

## SOLVENT VOC EMISSION INVENTORIES 2025 (data 2024)

ESIG has finalised its 2025 volatile organic compounds (VOC) emission inventories for substances used as solvents with 2024 data. The ESIG emission inventories were carry out with technical and methodological support from TNO.

The data show a decoupling of VOC emissions from sales: a structural shift toward low-EF segments has markedly reduced emissions intensity, so that in 2024—despite stable or rising sales—VOC emissions again reached their lowest level on record.

### General trend and comparison (amounts in kilotons)

year	ESIG VOC emissions	ESIG VOC emissions with ethanol	EMEP inventories*	EMEP vs ESIG difference
2008	2159	NA	3369	36%
2009	1917	NA	3029	37%
2013	1775	2323	2754	16%
2015	1842	2366	2689	14%
2016	1628	2002	2593	30%
2017	1613	1980	2635	33%
2018	1813	2145	2614	22%
2019	1765	2120	2584	22%
2020	1538	2263	2747	21%
2021	1663	2207	2616	19%
2022	1470	1816	2499	38%
2023	1350	1741	2421	39%
2024	1256	1624		

\* based on reporting in 2025; source TNO (2025), ESIG VOC Inventory 2025, Report R12898

ESIG based VOC emissions from applications using substances as solvents have shown a clearly declining trend since the mid2010s. Compared with 2015, emissions without ethanol fell from 1,842 kt to 1,256 kt in 2024 (-31.8%); with ethanol, they fell from 2,366 kt to 1,624 kt (-31.4%). Thus, 2024—after 2022 and 2023—again marks the lowest year in the entire time series. Compared with 2015, emissions without ethanol fell from 1,842 kt to 1,256 kt in 2024 (-31.8%); with ethanol, they fell from 2,366 kt to 1,624 kt (-31.4%). Thus, 2024—after 2022 and 2023—again marks the lowest year in the entire time series.

The development is essentially driven by two mechanisms:

(1) COVID-19 special effect (2020/21)

While ESIG emissions excluding ethanol declined during this period, the sharply increased ethanol consumption for hand sanitizers led to significantly higher total emissions (2020: 2,263 kt; 2021: 2,207 kt). From 2022 onward, levels normalized (total 1,816 kt), followed by a further decrease to 1,741 kt in 2023 and another -7% in 2024 (total 1,624 kt).

(2) Structural market shifts across end-uses segments.

Markets continue to move away from high-emitting applications involving substances used as solvents (e.g., Coatings—Industrial and Professional/Consumer, and Agrochemicals) toward low-EF segments such as Polymers Processing, Functional Solvents, or Use as Fuel/Combustion. These categories have much lower emissions per tonne. As a result, overall sales can edge up in some years without increasing emissions—as in 2024, when, despite a modest +1% rise in solvent uses sales, emissions still declined. The high-EF, VOC-relevant segments have shown markedly falling sales for years and therefore contribute disproportionately to the reduction in total emissions. This explains why 2024, despite higher overall sales, again achieves the lowest emission level in the time series.

The temporary uptick in 2018 points to possible under-reporting in earlier years.

Compared with EMEP, officially reported VOC emissions are consistently higher than ESIG values. The gap typically amounts to around 20% (2015: 14%) but rises to 30–33% in 2016/2017 and reaches 38–39% in 2022/2023. According to TNO, this is mainly due to scope differences (EMEP includes additional VOC sources), methodological variation in national inventories, possible coverage limits of ESIG data, and uncertainties in intra-EU trade allocation. For 2024, a comparison with EMEP is not yet possible, as the corresponding official country submissions will only be available in 2026.

