsible for a significant share of generation of hazardous waste, the emissions data do not provide sufficient detail to consider emissions trends at a regional level.

Table 10: Key challenges identified in Poland

Use of coal as an energy source	PL-1
IED activities / sectors	1.1. Combustion of fuels in installations with a total rated thermal input of 50 MW or more;
Medium and pollutants	The pollutants are different in each Member State depending on the type of coal used. NO_x is a general challenge for coal combustion. Specific to Poland are challenges with hydrogen chloride (HCl) and hydrogen sulphide (HS). (pers. comm., 2017)
Description	Coal is the main source of energy in Poland with the majority of LCPs reliant on coal with over 70% of Polish energy coming from coal. The challenge for this industrial activity in Poland will be compliance with the proposed BAT-AELs*. There are concerns that the proposals are not accompanied by a cost benefit assessment at Member State level. It is estimated that meeting the proposed requirements within the set timeframe (by 2021) would cost Polish coal-fired power plants €2.3 billion (PAP, 2017). It should be noted that although the Polish authorities provided feedback on potential challenges they are facing the LCP BAT Conclusions have been adopted.
Years applicable / current	Ongoing
Related infringement cases	None identified
Public complaints	None to date, however it was expected that industry would issue complaints following adoption of the BAT-AELs.
Media Attention	Air pollution resulting from coal combustion more generally receives considerable media attention – with headlines such

[1] The challenges and pressures included here do not concern the implementation of the IED.

Use of coal as an energy source	PL-1
	as "Polish pollution akin to smoking 4,000 cigarettes a year" (Euractiv, 2017b) and "Smog-plagued Poland tries to escape tag as 'Europe's China'" (Euractiv, 2017c). The high concentration of industrial activity leading to heightened exposure receives less media attention – particularly in more recent years, little has been reported by online media sources (except by specialist media sources, e.g. PHYS.ORG, 2017). Some national media coverage highlighting the cost to industry and claiming that the proposed BAT-AELs could threaten Poland's electricity supply. EU media covers both impact on economy and on air pollution – referring to risks to jobs and human health (e.g. Crisp, 2016; Euractiv, 2017a)
Political interventions	Poland took the European Commission to Court in relation to their objection of the LCP BAT conclusions.
Policies implemented to address challenge	None to date – however, it was expected that following adoption of the BAT-AELs, there will be further applications for derogations under the IED (of which there are currently only three to four) (Pers. Comm., 2017).
Related policies	The EU Winter Package and its proposals to cut CO_2 emissions from power plants by limiting CO_2 emissions at new power plants to 550g/kWh. These proposals are considered to add to the economic pressures facing the power industry in Poland from the proposed BREF – as discussed above (pers. comm., 2017 – also reported in national media, e.g. Biznes, 2017; Climate Home, 2017).

High geographic concentration of industrial activity	PL-2
IED activities / sectors	1.1. Combustion of fuels in installations with a total rated thermal input of 50 MW or more; 2. Production and processing of metals; 4. Chemical industry
Medium and pollutants	Emissions to air (SO_2, NO_2, PM_{10} (and PAHs contained within)), CO, O_3, N and S (concentrations reported as equivalents, wet deposition), heavy metals (Pb, Cd, Ni, Cr).
Description	The "Black Triangle" region between Poland, Germany and the Czech Republic is an industrial corridor spanning 60 km on either side of the northern Czech border. It is an area framed by mountains, trapping air and intensifying pollution issues. The region is a natural source of lignite, which could not be transported far when first mined resulting in a high geographic concentration of industrial activity using lignite as its source of energy (ČHMÚ et al. 2002; ČHMÚ et al. 2003). The region hosts a high concentration of lignite power plants, chemical plants and steel factories. The lignite plants in the region were rated among the 10 most polluting in the EU by the EEA, including: the 5,420MW thermal lignite Belchatow Power Station in Poland (second most polluting plant – and the largest thermal power plant in Europe and the second largest fossil fuel power station in the world, providing 20% of Poland's electricity), the Elektrownia Turow 1500MW lignite

