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VOC emissions from solvents until 2022

ESIG VOC Inventory 2023

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Summary

Since 2008, ESIG has consistently released its emission inventories for VOC emissions from solvents produced by member companies, encompassing a significant portion of solvent-related VOC emissions in the European Union. TNO has been actively collaborating with ESIG on VOC emission inventories for the solvent sector since 2019. This report presents the ESIG VOC inventory for the year 2022, providing comprehensive coverage for emissions spanning the years 2013 and 2015-2021. Methodological updates to the treatment of ethanol-related emissions during and post the COVID-19 pandemic have been implemented, refining the accuracy of the inventory.

In 2022, overall VOC emissions experienced an 18% reduction compared to 2021, primarily attributed to diminished ethanol usage, which supplements the solvent data collected by ESIG. This is likely mirroring the diminishing use of ethanol-based hand sanitizers post-Covid-19. However, isolated from other data sources, solvent-related VOC emissions still indicated a 12% reduction, reflecting the comparable decrease in solvent sales reported by ESIG members in 2022. This constitutes the highest yearly reduction in VOC emissions, similar to the reduction reported in 2016, and the lowest absolute value of VOC emissions with and without ethanol across the inventory. Without a definitive explanation for this decline, it is important to emphasize the impact of solvent sale data on result uncertainty. And despite improvements in methodology over the years, uncertainties persist in estimating import and export values and ethanol use data, further contributing to the overall uncertainty. Therefore, it is recommended to ensure consistency across the timeseries, conduct in-depth studies and collaborate with experts to refine the approaches for import/export and ethanol, and to consider adding new solvents in future versions of the inventory. Ongoing and recommended updates and expansions enhance the robustness of this inventory, increasing its value for national inventory compilations at the EU Member State level.

1 Introduction

Volatile organic compounds (VOC) emitted into the atmosphere play an important role in the formation of tropospheric ozone and secondary organic aerosols, which have negative consequences on human health and the environment. To mitigate these impacts, the EU has agreed on reduction commitments for its Member States as part of the National Emission reduction Commitments Directive (NECD), Directive 2016/2284/EU.

To monitor compliance with the reduction commitments, and to check if Member States are on track to meet future commitments, each Member State is required to annually submit emission inventories. These inventories consist of a complete overview of all anthropogenic emissions estimated based on consistent methodologies. Typically, they combine an activity rate (e.g. amount of fuel used or industrial production) with an emission factor, which is a representative factor indicating the amount of emission per unit of activity. Default emission factors are available from the EMEP/EEA Guidebook, which is the main technical guidance document in support of emission inventories. However, many countries have developed their own methodologies considering nationally available knowledge and local circumstances.

VOC emissions from solvents are a key part of the overall non-methane VOC (NMVOC) emission inventories in the EU. Given that solvents do not emit methane, there is no difference between NMVOC and VOC. These emissions, however, are difficult to quantify in national emission inventories, mainly because of the difficulties in estimating the amount of solvent used across the numerous indirect applications of solvents. Solvents are used in many different applications, including at small scales by industries and households. Unfortunately, statistics rarely provide precise figures on the quantity of these products, or the annual volume of solvents used in a country. Moreover, the EU's free movements of goods makes it harder to estimate country-specific quantities. Simplified approaches, like using an average emission factor per person for domestic solvent use, are therefore commonly applied. However, these methods overlook country-specific variations and cannot effectively monitor the impact of targeted emission reduction strategies.

To address this challenge, the European Solvents Industry Group (ESIG), a division of the European Chemical Industry Council (CEFIC), has been collecting data on solvent quantities introduced into the European Union market. This data serves as a basis for calculating emissions. In recent years, numerous inventory teams have expressed interest in the ESIG data-driven inventory, recognizing the hurdles in sourcing accurate data for this emission source. Nonetheless, it is important to note that the ESIG inventory does not encompass all VOC-emitting products used or mandated for reporting by countries. Some substances emitting VOCs do not fall under the category of solvents, and while ESIG member companies represent most solvent producers, there are gaps in coverage. Moreover, there might be instances of net imports or exports of solvents to or from the EU as a whole.

This report describes how these emissions have been calculated by TNO for the 2023 ESIG VOC inventory. The temporal coverage of the inventory has been extended to include 2022, resulting in an inventory that spans from 2013 to 2022, excluding 2014, where data is not available. Moreover, the methodology has been slightly updated to improve usability of the dataset for emission inventory compilers.

