



Ricardo
Energy & Environment

Industrial emissions policy country profile – Denmark

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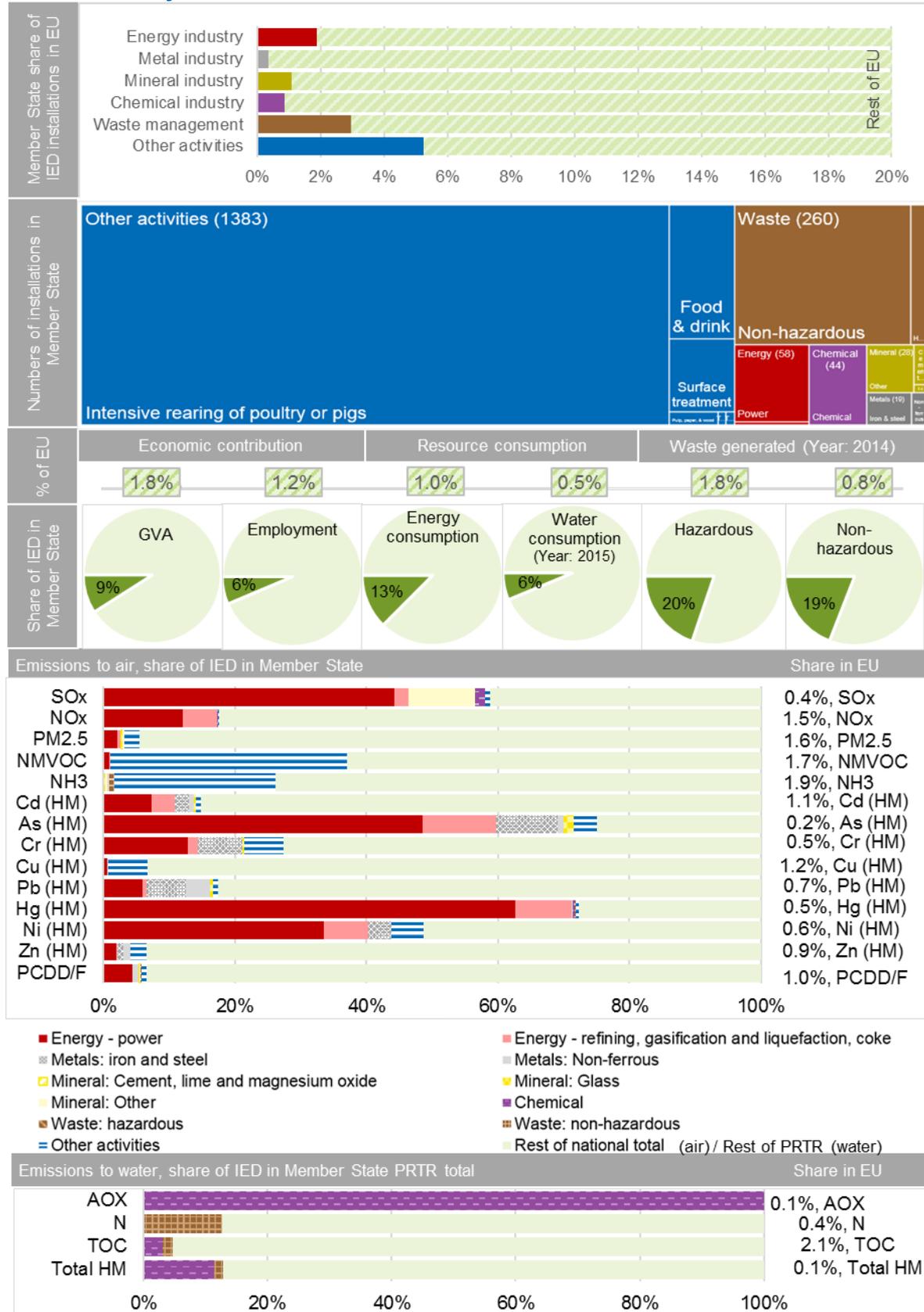
Appendix 1 Mapping industrial sectors across data sources for Denmark

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

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
DK	Denmark
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
NMVOG	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 Denmark



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 Denmark.

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 Denmark and how they have been addressed.

The profile also identifies the impact of industrial sectors or activities in Denmark, 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

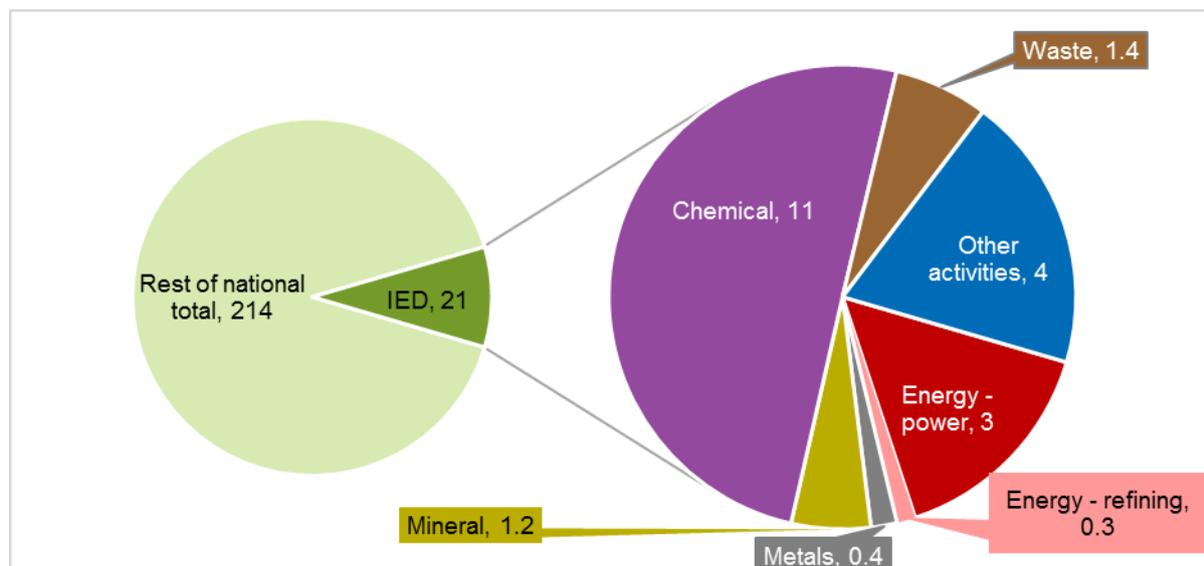
The contribution of industrial sectors to Denmark's economy is assessed using the gross value added (GVA) and employment indicators.

Industrial sectors contribute 21 billion EUR; a relatively small share of the total national GVA in Denmark in 2015 (9%) (illustrated in Figure 1). The chemical industrial sector accounts for the largest contribution, followed by 'other activities' and the energy-power industrial sectors (see Figure 1). The key contributor to the GVA within 'other activities' is food and drink production; amounting to 2.7 billion EUR (67% of 'other activities'). By GVA, the chemical sector, energy - power sector and food and drink production within 'other activities' are the most significant industrial sectors in Denmark, accounting for more than 80% of total GVA for industrial sectors.

As regards employment in 2015, 'other activities' is the most significant industrial sector, followed by the chemical, energy – power and mineral sectors (Figure 2). Within 'other activities', 89% of employment is for food and drink production. Taken together, the GVA and employment data indicate that the chemical sector, food and drink production within 'other activity' and the energy-power sector are significant to the economy in Denmark.

There is no data reported for the energy – refining sector¹ owing to confidentiality reasons. In 2015 there were two installations reported to be operating in this industrial sector – however, it is not possible to determine their potential significance as there is no indication of the scale of their economic contribution (GVA or employment).

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

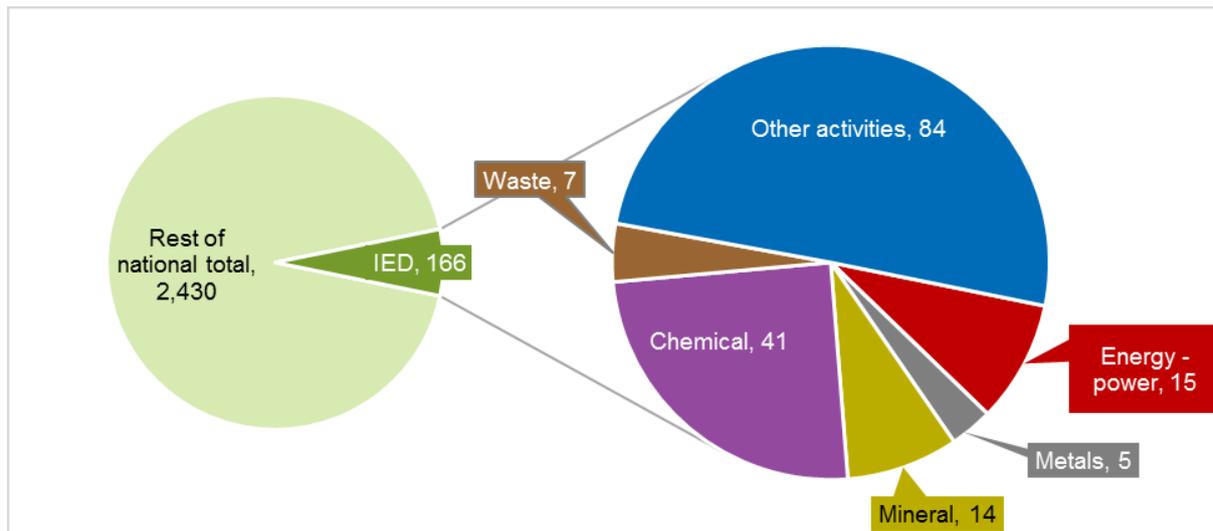


Note: Rest of national total means all NACE reporting minus the industrial sectors shown here.

Source: Eurostat (2017a)

¹ Energy – refining is grouped in these profiles with gasification and liquefaction and coke; however, as no permitted installations were reported for these IED activities, the sector is referred to as energy – refining for the Danish profile.

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



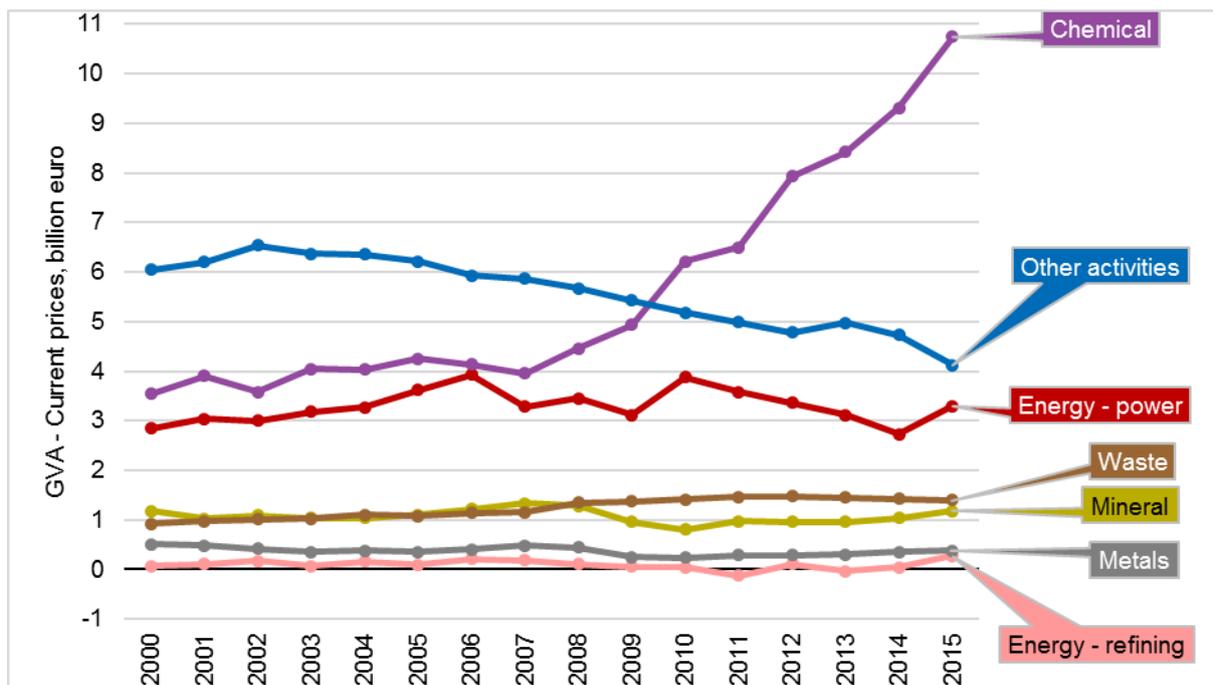
Note: Rest of national relates to all NACE activity minus industrial sector activity shown here. No employment data are provided for energy-refining sector. Employment data for some 'other activities' were estimated for the year 2015 and do not include tanning [of leather] as the data is marked as confidential by Eurostat.

Source: Eurostat (2017b)

The main area of economic growth in Denmark, as measured by growth in GVA, has been the chemical industrial sector, significantly increasing GVA in the period 2000 to 2015 (see Figure 3). The trend in GVA for the other industrial sectors remains fairly static. Only for 'other activities' a continuous decrease can be observed over the time period. The GVA for the chemical industrial sector has increased significantly between 2007 and 2015 despite a decrease in the reported number of permitted installations between 2011 and 2015 (58 installations in 2011, 44 installations in 2015).

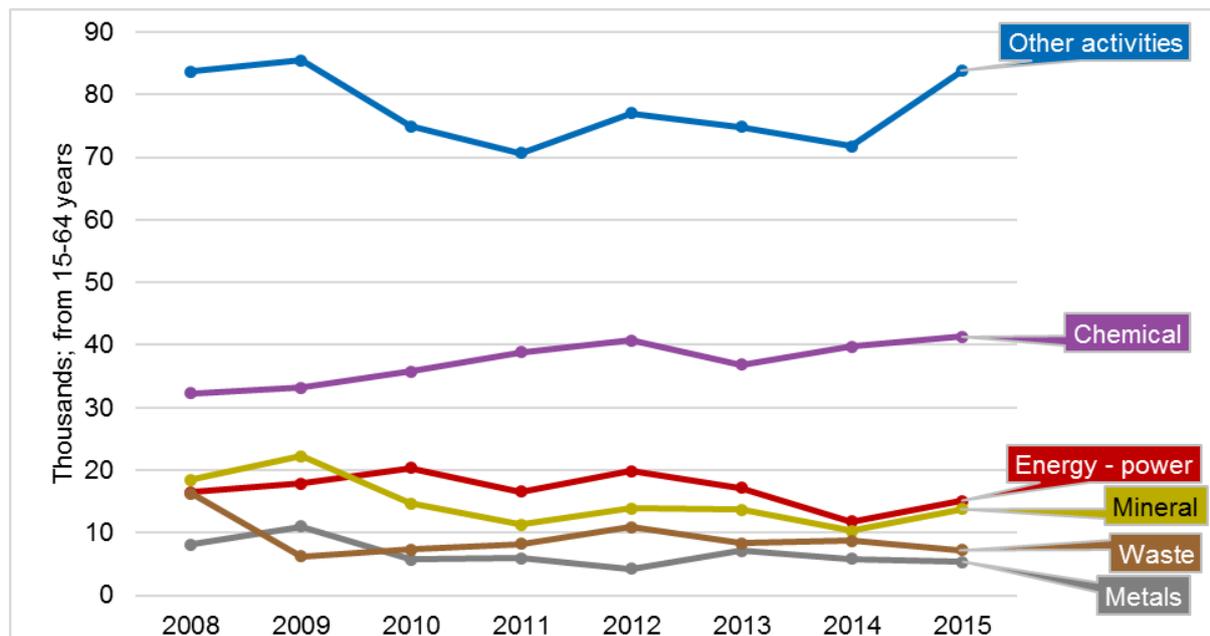
For employment data, a similar trend can be seen, although the observed increases for the chemical sector are less significant (Figure 4).

Figure 3: Gross value added of industrial sectors (2000-2015)



Source: Eurostat (2017a)

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



Note: No employment data are provided for energy-refining industrial sector. Employment for 'other activities' was estimated for the years 2012 and 2015 and do not include tanning [of leather] for the entire time series shown here as the data is marked as confidential by Eurostat.

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. Overreporting is expected to be greatest for the waste management GVA data because it not only includes waste management, but also water supply, sewerage and waste remediation. No data could be included within 'other activities' for intensive rearing of poultry or pigs as reporting was not at the appropriate level of NACE classification.

Table 2: Gaps in GVA data for Denmark

Missing data	Description	Conclusion and actions taken
Changes in IED activity between years	No IED installations are permitted for textiles before 2015.	The preferred option is to exclude data for textiles to avoid overreporting in the years between 2000 and 2014. However, the subsectors of textiles and tanning [of leather products] are reported together as one subtotal; so although no IED installations are permitted for tanning, the GVA cannot be excluded for this activity.

