

euro
chlor 17.


A sector group of Cefic 

Chlor-alkali
industry review

Remaining safe
and competitive
while achieving
climate neutrality

Moving Euro Chlor along
its Transition Pathway

2022
2023

Note: The content from this year's Industry Review (covering September 2022-August 2023) reflects the four main elements of our Mid-Century Strategy (MCS). Out of 16 key parameters, seven have been reported in our Sustainability Programme since 2001 and are marked with an  icon so they can be compared with previous editions.

We are delighted to announce that this year's contribution from our members (to the 2022 Euro Chlor Sustainability Questionnaire) was almost complete, covering 99.4% of Euro Chlor member's capacity in 2022. The Euro Chlor team will continue its efforts to keep this high participation rate.

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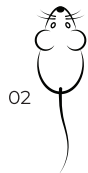
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Climate Neutral Player



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Members and Partners



Remaining safe and competitive while becoming climate neutral...

Safety, competitiveness and climate neutrality; three major topics Euro Chlor has been addressing over the past year. Together with circularity, they form the four elements of the Euro Chlor Mid Century Strategy (MCS) (<https://www.eurochlor.org/mcs>).

Keeping people safe, reducing greenhouse gas (GHG) emissions by using carbon neutral electricity, and finding solutions to become even more flexible in their operations; all of this is asked from an industry that has been significantly impacted by the European energy crisis. To support our membership, the Euro Chlor team has accelerated its work to tackle the consequences of the increasing energy price differences between the EU and other regions, and the limited reliable renewable energy availability. We are grateful for the excellent support of a newly created 'Energy Crisis Team', a sub-group of our Management Committee, who meet regularly to provide strategic advice on the key energy files and oversaw a new Cost Competitiveness study carried out by Argus Media. With support from Cefic, we are explaining the impact of the energy crisis at EU level to prevent this from becoming a roadblock in our ongoing Transition Pathway.

The pace at which the EU is proposing and adopting legislation to implement its Green Deal is faster than ever. Therefore, we have organised many additional meetings, amongst others on the universal PFAS REACH restriction proposal.

Potentially linked to the economic and regulatory challenges faced by our membership, our sustainability results this year are unsatisfactory. Many of our safety indicators have been negatively impacted, so we must further step up our efforts to reverse a potential downward trend in process safety. On the positive side, we have reduced our carbon footprint and transport incidents.

The Euro Chlor team remains motivated and ready to face our many challenges, supported by an engaged Management Committee. The latter started to meet more regularly to focus on the safety, energy, competitiveness and circularity topics, whilst following up on some exciting new communications tools that show the benefits of the entire chlor-alkali value chain.

I thank the whole Euro Chlor team and our active members for their invaluable contribution and invite you all to read about our 2022-2023 activities throughout this Industry Review.

Marleen Pauwels
Euro Chlor Manager
Executive Director Halogens Industry Sector



... moving Euro Chlor along its Transition Pathway

I acknowledge that this past year has been tough for Euro Chlor members across Europe. We saw reduced production levels due to a challenging economic situation and were faced with an inappropriate benchmark for our ETS indirect compensation via State Aid. This coincided with an unprecedented regulatory agenda triggered by the Green Deal, which has put additional pressure on the entire EU chemical industry. This does not encourage investments in the EU versus the rest of the world. Our interactions with the European Commission services, up to Directorate General level, are intense and we bring consistent messages to help the industry move in the right direction.

However, we still need to restore our competitiveness and implement measures to apply the learnings from our Argus Media Cost Competitiveness Study. This includes further developing and implementing activities that fulfil our need for abundant competitive, low carbon electricity.