2 Methodology

This section describes the methodology followed for the ESIG VOC inventory in 2023. The general methodology for establishing the inventory is in line with the method applied in earlier ESIG inventories (see TNO Reports R12311, 2020; R12580, 2021; R12732, 2022).

2.1 General methodology

The methodology begins by examining solvents released onto the market in each EU Member State, including the UK for all observed years. These solvents are categorized according to the REACH end-use classification. A conversion matrix linking REACH categories with NFR reporting segments is included in the EMEP/EEA Guidebook and depicted in Table 1. It's important to note that this process records only the total solvent volume, omitting specific chemical details.

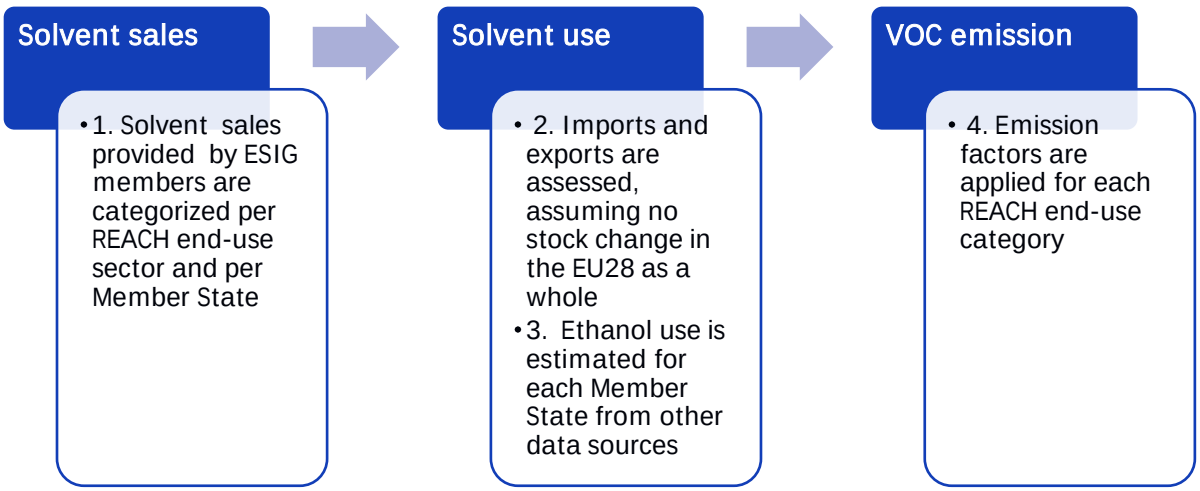

Figure 2.1: ESIG VOC inventory methodology overview

The approach involves several key steps:

1. Data on solvent sales, representing most of Europe's solvent production, are gathered from ESIG member companies. In 2022, one new member company contributed to the 2022 solvent sales data. Sales figures are categorized by country and REACH end-use sector (refer to Table 1 for sector listings). A challenge arises when solvents are sold to distributors or resellers, making their final use unclear. The amount sold to these intermediaries is proportionally allocated across REACH end-use sectors, including a special category for 'other'.

2. The inventory presupposes that solvent sales equal annual usage, implying no change in stock levels and disregarding net solvent imports or exports within the EU28, or EU27+UK. Given the fluidity of the European market, solvents sold in one country might be used in another. This necessitates estimating solvent destination

due to the lack of comprehensive European tracking data. Previous attempts to refine this estimation were inadequate, so import and export proportions from intra-EU trade from 2013 and 2015 are extrapolated to subsequent years. Recent methodology revisions are elaborated in Section 2.2.

3. Ethanol production is not incorporated into ESIG's solvent inventory, as ethanol producers are not ESIG members. However, ethanol's growing importance has led to its inclusion in the inventory originally from 2016 onwards, and more recently was included in the inventory back to 2013 to achieve time series consistency in the emission period reported. Ethanol usage as a solvent is approximated using data from European Renewable Ethanol (ePURE), with detailed estimation techniques outlined in Section 2.3.

4. A consistent set of emission factors, detailed in Section 2.4, is applied.

While individual country data on solvent sales exist, confidentiality issues sometimes necessitate grouping countries together, with groupings varying by year. For 2022, similarly as to 2021, the following countries were grouped:

- Belgium and Luxembourg
- Bulgaria and Romania
- Cyprus, Greece and Malta
- Estonia, Latvia and Lithuania

This methodology is largely similar to previous ESIG inventories, it includes, however, an update of the ethanol calculations for 2020-2021 and 2022, along with some minor improvements. The most recent year, 2022, was furthermore added to the time series.