High geographic concentration of industrial activity	PL-2
	plant (rated seventh) and Kozienice Power Station 2820MW coal plant (rated eighth) (EEA, 2016c). Owing to the high concentration of industrial activity, the environmental pressures are particularly susceptible to changes in the climate, with severe impacts in summer months when the temperature increases. Moreover, the transboundary nature of the problem requires cooperation between three Member States (ČHMÚ et al. 2002; ČHMÚ et al. 2003). Transboundary pollution from coal power plants in Poland has been found to be the worst in Europe, causing 4,690 premature deaths outside its borders. 85% of Poland's electricity is generated from coal facilities (WWF, 2016).
Years applicable / current	1991 - Ongoing
Related infringement cases	Poland was referred to the Court of Justice over breaching PM_{10} limits caused by low-stack emissions (stacks below 40 m), and household heating (European Commission, 2015).
Public complaints	Polish environmental groups (Greenpeace, ClientEarth and local activists, Action Democracy and City is Ours) issued a complaint against local authorities to the EU in February 2017 for ongoing exposure to toxic smog in the region. The complaint was accompanied by a public petition signed by 24,000 Poles (PHYS.ORG, 2017)
Media Attention	Air pollution resulting from coal combustion more generally receives considerable media attention – with headlines such as “Polish pollution akin to smoking 4,000 cigarettes a year” (Euractiv, 2017b) and “Smog-plagued Poland tries to escape tag as ‘Europe’s China’” (Euractiv, 2017c). The high concentration of industrial activity leading to heightened exposure receives less media attention – particularly in more recent years, little has been reported by online media sources (except by specialist media sources, e.g. PHYS.ORG, 2017).
Political interventions	Previously, a derogation requesting more time to comply with the emission limits for benzene was applied for (under the IPPCD) by a large petrochemical complex near the Czech border in the Kedzierzyn-Kozle district; the derogation was refused (ENDS Europe, 2012).
Policies implemented to address challenge	PHARE Black Triangle Project – transboundary project (between the Czech Republic, Germany and Poland), funding demonstration projects, improving cooperation, and establishing ~40 monitoring stations (Joint Air Monitoring System) (ČHMÚ et al. 2002; ČHMÚ et al. 2003). Poland is looking to diversify its energy sources: in 2016, plans for a liquefied natural gas terminal were initiated – in the long term will reduce dependency on lignite (IEA, 2016). More generally, the European Commission reported that the use of environmental taxes in Poland and removal of certain fiscal exemptions for agriculture and energy-intensive industries may help to reduce their environmental impact (ENDS Europe, 2017; European Commission, 2017).
Related policies	Climate policy.

Lack of comprehensive waste management system	PL-3
IED activities / sectors	5. Waste management
Medium and pollutants	Waste generated
Description	Waste generated per capita in Poland is below the EU average (272 kg p.a./ inhabitant compared to the EU average of 475kg p.a.); however, municipal waste is largely disposed of in landfills (53% in 2014 compared to the EU average of 28%). There have also been problems arising from illegal landfilling and fly tipping. The challenges facing the sector have been linked to insufficient site inspections (carried out by municipal authorities) and low investments in waste management infrastructure. The EIR recommends that a comprehensive waste management system is developed for Poland (taking a green circular economy approach and integrating recycling and energy savings, etc.) (European Commission, 2017).
Years applicable / current	Ongoing
Related infringement cases	None identified
Public complaints	None identified
Media Attention	The issue of fly tipping has received attention in specialist media sources (e.g. Ekologia).
Political interventions	In 2015, the Supreme Chamber of Control (NIK [*Najwyższa Izba Kontroli]*) reviewed the national waste management regulation, implemented in 2013. The auditors recommended that further investigation was carried out to understand the challenges facing the sector (NIK, 2015).
Policies implemented to address challenge	National legislation for waste management was agreed in 2012 and implemented in 2013. The legislation assigned responsibility to municipal authorities and aimed to address 'wild dumps' (fly tipping) by bringing down the cost of waste disposal among other measures (NIK, 2015).
Related policies	None identified

7 References

AMEC (2016) Supporting the evaluation of Regulation (EC) No 166/2006 concerning the establishment of a European Pollutant Release and Transfer Register and its triennial review.

Biznes (2017) Winter package will determine the future of Polish economy. 28 June 2017. http://biznesalert.com/winter-package-will-determine-the-future-of-polish-economy/

CEPI (2016) Key statistics 2016 European Pulp and Paper Industry. http://digibook.digi-work.com/Digibooks.aspx/Get/cepi/1641/KeyStatistics2016_Finalpdf

CEPS et al. (2016) Composition and drivers of energy prices and costs: case studies in selected energy-intensive industries. Final Report;

ČHMÚ, WIOŚ, LfUG, UBA (2002) Common report on air quality in the black triangle region 2001. http://www.wroclaw.pios.gov.pl/pliki/miedzynarodowe/raport2001.pdf

ČHMÚ, WIOŚ, LfUG, UBA (2002) Common report on air quality in the black triangle region 2002. http://www.wroclaw.pios.gov.pl/pliki/miedzynarodowe/raport2002.pdf

Climate Home (2017) Poland cannot afford share of EU 2030 climate target. 21 July 2017. http://www.climatechangenews.com/2016/07/21/poland-cannot-afford-share-of-eu-2030-climate-target/

Crisp, J. (2016) Workers will lose jobs in green revolution, admits EU's energy boss, Euractiv, 13 September 2016. https://www.euractiv.com/section/energy/news/tuesday-workers-will-lose-jobs-in-green-revolution-admits-eus-energy-boss/

EC (2010) BREF: Cement, Lime and Magnesium Oxide Manufacturing Industries. European Commission.