Table 3: Gaps in employment data for Denmark

Missing data	Description	Conclusion and actions taken
Data gaps for whole sector	No employment data for the energy - refining industrial sector. Not reported owing to confidentiality reasons	No data included.
Missing data	No employment data for 'other activities' for the years 2012 and 2015. No data available for 'other activities' for the years 2012 and 2015	Data was extrapolated.
Changes in IED activity between years	No IED installations are permitted for textiles before 2015.	The preferred option is to exclude data for textiles to avoid overreporting in the years between 2000 and 2014.

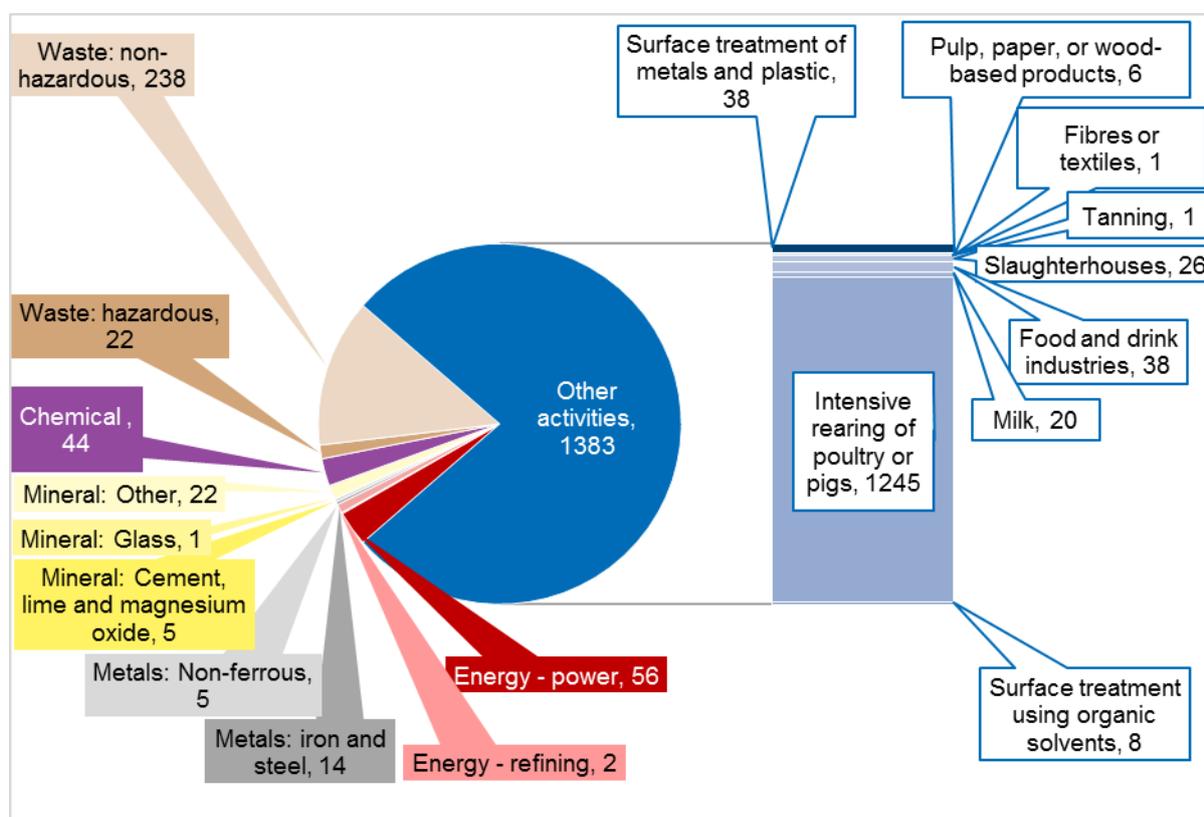
2.2 Number of IED installations

The main industrial sector in Denmark in 2015, according to the reported number of permitted IED installations, is intensive rearing of poultry or pigs within 'other activities', comprising 70% of total IED installations in 2015 (Figure 5, Table 4). This is followed by the non-hazardous waste management sector, although this is not a significant contributor to the national GVA.

Within 'other activities', only a small number of food and drink production installations are reported to be permitted under the IED, despite being a key contributor to the national GVA. While it is recognised that the GVA data for this sector is overreporting compared activity scope strictly limited to the IED, the reasons for such a contrast between GVA and numbers of reported permitted installations are not clear from the available data.

Permits are reported for the majority of IED activities in Denmark, except for production of coke (IED activity 1.3), gasification or liquefaction (IED activity 1.4), metal ore (IED activity 2.1) and the production of phosphorus-, nitrogen- or potassium-based fertilisers (IED activity 4.3).

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



Note: No distinction is made between poultry, pigs or sows in the reported data for permitted IED installations in 2015 and so the total is grouped together under intensive rearing of poultry or pigs.

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

Table 4: Number of installations in 2011 and 2015 by industrial sector, with IED activity detail

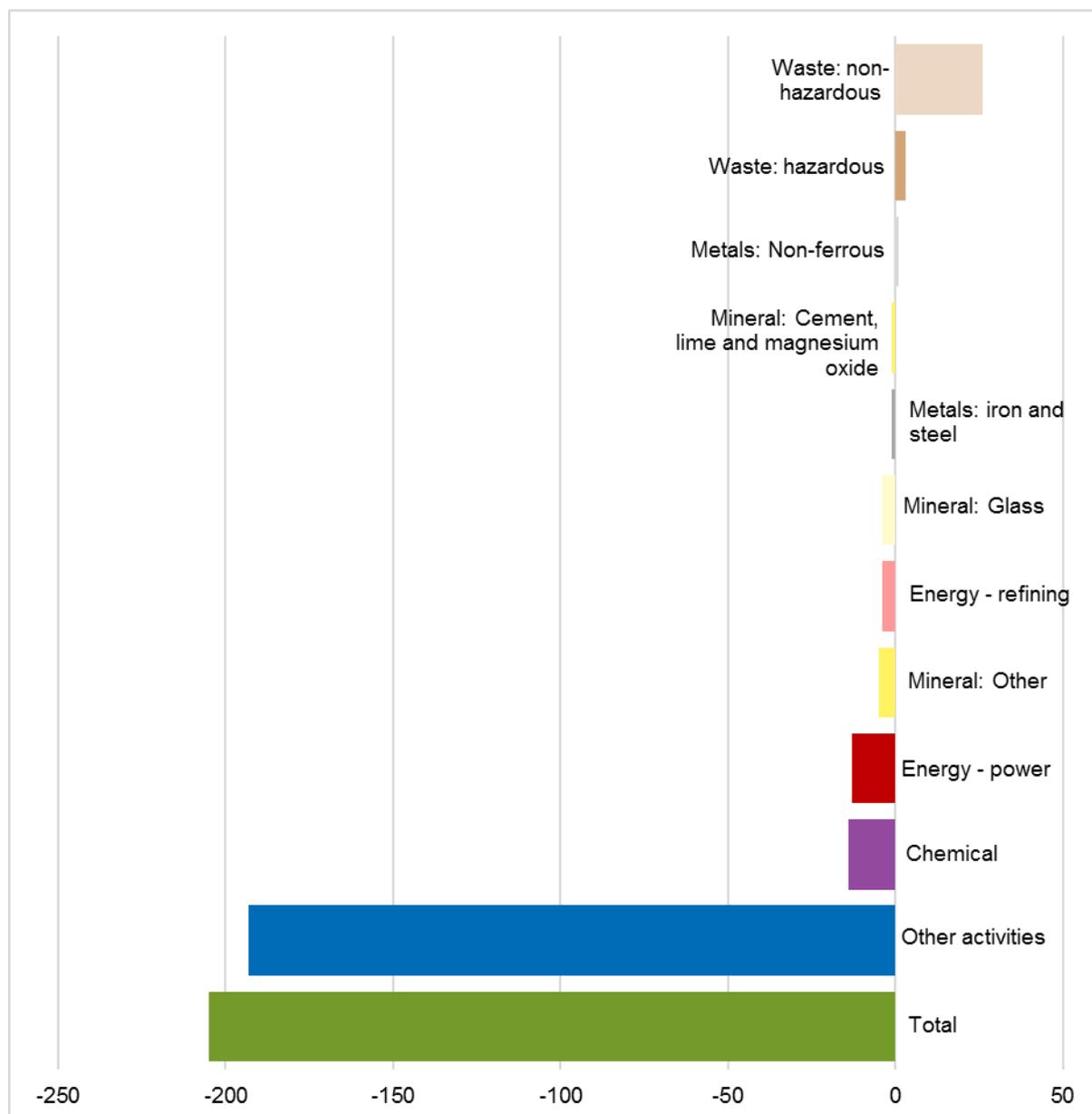
Industrial sector, with IED activity detail	2011	2015	Change in number of IED installations 2011 to 2015
Energy: power <i>1.1 Combustion</i>	69	56	-13
Energy: refining <i>1.2 Refining</i>	6	2	-4
Metals: iron and steel	15	14	-1
<i>2.2 Pig iron or steel</i>	1	1	0
<i>2.3 Processing of ferrous metals</i>	8	8	0
<i>2.4 Ferrous metals foundries</i>	6	5	-1
Metal: non-ferrous <i>2.5 Processing of non-ferrous metals</i>	4	5	1
Mineral: Cement, lime and magnesium oxide <i>3.1 Cement, lime and magnesium oxide</i>	6	5	-1
Metal: glass <i>3.3 Glass</i>	5	1	-4
Mineral: Other	27	22	-5
<i>3.4 Mineral fibres</i>	0	3	3
<i>3.5 Ceramics</i>	27	19	-8
Chemical	58	44	-14
<i>4.1 Organic chemicals</i>	15	9	6
<i>4.2 Inorganic chemicals</i>	20	5	-15
<i>4.3 Phosphorus-, nitrogen- or potassium-based fertilisers</i>	3	0	-3
<i>4.4 Plant protection products</i>	2	2	0
<i>4.5 Pharmaceutical products</i>	18	28	10
Waste: hazardous <i>5.1 Disposal / recovery</i>	19	22	3
Waste: non-hazardous	212	238	26
<i>5.2 co-/ incineration of hazardous and non-hazardous waste</i>	32	28	-4
<i>5.3 Disposal of non-hazardous</i>	13	40	27
<i>5.4 Landfills</i>	157	159	2
<i>6.5 Disposal of animal carcasses</i>	10	11	1
Other activities	1576	1383	-193
<i>6.1 Pulp, paper, or wood-based products</i>	4	6	2
<i>6.2 Textiles</i>	0	1	1
<i>6.3 Tanning</i>	1	1	0
<i>6.7 Surface treatment using organic solvents</i>	10	8	-2
<i>2.6 Surface treatment of metals and plastic</i>	40	38	-2
<i>6.4 (a) Slaughterhouses</i>	21	26	5
<i>6.4 (b) Food and drink</i>	44	38	-6
<i>6.4 (c) Milk</i>	23	20	-3
<i>6.6 Intensive rearing of poultry or pigs</i>	1433	1245	-188
Total	1997	1792	-205

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. No distinction is made between poultry, pigs or sows in the reported data for permitted IED installations in 2015 and so the total is grouped together under intensive rearing of poultry or pigs.

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

Between 2011 and 2015, there was a decrease in the reported number of IED installations permitted in Denmark (Figure 6). This decrease is mainly due to a reported reduction in the number of installations for intensive rearing of poultry or pigs within 'other activities' (from 1,433 installations in 2011 to 1,245 installations in 2015).

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



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.

Table 5: Data gaps in numbers of permitted IED installations for Denmark

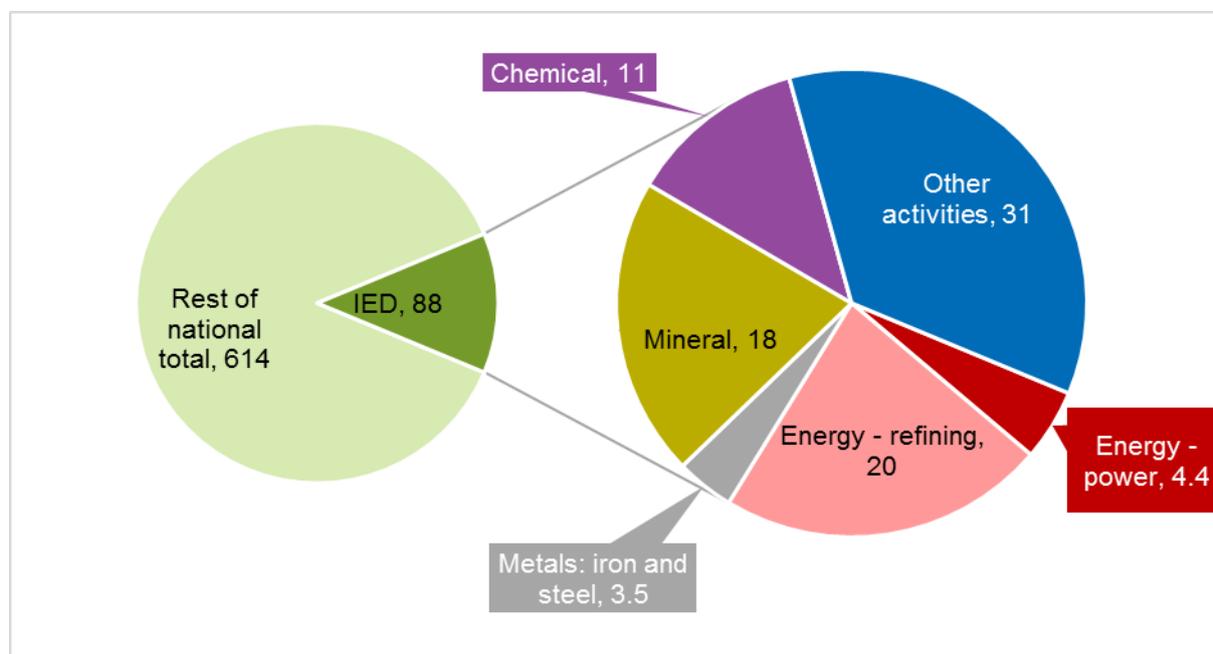
Missing data	Suitability	Conclusion and actions taken
Different granularity in reporting between years	In 2015, the number of permitted IED installations for intensive rearing of poultry or pigs is reported together.	No distinction is made between farming practices for this sector.

3 Resource use in industrial sectors

3.1 Energy consumption

Industrial sectors contribute to less than 13% of the total energy consumption in Denmark in 2015 based on data available from Eurostat (although data is lacking for some sectors as discussed below). Together with the overall number of permitted installations and contribution to the economy, the energy consumed by industrial sectors indicates that the energy-refining industrial sector (20 PJ, 23% of total energy consumption for industrial sectors) and the mineral industrial sector (18 PJ, 21%) are the most energy intensive industries in Denmark (Figure 7), whereas the 'other activities' industrial sector has a large energy consumption as well as a significant number of IED installations. Another significant sector is the chemical industrial sector. The energy consumed by activities within the industrial sector of 'other activities' can mostly be attributed to the food and drink sector (24 PJ). Relative energy consumption in the energy-refining industrial sector is quite high when comparing to the number of installations in 2015 (two permitted installations). Note that no data was reported for the non-ferrous metal and the waste management industrial sectors (explained in Table 6).