2.2 Assessing import and export within the EU

For 2013-2017, the trading of solvents between EU Member States was assessed using import and export shares established for the 2013 and 2015 inventories, as detailed in the ESIG position paper (ESIG, 2018) and a related scientific publication (Pearson, 2019). This method was also applied to 2016 and 2017 data. Due to confidentiality, some data were grouped by country clusters. This sometimes caused skewed results in smaller countries when based predominantly on a larger country's data. To address this, solvent usage per country was reviewed and compared with the EU average per capita solvent use. Adjustments were made to maintain the per capita use within twice the EU average, balancing the import/export figures within each country group.

For 2018-2022, the approach involved extrapolating data from 2013-2017. Solvent sales data at the country level were collated, and the previous year's import/export percentages were applied for an initial estimate of the current year usage. Adjustments were made to align the total use in each country with the current year's sales figures. Significant yearly fluctuations in a country's solvent sales prompted a reassessment of import/export amounts. A cap was placed on the maximum yearly percentage change for each country. Excess solvent use above this cap was reallocated among countries below the cap, proportionate to their current year estimates. Caps varied yearly: 15% for 2018, 2020 and more recently, 2022, and 10% for 2019 and 2021, reflecting differences in total EU28 solvent usage.

2.3 Estimating emissions from ethanol use

Ethanol use, which is not covered by ESIG members, has been significant, particularly during the Covid-19 pandemic. Its usage in the EU28 (EU27+UK) was estimated from production and import data, excluding possible exports due to lack of data. The industry's share of ethanol use (products excluding fuel use, food and beverages) is assumed to be 75% for solvent applications and was based on ESIG expert estimates and converted to mass using a density of 789 kg/m3.

$$E = \rho_{Ethanol} \times Share_{solv\_ind} \times (Production + Import) \times Share_{ind\_prod}$$

where:

E	Total ethanol use in EU28 (ton)
$\rho_{Ethanol}$	Density of ethanol (kg/m^3)
$Share_{solv\_ind}$	Share of use for solvents in industrial applications (estimated at 75%)
$Production$	Total ethanol production in EU28 (m^3)
$Import$	Total ethanol import into EU28 (m^3)
$Share_{ind\_prod}$	Share of ethanol production for industrial applications

In 2020 and 2021, the methodology differed due to the high demand for ethanol-based hand sanitizers during the COVID-19 pandemic. The spike in 2020 imports was attributed entirely to ethanol use, while the reduced 2021 imports corresponded to a lower ethanol use. For 2022, a large increase in imports is observed again. Since detailed fuel use is not yet available in Eurostat data for 2022, and that other data sources do not suggest large changes in road transport biofuel consumption (Eurostat, 2022), it was assumed that the increase in imports is partly contributing to increased fuel use.

2.4 Emission factors

VOC emissions from solvent use were calculated using established emission factors specific to each REACH end-use sector. These factors (kg VOC emission per kg product) are unchanged from previous ESIG VOC inventories and are listed in table 1, along with their NFR category links, as per the EMEP/EEA Guidebook (2019 version) Chapter 2D3a (EEA, 2019).

Table 1: Emission Factors per REACH end-use sector

REACH end-use sector	EF (kg/kg solvent)	Link to NFR category
Agrochemical uses	1	2D3a
Binder and Release Agents	1	2D3i
Blowing Agents	1	2D3i
Cleaning Industrial + Leather treatment, electronics, semiconductor	0.7	2D3e
Cleaning-Professional Consumer	0.5	2D3a
Coatings-Industrial + adhesives, resins, inks, refining and blending + reprographics	0.75	2D3d (80%), 2D3h (15%), 2D3i (5%)
Coatings-Professional/Consumer + Thinners, paint industry + emulsions + automotive	0.75	2D3a (30%), 2D3d (70%)
De-Icing	1	2D3a (50%), 2D3i (50%)
Functional Solvents (incl. solvents used in chemical processes, e.g. process aids, intermediates, extraction, dewaxing agents)	0.1	2D3g
Metal working/rolling oils/Lubricant uses	0	2D3i
Oil field chemicals-drilling-mining-extraction	0	2D3i
Other consumer uses (household, aerosols, cosmetics)	0.9	2D3a
Pharmaceuticals manufacturing	0.3	2D3g
Polymers Processing (incl. rubber-tyre production) + Industrial resins, synthetic rubber, process	0.1	2D3g
Road and construction	0.95	2D3b
Use as Fuel/Combustion + Fuel additives	0.0025	2D3i
Water Treatment	0.05	2D3i
Ethanol (in hand sanitizers but also in other applications)	0.9	2D3i