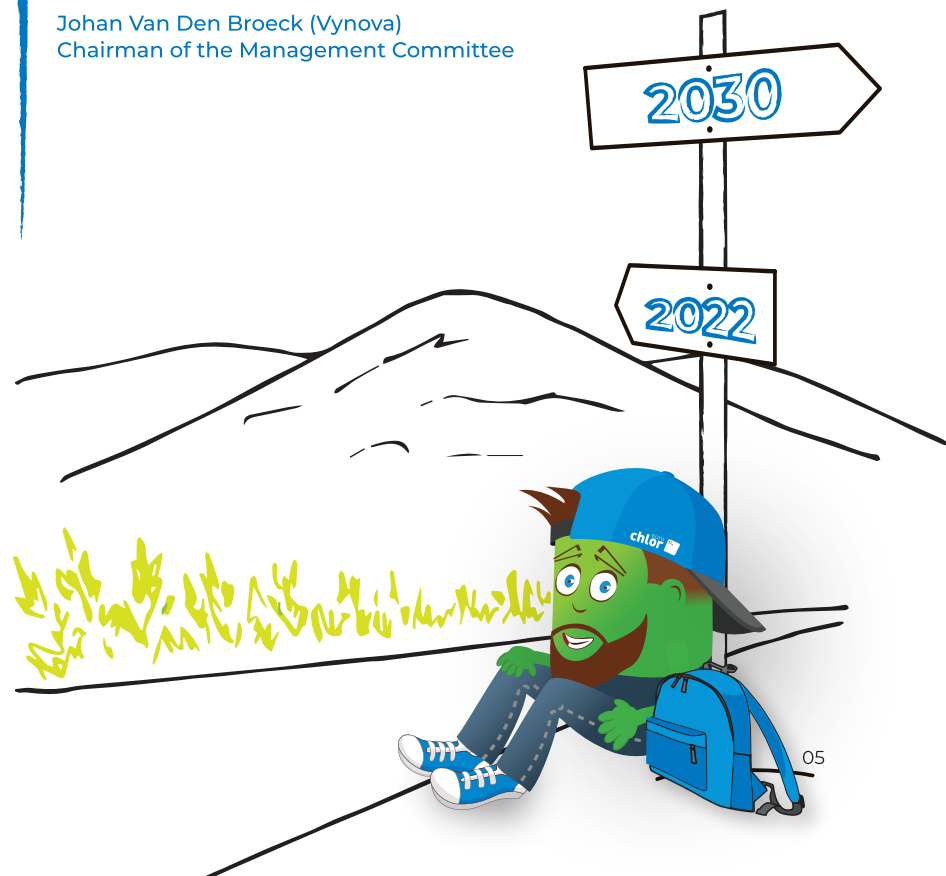
Meanwhile, as Chairman of Euro Chlor, I can only emphasise that we need to keep moving towards being a Safety Leader for the chemical industry. Our results have deteriorated in 2022 and we must urgently reverse this trend by stepping up our efforts. We need to further implement the Safe Loading and Unloading Commitment by engaging transport companies and downstream users. We need to build on our safety trainings and use new tools such as the upcoming interactive safety game.

We are also looking for practical solutions to fully utilise our hydrogen, as set as a goal in our MCS. This includes work on hydrogen infrastructure across Europe, highlighting chlor-alkali's role in the EU hydrogen economy, and investigating the availability and use of carbon neutral energy to give our high quality and low carbon hydrogen the recognition it deserves.

Finally, we will launch an engaging benefits campaign to reach a wider audience across Europe that highlights the crucial role of chlor-alkali products. This new campaign comes at a vital crossroads as authorities begin to discuss just what 'chemicals' are critical, or 'essential', for Europe.

Needless to say, Euro Chlor has its work cut out for another year. I thank the membership and Euro Chlor team for their hard work over the past 12 months and gladly offer my leadership to help drive towards some good results that will keep our key part of the chemical industry alive and kicking in the EU.

Johan Van Den Broeck (Vynova)
Chairman of the Management Committee



Process incidents and losses and LOPC incidents per chemical

Safety remains a key priority for Euro Chlor and is always the first item on the agenda of all the relevant Committees. In 2022, our process incidents and losses increased to 5.02 incidents per million tonnes of chlorine from 1.77 in 2021. This translates, in absolute numbers, to 41 process incidents reported via our annual Sustainability Questionnaire. As the first graph shows, the results fluctuate per year, but this year sees the highest peak since we first started measuring in 2001.