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

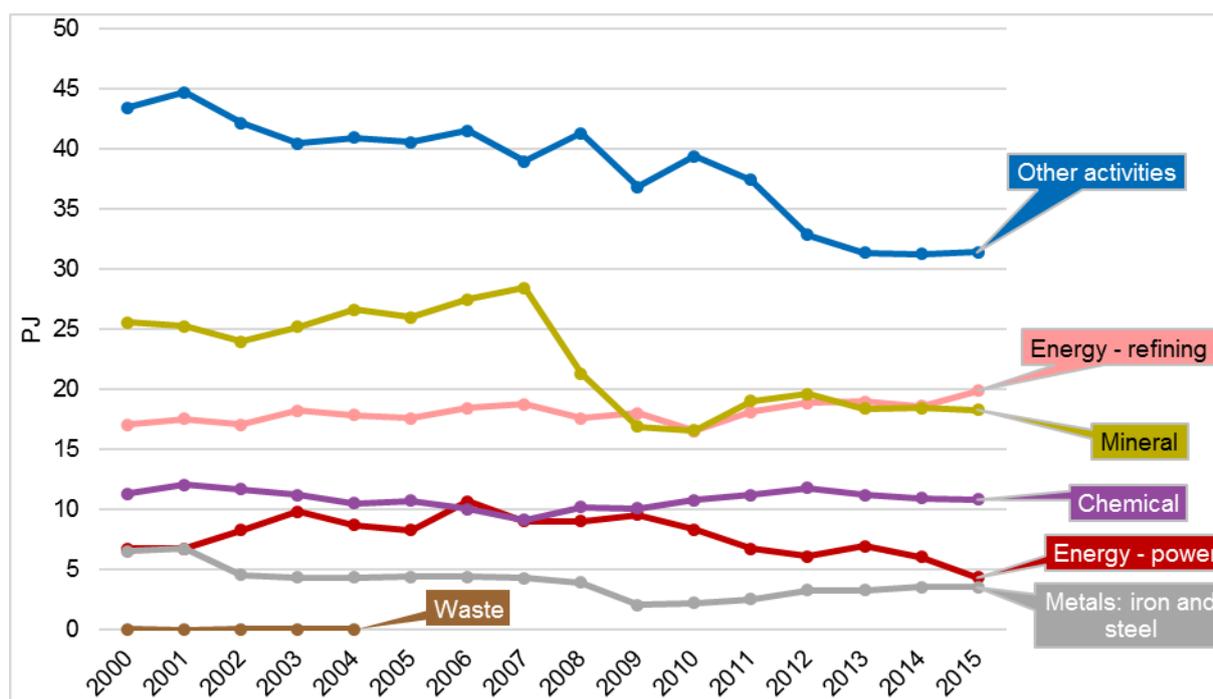


Note: Rest of national total relates to gross inland consumption minus the industrial sectors shown here. No data were available for the non-ferrous metal and waste management sectors.

Source: Eurostat (2017c)

The time series in Figure 8 shows that energy consumption has decreased for all industrial sectors from 2000 to 2015, except for the energy-refining sector which shows a slight upwards trend. For some sectors (energy-refining and metals: iron and steel) there is a slight increase in energy consumption for the recent period 2010 to 2015.

No energy consumption data were reported for the years 2005 to 2015 for the waste management industrial sectors. This is a significant gap in the data in light of the number of installations within this industrial sector operating in Denmark.

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

Note: Data for the waste management sector were only reported from 2000 to 2004 with very small amounts.

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 6: Gaps in energy consumption data for Denmark

Missing data	Description	Conclusion and actions
Limited time series	Only one energy balance indicator is available for the waste management sector (for non-hazardous waste management sectors, B_101318 – Consumption in Gasification plants for biogas). Only a limited times series available (2000-2004).	Conclude gasification plants for biogas in Denmark stopped operating in recent years. No action taken.
Data gap	No energy consumption data were reported in the non-ferrous metal industrial sector	No action
No IED installations reported for coke and gasification and liquefaction	Separate energy balance indicators are reported for this IED activity within the energy – refining sector.	Respective energy balance indicators removed from energy consumption for energy - refining, etc. to avoid over reporting.
Changes in IED activity between years	No IED installations are permitted for textiles before 2015.	The preferred option is to exclude data for textiles to avoid overreporting in the years between 2000 and 2014. However, the subsectors of textiles and tanning [of leather products] are reported together as one subtotal; so although no IED installations are permitted for tanning, the energy consumption cannot be excluded for this activity.

3.2 Water consumption

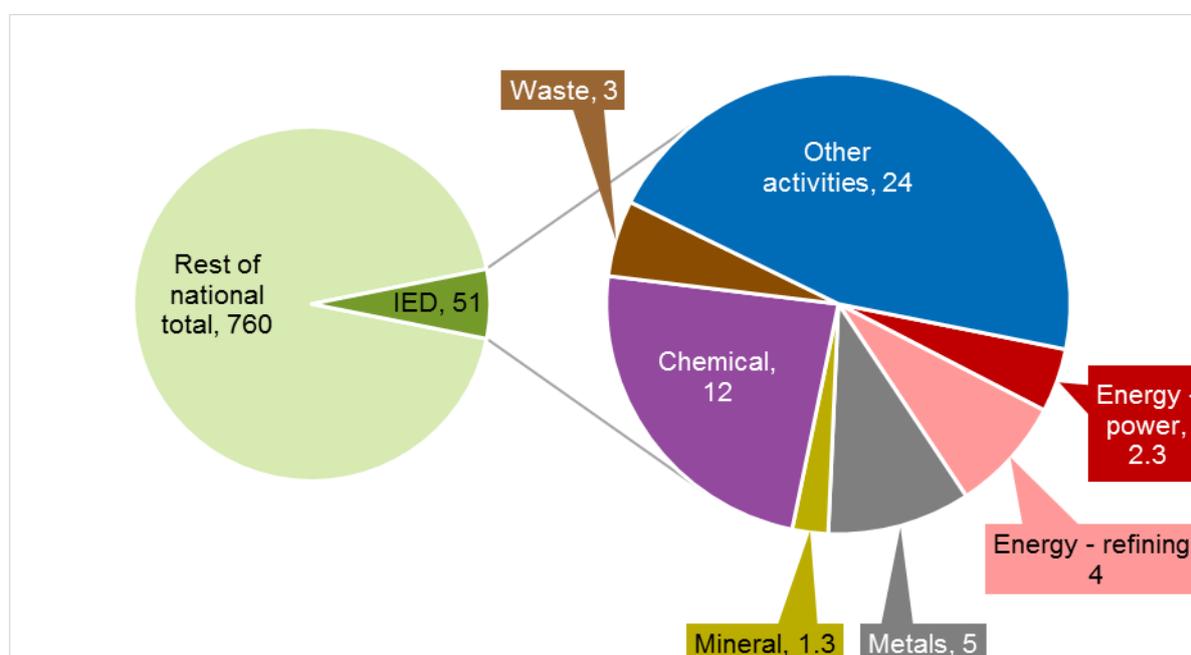
Very limited data is available in Eurostat (2017d) for the national total (with the latest data reported for 2009 covering public water supply only – excluding self-supply).

Data for water consumption by industrial sector in Denmark is not reported to Eurostat. National data is available for the years 2010 to 2016 (Danmarks Statistik's Statistikbanken, 2018).

The reported data shows that the industrial sectors are responsible for a relatively small share of total water consumption in Denmark (51.4 million m³; accounting for ~6.8% of total water consumed in 2015; Figure 9). Of this, 'other activities' is the largest consumer (using almost half the water consumed by total industry in 2015), followed by the chemical, metal and energy – refining sectors.

Within 'other activities', the sector consuming the largest quantity of water is the production of food and drink (accounting for ~95% of the water consumed by 'other activities'). In light of the large number of permitted IED installations for intensive rearing of poultry or pigs, the fact that no water consumption data could be reported for this industrial sector is likely to be a significant gap.

Figure 9: Water consumption (million m³) for selected industrial sectors (2015)

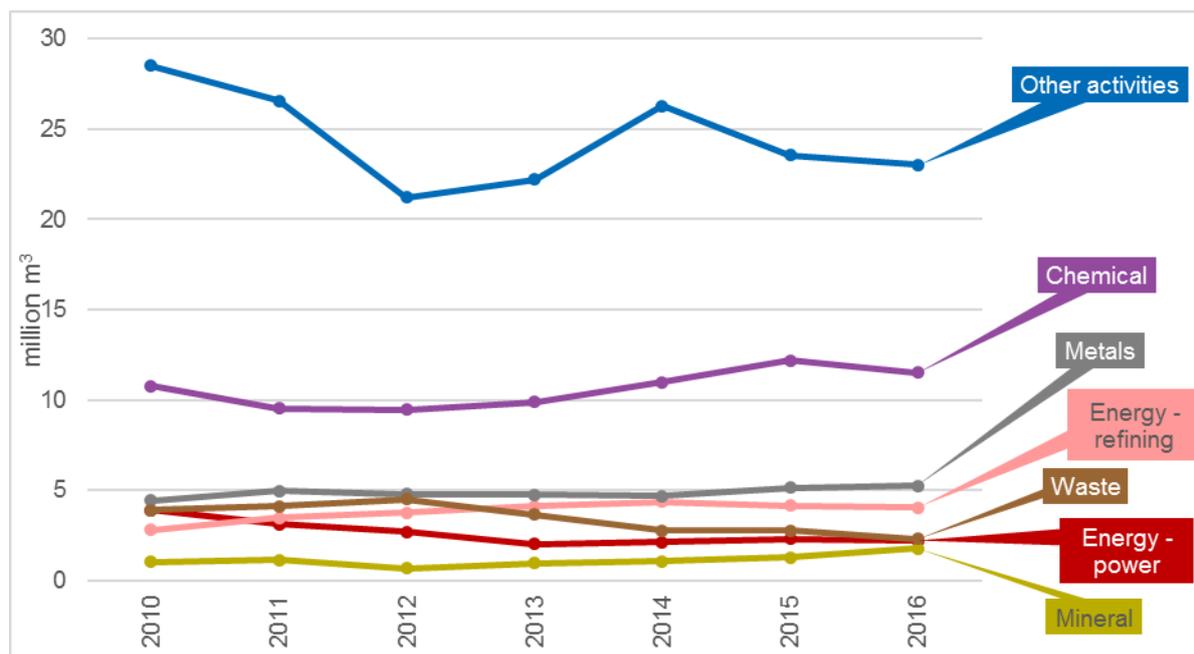


Note: Rest of national total relates to all national reporting codes minus the industrial sectors shown here.

Source: Danmarks Statistik's Statistikbanken (2018)

Water consumption has fluctuated in the sector 'other activities' over the years (see Figure 10). For the waste management sector a decreasing trend can be observed since 2012 whereas in the other sectors water consumption has not changed or slightly increased.

Figure 10: Water consumption (million m³) for selected industrial sectors (2010-2016)



Note: limited time series

Source: Danmarks Statistik's Statistikbanken (2018)

Limitations

More complete reporting of water consumption by industrial sector was identified at national level. This dataset reports total water use using national reporting codes. The dataset is available for the years 2010 to 2016.

Table 7: Data gaps in water consumption data for Denmark

Missing data	Description	Conclusion and actions taken
Limited data reported to EU datasets	National dataset has been provided and used. This reporting is more detailed; however, limited timeseries (2010-2016), and reported by national reporting code	National dataset used. Additional mapping undertaken; limited timeseries presented.
Changes in IED activity between years	No IED installations are permitted for textiles before 2015.	The preferred option is to exclude data for textiles to avoid overreporting in the years between 2000 and 2014. However, the subsectors of textiles and tanning [of leather products] are reported together as one subtotal; so although no IED installations are permitted for tanning, the water consumption cannot be excluded for this activity.

4 Emissions from industrial sectors

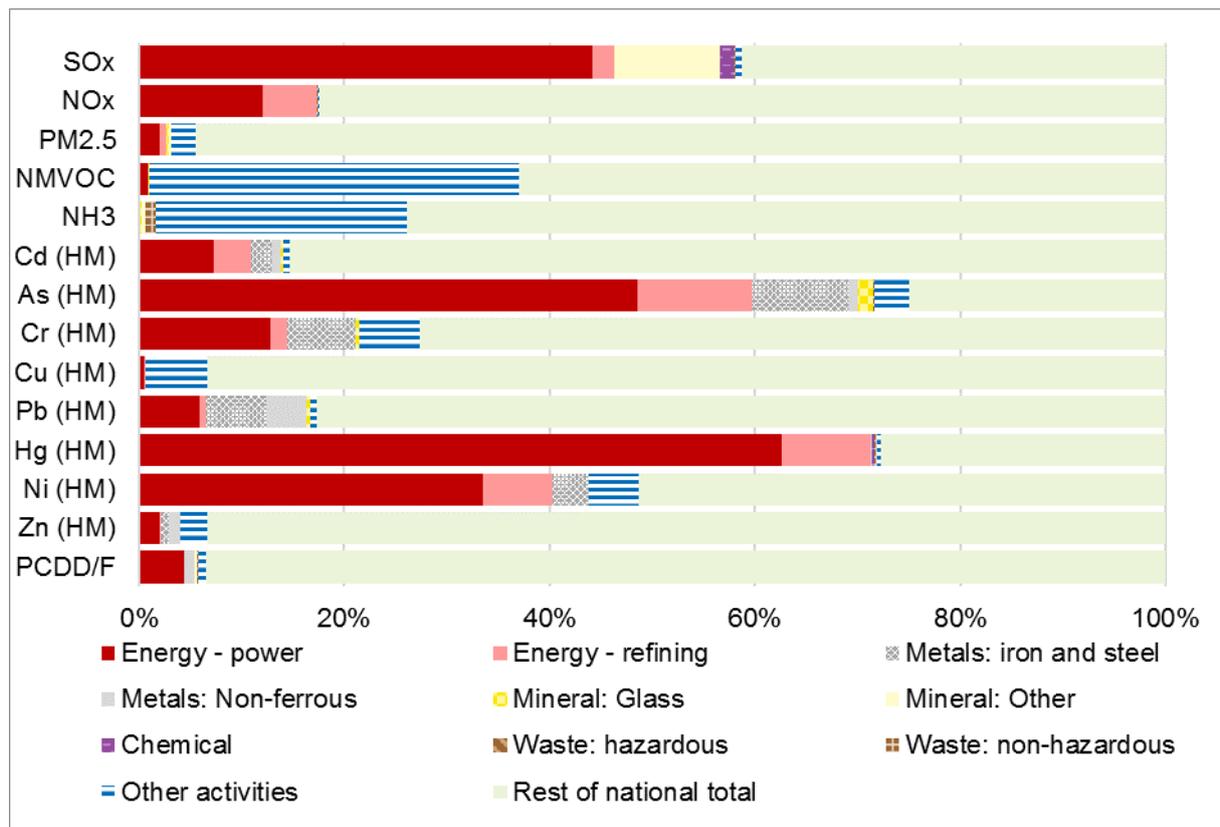
4.1 Emissions to air

Data were taken from inventories submitted by Member States under the CLRTAP (EEA, 2017a). The data reported under CLRTAP from Denmark are based where available on the data reported by individual installations to E-PRTR. Overall, considering available data, industrial sectors are responsible for less than half of the emissions of most pollutants emitted to air in 2015 (Figure 11). The exceptions to this are SO_x, As and Hg emissions, for which industrial sectors contribute more significantly to the total national emissions.

For most pollutants, the energy – power sector contributes the greatest proportion of emissions to total industrial emissions (in particular, SO_x, NO_x, Cd, As, Hg, Ni, PCDD/F and PCBs) (Figure 12). The energy – refining and metals: iron and steel sectors also contributes a reasonable proportion to total industrial emissions for As, Cd, Cr, and Ni (and NO_x and Hg with respect to energy – refining only). For specific pollutants, 'other activities' contributes a significant proportion to total industrial emissions. This includes NH₃ (primarily from intensive rearing of poultry or pigs), NMVOC, PM_{2.5} and some of the heavy metals (namely As, Cr, Cu, Ni and Zn).

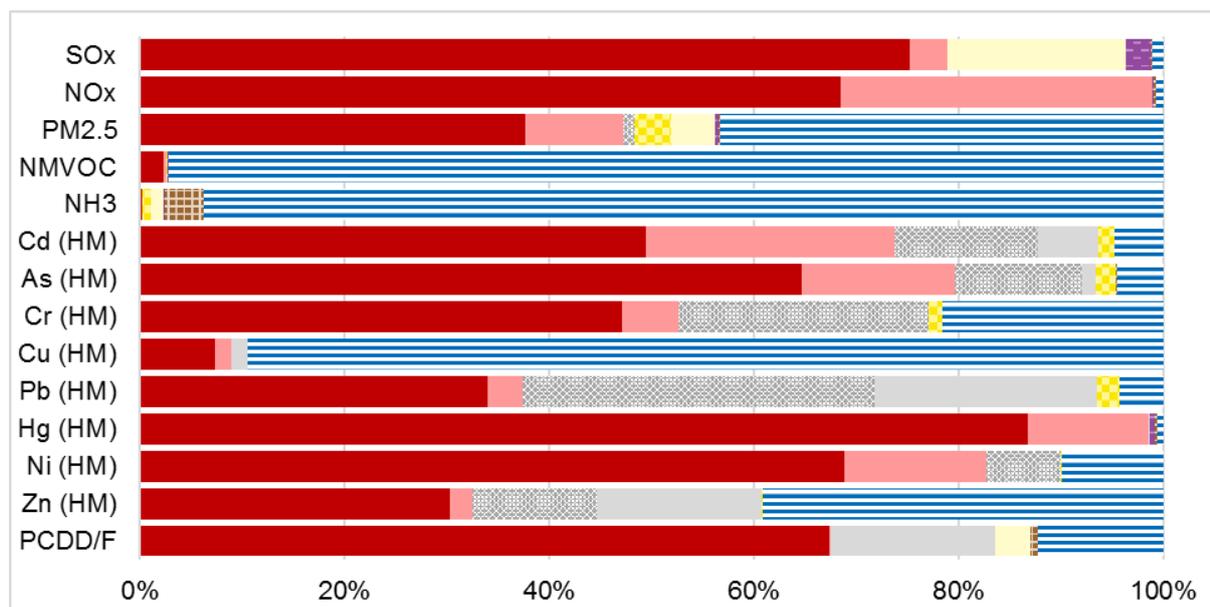
Despite the reported number of IED installations in 2015 (238 permitted installations), emissions to air were quite low for the non-hazardous management industrial sector. No data were reported for the hazardous waste management industrial sector. For some other industrial sectors, emission data were only reported for some pollutants.