3 Results

3.1 Import and export

Table 2 illustrates the import and export dynamics of solvents, detailing the net transactions for each country (or group of countries when confidentiality requirements apply). Positive values in the table signify a surplus in imports, while negative values indicate a surplus of exports. This data provides an insight into the movement of solvents in the EU28, that is crucial for quantifying per country VOC emissions.

Table 2: Net imports of solvents per country (or countries group) in kton VOC emissions

Country	2013	2015	2016	2017	2018	2019	2020	2021	2022
Austria	9.6	32	34	33	41	19	11	14	10
Slovenia						-0.2	-1.7	-1.1	-0.2
Croatia*	**n/a**					20	17	18	16
Belgium	-60	-99	-94	-95	-156	-128	-73	-86	-93
Luxembourg									
Bulgaria	46	40	37	37	41	43	38	36	38
Romania									
Cyprus	-8.1	-3.2	16	15	15	1.5	17	16	16
Greece						14			
Malta	0.9	0.5		0.9		0.9			
Czech Republic	49	48	49	53	55	31	27	20	26
Slovakia						21	21	22	22
Denmark	2.6	6.8	7.1	7.1	8	-1	-3.2	-2.7	-0.8
Finland	19	29	7.8	7.8	10	9.4	6	-2.5	10
Estonia			23	22	26	12	23	22	22
Latvia									
Lithuania						11			
France	5.6	0.8	4.4	4.2	1.4	-7.4	24	6.6	-1.1
Germany	-291	-243	-246	-246	-288	-302	-302	-306	-281
Hungary	15	16	17	17	19	20	16	17	17
Ireland	0.5	0.1	0.3	0.3	1.4	0.6	-0.7	-0.4	-0.9
Italy	133	128	116	114	129	112	70	85	62
Netherlands	-89	-113	-119	-119	-108	-87	-104	-101	-92
Poland	69	64	51	53	62	61	57	59	56
Portugal	78	78	76	35	39	35	31	33	38
Spain				39	64	81	73	86	76
Sweden	18	15	15	15	16	15	9.8	12	11
United Kingdom	3.7	0.7	4.4	4.3	22	16	43	54	50

** Croatia was not included in the 2013 inventory as it only joined the EU on July 1st, 2013.*

3.2 Ethanol

The Table 3 data illustrates the VOC emissions stemming from the use of ethanol as a solvent across all recorded years. Notably, the years 2020 and 2021 exhibit heightened uncertainty, primarily due to the increased importance of ethanol for hand sanitizers during the COVID-19 pandemic. As mentioned in earlier versions of this inventory, VOC emissions in 2013 and 2015 show higher levels compared to the subsequent years (2016-2019). This discrepancy poses challenges in explanation, suggesting potential issues related to data quality and/or completeness during these initial years. Conversely, a distinctive surge in VOC emissions is evident in 2020 and, to a lesser extent, 2021, due to the widespread adoption of ethanol-based hand sanitizers amid the ongoing pandemic. In 2022, with the effects of the pandemic winding down, we observe ethanol values akin to pre-pandemic times.