EC (2013) Communication from the Commission (COM/2013/407) Action Plan for a competitive and sustainable steel industry in Europe http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52013DC0407

EC (2015) Statistical pocketbook 2015 EU Energy in figures. http://ec.europa.eu/energy/sites/ener/files/documents/PocketBook_ENERGY_2015%20PDF%20final.pdf

EC (2016) Supporting the evaluation of Regulation (EC) No 166/2006 concerning the establishment of a E-PRTR and its triennial review. European Commission.

EEA (2016) EEA country factsheets on industrial emissions. http://www.eea.europa.eu/themes/industry/industrial-pollution

EEA (2016b) Mapping industry across datasets. https://forum.eionet.europa.eu/nrc-industrial-pollution/library/consultations/2016/draft-2016-country-profiles/methodology/mapping-industry-across-datasets/

EEA (2016c) 3.4 Transboundary air pollution. http://www.eea.europa.eu/publications/92-9157-202-0/page304.html

EEA (2017a) Data on emissions of air pollutants submitted to the LRTAP Convention and copied to EEA https://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-convention-on-long-range-transboundary-air-pollution-lrtap-convention-11 [last update: 12 July 2017]

EEA (2017b) European Pollutant Release and Transfer Register [last update: 17 July 2017]. http://prtr.ec.europa.eu/#/home

ENDS Europe - Brussels urges countries to tap into green taxes - 23 February 2017

ENDS Europe (2012) Poland refused more time to meet benzene limit. http://www.endseurope.com/article/29550/poland-refused-more-time-to-meet-benzene-limit

Ekologia (n.d.) NIK: growing problem dumps http://www.ekologia.pl/srodowisko/ochrona-srodowiska/nik-problem-dzikich-wysypisk-narasta,17285.html

ETC/ACM (2016) Summary report on 2014 E-PRTR data. European Environment Agency.

Euractiv (2017a) Smog chokes coal-addicted Poland, Euractiv, 6 February 2017. http://www.euractiv.com/section/climate-environment/news/smog-chokes-coal-addicted-poland/

Euractiv (2017b) "Polish pollution akin to smoking 4,000 cigarettes a year", Euractiv. 20 January 2017. http://www.euractiv.com/section/health-consumers/news/polish-pollution-akin-to-smoking-4000-cigarettes-a-year/

Euractiv (2017c) "Smog-plagued Poland tries to escape tag as 'Europe's China'", Euractiv. 10 February 2017. http://www.euractiv.com/section/climate-environment/opinion/smog-plagued-poland-tries-to-escape-tag-as-europes-china/

European Commission (2015) Commission refers Poland to the Court of Justice of the EU over poor air quality. http://europa.eu/rapid/press-release_IP-15-6225_en.htm

European Commission (2017) Commission Staff Working Document: The EU Environmental Implementation Review – Country Report, Poland. SWD (2017) 53 final. Brussels, 3.2.2017. http://ec.europa.eu/environment/eir/pdf/report_pl_en.pdf

Eurostat (2017a) National accounts aggregates by industry [nama_10_a64] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64&lang=en

Eurostat (2017b) Employment by sex, age and detailed economic activity [lfsq_egan22d] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsq_egan22d&lang=en

Eurostat (2017c) Simplified energy balances - annual data [nrg_100a] http://appsso.eurostat.ec.europa.eu/nui/show.do?wai=true&dataset=nrg_100a

Eurostat (2017d) Water use in the manufacturing industry by activity and supply category [env_wat_ind] and Water use by supply category and economical sector [env_wat_cat] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_wat_ind&lang=en and http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_wat_cat&lang=en

Eurostat (2017e) Generation of waste by waste category, hazardousness and NACE Rev. 2 activity [env_wasgen] http://appsso.eurostat.ec.europa.eu/nui/show.do?lang=en&dataset=env_wasgen

IEA (2016) Energy policies of IEA countries – Poland. 2016 Review. https://www.iea.org/publications/freepublications/publication/Energy_Policies_of_IEA_Countries_Poland_2016_Review.pdf

Katarzynat, G. and B. Slusarczyk (2010) Steel sector in Poland and its condition after accession to the European Union. Annales Universitatis Apulensis Series Oeconomica, 12(2). http://www.oeconomica.uab.ro/upload/lucrari/1220102/07.pdf

McKinsey (2015) Poland 2025: Europe's new growth engine.

NIK (2015) NIK on municipal waste [*NIK o odpadach komunalnych*], 22 June 2015. https://www.nik.gov.pl/aktualnosci/srodowisko/nik-o-odpadach-komunalnych.html

PAP (2017) New EU pollution limits could cost Poland billions. http://thenews.pl/1/12/Artykul/304795,New-EU-pollution-limits-could-cost-Poland-billions

PHYS.ORG (2017) Polish activists complain to EU about toxic smog. 17 February 2017. https://phys.org/news/2017-02-activists-eu-toxic-smog.html

WWF (2016) Coal-burning EU countries make their neighbours sick. http://wwf.panda.org/?272730/Dark-Cloud

Appendices

Appendix 1 Mapping industrial sectors across data sources for Poland

Appendix 2 Emissions to air by pollutant and industrial sector (detail)