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.

Source: EEA (2017a)

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

Note: The key for this chart is shown in Figure 11

Source: EEA (2017a)

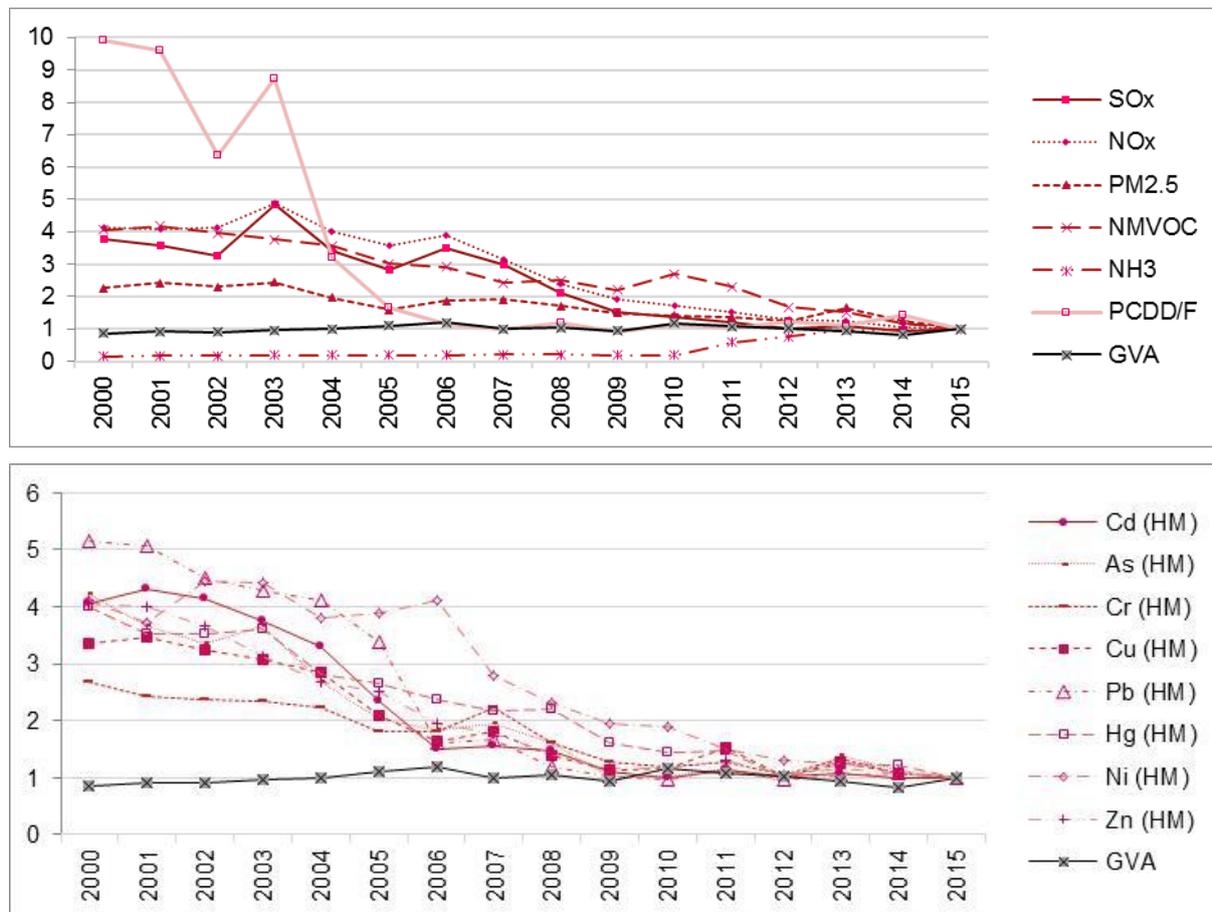
In the following sections, emissions to air are shown in indexed charts by sector, with the exception of the hazardous waste management industrial sector for which no data were reported. This was done to compare the development of pollutant emissions with the GVA in specific sectors in the time period 2000 to 2015. For most industrial sectors, emissions to air shows decreasing trends. For many sectors, an especially decreasing trend until 2009 can be observed, which was also observed in other country profiles. This decrease is expected to be related to tighter controls on these pollutants driven by EU legislation. In many cases, decoupling from GVA growth appears to have occurred.

Appendix 2 includes full details on the emissions reported by industrial sector and year for the pollutants included in scope of this profile.

Energy industry

For the energy - power industrial sector, there was a decrease in emissions to air for all pollutants included in this profile between 2000 and 2015 except for NH₃, which increased gradually over time (Figure 13). This decrease can especially be observed for the time period 2000 to 2010. From 2010 onwards, these emissions have only slightly decreased or stayed relatively constant. The GVA has remained fairly static over the whole time period which could lead to the assumption that pollutant emissions were slightly decoupled from the GVA.

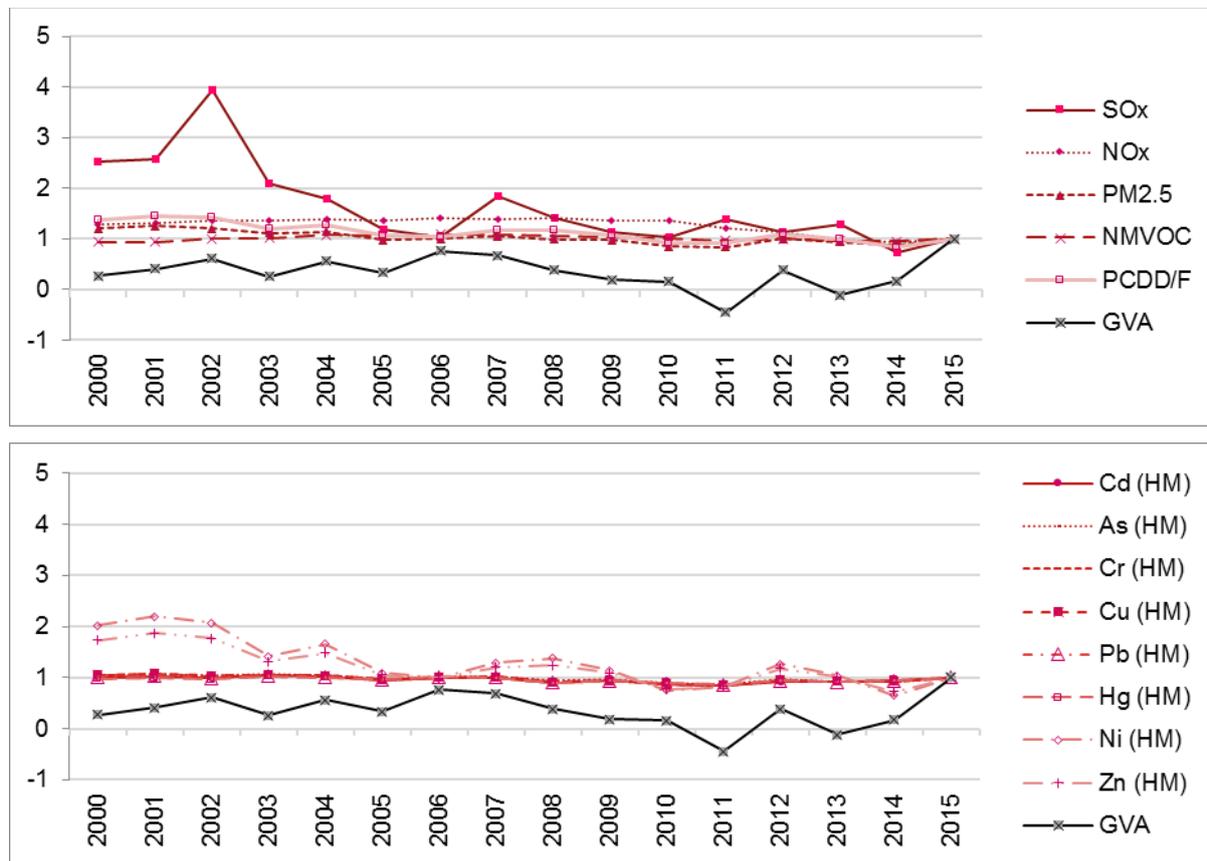
Figure 13: Indexed emissions to air from the energy - power industrial sector (indexed to 2015=1)



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

In the energy-refining industrial sector, emissions have slightly decreased or stayed stable for all pollutants from 2000 to 2015 (see Figure 14). Decreases can be observed for SO_x, Ni and Zn in the period 2000-2006. Note that the trend lines for most of the heavy metals generally are the same from 2000 to 2015. This means the emissions are reported to be constant over this period. It should be noted that there were only two reported IED installations permitted in Denmark for this industrial sector in 2015. No data on NH₃ emissions were reported.

Figure 14: Indexed emissions to air from energy - refining (energy industrial sector) sector (indexed to 2015=1)



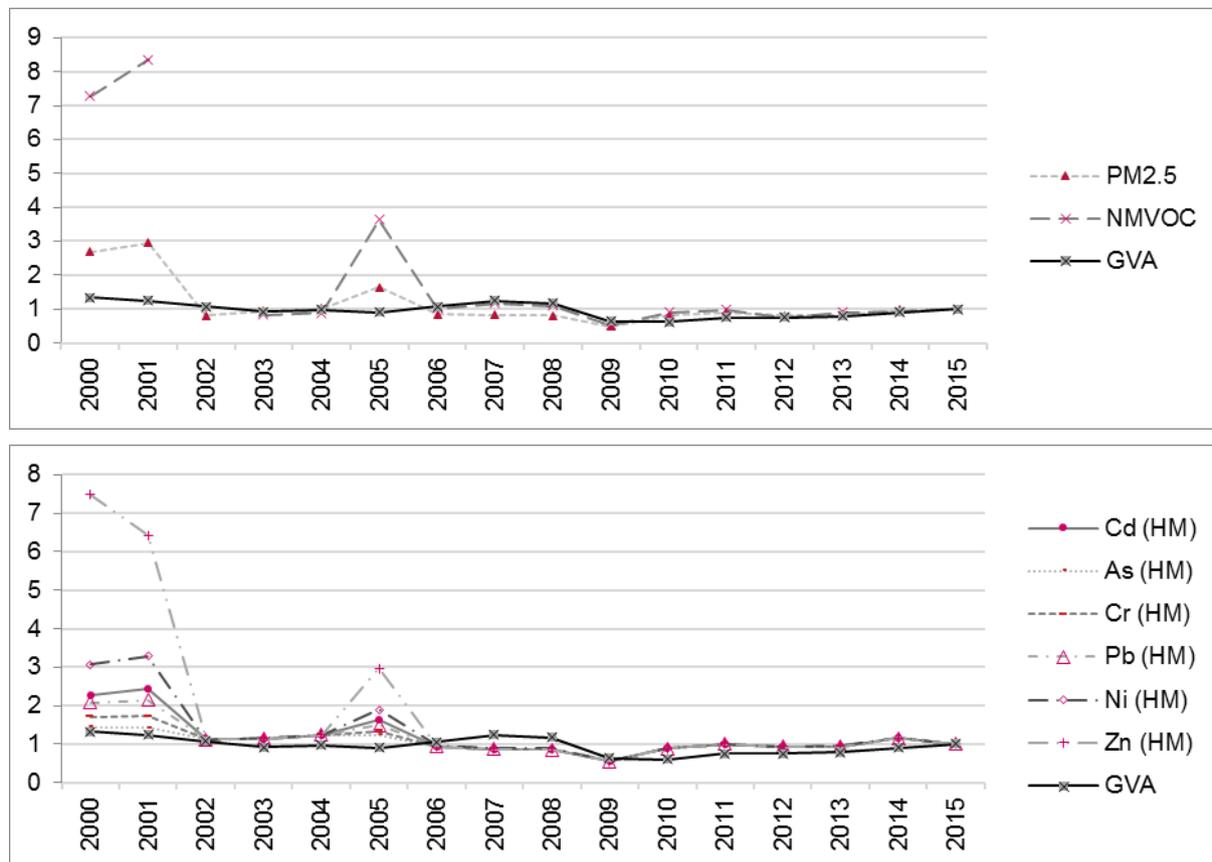
Note: No NH₃ data reported.

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

Metal industry

Within the iron and steel industrial sector, all reported pollutant emissions have generally decreased in the period 2000 to 2009 but then showing a slight upwards trend until 2015, in line with GVA (Figure 15). Spikes can be observed for some pollutant emissions in 2001 and 2005, the reasons for these are not known. Data were reported for PM_{2.5}, NMVOC and most heavy metals except for Cu and Hg.

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



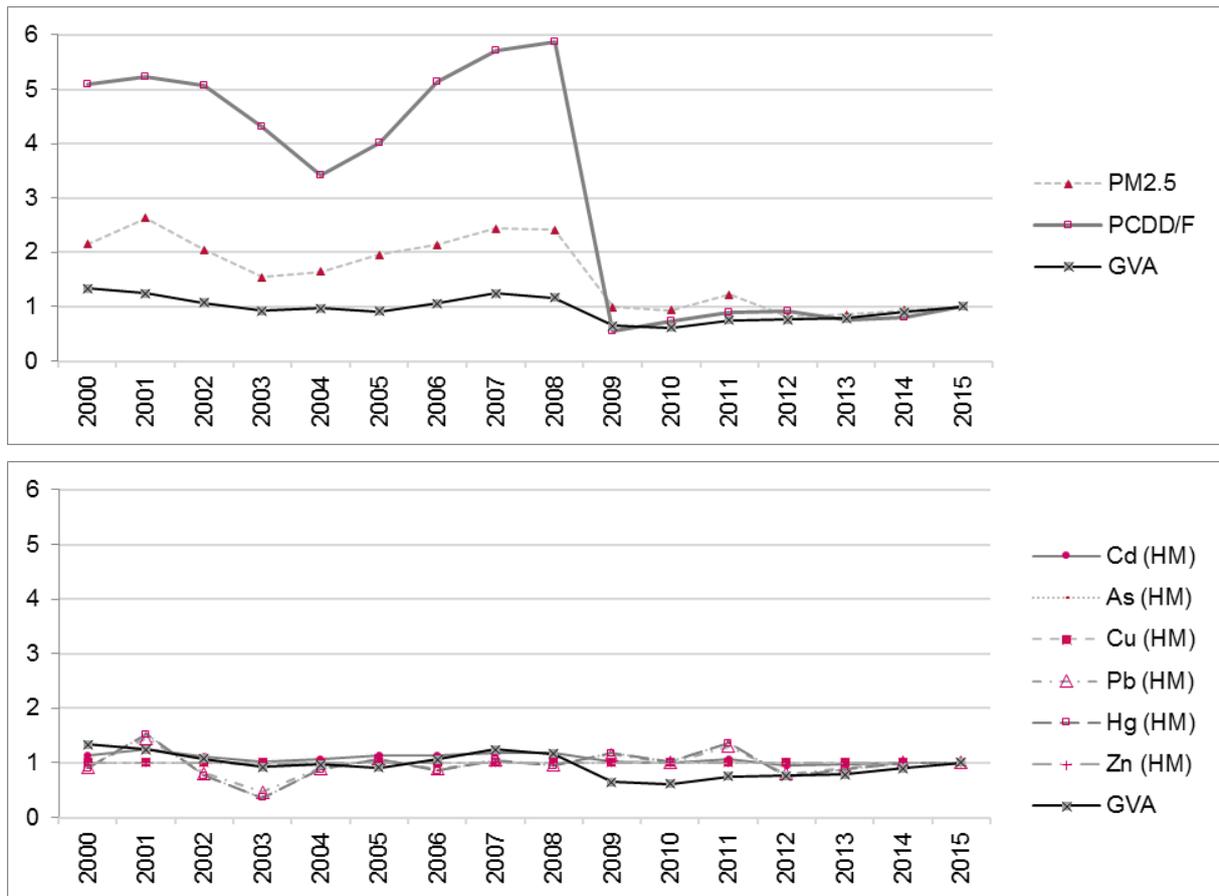
Note: Zero emissions reported for NMVOC in 2002. Value not plotted to avoid misrepresenting the trend. Only PM_{2.5} and NMVOC reported for non-heavy metal pollutants (first chart). All heavy metal pollutants reported except Cu and Hg (second chart).