Table 3: Estimated VOC emissions from ethanol per country in kton VOC emissions

Country	2013	2015	2016	2017	2018	2019	2020	2021	2022
Austria	9.2	8.8	6.4	6.3	5.7	6.1	12.5	9.4	6.0
Belgium	12.1	11.6	8.3	8.1	7.4	7.9	16.2	12.2	7.8
Bulgaria	7.9	7.4	5.2	5.1	4.6	4.8	9.8	7.3	4.6
Croatia	4.6	4.4	3.1	3.0	2.7	2.8	5.7	4.3	2.6
Cyprus	0.9	0.9	0.6	0.6	0.6	0.6	1.3	0.9	0.6
Czech Republic	11.4	10.9	7.7	7.6	6.9	7.4	15.1	11.1	7.1
Denmark	6.1	5.8	4.2	4.1	3.8	4.0	8.2	6.2	3.9
Estonia	1.4	1.4	1.0	0.9	0.9	0.9	1.9	1.4	0.9
Finland	5.9	5.6	4.0	3.9	3.6	3.8	7.8	5.9	3.7
France	71.1	68.5	48.9	47.9	43.5	46.6	95.1	71.6	45.6
Germany	87.3	83.7	60.3	59.2	53.7	57.5	117.2	88.0	56.0
Greece	11.9	11.2	7.9	7.7	7.0	7.4	15.1	11.3	7.1
Hungary	10.7	10.2	7.2	7.0	6.3	6.8	13.8	10.3	6.5
Ireland	5.0	4.8	3.5	3.4	3.1	3.4	7.0	5.3	3.4
Italy	64.7	62.6	44.5	43.4	39.2	41.4	84.1	62.7	39.7
Latvia	2.2	2.0	1.4	1.4	1.3	1.3	2.7	2.0	1.3
Lithuania	3.2	3.0	2.1	2.0	1.8	1.9	3.9	3.0	1.9
Luxembourg	0.6	0.6	0.4	0.4	0.4	0.4	0.9	0.7	0.4
Malta	0.5	0.5	0.3	0.3	0.3	0.3	0.7	0.5	0.4
Netherlands	18.2	17.4	12.5	12.2	11.1	12.0	24.5	18.5	11.8
Poland	41.2	39.2	27.9	27.2	24.6	26.3	53.5	40.0	25.3
Portugal	11.4	10.7	7.6	7.4	6.7	7.1	14.5	10.9	7.0
Romania	21.7	20.5	14.5	14.1	12.7	13.4	27.2	20.3	12.8

Slovakia	5.9	5.6	4.0	3.9	3.5	3.8	7.7	5.8	3.7
Slovenia	2.2	2.1	1.5	1.5	1.3	1.4	3.0	2.2	1.4
Spain	50.6	47.9	34.1	33.4	30.3	32.5	66.7	50.1	31.9
Sweden	10.4	10.0	7.2	7.2	6.6	7.1	14.6	11.0	7.0
United Kingdom	69.2	66.8	48.0	47.2	43.0	46.2	94.5	71.4	46.1
EU28	**547**	**524**	**374**	**367**	**333**	**355**	**725**	**544**	**347**

3.3 Overall VOC emissions

Table 4 presents the comprehensive data on total volatile organic compound (VOC) emissions for the years 2013 and 2015-2021. Similarly to the approach in Table 2, countries are grouped when individual country-level data cannot be disclosed due to confidentiality constraints. Noteworthy trends emerge, with emissions in 2016 and 2017 significantly lower than those recorded in 2013 and 2015. However, a discernible increase surfaces in 2018, prompting speculation about potential underreporting by companies regarding their production activities during those periods.

The surge in emissions in 2020, and to some extent in 2021, finds its roots in the escalated use of ethanol for hand sanitizers amid the ongoing global health crisis. It's important to note, though, that in 2020, lower quantities of non-ethanol solvents were reported by ESIG. This discrepancy may be attributed to Covid-related measures impacting the industry that year—possibly resulting in reduced production or partial closures during the initial lockdown period. This, in turn, acts as a partial counterbalance to the heightened VOC emissions stemming from ethanol use. In 2022, we observe a sharp decrease in VOC emissions of about 18% compared to 2021. It is mainly due to a 36% decrease in ethanol use compared to 2021, given the winding impact of the pandemic.It also remains the lowest year on record across this inventory, highlighting a significant decrease in VOC emissions from ESIG solvents. Despite one company being added to the list of ESIG members reporting data for this inventory, 2022 solvent sales data was the lowest recorded across the inventory, with a total decrease of 13% and an average change of 24% across the different usage sectors, compared to 2021. Without a clear explanation for this decline, it's important to emphasize the impact that solvent sales data has on the uncertainty of the results.