Appendix 1: Mapping industrial sectors across data sources for Poland

Industrial sector †	GVA	Employment ‡	Energy consumption	Water consumption	Emissions to air	Emissions to water ^	Waste generated
	Eurostat (2017a)	*Eurostat (2017b)*	*Eurostat (2017c)*	*Eurostat (2017d)*	*EEA (2017a)*	*EEA (2017b)*	*Eurostat (2017e)*
Sector classification	*NACE Rev 2*	*NACE Rev 2*	*Energy balance indicator*	*NACE Rev 2*	*NFR14 sector classification*	*E-PRTR*	*NACE Rev 2*
Time series available	*2000-2015, annually*	*2008-2015, annually*	*2000-2015, annually*	*2000-2015, annually*	*2000-2015, annually*	*2007-2015, annually*	*2004-2014, every 2 years*
Energy power	D (electricity, gas, steam and air conditioning supply)	D35 (electricity, gas, steam and air conditioning supply)	B_101301 - Own Use in Electricity, CHP and Heat Plants	D (electricity, gas, steam and air conditioning supply)	1A1a Public electricity and heat production; 1A2a-f Stationary combustion in manufacturing industries and construction	Power generation (1c)	D (electricity, gas, steam and air conditioning supply)
Energy: refining, gasification and liquefaction, coke	C19 (coke and refined petroleum products)	C19 (coke and refined petroleum products)	B_101307 - Petroleum Refineries; B_101312 - Coke Ovens; B_101314 - Gas Works; B_101316 - Coal Liquefaction Plants; B_101317 - Liquefaction (LNG) / regasification plants; B_101319 - Gas-to-liquids (GTL) plants (energy); B_101320 - Non-specified (Energy)	**DATASETS COMBINED:** C19 (coke and refined petroleum products) **AND** C20 (chemicals) and C21 (pharmaceutical products)	1A1b Petroleum refining; 1A1c Solid fuels and other energy industries	Refining (1a), gasification and liquefaction (1b), coke ovens (1c)	C19 (coke and refined petroleum products)
Metals: iron and steel	C24 (basic metals)	C24 (basic metals)	B_101315 - Blast Furnaces B_101805 - Iron and Steel	C24 (basic metals)	2C1 Iron and steel	Iron and steel manufacturing (2a-d)	C24-C25 (basic metals; fabricated metal products, except machinery and equipment)
Metals: non-ferrous			B_101810 - Non-Ferrous Metals		2C2-7 Non-ferrous metals	Non-ferrous metal production (2e)	
Minerals: cement, lime and magnesium oxide	C23 (non-metallic mineral products)	C23 (non-metallic mineral products)	B_101820 - Non-Metallic Minerals	Insufficient granularity in reported data	2A1 Cement; 2A2 Lime	Cement, lime and magnesium oxide (3c);	C23 (non-metallic mineral products)
Minerals: glass					2A3 Glass	Glass (3e)	
Minerals: other					2A6 Other	Other (3f-g)	
Chemical	C20 (chemicals); C21 (pharmaceutical products)	C20 (chemicals); C21 (pharmaceutical products)	B_101815 - Chemical and Petrochemical	**DATASETS COMBINED:** C20 (chemicals) and C21 (pharmaceutical products) **AND** C19 (coke and refined petroleum products)	2B1 Ammonia; 2B6 Titanium dioxide; 2B2 Nitric acid; 2B7 Soda ash; 2B3 Adipic acid; 2B10a Other; 2B5 Carbide; 2J Production of POPs	Chemical industry (4a-f)	C20-C22 (chemicals; pharmaceuticals; rubber and plastic products)
Waste: hazardous	E37-E39 (water supply; sewerage, waste management and remediation)	E38 (waste collection, treatment and disposal activities; materials recovery)	No indicator	Insufficient granularity in reported data	5C1bi Industrial waste incineration 5C1biv Sewage sludge incineration; 5C1bii Hazardous waste incineration; 5C1bv; Other waste incineration; 5C1biii; Clinical waste incineration	Hazardous waste (5a)	E37-E39 (water supply; sewerage, waste management and remediation)
Waste: non-hazardous			B_101318 - Gasification plants for biogas	Insufficient granularity in reported data	5A Solid waste disposal on land; 5C1a Municipal waste incineration; 5B1 Composting; 5C1bv Cremation; B2 Anaerobic digestion at biogas facilities; 5D2 Industrial wastewater handling	Non-hazardous waste (5b-e; g)	
'Other activities': Food and drink products	C10-C12 (food and drinks and tobacco)	C10 (food products); C11 (drink products)	B_101830 - Food and Tobacco	**DATASETS COMBINED:** C10-12 (food and drinks and tobacco); C13-15 (textiles; wearing apparel; leather); C16-17 (paper and wood products)	2H Food and beverages industry	Food and drink (8a-c)	C10-C12 (food products; drink products; tobacco)
Textiles	C13-C15 (textiles; wearing apparel; leather)	C13 (textiles)	B_101835 - Textile and Leather		No indicators	Pre-treatment or dyeing of textile fibres or textiles (9a);	C13-C15 (textiles; wearing apparel; leather)
Wood and wood products	C16 (wood products)	C16 (wood products);	B_101851 - Wood and Wood Products		2I Wood processing		C16 (wood products)
Paper and board, pulp	C17 (paper and paper products)	C17 (paper and paper products)	B_101840 - Paper, Pulp and Print		2H1 Pulp and paper industry	Pulp, paper and wood production (6a-c)	C17-C18 (paper and paper products; printing)
Intensive rearing of pigs and poultry	Insufficient granularity in reported data	Insufficient granularity in reported data	No indicators	Insufficient granularity in reported data	3B4gi Manure management - Laying hens; 3B4gii Manure management - Broilers	Intensive rearing of poultry and pigs (7a)	Insufficient granularity in reported data
Surface treatment	Insufficient granularity in reported data	Insufficient granularity in reported data	No indicators	Insufficient granularity in reported data	2D3d Coating applications; 2D3e Degreasing; 2D3f Dry cleaning; 2D3g Chemical products; 2D3h Printing; 2D3i Other solvent use; 2G Other product use; 2H3 Other industrial processes	Surface treatment (2f; 9c); Production of carbon (9d)	Insufficient granularity in reported data
Rest of national total	*All NACE activities*	*All NACE activities*	*B_100900 – Gross inland consumption*	*All NACE activities*	National total for the entire territory (based on fuel sold)	*National total for all E-PRTR activities reported*	*All NACE activities plus households*