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

Within the non-ferrous metals industrial sector, reported pollutant emissions vary over time, with a significant decrease from 2008 to 2009 for certain pollutants (PCDD/F and PM_{2.5} emissions). GVA followed a similar trend, however in lower magnitude (Figure 16). Data were reported for PM_{2.5}, PCDD/F and most heavy metals except for Ni and Cr.

The reported PCDD/F emissions were calculated from fuel consumption data in the national Danish energy statistics and emission factors. The non-ferrous metals industrial sector is relatively small in terms of the number of permitted installations (5 permitted IED installations in 2015), and small changes in the fuel consumption can lead to large relative changes in the emissions, as seen for PCDD/F in Figure 16. (Danish Environment Protection Agency, Personal Communication)

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



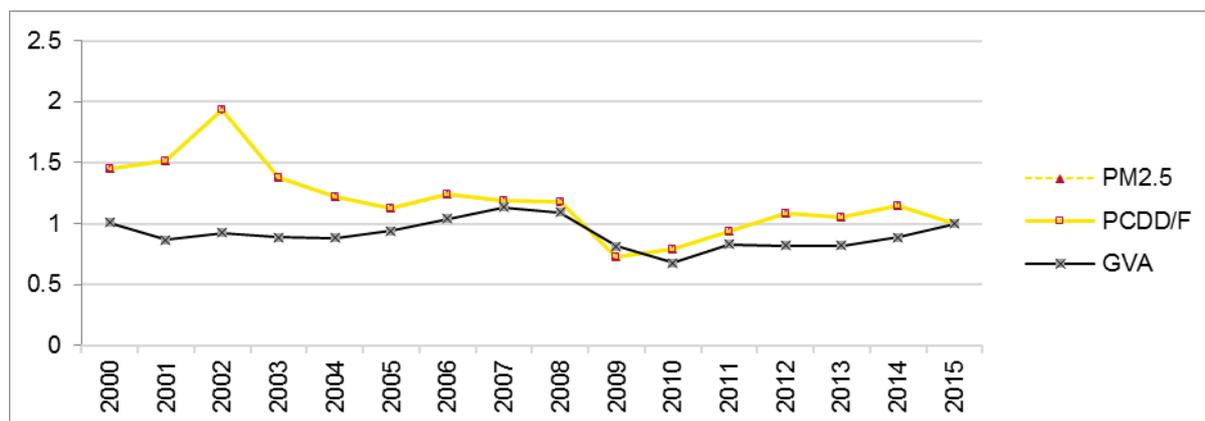
Note: Only PM_{2.5} and PCDD/F reported for non-heavy metal pollutants (first chart). All heavy metal pollutants reported except Cr and Ni (second chart).

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

Mineral industry

In the **cement, lime and magnesium oxide** mineral industrial sector, only PM_{2.5} and PCDD/F emissions were reported. Overall emissions of both pollutants, follow exactly the same downward trend from 2000 to 2009, showing a slight increase afterwards (Figure 17 – note both pollutants follow same single trendline shown). The same trend can be observed for GVA. This may reflect regulatory requirements under the IPPC Directive and/or the economic crisis and subsequent recovery thereafter. However, DCE (2017) indicates that process emissions from the production of cement were reported together with combustion emissions that are included in energy-power.

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



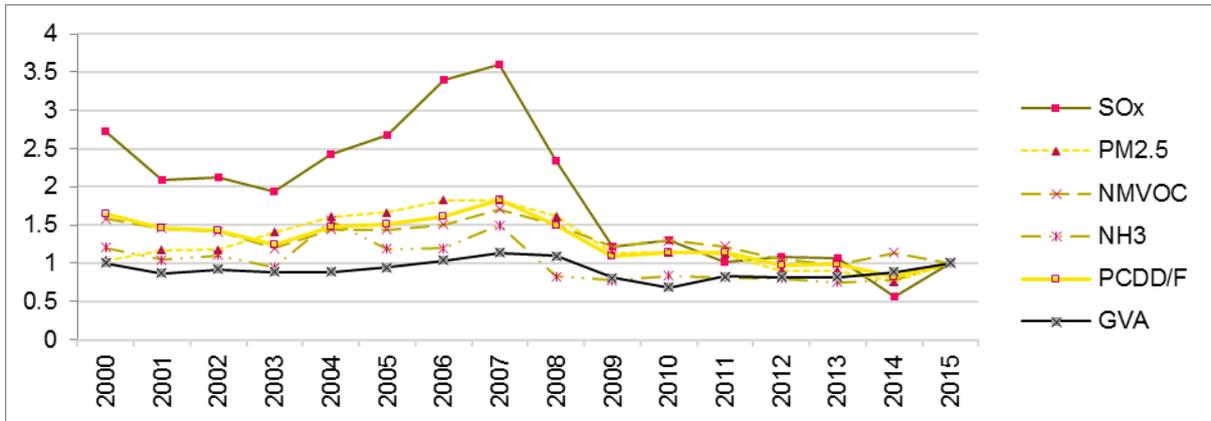
Note: Only PM_{2.5} and PCDD/F reported for non-heavy metal pollutants. No heavy metal pollutants reported.

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

Within the other mineral industrial sector (principally **ceramic manufacturing**), overall emissions decreased from 2000 to 2015 but with some variation in between (Figure 18). NO_x and heavy metals were not reported, although NO_x from stone wool production within ceramic manufacturing is included in the energy sector (DCE, 2017).

The most marked change in the time series is the reduction in all reported pollutants, and especially SO_x emissions, between 2007 to 2009. This time period coincides with a (proportionally smaller) decline in the GVA (2008-2010), the IPPC Directive permitting deadline of existing installations (2008) and the publication of the Best Available Techniques Reference Document for the Ceramic Manufacturing Industry (August 2007). The reduction in emissions could be linked to reduced levels of production. However, the Danish competent authority has suggested that they have no evidence that specific mitigation techniques (refits) were implemented in this time period, and that the more likely reason for the reduction in emissions is a decrease in the number of installations reporting emissions from 14 in 2007 to 10 in 2009 (Danish Environment Protection Agency, Personal Communication).

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



Note: No NO_x emissions data reported for non-heavy metal pollutants. No heavy metal pollutants reported.

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

In the **glass** mineral industrial sector CLRTAP reported PM_{2.5}, NMVOC and NH₃ emissions decreased from 2000 to 2010 and have slightly increased afterwards with some variations (Figure 19). Heavy metal emissions decreased for all pollutants reported. From 2005 to 2006, a significant fall in pollutant emissions can be observed, the reasons for this are unknown. The number of reported permitted installations in the sector reduced from 5 to 1 between 2011 and 2015, but these numbers differ from the number of facilities reporting to E-PRTR in the glass sector. Cu and Hg emissions were not reported.

NO_x and SO_x emissions to air would be expected from this sector, but they are not reported separately for the production of glass and are instead included in emissions elsewhere in the inventory (DCE, 2017). It is expected that these emissions are occurring from stationary combustion processes which are reported for the mineral sector as a whole and have been incorporated within the energy – power sector in this profile.

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



Note: Only PM_{2.5}, NMVOC and NH₃ reported for non-heavy metal pollutants (first chart). All heavy metal pollutants reported except Cu and Hg (second chart). Axis not aligned between the figures because reported heavy metal emission changes were significantly higher.

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

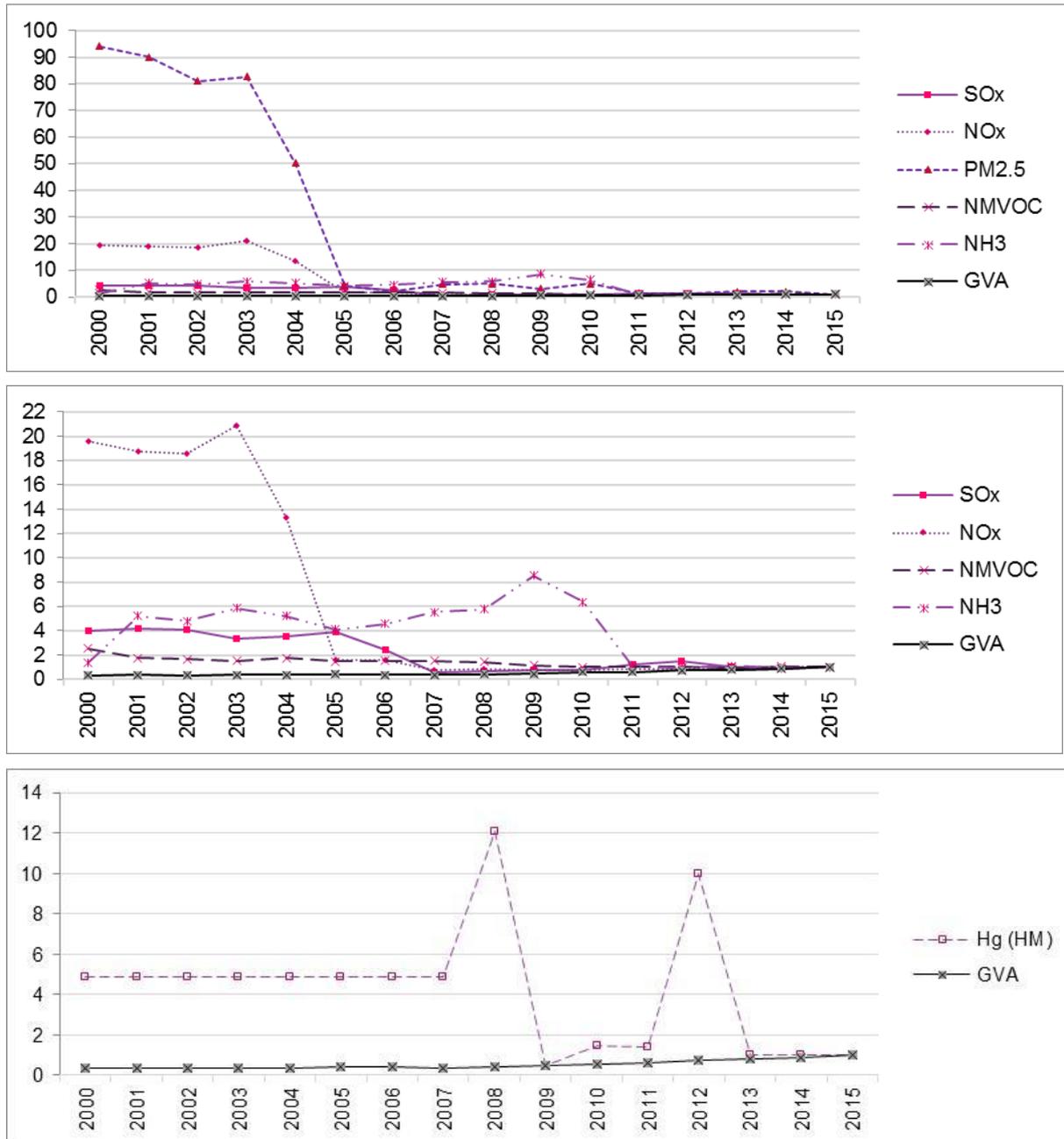
Chemical industry

Within the chemical industrial sector, all reported emissions have decreased from 2000 to 2015, showing several variations in between. A significant decrease can be observed for PM_{2.5} and NO_x between 2003 and 2005 resulting from the 2004 shut down of the company Kemira, which until then accounted for most of the emissions of PM_{2.5} and NO_x in the chemical industrial sector.

Since then, these emissions have remained fairly constant (Figure 20). Hg emissions have decreased but with significant year to year variation. No data for other heavy metal emissions were reported.

Considering that the GVA increased from 2000 to 2015 it can be concluded that relative emissions have been slightly reduced over time.

Figure 20: Indexed emissions to air from the chemicals industry (indexed to 2015=1)



Note: All non-heavy metal pollutants reported except PCDD/F (first chart). PM_{2.5} is removed as outlier to make detail for other pollutants visible (second chart). Only Hg reported for heavy metal pollutants (third chart).

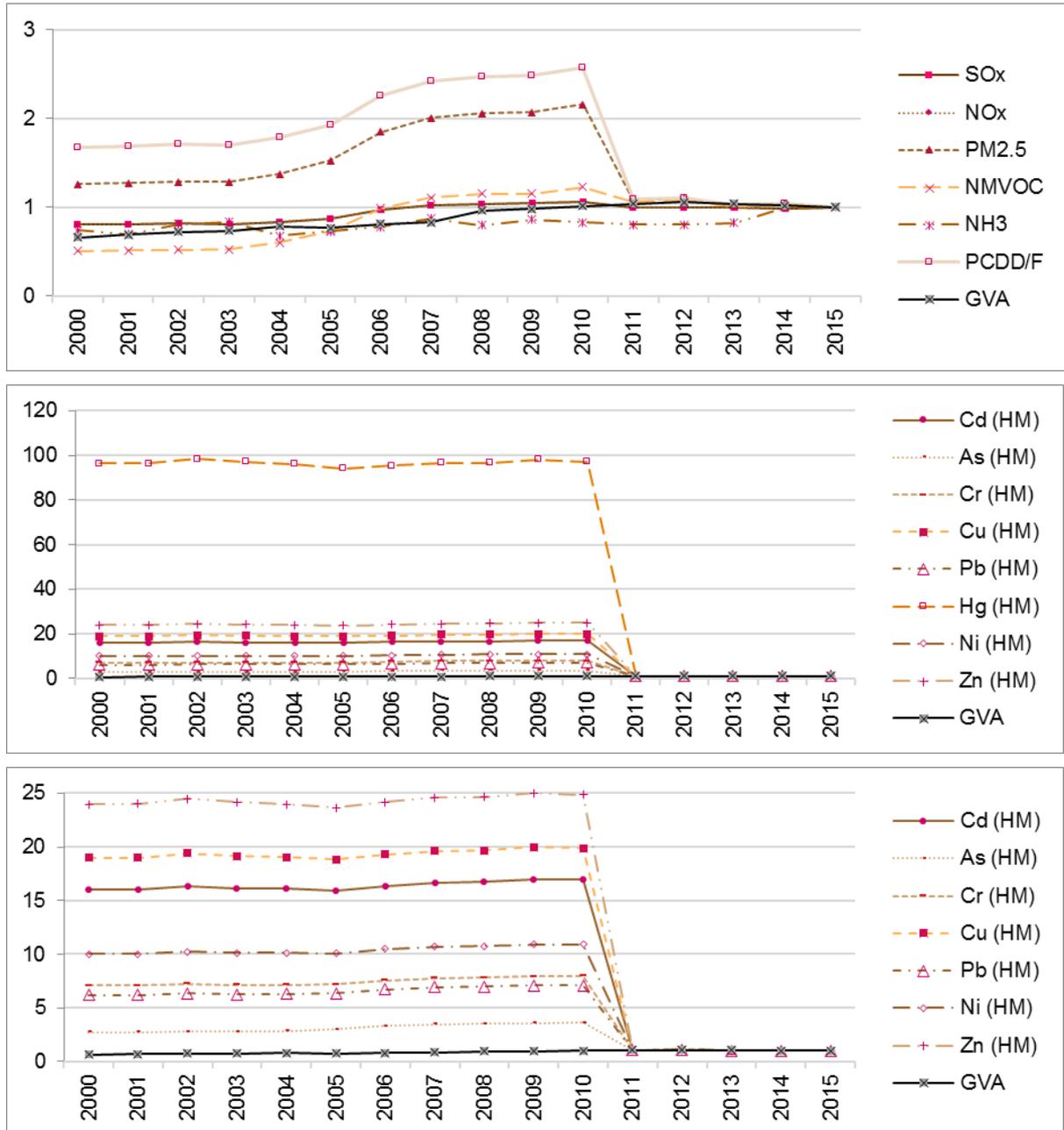
Source: EEA (2017a), Eurostat (2017a)

Waste management industry

For the hazardous waste management industrial sector no emissions were reported (they are marked as not occurring in the CLRTAP inventory).

Pollutant emissions from the non-hazardous waste management industrial sector slightly increased or remained stable between 2000 and 2010, showing a significant downward trend from 2010 to 2011 for most pollutants and remaining at similar levels afterwards until 2015 (Figure 21). Note that the absolute heavy metal emissions were very low in this sector in general. The GVA has gradually increased over the whole time period.

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



Note: All pollutants reported (first and second charts). Pb is removed as outlier to make detail for other pollutants visible (third chart).