Table 4: VOC emissions per country (or countries group) in kton for 2013 and 2015-2022 (including ethanol use)

Country	2013	2015	2016	2017	2018	2019	2020	2021	2022
Austria	63	88	84	84	91	58	54	55	44
Slovenia						13	15	15	12
Croatia*	**n/a**					24	24	24	19
Belgium	59	63	33	37	41	38	43	41	37
Luxembourg									
Bulgaria	81	72	63	63	64	68	82	68	61
Romania									
Cyprus	38	36	36	32	36	2	45	38	37
Greece						30			
Malta	1	1		1		1			
Czech Republic	83	82	74	81	83	51	55	55	45
Slovakia						28	32	33	27
Denmark	25	24	20	19	19	21	25	25	20
Finland	56	62	28	27	29	29	28	29	23
Estonia			32	29	33	16	35	35	31
Latvia									
Lithuania						16			
France	295	270	219	216	237	256	273	267	226
Germany	326	409	259	236	257	256	277	262	205
Hungary	33	32	29	29	32	35	38	35	32
Ireland	23	21	14	14	14	15	20	17	17
Italy	386	381	347	334	373	352	343	342	268
Netherlands	78	74	94	95	101	93	102	100	80
Poland	160	141	125	133	137	128	157	154	123
Portugal	323	332	289	52	58	54	54	54	57
Spain				233	270	249	250	255	206
Sweden	68	49	40	43	48	49	51	50	48
United Kingdom	220	228	216	220	224	239	258	253	201
EU28	**2318**	**2366**	**2002**	**1979**	**2145**	**2120**	**2263**	**2207**	**1816**

** Croatia was not included in the 2013 inventory as it only joined the EU on July 1st, 2013.*

Table 5 and Figure 2 present a comparative analysis between the total VOC emissions from solvents in the EU28 as calculated in this study and the figures reported by individual countries in their official inventories. Unfortunately, a comparison for 2022 is not feasible as official country-reported emission data will be submitted only in Spring 2024. The table also encompasses data from 2008 and 2009, computed earlier using a distinct methodology that excluded ethanol, leading to a more pronounced disparity between ESIG and EMEP. Particularly from 2013 onward, the difference typically hovers around 11-23%, except for 2016 and 2017, where a larger variance is noted. Given the relatively low ESIG numbers

during these years, it is conceivable that the ESIG inventory might have underestimated emissions during that period. The overarching trend in the comparison reveals that country-reported emissions tend to surpass those recorded in the ESIG inventory.
This divergence can be attributed to a confluence of factors:

1. The EMEP data includes VOC emissions from the use of all products, not only solvents. While most emission reported in the EMEP data is from solvents, it does mean the comparison is not fully fair and a lower emission when calculating based on ESIG data is expected. Examples of emission sources not covered by the ESIG inventory are the use of liquefied gases used as propellants (and subsequently behaving as solvents) in aerosol dispensers in the UK inventory (Pearson, 2019) or the use of methanol in de-icing applications. Depending on the methodology used by each country, these may be (partially) included in the official national inventories. Despite this difference in coverage, the comparison is still useful to identify such possible scope differences and help discussions with countries to improve the inventories.

2. Additional uncertainty is introduced given the variation in methodologies used by different countries that often rely on simplified approaches due to lack of data.

3. While the ESIG inventory covers a substantial majority of solvent producers, it may not encapsulate the entirety of solvent production in Europe or potential imports from outside the EU—both of which could be relevant factors.

4. The assessment of intra-EU import and export, coupled with the estimation of emissions from ethanol, introduces significant uncertainties to the ESIG inventory, particularly in relation to the distribution of emissions across countries.

Table 5: Comparison between the ESIG VOC inventory (including and excluding ethanol use) and officially reported emissions of VOC (EMEP) for the EU28 across all years

Year	ESIG excl. ethanol	Ethanol	ESIG incl. ethanol	EMEP	Difference	Difference (%)
2008*	2159	-	2159	3369	1210	56%
2009*	1917	-	1917	3029	1015	58%
2013*	1775	547	2323	2706	383	16%
2015	1842	524	2366	2632	267	11%
2016	1628	374	2002	2617	615	31%
2017	1613	367	1980	2678	698	35%
2018	1813	333	2145	2644	499	23%
2019	1765	355	2120	2589	468	22%
2020	1538	725	2263	2751	488	22%
2021	1663	544	2207	2692	485	22%
2022	1470	346	1816	-	-	-

** Croatia was not included in the 2008, 2009 and 2013 inventories as it only joined the EU on July 1st, 2013.*

Moreover, it is worth noting that the 2022 update to the EMEP data resulted in a considerable increase of the overall VOC emission values throughout the time series, with amended values being 3-4% higher for the period between 2008 and 2019 and 7% higher for 2020 This has led to a heightened disparity between ESIG and EMEP emissions compared to the previous version of this report.