## ESIG VOC Emissions Numbers 2024 per country

<i>Summary of results for aggregated country groups applied by ESIG 2024</i>				
Countries	TOTAL EMISSIONS BY COUNTRY OF PRODUCTION Hydrocarbon + Oxygenated substances used in solvent applications (kiloton/country)	IMPORT/EXPORT Corrections	Ethanol emissions	Emissions NMVOC in kiloton/country
Austria	24,47	6,74	6,50	37,70
Belgium + Luxembourg	83,43	-62,38	8,86	29,91
Bulgaria + Romania	4,65	36,47	18,11	59,23
Croatia	2,67	19,05	2,74	24,46
Cyprus + Greece + Malta	7,84	13,55	8,47	29,86
Czech Republic	16,82	29,83	7,74	54,39
Denmark	20,27	-2,75	4,23	21,75
Estonia + Latvia + Lithuania	5,95	19,61	4,36	29,92
Finland	10,91	7,98	3,98	22,87
France	114,66	15,83	48,60	179,09
Germany	369,20	-239,85	59,23	188,58
Hungary	7,13	14,10	6,80	28,03
Ireland	12,57	-1,21	3,80	15,15
Italy	160,93	38,74	41,86	241,53
Netherlands	148,27	-91,13	12,74	69,88
Poland	40,92	45,51	25,99	112,43
Portugal	7,60	28,64	7,55	43,79
Slovakia	1,64	21,81	3,85	27,30
Slovenia	9,98	-1,11	1,51	10,38
Spain	94,69	56,49	34,51	185,69
Sweden	29,27	7,57	7,49	44,32
United Kingdom	81,86	36,51	49,28	167,65
<b>Total EU-27+UK</b>	<b>1 255,72</b>	<b>0,00</b>	<b>368,18</b>	<b>1 623,90</b>

*Based on TNO (2025), internal dataset provided for the ESIG VOC Inventory project 2025 (Report R12898)*

Import and export data for 2016 and 2017 were based on adjusted 2015 figures from J. Pearson. From 2018 onwards, estimates were adjusted annually for changes in VOC emissions. In 2021, estimates were revised for consistency across all years, affecting country-level data but not EU28 totals. Trade within the EU was analysed using import/export shares from 2013 and 2015. Adjustments ensured that each country's per-capita solvent-use remained within twice the EU average. From 2018 onwards, import/export estimates were based on extrapolated 2013 data, with annual adjustments to account for fluctuations in solvent-use sales. Caps on year-to-year percentage changes were applied to manage these variations, differing by year to reflect changes in solvent-use patterns across the EU27+UK.

National VOC emissions from solvent-use are primarily driven by the sectoral composition and intra-EU trade flows rather than by the volume of solvent-use substance production in a given country.

**Sector mix.** At EU level, Coatings – Industrial is the dominant contributor to solvent use-related VOC emissions (excluding ethanol). Additional relevant contributions arise from Other consumer uses, Blowing Agents, Polymers Processing, and Coatings – Professional/Consumer. Countries with a high share of these high-emitting applications (e.g., Coatings, Agrochemicals) naturally exhibit disproportionately higher emissions. Conversely, an increasing share of low-EF segments—such as Polymers Processing, Functional Solvents, or Use as Fuel/Combustion—leads to lower or declining emissions, even where sales volumes rise.

**Intra-EU trade correction.** The intra-EU trade adjustment allocates emissions to the country of use, not the country of production. As a result, large production hubs appear as net exporters of emissions, while high-consumption countries emerge as net importers with higher end-emissions. The ethanol component, modelled separately, influences national totals but does not alter the fundamental importance of the sector mix.

## Country differences

At the upper end of end-emissions are Italy, Germany, Spain, France, and the United Kingdom. The 2024 vs. 2023 trend in these countries shows broadly declining emissions—in some cases markedly (e.g., France, United Kingdom); Germany shows a slight decrease, and Spain and Italy also exhibit lower values. At the lower end of the distribution are countries such as Slovenia, Slovakia, Portugal, Ireland, and Denmark. Here, developments are heterogeneous: some countries record increases (e.g., Denmark, Slovakia), while others show declines (e.g., Portugal).

National differences therefore arise from a combination of

- (i) the share of high- vs. low-emitting applications,
- (ii) the consumption profile, and
- (iii) the direction of intra-EU trade flows.

Consequently, emission trends diverge between countries even though the ESIG inventory applies a uniform methodological framework across the EU-27 and the UK.