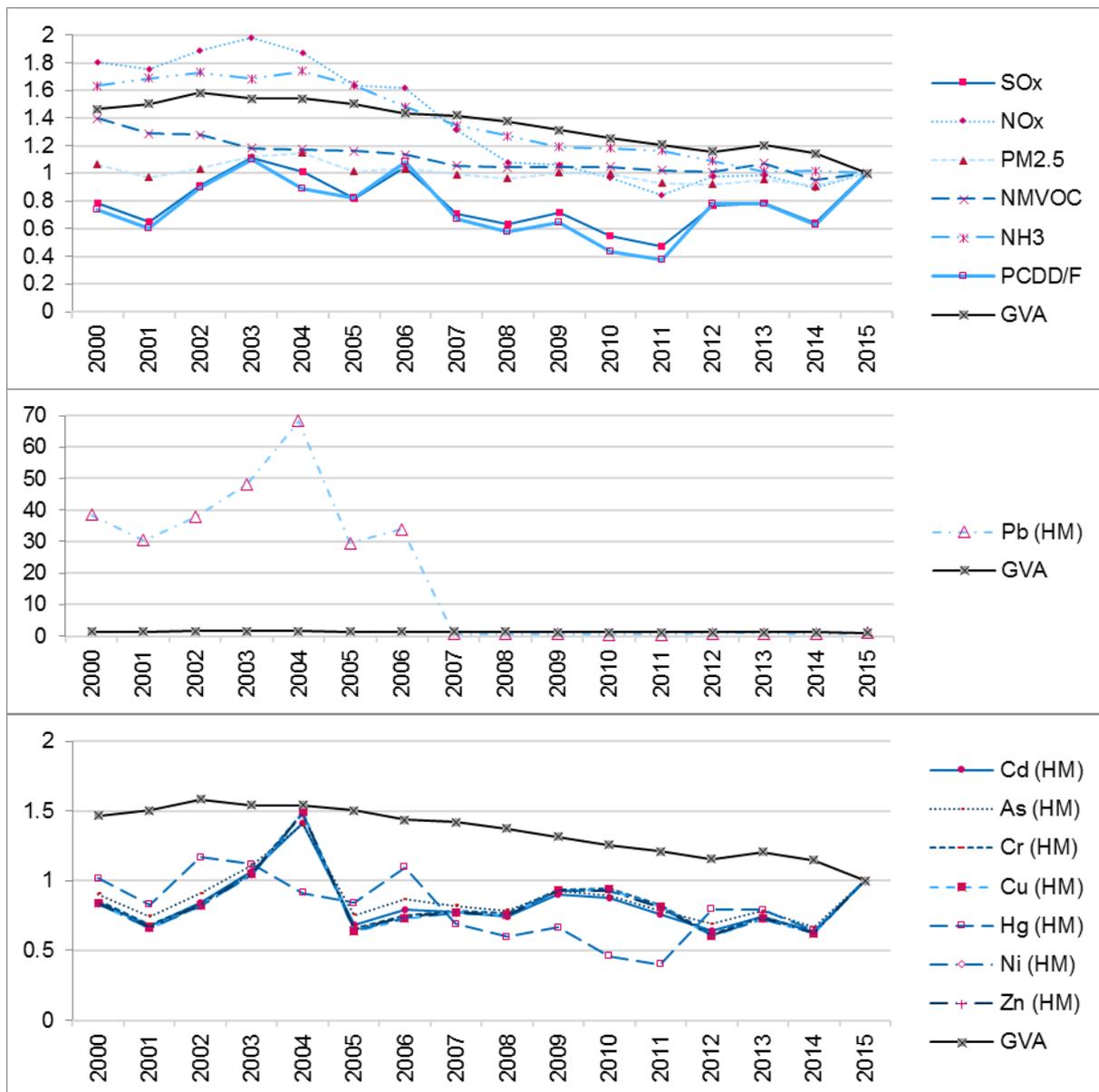
Source: EEA (2017a), Eurostat (2017a)

‘Other activities’

Within the ‘other activities’ industrial sector most pollutant emissions have decreased from 2000 to 2014, with some fluctuations, especially for Pb (Figure 22). SO_x and PCDD/F emissions have been more volatile over this time period and seem to follow the same trend. GVA has also followed a decreasing trend similar to the majority of pollutants emissions. In the period 2014 to 2015, a small increase for most pollutants can be observed.

For the key pollutants from this sector (NH₃ - from the intensive rearing of poultry and pigs, and NMVOC - from surface treatment activities), the trend over time is a reduction in emissions. For the intensive livestock rearing, this agrees with the declining trend in numbers of permitted installations (from 2011 to 2015) and may well reflect improved efforts to limit pollution driven by EU legislation. According to Scorupsi (2013), Denmark is one of the biggest contributors of NH₃ emissions to the Baltic Sea in comparison with other countries in the Baltic Sea region. However, Denmark has already implemented national regulations to reduce NH₃ emissions from intensive rearing of poultry or pigs.

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



Note: All pollutants reported (first and second charts). Pb is removed as outlier to make detail for other pollutants visible (third chart). GVA data only relates to the food and drink sector within ‘other activities’.

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 8: Gaps in emissions to air data for Denmark

Missing data	Description	Conclusion and actions taken
Partial time series for certain pollutants and sectors	No extrapolation or interpolation undertaken as explained in the accompanying methodology paper.	No action
Data gaps	No data reported for the hazardous waste management industrial sector. This is due to the fact that none of the permitted IED installations had emissions above the threshold limits defined under PRTR (the Danish EPA reports PRTR data to the LRTAP) (Danish EPA Pers. Comm.).	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, PNEC) and expressed in Hg equivalents.

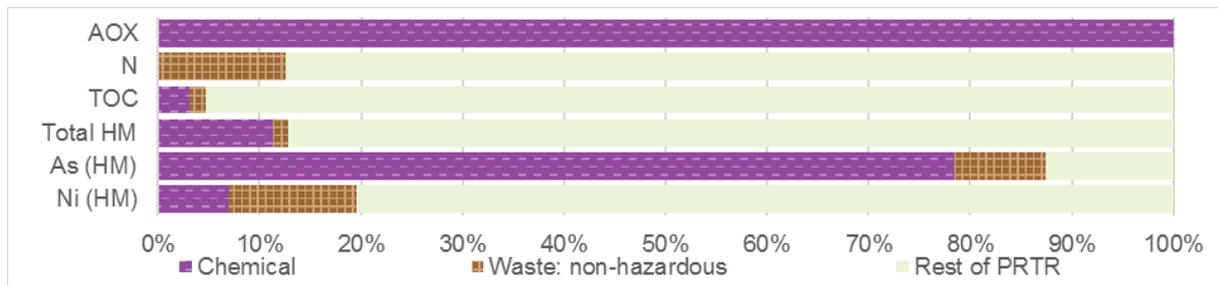
Pollutant emissions are reported only for the chemical and the non-hazardous waste management industrial sectors. Data is based on reported data to the E-PRTR. Owing to the relatively high portion of SMEs in Denmark, industrial activities are only rarely above the emission reporting threshold of the E-PRTR.

Furthermore, typically, industrial installations in Denmark discharge waste water to municipal waste water treatment systems with only a few installations having their own dedicated waste water treatment systems. The industrial sector data presented here does not aim to cover emissions to water from municipal waste water treatment systems, as this is not regulated by the IED and is therefore captured under 'rest of national total'. Thus, the small quantities of emissions to water presented here are expected to be underreporting for most IED activities in Denmark.

Therefore, there are few emitters of waste water directly to the environment within the population of IED industries. The number and type of pollutants for which emissions are reported varies per industrial sector. Therefore, comparison of sectors for one pollutant is difficult. No further data sources for emissions to water were identified to strengthen data reported to the E-PRTR.

With the limitations set out above, Figure 23 presents, per pollutant, the proportion that emissions of reported parameters to water for the industrial sectors made up of total emissions to water reported overall in E-PRTR (i.e. rest of PRTR total) in 2015. AOX and As represented 100% and around 90%, respectively, of the total pollutants emitted. The figure below also shows that the chemical industrial sector is the sole reported emitter of AOX emissions and the main emitter of As emissions to water in 2015. For cyanides, P, Cd, Cr, Cu, Pb, Hg, Zn, diuron, and PCBs, no data were reported.

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



Note: Rest of PRTR relates to the total for E-PRTR reporting minus the industrial sectors shown here. Only data were available for the chemical and the non-hazardous waste management industrial sectors.

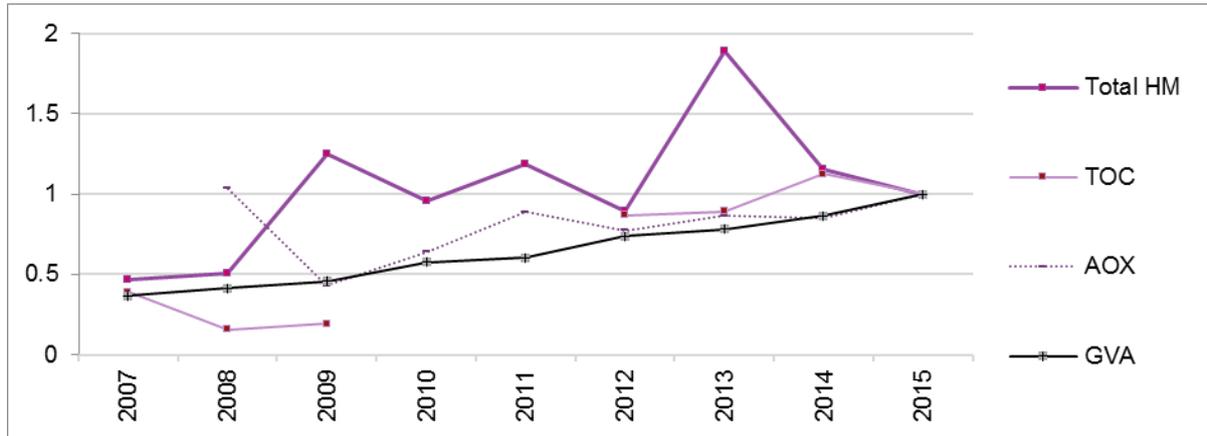
Source: EEA (2017b)

In the following subsections, emissions to water are shown in indexed charts by industrial sector, for the chemical and the non-hazardous waste management industrial sectors (the only sectors with reported data). The emissions data were indexed to compare the development of pollutant emissions with the GVA in specific industrial sectors from 2007 to 2015. Full details on the emissions reported by pollutant, industrial sector and year are presented in tabular format in Table 9.

Chemical industry

There is limited reporting of emissions to water by the chemical industrial sector to E-PRTR as most installations emissions are below the reporting thresholds that apply, and because most chemical installations discharge to a downstream waste water treatment plant. Thus, the emissions trend presented below from a limited number of installations may not necessarily correspond well with the sector-wide GVA trend (Figure 24). For the limited number of IED installations reporting emissions to water to the E-PRTR, emissions were only reported regularly for heavy metals, TOC and AOX. The fluctuation observed for heavy metal emissions is due to variations of Cu and As emissions reported every year between 2009 and 2014. In addition, total P is reported to E-PRTR for selected years to 2013, but is not shown in the figure below (see Table 9).

Figure 24: Indexed emissions to water from the chemical sector (indexed to 2015=1)



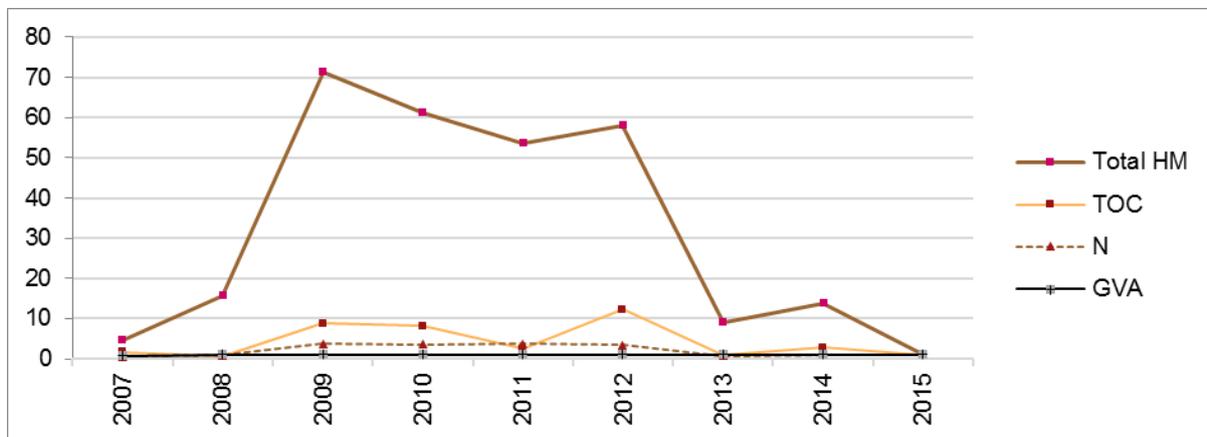
Note: Zero emissions reported for TOC in 2010 and 2011, and for AOX in 2007. Values are not plotted in the chart to avoid misrepresenting the trend. Data only reported for heavy metals, TOC and AOX.

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

Waste management industry

Emissions to water from the waste management industry are only reported for the non-hazardous waste management industrial sector. The pollutant emissions reported include aggregated total heavy metals, TOC and total N. For all pollutants reported, emissions have remained fairly similar in 2015 as they were in 2000. Total heavy metal emissions present a peak between 2009 and 2012 (Figure 25). This peak is due to higher values reported for Zn in this time period and variation in the number of facilities reporting. Owing to the small number of installations reporting emissions to water it is not possible to establish if this represents a trend or not. GVA has slightly decreased over time.

Figure 25: Indexed emissions to water from the non-hazardous waste management industrial sector (indexed to 2015=1)



Note: Data only reported for total heavy metals, TOC and total N.

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

Additional data for emissions to water

Additional data reported to E-PRTR for emissions to water are presented in Table 9 – including for pollutants with no time series. Additional comments provided by the Danish EPA to provide context for the emissions data are shown below the table. For most sectors, the number of installations reporting emissions is much lower than the number of installations in the sector.

Table 9: Emissions to water by pollutant and industrial sector (all available data) (kg)

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy - power									
Total HM	3.25	7.43	2.70	0.14	-	-	-	-	-
Energy - refining [Note 1]									
TOC	-	-	126,000	54,700	-	-	-	-	-
Total N	-	-	236,000	-	-	-	-	-	-
Mineral: Cement, lime and magnesium oxide [Note 2]									
Total P	-	133,000	-	-	-	-	-	-	-
Total N	-	107,000	-	-	-	-	-	-	-
Chemical [Note 3]									
Total HM	5,89	6,46	15,82	12,16	15,07	11,31	23,99	14,60	12,67
Total P	-	-	-	5,600	7,220	-	6,950	-	-
TOC	132,000	53,000	65,000	-	-	293,000	301,000	380,000	337,000
AOX	-	3,700	1,540	2,290	3,180	2,770	3,090	3,040	3,580
Waste: hazardous									
Total HM	-	-	-	-	-	0.15	-	-	-
TOC	-	-	-	-	-	55,000	-	-	-
Waste: non-hazardous [Note 4]									
Total HM	8.10	27.56	124.57	106.94	93.83	101.36	15.78	24.25	1.75
Total P	6,650	-	105,600	80,500	109,980	184,800	15,000	11,000	-
TOC	277,700	117,800	1,521,000	1,399,500	423,900	2,127,000	188,000	482,000	173,200
Total N	104,000	162,000	636,000	606,300	649,000	602,000	116,000	180,300	173,200
Other activities									
Total HM	-	0.24	-	-	-	-	0.20	0.22	-
Total P	-	-	119,000	-	-	-	-	-	-
TOC	211,600	333,700	157,000	110,000	67,300	66,400	149,700	146,200	-

Notes provided by the Danish EPA:

Note 1: Energy-refining data reflects data from one facility (out of two refining installations) that reported total N and TOC in 2009. This facility discharges all waste water to an urban waste water treatment plant (UWWTP).

Note 2: Mineral sector data represents one lime production installation which reported releases in 2008.

Note 3: Chemical sector data on total P and AOX represents data from one facility. Data on TOC emissions are from one facility in years 2007 and 2012-2015, and a second facility in years 2008 and 2009.

Note 4: Non-hazardous waste. The majority of the 2,127t of TOC emissions and 167t total P in 2012 are from one UWWTP (main activity) which has a separate associated IED activity of 5.3 incineration of sewage sludge. The emissions released to water are discharges from the UWWTP not the incineration activity. The TOC emissions of 482t in 2014 is from an UWWTP with a separate anaerobic digester which has no water discharges; the water discharges are actually from the UWWTP. The TOC, total N and metal emissions in 2015 reported to E-PRTR are from landfill sites and represent emissions released to the aquifer which could be reported as a release to soil.