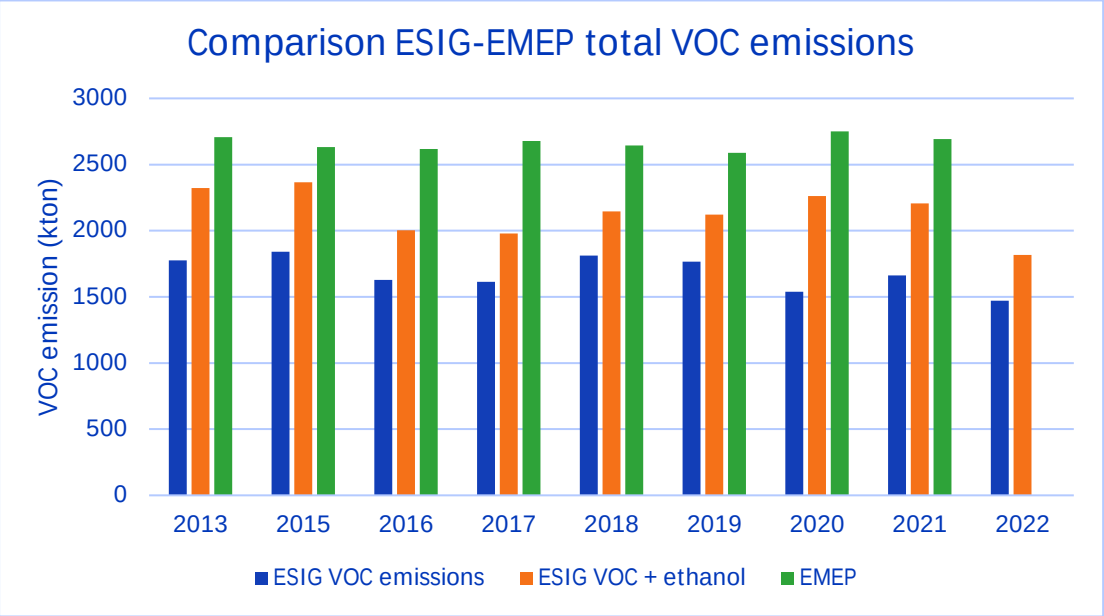

Figure 3.1: Comparison between total VOC emissions in kton from the ESIG VOC inventory (including and excluding ethanol use) and officially reported emissions of VOC (EMEP) for the EU28 for 2013 and 2015-2022

While the overall disparity between ESIG and EMEP emission estimates remains relatively marginal, a closer examination at the country level (figure 3.2) reveals a noteworthy trend. This Figure compares ESIG and officially reported emissions to EMEP for the year 2021. Some nations exhibit a commendable concordance between the two datasets, while others, exemplified by Germany and France, manifest substantial divergences. These disparities stem from methodological distinctions within individual countries' emission inventories, but such disparities may also signify deficiencies in the ESIG inventory's methodology regarding the accurate incorporation of import and export of solvents.