## ESIG VOC Inventories for the EU – a top-down approach<sup>1</sup>

<sup>1</sup> For more information on the method used, former technical papers can be consulted: [https://www.esig.org/wp-content/uploads/2018/03/201802\\_ESVOC\\_techncial-paper-solvent-VOC-emissions-2015\\_final-1.pdf](https://www.esig.org/wp-content/uploads/2018/03/201802_ESVOC_techncial-paper-solvent-VOC-emissions-2015_final-1.pdf)

The ESIG VOC inventory methodology involves several key steps to ensure accurate and comprehensive data collection and analysis of substance emissions of solvent use across Europe. The process includes collecting sales data for substances placed on the market and used as solvents, applying emission factors, and making necessary import/export corrections. Here is a detailed breakdown of each step:

#### Data Collection:

- **Sales data for substances used as solvents:** Sales data for substances placed on the market and used as solvents, representing the majority of Europe's production of substances used as solvents, is collected from ESIG member companies. This data is categorized by country and REACH end-use sector. The sales data cover around 90% of all oxygenated and hydrocarbon substances used as solvents and classified as VOCs in the European Union, which is why the dataset is treated as highly confidential. Cefic collates and analyses these data carefully and confidentially.
- **Intermediary Sales:** When substances used as solvents are sold to intermediaries, such as distributors or resellers, their final use becomes uncertain. These intermediary sales are proportionally distributed across REACH end-use sectors, including an additional 'other' category to account for unspecified uses.

#### Assumptions and Estimations:

- **Annual Usage Assumption:** The inventory assumes that sales of substances used as solvents correspond to annual usage, meaning there is no change in stock levels. This assumption simplifies the calculation by disregarding any net imports or exports for the EU27+UK as a whole.
- **Destination Estimation:** Given the mobility within the European market, substances which can be used as solvents sold in one Member State may be used in another. Due to the lack of comprehensive EU-wide tracking data, the final use of substances applied as solvents must be estimated. Import and export proportions from 2013 and 2015 are extrapolated to subsequent years to refine these estimations.

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<https://www.esig.org/wp-content/uploads/2019/03/Atmospheric-Environment-John-VOC-article-201903.pdf>

## Ethanol Usage:

- **Inclusion of Ethanol:** Ethanol has been included in the inventory since 2016, with data extended back to 2013 to maintain consistency over the reporting period. Estimated ethanol usage as a solvent is based on data from the European Renewable Ethanol (ePure).
- **Revised Distribution:** The distribution of ethanol use over individual Member States has been revised. The old distribution was based on a Eurostat indicator for the use of personal care products, where some countries were missing and therefore received no emissions related to ethanol. Given the COVID-19 pandemic, ethanol has become a significantly more important source of emissions, and the products are used by the general population. Therefore, a distribution proportional to the total population in each year has been assumed in the new inventory.

## Emission Factors:

- **Application of Emission Factors:** A consistent set of emission factors is applied to estimate the percentage of VOCs emitted into the air. These factors depend on two parameters: the final end-use of the substances applied as solvents, and the type of substances used as solvents. Emission factors are based on realistic data and assumptions from environmental safety assessments.
- **VOC Classification:** Not all substances used as solvents are classified as VOCs, and not all substances classified as VOCs are used as solvents. Their respective properties, such as boiling point range and molecular weight, determine whether they are classified as VOCs. For example, a C6 hydrocarbon (hexane) which can be used as a solvent is classified as a VOC, whereas a heavier C14–C19 hydrocarbon, which can also be used as a solvent, is not.

## Import/Export Corrections:

- **Estimation of Import/Export Data:** Due to the free flow of goods in the EU, there is no direct data on the import and export of substances which can be used as solvents within the EU Member States. Cefic uses Eurostat data to calculate net chemical transfer for each Member State by assuming that the percentage of chemical transfer is directly proportional to the percentage of movements of substances that can be used as solvents, an estimate of solvent-related import and export linked to downstream activities is generated for each country.
- **Adjustments for Smaller Countries:** For the 2021 ESIG emissions, the import and export assumptions have been reassessed, with adjustments made especially for smaller countries to ensure accurate estimates.