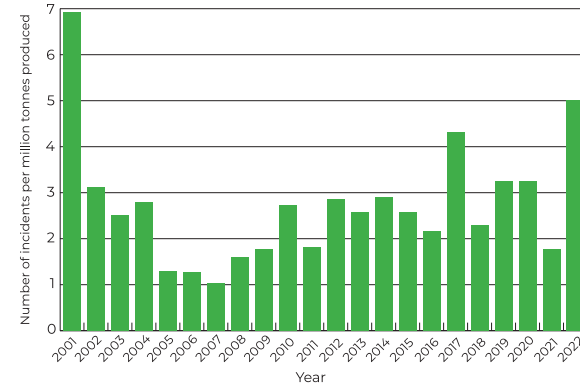
Since the start of our third Sustainability Programme in 2021, we also report a detailed overview of the Loss of Primary Containment (LOPC) incidents for each chemical as part of the process incidents and losses (second graph).

Since these figures do not correspond with our vision of zero incidents, Euro Chlor has tried to implement ways to reach this vision. Following **Euro Chlor's safety training programme** for members and partners over the last two years, and to build on our **Commitment on safe loading and unloading of chlor-alkali related products**, an **online safety training for transport companies** was developed. Two identical training sessions took place in March 2023 for 28 participants from 17 transport companies. These sessions identified that further work needs to be done by members to improve safe unloading at their customers.

Our safety performance has suffered this year and we really need to get our eye back on the ball.

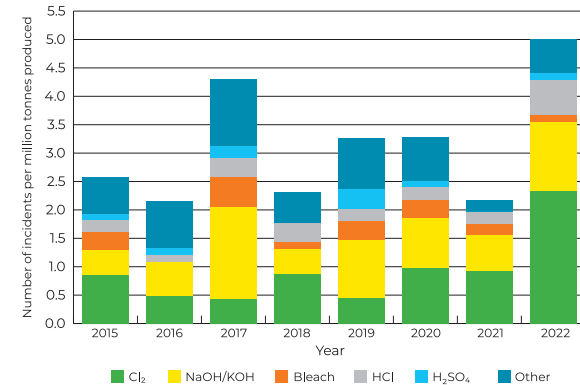
Ton Manders
Technical & Safety Director

Process incidents and losses



Strong increase compared to 2021.

LOPC incidents and other process incidents



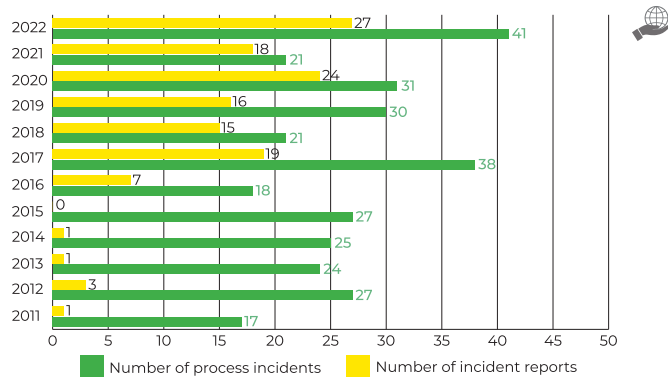
Strong increase compared to 2021.

Another ongoing safety initiative has been the development of an **interactive safety game** for engineers and operators to simulate and respond to safety incidents and issues. Since it was mentioned in previous reviews, testing has taken place with operators in several plants and companies have ordered their respective game boxes. After a significant delay in production of the final boxes due to the COVID-19 pandemic, we are now in the last phase. The Euro Chlor team is working on the best way to train the facilitators and accelerate the roll-out of the game boxes in the autumn of 2023. This will be one of the initiatives that aims to bring the number of process incidents down.