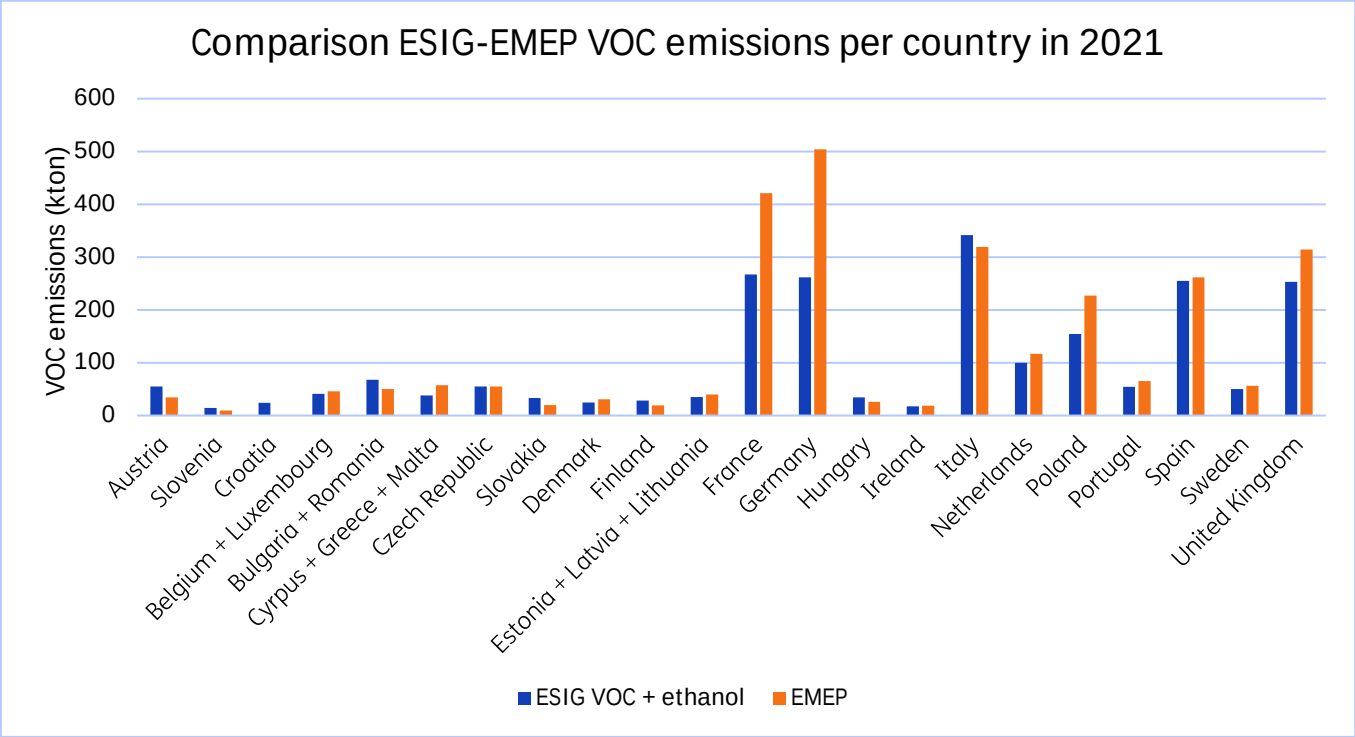

Figure 3.2: Comparison between total VOC emissions in kton from the ESIG VOC inventory (including ethanol use) and officially reported emissions of VOC (EMEP) per country (or countries group) for 2021

Beyond the previously mentioned uncertainties, the years 2020 and 2021 introduce an additional layer of uncertainty pertaining to VOC emissions from ethanol, which has not been consistently addressed in emission inventories. Additionally, as can be seen in the figure, there is no EMEP data available for Croatia in 2021. This is because Croatia had not reported their 2021 emissions on time for the 2022 EMEP inventory.

4 Conclusions

This 2023 report details the updated VOC emission inventory for solvents, utilizing solvent sales data provided by ESIG, the European Solvents Industry Group. This data covers solvent distribution per country and REACH end-use sector. The inventory does not account for net imports to or from the EU but includes intra-EU trade estimates based on previous ESIG inventories and expert judgement. Emissions are calculated using emission factors for each REACH sector.

The inventory offers a reliable approach to estimating VOC emissions from solvents within the EU28 (EU27+UK), based on data from solvents produced and marketed in these countries. However, the voluntary nature of data collection from ESIG members, aligned with the REACH Directive reporting system, may introduce reporting inconsistencies or gaps. Given the free movement of goods in the European market, solvents and their resultant VOC emissions might occur in different countries than where they were sold. Estimations for solvent trade between EU Member States have been made using expert opinions and proxy data, but this remains a significant uncertainty factor, especially for individual countries. The uncertainty was likely higher for 2020 and 2021 due to the increased but hard-to-quantify use of ethanol in disinfectants during the Covid-19 pandemic. It is therefore important to be careful when interpreting country-level results.

To conclude, recommendations stemming from this study include:

1. Maintaining consistency across the timeseries, in terms of data collection, sources of emissions and methodology through the continuous updates and expansions of the inventory.

2. Despite there being significant improvements to the inventory across the years, further refinements to the methodology are key to enhancing the inventory's reliability and applicability. This especially concerns:

    2.1. The approach for estimating intra-EU imports and exports, which presently relies on expert judgment. Enhancements can be achieved by exploring ways to improve import-export data collection or conducting a comprehensive study to obtain more accurate numbers.
    2.2. The methodology for estimating VOC emissions from ethanol utilization, currently dependent on proxy data and assumptions regarding the industrial proportion of imports. Collaboration with industry experts, such as ePURE, is recommended to collectively explore strategies for enhancing the current methodology.

3. Expanding the inventory by investigating what other potential solvents, besides ethanol, should be included in future versions of this inventory.

5 References

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