## Confidentiality and Grouping:

- **Data Grouping:** Solvent-use sales data by Member State is grouped to comply with competition laws. Since 2020, the following country groupings have been used: Belgium and Luxembourg, Bulgaria and Romania, Cyprus, Greece and Malta, and Estonia, Latvia and Lithuania. This grouping helps maintain confidentiality and comply with statistical rules.

## Per capita emissions (kg/person) derived for the year 2015 for all sectors and for NFR category 2D3a only

Per capita all sectors	All sectors				
	2015 - 2017	2018 - 2020	2021 - 2023	2015 - 2024	Change 2024 vs 2013
AT	5,73	6,24	5,13	5,54	-31%
BE	3,74	3,37	3,05	3,29	-52%
BG	2,47	2,33	2,11	2,30	-26%
HR	5,73	6,05	5,54	5,83	485%
CY	2,74	2,75	2,40	2,58	-32%
CZ	4,94	4,94	4,74	4,89	-4%
DK	3,68	3,70	3,71	3,69	-17%
EE	5,08	5,42	4,67	4,97	-12%
FI	5,08	5,21	4,35	4,80	-14%
FR	3,53	3,80	3,43	3,49	-42%
DE	3,68	3,18	2,63	3,07	-44%
GR	2,95	3,18	3,13	3,03	-20%
HU	3,09	3,58	3,41	3,32	-13%
IE	3,50	3,30	3,17	3,27	-44%
IT	5,87	5,95	4,90	5,43	-36%
LV	5,08	5,51	6,21	5,56	11%
LT	5,08	5,62	5,03	5,21	5%
LU	3,74	3,61	3,13	3,38	-53%
MT	2,65	2,94	2,38	2,59	-37%
NL	5,16	5,68	4,83	5,09	-16%
PL	3,51	3,71	3,58	3,55	-27%
PT	5,32	5,35	5,18	5,17	-27%
RO	2,47	2,87	2,54	2,60	-21%
SK	4,94	5,57	5,53	5,32	-4%
SI	5,73	6,49	5,95	5,94	-18%
ES	5,32	5,46	4,66	5,01	-32%
SE	4,48	4,81	4,49	4,55	-41%
UK	3,39	3,61	3,14	3,28	-30%
<b>average</b>	<b>4,16</b>	<b>4,24</b>	<b>3,73</b>	<b>3,95</b>	<b>-32%</b>

Based on TNO (2025), internal dataset provided for the ESIG VOC Inventory project 2025 (Report R12898)

Per capita VOC emissions from substances that can be used as solvents have declined markedly since the mid-2010s; compared with 2015, the 2024 level is roughly one-third lower. The pandemic-related peak in 2020/2021 (driven by ethanol use in hand sanitizers) gives way to a renewed downward trend from 2022 onwards, making 2024 the lowest value in the entire time series.

In the 2024 country comparison, the highest per-capita values are observed in Croatia, Latvia, Slovakia, the Czech Republic, and Lithuania. At the lower end of the distribution are Malta, Cyprus, Germany, Romania, and Luxembourg, closely followed by Belgium and the United Kingdom.

Across 2015→2024, many countries show substantial reductions (including Belgium, Germany, Luxembourg, Ireland, France, Italy, Spain, and Austria), while others record moderate declines (such as the Netherlands, Denmark, Finland, Greece, Hungary, Poland, Romania, Slovenia, and Sweden).

### Demographic context.

- Moderate EU-wide population growth: The overall population of the EU-27 + UK increases modestly over the period.
- Heterogeneous dynamics: Some countries grow steadily, while others experience population decline.
- Strong population growth: Malta, Luxembourg, Ireland, Sweden, the United Kingdom, Austria, Cyprus, as well as the Netherlands, Belgium, Denmark, and the Czech Republic.
- Moderate growth among large Member States: France, Germany, Spain.
- Declining populations: Bulgaria, Croatia, Latvia, Greece, Romania, Poland, Italy, Hungary.
- Slovakia: Largely stable, with slight decline in recent years.