Notes: † Number of IED installations is reported against IED activities for years 2011, 2013 and 2015. ‡ Additional NACE activities are applicable to the industrial sector categories but not included here as no data reported for Poland (excluded activities include: Leather (C15))
^ Additional E-PRTR activities are applicable to the industrial sector categories but not included here as no data reported for Poland (excluded activities include: Tanning of hides and skins (9b))

Appendix 2: Emissions to air by pollutant and industrial sector (detail)

Notes: Emissions rounded to two decimal places unless data is less. Industrial sectors and pollutants with no data reported a cross the timeseries have been removed.

Source: EEA (2017a)

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy - power																	
SO_x	kt	1,201	1,160	1,059	1,048	991.21	947.88	991.37	949.46	718.75	580.89	619.98	601.14	567.33	549.26	519.67	498.72
NO_x	kt	369.43	371.12	356.80	363.44	355.85	351.21	357.13	349.52	318.68	311.90	336.20	325.23	311.30	308.88	283.10	269.03
$PM_{2.5}$	kt	39.13	38.53	36.13	36.03	34.81	32.97	32.34	31.26	26.06	23.55	25.58	23.62	23.65	23.64	22.66	22.52
NMVOC	kt	22.40	21.91	21.41	22.05	22.16	22.54	23.05	23.43	23.78	24.40	26.48	28.27	30.53	29.89	30.21	30.14
Cd (HM)	t	11.51	10.08	9.50	9.36	9.37	8.38	8.22	8.67	8.04	7.07	7.65	7.98	8.10	7.80	8.18	7.90
As (HM)	t	25.78	25.83	26.18	28.02	27.19	27.23	27.11	25.97	24.61	23.20	24.26	24.66	24.49	23.87	25.33	25.36
Cr (HM)	t	14.56	13.75	12.96	12.92	12.37	11.64	11.58	11.44	10.41	9.80	10.51	10.59	10.63	10.38	10.19	10.26
Cu (HM)	t	217.94	220.85	226.00	242.23	235.55	233.97	233.72	223.57	210.55	196.55	205.92	208.56	204.65	199.46	214.68	217.73
Pb (HM)	t	256.50	244.44	247.69	270.01	262.83	258.45	259.95	263.92	253.41	235.32	252.29	250.77	258.57	251.23	261.22	251.07
Hg (HM)	t	8.54	8.53	8.14	8.37	8.12	8.07	8.05	7.97	7.83	7.42	7.33	7.38	7.76	8.27	7.94	8.87
Ni (HM)	t	67.38	61.04	57.55	56.08	53.15	46.89	45.48	43.43	36.78	33.89	36.00	35.69	34.93	33.16	32.14	38.11
Zn (HM)	t	614.31	586.61	573.86	598.79	583.11	550.77	546.11	558.82	521.34	490.98	532.36	534.70	553.74	535.94	578.01	560.84
PCDD+PCDF	g	34.06	31.20	32.13	33.59	38.13	34.10	35.21	32.13	35.38	32.65	38.04	41.87	44.33	46.34	50.31	53.21