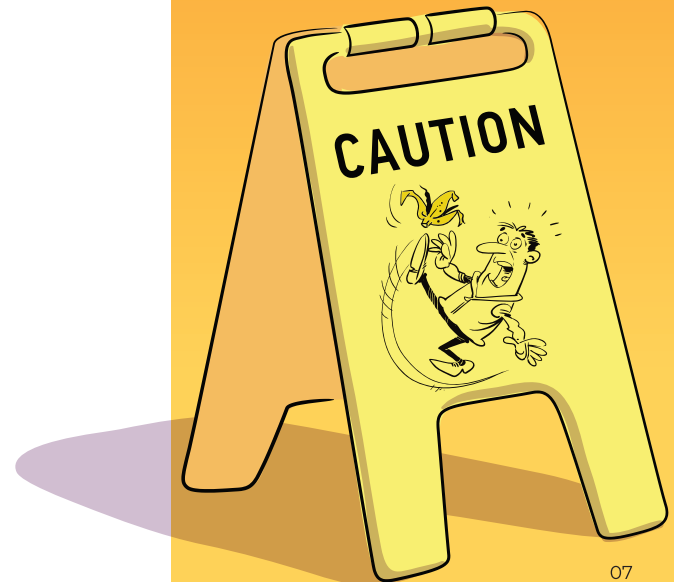
Incident reporting

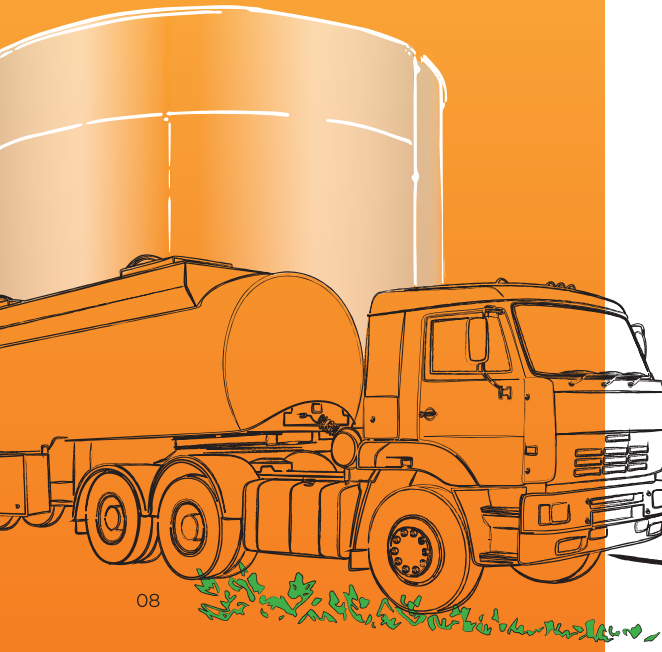
Ten years of consistent efforts by Euro Chlor members, the General Technical Committee (GTC) and GEST (Working Group Production, Storage and Transport Safety), led to a steadily increasing incident reporting rate of 86% in 2021. In 2022, however, we note a decrease to 66%. This recent dip could be due to the huge economic pressure and increasing workload following the political and environmental changes in the external world. These have, in turn, increased the pressure on production sites.

Evolution of process incidents and incident reports



↘ Decrease in the coverage rate of incident reports.





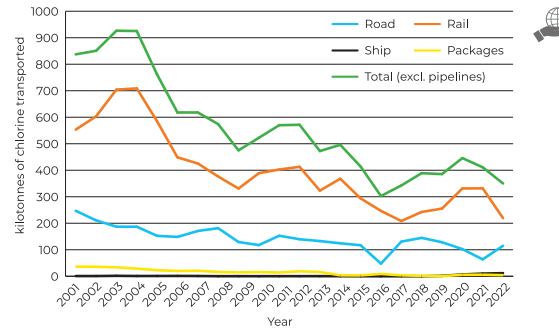
Transportation of chlorine

Although the graph shows a slight decrease in absolute tonnes transported, as a percentage of production it increased from 4.3% to 4.8%.