2D3a only					
	2015 - 2017	2018 - 2020	2021 - 2023	2015 - 2024	change 2024 vs 2013
AT	1,29	1,95	1,45	1,52	-14%
BE	1,28	1,27	1,26	1,25	-37%
BG	1,03	1,20	0,97	1,04	-40%
HR	1,26	1,51	1,65	1,61	161%
CY	0,98	1,19	1,05	1,06	-16%
CZ	1,59	1,75	1,56	1,62	-10%
DK	1,71	2,09	1,91	1,89	-36%
EE	1,40	1,85	1,74	1,62	-33%
FI	1,31	1,85	1,66	1,55	-17%
FR	1,16	1,55	1,53	1,38	-41%
DE	1,24	1,33	1,14	1,21	-36%
GR	1,12	1,28	1,15	1,16	-40%
HU	1,39	1,42	1,48	1,41	-27%
IE	1,07	1,16	1,25	1,20	8%
IT	1,30	1,52	1,41	1,37	-34%
LV	1,40	1,72	2,73	1,89	-31%
LT	1,29	1,66	1,51	1,55	66%
LU	0,93	1,37	2,26	1,52	2%
MT	1,00	1,38	1,14	1,15	-16%
NL	1,44	1,70	1,69	1,57	-20%
PL	1,07	1,31	1,24	1,19	-20%
PT	1,43	1,82	1,79	1,64	-11%
RO	0,93	1,09	1,05	1,00	-31%
SK	1,42	3,71	1,52	2,10	-17%
SI	1,09	1,38	1,79	1,42	17%
ES	1,47	1,97	1,75	1,68	-26%
SE	1,19	1,58	1,50	1,42	-22%
UK	1,17	1,46	1,45	1,32	-43%
<b>Average</b>	<b>1,25</b>	<b>1,53</b>	<b>1,42</b>	<b>1,37</b>	<b>-31%</b>

Based on TNO (2025), internal dataset provided for the ESIG VOC Inventory project 2025 (Report R12898)

The per-capita emissions in 2D3a (Domestic solvent use including fungicides) have declined markedly across the EU since the mid-2010s; compared with 2015, the 2024 level is roughly one-third lower. The pandemic-related peak in 2020/2021 (resulting from the allocation of ethanol to the 2D3a category) is followed by a renewed downward trend from 2022 onwards, with 2024 representing the lowest value in the entire time series. In the 2024 country comparison, the major economies (Germany, France, Italy, Spain, and the United Kingdom) show low values around 1.0, reflecting substantial improvements relative to 2015.

Some countries exhibit more volatile patterns, with temporary spikes observed in Slovakia (2018/2020), Latvia (2023), Croatia (2024), and Lithuania (2024). These fluctuations can be associated with ethanol-driven peaks, shifts in sectoral composition, allocation and trade-related effects, as well as the amplifying impact of smaller population bases.

## How to access and use ESIG data?

The ESIG inventories are an accepted Tier 2a method according to the EMEP/EEA air pollutant emission inventory guidebook, however, the top-down approach using REACH end uses and confidentiality considerations make it difficult to use the data when establishing the country inventories.

Due to the high confidentiality of sales data, Cefic statistics impose certain rules. When there are fewer than 3 original entries there is no show of data for a category. In a few cases, countries are grouped to allow to display at least some numbers. Here again, population numbers could serve to split between countries to get some results.

Thanks to efforts done by the UK, a table is added as an annexe to the EMEP/EEA air pollutant emission inventory guidebook 2019, chapter 2.D.3.a. Domestic solvent use mapping the NFR categories against Reach end-use sectors showing where and when ESIG data can be used (see table below). For instance, for INDUSTRIAL CLEANING: 100% is attributed to 2D3e, so in case of no own activity data the ESIG number can be used instead.

Since ESIG data are based on actual data from EU manufacturers of substances that can be used as solvents, the ESIG emission inventories remain a valuable source of information and can also be used for comparative purposes.

Member States can obtain more information upon request for full details per REACH category provided data is not confidential. Additionally, based on the mapping, ESIG can per member state, provided no confidentiality claims apply, provide a reattribution to the NFR categories.