Source: EEA (2017b), Danish EPA (Personal Communication)

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 reporting thresholds which apply (also reflected as inconsistencies between years). E-PRTR also has a limited timeseries.

Table 10: Gaps in emissions to water data for Denmark

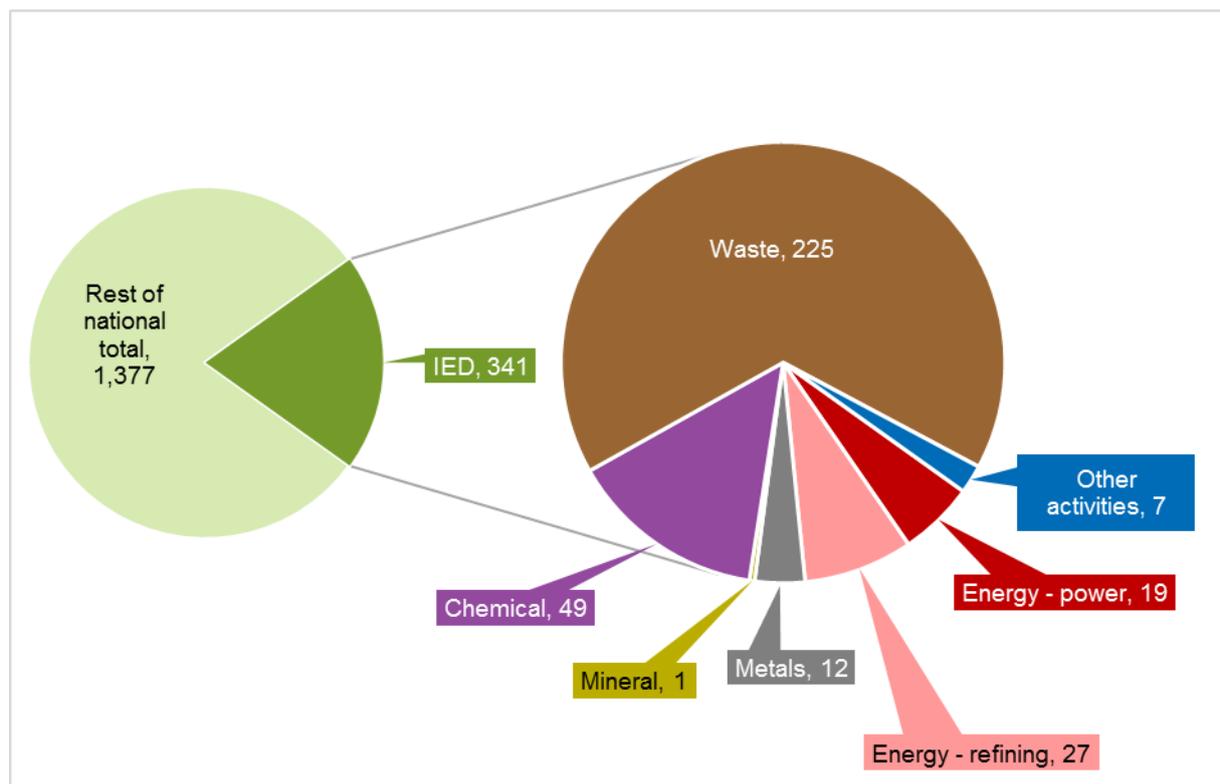
Missing data	Description	Conclusion and actions taken#
Gaps in time-series for certain pollutants	No gap-filling for emissions data has been carried out – as explained in the accompanying methodology paper	No action
Data gaps for sectors	No data reported for several sectors, including intensive rearing of poultry or pigs.	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 account for less than one quarter of total hazardous waste generated in Denmark in 2014 (Figure 26). Of this, the waste management industrial sector generates the largest quantity (66% of total hazardous waste from industrial sectors), followed by the chemical (14%) and the energy – refining (8%) industrial sectors.

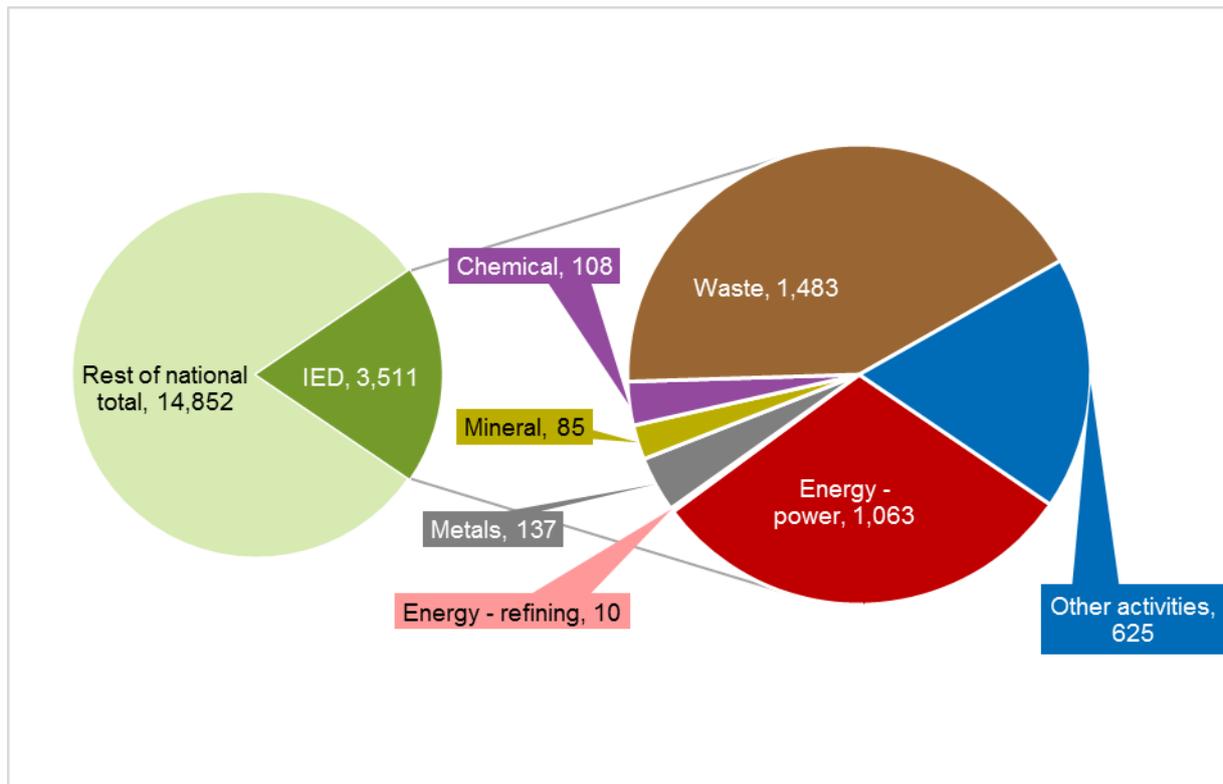
Figure 26: Hazardous waste generation by industrial sector in 2014 (kt)



Note: Rest of national total relates to all NACE activity minus the industrial sectors shown here.

Source: Eurostat (2017e)

Industrial sectors also account for less than one quarter of total non-hazardous waste generated in 2014 (Figure 27) – with the waste management industrial sector again accounting for a considerable amount of this (42% of total non-hazardous waste from industrial sectors). It is followed by the energy – power (30%) and ‘other activities’ (18%) industrial sectors.

Figure 27: Non-hazardous waste generation by industrial sector in 2014 (kt)

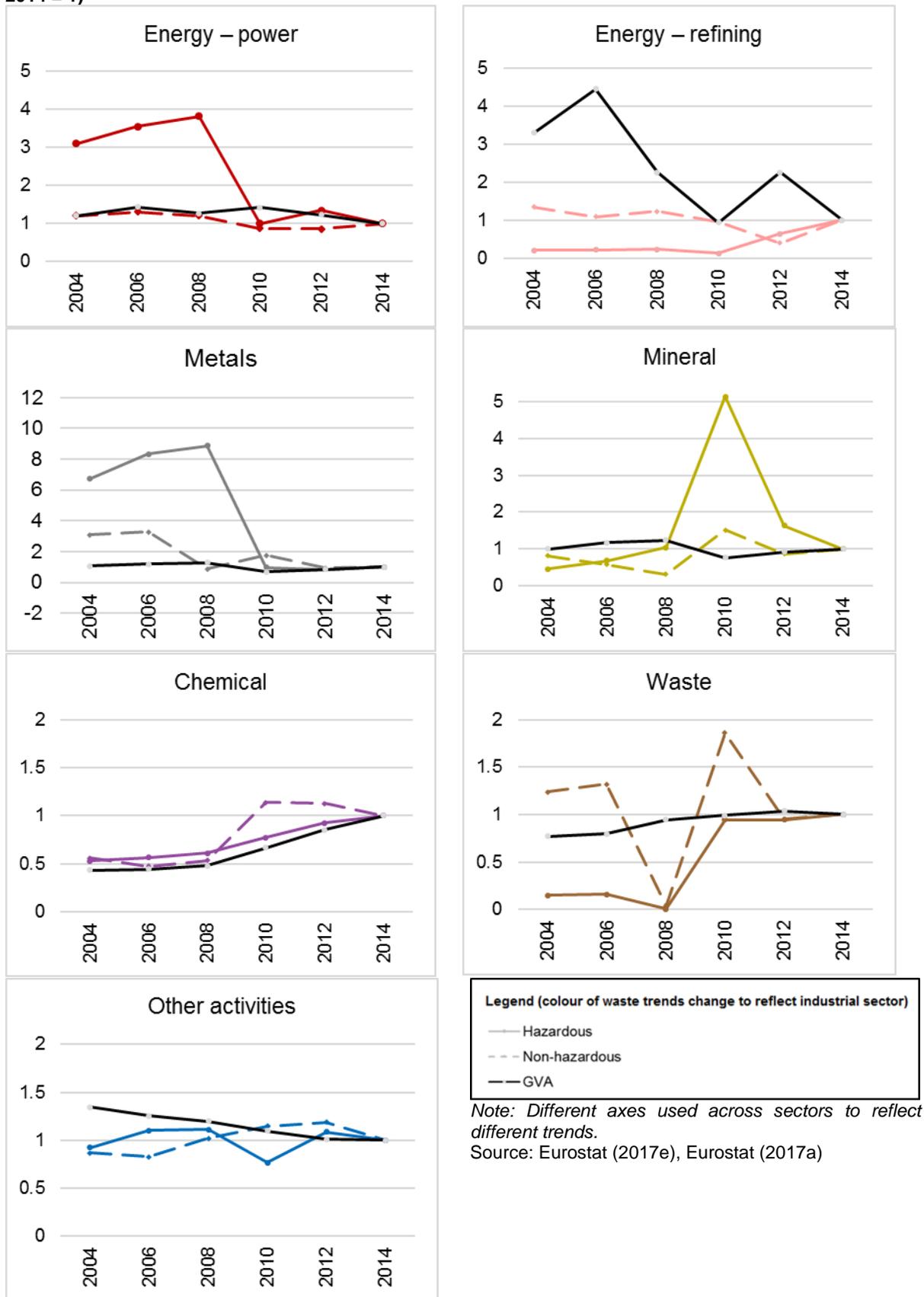
Note: Rest of national total relates to all NACE activity minus the industrial sectors shown here.

Source: Eurostat (2017e)

Hazardous waste generated has increased between 2004 and 2014 in the majority of industrial sectors, except in the case of the metals and energy-power industrial sectors, where it drastically decreased from 2008 to 2010 (Figure 28). In both industrial sectors GVA slightly decreased over time. In the waste management industrial sector hazardous waste generation also slightly decreased with some fluctuations. A spike in waste generated was reported in 2010 for the mineral sector, but volumes subsequently fell to similar volumes as previous reporting years. It is not clear what caused this spike. The GVA has decreased in most sectors over time. Only in the waste management and chemicals industrial sectors has it increased in line with waste generation.

Non-hazardous waste generation has decreased or remained stable between 2004 and 2014 in nearly all industrial sectors, except in the case of the chemical industrial sector, where it slightly increased (Figure 28). Non-hazardous waste generation in nearly all industrial sectors follows the same trend as the GVA.

Figure 28: Hazardous and non-hazardous waste generation by industrial sector relative to GVA (indexed; 2014 = 1)



Limitations

The use of NACE classifications for reporting has generally led to overreporting for waste generation data against each industrial sector compared to a scope strictly limited to IED. 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 11: Data gaps in waste generation data for Denmark

Missing data	Description	Conclusion and actions taken
Changes in IED activity between years	No IED installations are permitted for textiles before 2015.	The preferred option is to exclude data for textiles to avoid overreporting in the years between 2000 and 2014. However, the subsectors of textiles and tanning [of leather products] are reported together as one subtotal; so although no IED installations are permitted for tanning, the waste generation cannot be excluded for this activity.

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 analysis².

As shown in section 3, key industries in Denmark in terms of the reported number of IED installations are intensive rearing of poultry or pigs (70% of total in 2015), followed by non-hazardous waste management (13%). The sectors identified as making the largest contribution to the Danish economy as measured by GVA are chemicals (chemicals and pharmaceutical products, 50% of total industrial sector GVA), energy – power (15%) and food and drink production within the ‘other activities’ industrial sector (13%).

Based on the presentation of emissions data included in this profile, the industrial sectors identified in section 4 as contributing the largest burden to the environment for industrial emissions to air were: the energy-power sector for most pollutants, ‘other activities’ mainly for NMVOC and NH₃ emissions, iron and steel production for most of the heavy metals and energy-refining for several pollutants. The chemicals industry was identified as the more significant industry for emissions to water according to reported E-PRTR data (although there are major data gaps and this is based on data for 2 facilities out of a total of 40 IED chemical installations), this reflects that the majority of Danish industrial waste water is treated in municipal water treatment plants and hence not included in this study. The waste management industrial sector mainly contributes to hazardous and non-hazardous waste generation.

Note that intensive rearing of poultry and pigs is also expected to be an important sector as regards environmental pollution; however, no data could be evaluated for this sector for emissions to water since there is no reported discharge of waste water from these installations; reported NH₃ emissions to air data from manure management is assumed to align with intensive rearing of poultry or pigs.

No significant challenges/pressures related to the IED sector were identified in Denmark or reported by the Competent Authorities. According to the responsible institutions in Denmark, greater environmental pressures are related to non-industrial activities, and for PM such as traffic and wood-stoves in private homes.

² The challenges and pressures included here do not concern the implementation of the IED.