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy - refining, gasification and liquefaction, coke																	
SO_x	kt	34.60	37.74	37.27	36.54	38.92	37.37	40.98	32.16	30.34	29.31	26.61	23.97	23.48	13.21	14.39	12.93
NO_x	kt	14.04	14.72	12.70	11.71	12.48	12.14	14.72	14.86	13.20	10.45	8.48	7.82	8.10	4.56	3.81	4.02
$PM_{2.5}$	kt	1.17	1.18	0.92	0.98	0.89	0.81	0.82	1.06	1.00	0.86	0.86	0.81	0.72	0.60	0.57	0.63
NMVOC	kt	0.91	0.87	0.57	0.63	0.52	0.44	0.44	0.67	0.60	0.48	0.40	0.42	0.37	0.33	0.32	0.36
Cd (HM)	t	1.79	1.86	1.46	1.55	1.38	1.29	1.25	1.58	1.47	1.34	1.23	1.12	0.88	0.65	0.65	0.70
As (HM)	t	1.43	1.54	1.29	1.35	1.24	1.18	1.15	1.37	1.29	1.22	1.17	1.04	0.82	0.59	0.58	0.62
Cr (HM)	t	1.84	1.96	1.63	1.72	1.58	1.50	1.46	1.76	1.67	1.56	1.51	1.35	1.10	0.82	0.79	0.85
Cu (HM)	t	5.61	5.78	4.37	4.67	4.07	3.77	3.63	4.72	4.37	3.91	3.46	3.18	2.48	1.82	1.80	1.98
Pb (HM)	t	6.67	6.40	3.86	4.30	3.30	2.79	2.61	4.33	3.72	2.88	1.83	2.00	1.45	1.12	1.14	1.38
Hg (HM)	t	0.27	0.25	0.13	0.15	0.10	0.08	0.07	0.15	0.12	0.08	0.03	0.05	0.03	0.03	0.03	0.04
Ni (HM)	t	26.52	30.30	29.20	30.04	29.14	28.67	28.06	30.44	29.82	29.75	30.79	26.23	20.94	14.88	14.52	15.22
Zn (HM)	t	24.32	22.53	12.14	13.91	9.93	7.84	7.25	14.13	11.70	8.03	3.67	5.16	3.67	3.37	3.58	4.50
PCDD+PCDF	g	1.05	1.17	1.15	1.17	1.15	1.12	1.10	1.15	1.16	1.17	1.21	1.03	0.83	0.60	0.58	0.62

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Metals: iron and steel																	
SO_x	kt	0.20	0.17	0.15	0.18	0.22	0.21	0.25	0.27	0.27	0.23	0.24	0.26	0.25	0.22	0.22	0.24
NO_x	kt	1.74	1.52	1.29	1.36	1.70	1.37	1.65	1.70	1.59	1.26	1.39	1.55	1.47	1.48	1.51	1.59
$PM_{2.5}$	kt	2.45	2.04	1.92	2.03	2.33	1.77	2.09	2.19	1.99	1.42	1.68	1.85	1.83	1.80	1.94	2.04
NMVOC	kt	2.21	1.86	1.82	1.94	2.22	1.61	1.96	2.06	1.80	1.19	1.44	1.58	1.51	1.55	1.74	2.01
Cd (HM)	t	1.88	1.62	1.55	1.68	1.96	1.60	1.89	1.96	1.89	1.49	1.68	1.85	1.83	1.72	1.77	1.87
As (HM)	t	1.04	0.80	0.65	0.70	0.82	0.66	0.79	0.81	0.78	0.61	0.69	0.76	0.75	0.71	0.74	0.78
Cr (HM)	t	9.80	7.10	5.27	5.72	6.71	5.59	6.64	6.89	6.71	5.40	5.99	6.57	6.47	6.01	6.14	6.53
Cu (HM)	t	15.71	13.52	12.71	14.25	16.91	14.54	17.43	18.12	17.91	14.79	16.04	17.55	17.19	15.67	15.82	16.97
Pb (HM)	t	94.00	82.03	81.16	86.03	98.18	74.17	87.65	90.34	82.96	59.57	71.34	78.58	78.48	76.90	82.51	89.44
Hg (HM)	t	0.42	0.36	0.34	0.39	0.46	0.41	0.50	0.52	0.52	0.44	0.46	0.50	0.49	0.44	0.44	0.48
Ni (HM)	t	6.82	6.14	6.26	6.48	7.29	5.42	6.18	6.29	5.80	4.19	5.29	5.87	5.94	5.94	6.34	6.46
Zn (HM)	t	173.60	146.47	135.96	148.44	173.35	142.82	169.25	175.04	169.83	135.60	152.17	167.04	164.96	154.05	158.11	167.80
PCDD+PCDF	g	10.82	8.95	7.87	9.29	11.36	10.47	12.85	7.87	13.66	11.77	12.12	13.19	12.75	11.17	11.00	12.10
Metals: Non-ferrous																	
NO_x	kt	0.05	0.05	0.06	0.06	0.06	0.05	0.06	0.06	0.05	-	-	-	-	-	-	-
$PM_{2.5}$	kt	0.07	0.08	0.09	0.08	0.08	0.08	0.08	0.09	0.07	0.002	0.002	0.003	0.003	0.003	0.005	0.004
Cd (HM)	t	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.005	-	-	-	-	-	-	-
Pb (HM)	t	0.26	0.28	0.38	0.44	0.48	0.57	0.63	0.64	0.63	0.59	0.75	0.77	0.91	0.91	0.90	0.99
Ni (HM)	t	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.005	-	-	-	-	-	-	-
Zn (HM)	t	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-	-	-	-	-	-
PCDD+PCDF	g	0.10	0.11	0.12	0.11	0.12	0.11	0.11	0.12	0.09	-	-	-	-	-	-	-