## REACH end-use categories & Emission Factors

	End-use	Release to air	Remarks
1	Agrochemical uses	100%	assumed to be completely released into the atmosphere and involving substances that are classified as VOCs used in solvent applications
2	Blowing Agents	100%	
3	De-Icing	100%	
4	Binder and Release Agents	100%	
5	Industrial Cleaning	70%	Cleaning agents used industrially are mostly handled in a closed system and are partially released into the atmosphere.
6	Professional & Consumer Cleaning	50%	There are two types of products in this category: dry cleaning agents used by professionals that have a very low release percentage and other cleaning agents used by consumers that are completely released into the atmosphere. Therefore, an average 50% emission factor is applied.
7	Industrial, Professional and Consumer Coatings	75%	The emission factor for the entire coatings sector is derived from two components: consumer and professional decorative paints, which have an emission factor of 100%, and industrial coatings, where solvent-use substances are mostly recovered, resulting in an assumed emission factor of 10%. Therefore, a conservative overall emission factor of 75% is applied.
8	Functional Solvents	10%	include substances which can be used as a solvent and are involved in chemical processes such as intermediates, polymerization, and extraction, resulting in a low emission factor of 10%
9	Metal working/Rolling Oils/Lubricant uses	0%	taken over from ATIEL, the Technical Association of the European Lubricants Industry
10	Oil field chemicals-Drilling-Mining-Extraction	0%	The substances which can be used as solvents are mostly heavy and therefore non-VOC.
11	Polymers Processing (incl. rubber-tyre production)	10%	Value from ESIG GES/SpERCs
12	Road and Construction	95%	Value from ESIG GES/sPERCs
13	Use as Fuel/Combustion	0.25%	Substances which can be used as solvents and are used in combustion are fully burnt, generating water and carbon dioxide, and therefore do not produce any VOC emissions into the atmosphere. A conservative emission factor of 0.25% is applied to account for potential leaks.
14	Water Treatment	5%	Value from ESIG GES/SpERCs
15	Other Consumer uses (household, aerosols, cosmetics)	90%	Substances used by consumers in household and aerosol applications are completely released into the atmosphere. In cosmetic applications, substances which can be used as solvents are predominantly heavy and therefore non-VOC. Consequently, an estimated emission factor of 90% has been applied.
16	Pharmaceuticals Manufacturing	30%	Value from ESIG GES/sPERCs

Table annexed to the EMEP/EEA air pollutant emission inventory guidebook 2019, chapter 2.D.3.a.Domestic solvent use

REACH end-use sector	2D3a	2D3b	2D3c	2D3d	2D3e	2D3f	2D3g	2D3h	2D3i
Agrochemical uses	100%								
Binder and Release Agents									100%
Blowing Agents									100%
Cleaning-Industrial + Leather treatment, electronics, semiconductor					100%				
Cleaning-Professional Consumer	100%								
Coatings-Industrial + adhesives, resins, inks, refining and blending + reprographics				80%				15%	5%
Coatings-Professional/Consumer + Thinners, paint industry + emulsions + automotive	30%			70%					
De-icing	50%								50%
Functional Solvents (inc. solvents used in chemical processes, e.g. process aids, intermediates, extraction, dewaxing agents)							100%		
Metal working/rolling oils/Lubricant uses									100%
Oil field chemicals-drilling-mining-extraction									100%
Other consumer uses (household,aerosols,cosmetics)	100%								
Pharmaceuticals manufacturing							100%		
Polymers Processing (inc.rubber-tyre production) + Industrial resins, synthetic rubber, process							100%		
Road and construction		100%							
Use as Fuel/Combustion + Fuel additives									100%
Water Treatment									100%
Others	100%								



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#### About ESIG

ESIG, Sector Group of Cefic, is a joint activity of the European manufacturers of hydrocarbon (HSPA) and oxygenated (OSPA) solvents.

Our primary objective is to equip our members with the necessary advice and guidance to ensure compliance with the most up-to-date legislation. Simultaneously, we encourage our members to share ESIG's insights and recommendations with all stakeholders involved in the use or handling of their solvent products. Our overarching goal is to establish industry positioning and ensure that the regulatory framework pertaining to the manufacturing, storage, distribution, and usage of these solvents is rooted in sound science and best practices.