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Appendices

Appendix 1 Mapping industrial sectors across data sources for Denmark

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

Appendix 1: Mapping industrial sectors across data sources for Denmark

Industrial sector	GVA Eurostat (2017a)	Employment Eurostat (2017b)	Energy consumption Eurostat (2017c)	Water consumption Danmarks Statistik's Statistikbanken (2018)	Emissions to air EEA (2016c)	Emissions to water EEA (2017)	Waste generated Eurostat (2017e)
	NACE Rev 2	NACE Rev 2	Energy balance indicator	National reporting codes	NFR14 sector classification	E-PRTR	NACE Rev 2
Time series available	2000-2015, annually	2008-2015, annually	2000-2015, annually	2010 – 2016, annually	2000-2014, 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	V350010 Production and distribution of electricity	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	C19 (coke and refined petroleum products)	C19 (coke and refined petroleum products)	B_101307 - Petroleum Refineries; B_101320 - Non-specified (Energy)	V190000 Oil refinery etc.	1A1b Petroleum refining; 1A1c Solid fuels and other energy industries	Refining (1a)	C19 (coke and refined petroleum products)
Metals: iron and steel	C24 (basic metals)	C24 (basic metals)	B_101805 - Iron and Steel	V240000 Manufacture of 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	No estimate	2C2-7 Non-ferrous metals	Non-ferrous metal production (2e)	
Minerals, in aggregate (cement, lime and magnesium oxide, glass and other)	C23 (non-metallic mineral products)	C23 (non-metallic mineral products)	B_101820 - Non-Metallic Minerals	V230020 Manufacture of concrete and bricks; V230010 Manufacture of glass and ceramic products;	2A1 Cement; 2A2 Lime; 2A3 Glass; 2A6 Other	Cement, lime and magnesium oxide (3c); Glass (3e); Other (3f-g)	C23 (non-metallic mineral products)
Chemical	C20 (chemicals); C21 (pharmaceutical products)	C20 (chemicals); C21 (pharmaceutical products)	B_101815 - Chemical and Petrochemical	V200010 Manufacture of basic chemicals; V200020 Manufacture of paints and soap etc.; V210000 Pharmaceuticals	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	V383900 Waste management and materials recovery	5C1bi Industrial waste incineration 5C1biv Sewage sludge incineration 5C1bii Hazardous waste incineration 5C1bvi 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		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	V100010 Production of meat and meat products; V100020 Processing and preserving of fish; V100030 Manufacture of dairy products; V110000 Manufacture of beverages	2H Food and beverages industry	Food and drink (8a-c)	C10-C12 (food products; drink products; tobacco)
Textiles, tanning							
Paper and board, pulp,	C13-C15 (textiles; wearing apparel; leather)	C13-C15 (textiles; wearing apparel; leather)	B_101835 - Textile and Leather	V130000 Manufacture of textiles; V150000 Manufacture of leather and footwear	Not available	Pre-treatment or dyeing of textile fibres or textiles (9a); Tanning of hides and skins (9b)	C13-C15 (textiles; wearing apparel; leather)
Intensive rearing of pigs and poultry	C16 (wood products)	C16 (wood products);	B_101851 - Wood and Wood Products	V160000 Manufacture of wood and wood products	2I Wood processing		C16 (wood products)
Surface treatment	C17 (paper and paper products)	C17 (paper and paper products)	B_101840 - Paper, Pulp and Print	V170000 Manufacture of paper and paper products; V180000 Printing etc.	2H1 Pulp and paper industry	Pulp, paper and wood production (6a-c)	C17-C18 (paper and paper products; printing)
	Insufficient granularity in reported data	Insufficient granularity in reported data	No indicators	No estimates	3B4gi Manure management - Laying hens; 3B4gii Manure management - Broilers	Intensive rearing of poultry and pigs (7a)	Insufficient granularity in reported data

Industrial sector	GVA Eurostat (2017a)	Employment Eurostat (2017b)	Energy consumption Eurostat (2017c)	Water consumption Danmarks Statistik's Statistikbanken (2018)	Emissions to air EEA (2016c)	Emissions to water EEA (2017)	Waste generated Eurostat (2017e)
	NACE Rev 2	NACE Rev 2	Energy balance indicator	National reporting codes	NFR14 sector classification	E-PRTR	NACE Rev 2
<i>Time series available</i>	<i>2000-2015, annually</i>	<i>2008-2015, annually</i>	<i>2000-2015, annually</i>	<i>2010 – 2016, annually</i>	<i>2000-2014, annually</i>	<i>2007-2015, annually</i>	<i>2004-2014, every 2 years</i>
	Insufficient granularity in reported data	Insufficient granularity in reported data	No indicators	No estimates	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	<i>All NACE activities</i>	<i>All NACE activities</i>	<i>B_100900 – Gross inland consumption</i>	National total for the entire territory (based on fuel sold)	<i>National total for all E-PRTR activities reported</i>	<i>All NACE activities plus households</i>	All NACE activities

Notes:

† Number of IED installations is reported against IED activities for years 2011, 2013 and 2015,

‡ Additional Energy Balance indicators are applicable to the industrial sector categories but not included here as no data reported for Denmark (excluded indicators are: 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_101315 - Blast Furnaces)

Appendix 1: Emissions to air by pollutant and industrial sector (detail)

Notes: Emissions rounded to two decimal places except in cases, where more decimal places were necessary to show the real value.

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	18.11	17.02	15.56	23.13	16.35	13.44	16.66	14.33	10.20	7.36	6.47	5.68	4.77	5.25	4.52	4.78
NO _x	kt	56.66	56.34	56.84	66.90	55.22	49.31	53.41	43.11	32.70	26.22	23.69	20.95	17.82	17.14	14.40	13.74
PM _{2.5}	kt	0.94	1.00	0.95	1.01	0.81	0.65	0.77	0.79	0.70	0.62	0.58	0.56	0.51	0.68	0.52	0.41
NM VOC	kt	3.94	4.07	3.86	3.65	3.46	2.93	2.83	2.36	2.42	2.14	2.62	2.23	1.63	1.48	1.12	0.97
NH ₃	kt	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.04	0.05	0.05	0.06
Cd (HM)	t	0.19	0.21	0.20	0.18	0.16	0.11	0.07	0.08	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.05
As (HM)	t	0.64	0.55	0.51	0.55	0.40	0.30	0.28	0.29	0.24	0.15	0.15	0.17	0.14	0.21	0.17	0.15
Cr (HM)	t	0.54	0.50	0.48	0.48	0.45	0.37	0.37	0.45	0.33	0.26	0.25	0.26	0.22	0.27	0.22	0.20
Cu (HM)	t	0.71	0.74	0.69	0.66	0.61	0.44	0.35	0.38	0.29	0.24	0.25	0.33	0.22	0.27	0.23	0.21
Pb (HM)	t	3.57	3.50	3.12	2.95	2.83	2.34	1.10	1.15	0.83	0.70	0.66	0.80	0.67	0.72	0.74	0.69
Hg (HM)	t	0.75	0.66	0.66	0.67	0.52	0.50	0.44	0.41	0.41	0.30	0.27	0.27	0.19	0.23	0.23	0.19
Ni (HM)	t	5.05	4.59	5.48	5.44	4.67	4.78	5.07	3.43	2.85	2.40	2.33	1.86	1.59	1.54	1.34	1.23
Zn (HM)	t	4.88	4.80	4.39	3.74	3.22	3.00	2.35	2.12	1.68	1.40	1.41	1.56	1.25	1.38	1.29	1.20
PCDD+PCDF	g	10.51	10.19	6.76	9.27	3.38	1.75	1.23	1.05	1.27	0.96	1.22	1.11	1.32	1.19	1.51	1.06

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy - refining																	
SO _x	kt	0.59	0.61	0.93	0.49	0.42	0.28	0.24	0.44	0.33	0.27	0.24	0.33	0.27	0.30	0.18	0.24
NO _x	kt	7.90	8.07	8.37	8.36	8.50	8.29	8.68	8.57	8.64	8.41	8.31	7.39	7.00	6.07	5.74	6.12
PM _{2.5}	kt	0.13	0.13	0.13	0.12	0.12	0.10	0.10	0.11	0.10	0.10	0.09	0.09	0.10	0.10	0.09	0.10
NMVOG	kt	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06
Cd (HM)	t	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
As (HM)	t	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Cr (HM)	t	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Cu (HM)	t	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
Pb (HM)	t	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07
Hg (HM)	t	0.02	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Ni (HM)	t	0.50	0.54	0.51	0.35	0.41	0.27	0.25	0.32	0.34	0.28	0.18	0.20	0.31	0.26	0.16	0.25
Zn (HM)	t	0.15	0.16	0.16	0.12	0.13	0.09	0.09	0.11	0.11	0.10	0.07	0.07	0.10	0.09	0.06	0.09
PCDD+PCDF	g	0.0022	0.0023	0.0022	0.0019	0.0020	0.0017	0.0017	0.0018	0.0019	0.0017	0.0014	0.0014	0.0017	0.0016	0.0013	0.0016
Metals: iron and steel																	
SO _x	kt	0.08	0.09	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-
NO _x	kt	0.03	0.04	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
PM _{2.5}	kt	0.03	0.03	-	0.0033	0.0035	0.01	0.0041	0.0046	0.0044	0.0021	0.0036	0.0039	0.0030	0.0036	0.0037	0.0040
NH ₃	kt	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01
Cd (HM)	t	0.04	0.04	0.03	0.03	0.04	0.04	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
As (HM)	t	0.18	0.18	0.12	0.12	0.13	0.14	0.10	0.09	0.09	0.06	0.10	0.11	0.10	0.10	0.12	0.11
Cr (HM)	t	0.01	0.01	-	-	-	0.0050	-	-	-	-	-	-	-	-	-	-
Cu (HM)	t	1.45	1.50	0.79	0.80	0.86	1.04	0.66	0.60	0.60	0.39	0.62	0.70	0.65	0.66	0.81	0.70
Pb (HM)	t	0.06	0.04	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-
Hg (HM)	t	0.39	0.42	0.14	0.15	0.16	0.24	0.12	0.11	0.11	0.07	0.12	0.13	0.12	0.12	0.15	0.13
Ni (HM)	t	3.62	3.11	0.55	0.56	0.60	1.44	0.46	0.42	0.42	0.27	0.43	0.49	0.45	0.46	0.56	0.48
Zn (HM)	t	0.52	0.52	-	-	-	0.75	-	-	-	-	-	-	-	-	-	-
PCDD+PCDF	g	0.08	0.09	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Metals: Non-ferrous																	
PM _{2.5}	kt	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cd (HM)	t	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
As (HM)	t	0.003	0.005	0.002	0.001	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.004	0.002	0.003	0.003	0.003
Cu (HM)	t	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Pb (HM)	t	0.41	0.64	0.36	0.21	0.40	0.47	0.39	0.47	0.43	0.51	0.45	0.58	0.35	0.40	0.44	0.44
Hg (HM)	kg	0.37	0.63	0.31	0.15	0.36	0.44	0.35	0.43	0.39	0.48	0.42	0.56	0.31	0.37	0.41	0.41
Zn (HM)	t	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
PCDD/F	g	1.29	1.33	1.29	1.10	0.87	1.02	1.30	1.45	1.49	0.14	0.19	0.23	0.23	0.19	0.20	0.25
Mineral: Cement, lime and magnesium oxide																	
PM _{2.5}	kt	0.0028	0.0029	0.0037	0.0026	0.0023	0.0021	0.0024	0.0023	0.0022	0.0014	0.0015	0.0018	0.0021	0.0020	0.0022	0.0019
PCDD+PCDF	g	0.0017	0.0017	0.0022	0.0016	0.0014	0.0013	0.0014	0.0014	0.0013	0.0008	0.0009	0.0011	0.0012	0.0012	0.0013	0.0011
Mineral: Glass																	
PM _{2.5}	kt	0.11	0.12	0.11	0.10	0.10	0.07	0.07	0.04	0.04	0.03	0.02	0.04	0.04	0.03	0.03	0.04
NMVOG	kt	0.05	0.05	0.05	0.05	0.06	0.05	0.06	0.06	0.05	0.05	0.03	0.04	0.04	0.04	0.04	0.04
NH ₃	kt	0.23	0.19	0.13	0.13	0.12	0.12	0.12	0.11	0.16	0.15	0.11	0.11	0.14	0.12	0.13	0.15
Cd (HM)	t	0.02	0.02	0.02	0.02	0.02	0.02	0.0018	0.0021	0.0023	0.0015	0.0017	0.0019	0.0021	0.0016	0.0016	0.0016
As (HM)	t	0.05	0.06	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.0044	0.01	0.01	0.01	0.0046	0.0047	0.0045
Cr (HM)	t	0.07	0.07	0.07	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Pb (HM)	t	0.33	0.17	0.22	0.27	0.44	0.15	0.01	0.02	0.02	0.02	0.02	0.03	0.12	0.02	0.01	0.05
Ni (HM)	t	0.04	0.05	0.04	0.04	0.04	0.04	0.0042	0.0050	0.01	0.0037	0.0042	0.0045	0.01	0.0038	0.0039	0.0037
Zn (HM)	t	0.06	0.03	0.04	0.04	0.04	0.04	0.0040	0.0048	0.01	0.0035	0.0040	0.0043	0.0048	0.0037	0.0037	0.0036
Mineral: Other																	
SO _x	kt	3.02	2.31	2.34	2.14	2.68	2.96	3.76	3.98	2.60	1.34	1.43	1.13	1.20	1.18	0.63	1.11
PM _{2.5}	kt	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.08	0.05	0.05	0.05	0.04	0.04	0.04	0.05
NMVOG	kt	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
NH ₃	kt	0.29	0.25	0.27	0.23	0.38	0.29	0.29	0.36	0.20	0.19	0.20	0.20	0.20	0.18	0.19	0.24
PCDD+PCDF	g	0.09	0.08	0.08	0.07	0.08	0.08	0.09	0.10	0.08	0.06	0.06	0.06	0.05	0.05	0.05	0.05

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Chemical																	
SO _x	kt	0.63	0.66	0.65	0.53	0.55	0.62	0.38	0.10	0.11	0.11	0.12	0.19	0.23	0.17	0.14	0.16
NO _x	kt	0.45	0.43	0.43	0.48	0.31	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
PM _{2.5}	kt	0.38	0.36	0.32	0.33	0.20	0.02	0.01	0.02	0.02	0.01	0.02	0.01	0.0045	0.01	0.01	0.0040
NMVOG	kt	0.07	0.05	0.05	0.04	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
NH ₃	kt	0.03	0.10	0.09	0.11	0.10	0.08	0.09	0.11	0.11	0.17	0.12	0.02	0.02	0.02	0.02	0.02
Hg (HM)	t	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048	0.01	0.0005	0.0015	0.0014	0.01	0.0010	0.0010	0.0010
Waste: hazardous																	
<i>None reported</i>																	
Waste: non-hazardous																	
SO _x	kt	0.01	0.01	0.01	0.01	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	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
PM _{2.5}	kt	0.0019	0.0019	0.0019	0.0019	0.0020	0.0023	0.0027	0.0030	0.0030	0.0031	0.0032	0.0016	0.0016	0.0015	0.0015	0.0015
NMVOG	kt	0.0014	0.0014	0.0015	0.0015	0.0017	0.0021	0.0028	0.0031	0.0032	0.0032	0.0034	0.0030	0.0030	0.0028	0.0029	0.0028
NH ₃	kt	0.54	0.51	0.59	0.61	0.49	0.53	0.56	0.63	0.58	0.63	0.60	0.58	0.58	0.60	0.73	0.73
Cd (HM)	t	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.000	0.000	0.000	0.000
As (HM)	t	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0008	0.0008	0.0008	0.0009	0.0009	0.0003	0.0003	0.0002	0.0002	0.0002
Cr (HM)	t	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007	0.0007	0.0007	0.0001	0.0001	0.0001	0.0001	0.0001
Cu (HM)	t	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0006	0.0006	0.000	0.000	0.000	0.000	0.000
Pb (HM)	t	0.0013	0.0013	0.0014	0.0013	0.0014	0.0014	0.0014	0.0015	0.0015	0.0015	0.0015	0.0002	0.0002	0.0002	0.0002	0.0002
Hg (HM)	t	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.0005	0.0005	0.0005	0.0005	0.0005
Ni (HM)	t	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0001	0.0001	0.0001	0.0001	0.0001
Zn (HM)	t	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.0003	0.0003	0.0003	0.0003	0.0003
PCDD+PCDF	g	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01

Pollutant	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Other activities																	
SO _x	kt	0.06	0.05	0.06	0.08	0.07	0.06	0.07	0.05	0.04	0.05	0.04	0.03	0.05	0.06	0.05	0.07
NO _x	kt	0.24	0.23	0.25	0.26	0.25	0.21	0.21	0.17	0.14	0.14	0.13	0.11	0.13	0.13	0.12	0.13
PM _{2.5}	kt	0.51	0.46	0.49	0.53	0.55	0.48	0.49	0.47	0.46	0.48	0.47	0.44	0.44	0.45	0.43	0.47
NMVOC	kt	55.07	50.77	50.48	46.61	46.41	45.87	44.84	41.69	41.26	41.31	41.30	40.42	39.91	42.41	37.58	39.45
NH ₃	kt	29.11	30.08	30.78	29.96	30.93	29.13	26.36	23.95	22.65	21.24	21.02	20.76	19.37	18.04	18.14	17.80
Cd (HM)	t	0.0039	0.0031	0.0039	0.0049	0.01	0.0032	0.0037	0.0036	0.0034	0.0041	0.0040	0.0035	0.0030	0.0034	0.0029	0.0046
As (HM)	t	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cr (HM)	t	0.08	0.06	0.08	0.10	0.14	0.06	0.07	0.07	0.07	0.09	0.09	0.08	0.06	0.07	0.06	0.09
Cu (HM)	t	2.16	1.71	2.11	2.69	3.84	1.64	1.88	1.99	1.94	2.39	2.41	2.11	1.55	1.87	1.61	2.58
Pb (HM)	t	3.30	2.61	3.24	4.13	5.84	2.53	2.90	0.06	0.05	0.06	0.04	0.04	0.07	0.07	0.06	0.09
Hg (HM)	t	0.0012	0.0010	0.0014	0.0014	0.0011	0.0010	0.0013	0.0008	0.0007	0.0008	0.0006	0.0005	0.0010	0.0010	0.0008	0.0012
Ni (HM)	t	0.15	0.12	0.14	0.18	0.26	0.11	0.13	0.14	0.13	0.16	0.16	0.14	0.11	0.13	0.11	0.18
Zn (HM)	t	1.31	1.03	1.28	1.63	2.30	1.00	1.15	1.20	1.17	1.44	1.44	1.26	0.95	1.13	0.97	1.55
PCDD+PCDF	g	0.14	0.12	0.17	0.21	0.17	0.16	0.21	0.13	0.11	0.12	0.08	0.07	0.15	0.15	0.12	0.19



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