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mineral: Cement, lime and magnesium oxide																	
$PM_{2.5}$	kt	1.79	1.46	1.37	1.43	1.51	1.50	1.75	2.03	2.04	1.82	1.87	2.23	1.86	1.75	1.86	1.84
Cd (HM)	t	0.12	0.10	0.09	0.09	0.10	0.09	0.11	0.13	0.13	0.11	0.13	0.15	0.13	-	-	-
As (HM)	t	0.18	0.14	0.13	0.14	0.15	0.14	0.16	0.19	0.19	0.17	0.19	0.23	0.19	0.18	0.19	0.19
Cr (HM)	t	1.50	1.21	1.12	1.17	1.28	1.14	1.35	1.58	1.60	1.42	1.58	1.90	1.59	1.48	1.58	1.55
Pb (HM)	t	3.01	2.41	2.24	2.33	2.57	2.27	2.71	3.15	3.20	2.83	3.16	3.80	3.18	2.97	3.16	3.11
Hg (HM)	t	0.30	0.24	0.22	0.23	0.26	0.23	0.27	0.32	0.32	0.28	0.32	0.38	0.32	-	-	-
Ni (HM)	t	1.50	1.21	1.12	1.17	1.28	1.14	1.35	1.58	1.60	1.42	1.58	1.90	1.59	1.48	1.58	1.55
Zn (HM)	t	3.01	2.41	2.24	2.33	2.57	2.27	2.71	3.15	3.20	2.83	3.16	3.80	3.18	2.97	3.16	3.11
PCDD+PCDF	g	23.76	20.74	19.60	20.53	21.68	17.49	19.36	19.60	19.52	17.04	17.99	20.36	17.99	17.10	18.17	19.42
Mineral: Glass																	
$PM_{2.5}$	kt	0.38	0.37	0.39	0.41	0.46	0.45	0.48	0.51	0.53	0.51	0.56	0.58	0.62	0.62	0.64	0.63
Cd (HM)	t	0.06	0.06	0.07	0.09	0.09	0.09	0.10	0.10	0.11	0.12	0.13	0.14	0.15	0.15	0.15	0.14
As (HM)	t	0.04	0.04	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.09
Cr (HM)	t	1.06	0.96	1.24	1.45	1.55	1.47	1.75	1.73	1.87	1.92	2.19	2.37	2.48	2.47	2.42	2.32
Cu (HM)	t	0.21	0.19	0.25	0.29	0.31	0.29	0.35	0.35	0.37	0.38	0.44	0.47	0.50	0.49	0.48	0.46
Pb (HM)	t	4.25	3.83	4.95	5.79	6.21	5.87	6.98	6.91	7.48	7.69	8.76	9.47	9.92	9.87	9.68	9.29
Hg (HM)	t	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
Ni (HM)	t	0.85	0.77	0.99	1.16	1.24	1.17	1.40	1.38	1.50	1.54	1.75	1.89	1.98	1.97	1.94	1.86
Zn (HM)	t	4.25	3.83	4.95	5.79	6.21	5.87	6.98	6.91	7.48	7.69	8.76	9.47	9.92	9.87	9.68	9.29
PCDD+PCDF	g	0.31	0.30	0.32	0.34	0.38	0.37	0.40	0.32	0.44	0.42	0.46	0.48	0.51	0.51	0.52	0.52
Chemical																	
SO_x	kt	3.81	3.70	3.64	3.92	4.39	4.24	4.52	4.86	4.36	3.05	4.09	4.71	3.83	3.54	3.88	4.33
NO_x	kt	12.13	12.09	10.03	12.32	13.12	13.63	13.38	13.99	13.79	12.26	13.04	13.41	13.97	13.77	14.50	14.91
$PM_{2.5}$	kt	1.25	1.17	1.08	1.27	1.34	1.35	1.34	1.44	1.32	1.05	1.26	1.34	1.40	1.34	1.41	1.49
NMVOC	kt	5.42	4.85	6.17	6.26	6.39	5.95	8.35	8.79	7.29	7.05	6.43	8.20	7.72	8.08	7.94	8.89
NH_3	kt	0.83	0.85	0.83	0.85	0.90	0.92	0.95	1.10	1.31	0.82	0.97	1.00	1.07	1.09	1.09	1.11
Cd (HM)	t	0.19	0.21	0.21	0.24	0.27	0.25	0.22	0.28	0.27	0.09	0.19	0.24	0.23	0.19	0.22	0.23
Hg (HM)	t	0.17	0.16	0.08	0.15	0.15	0.15	0.15	0.11	0.08	0.08	0.09	0.10	0.06	0.07	0.07	0.11

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Waste: hazardous																	
SO_x	kt	0.08	0.05	0.04	0.04	0.04	0.06	0.04	0.04	0.04	0.05	0.04	0.05	0.05	0.06	0.07	0.06
NO_x	kt	0.32	0.32	0.32	0.32	0.24	0.33	0.24	0.24	0.15	0.17	0.17	0.19	0.22	0.31	0.32	0.31
$PM_{2.5}$	kt	8.64	8.33	8.68	8.71	5.11	10.41	5.58	5.54	4.33	4.18	3.99	4.04	5.03	5.24	4.95	4.43
NMVOC	kt	2.09	2.40	2.47	2.48	1.77	2.43	1.63	1.72	0.99	1.10	1.12	1.20	1.48	2.23	2.29	2.19
PCDD+PCDF	g	0.09	0.17	0.17	0.17	0.17	0.09	0.19	0.17	0.03	0.03	0.03	0.04	0.04	0.10	0.10	0.10
Waste: non-hazardous																	
SO_x	kt	0.001	0.003	0.004	0.005	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NO_x	kt	0.005	0.03	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.04	0.04
$PM_{2.5}$	kt	0.43	0.38	0.37	0.35	0.33	0.40	0.39	0.39	0.37	0.34	0.32	0.32	0.33	0.27	0.19	0.16
NMVOC	kt	0.02	0.15	0.21	0.25	0.25	0.26	0.24	0.26	0.24	0.24	0.24	0.23	0.30	0.30	0.19	0.19
Cd (HM)	t	0.01	0.08	0.11	0.12	0.13	0.13	0.12	0.13	0.12	0.12	0.12	0.12	0.15	0.15	0.09	0.09
As (HM)	t	0.0001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.002
Cr (HM)	t	0.001	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01
Cu (HM)	t	0.01	0.08	0.11	0.12	0.13	0.13	0.12	0.13	0.12	0.12	0.12	0.12	0.15	0.15	0.09	0.09
Pb (HM)	t	0.10	0.91	1.26	1.46	1.51	1.55	1.44	1.53	1.43	1.41	1.43	1.38	1.77	1.75	1.11	1.11
Hg (HM)	t	0.003	0.03	0.04	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.05	0.04	0.06	0.06	0.03	0.03
Ni (HM)	t	0.0003	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.003	0.003
Zn (HM)	t	0.06	0.55	0.76	0.87	0.90	0.93	0.87	0.92	0.86	0.85	0.86	0.83	1.06	1.05	0.66	0.66
PCDD+PCDF	g	0.06	0.08	0.09	0.12	0.15	0.16	0.19	0.09	0.25	0.28	0.21	0.24	0.31	0.31	0.30	0.32

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Other activities																	
NO_x	kt	0.75	0.75	0.78	0.81	0.79	0.80	0.82	0.81	0.82	0.83	0.88	0.89	0.85	0.88	0.88	0.87
$PM_{2.5}$	kt	2.43	2.17	2.19	2.21	2.11	2.12	2.19	2.11	2.24	1.98	2.08	2.08	1.96	1.86	1.69	1.81
NMVOC	kt	124.69	125.59	134.53	129.67	139.64	142.67	166.18	153.36	178.44	164.25	172.16	173.10	164.98	169.78	176.56	185.23
NH_3	kt	124.47	126.46	133.63	125.76	115.26	121.50	125.19	120.68	103.87	96.46	98.63	89.76	79.95	77.91	78.88	80.83
Cd (HM)	g	6.25	5.23	5.24	5.38	5.13	5.15	5.27	5.03	5.58	4.67	4.87	4.88	4.66	4.18	3.54	3.95
As (HM)	g	9.94	8.32	8.33	8.55	8.16	8.19	8.38	8.00	8.87	7.43	7.74	7.76	7.41	6.65	5.63	6.28
Cr (HM)	g	22.13	18.52	18.54	19.04	18.17	18.23	18.66	17.80	19.75	16.54	17.24	17.28	16.50	14.81	12.54	13.98
Cu (HM)	g	9.50	7.95	7.96	8.17	7.80	7.83	8.01	7.64	8.48	7.10	7.40	7.42	7.09	6.36	5.39	6.00
Pb (HM)	g	3.13	2.62	2.62	2.69	2.57	2.57	2.64	2.51	2.79	2.34	2.43	2.44	2.33	2.09	1.77	1.97
Hg (HM)	g	6.25	5.23	5.24	5.38	5.13	5.15	5.27	5.03	5.58	4.67	4.87	4.88	4.66	4.18	3.54	3.95
PCDD+PCDF	g	0.59	0.56	0.58	0.57	0.62	0.59	0.63	0.58	0.63	0.59	0.61	0.67	0.68	0.68	0.67	0.67

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