Transportation of caustic

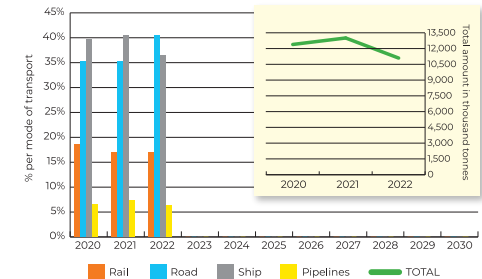
The total amount of caustic being transported through public areas has decreased from 13 million tonnes in 2021 to 11.1 million tonnes in 2022, which correlates with the decline in production. The main transport option moved from ship (36.4%) to road (49.4%).

Chlorine transported outside industrial sites (excluding pipelines)



Decrease in chlorine transportation tonnages, albeit increase in percentage of production.

Modes of caustic transport in the public area

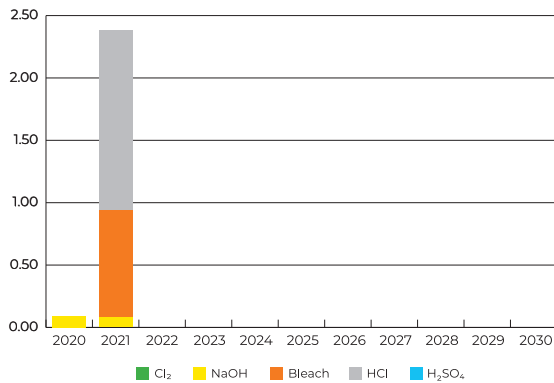


Decrease in caustic transportation.

Transport incidents for chlor-alkali related products

On a positive note, transport incidents for other chlor-alkali related products in addition to chlorine had a very good year with zero reported transport incidents.

Number of transport incidents per million tonnes transported

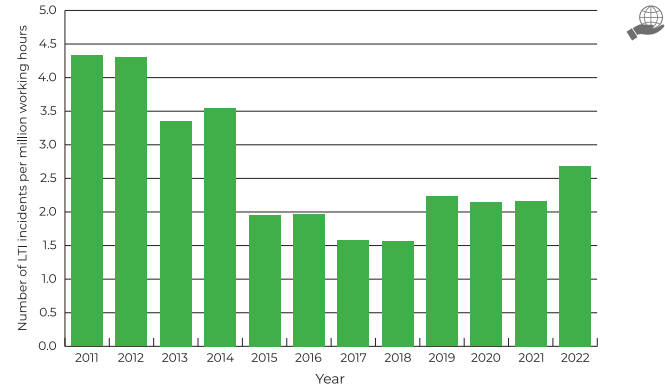


Zero transport incidents reported in 2022.

Occupational safety

As previously mentioned, Euro Chlor intensified its efforts in the safety field in recent years by organising safety trainings and discussing incidents in all the relevant groups. Despite these initiatives, we saw the Lost Time Injuries (LTIs) for member company staff and contractors increasing from 2.16 per million working hours in 2021 to 2.68 in 2022.

Chlor-alkali LTI frequency rate

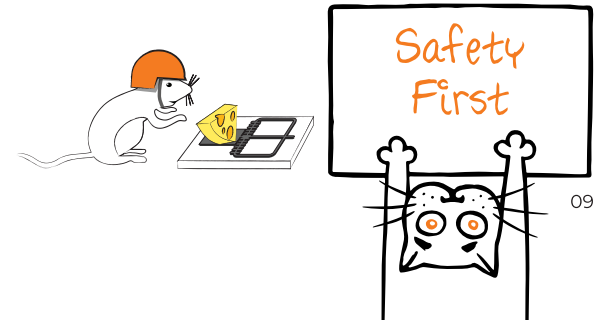


Increasing number of LTIs (member of staff + contractors now reported together as one figure).

A focus on chlorine inhalation for the Health Working Group

Euro Chlor's Health Working Group is playing its role in boosting incident reporting. Incidents involving chlorine emissions are being seen, but there has been a steady decline in the number of members who submit chlorine inhalation reports. To facilitate the reporting and increase member participation, our group of occupational physicians is working on new tools to make chlorine inhalation data return easier. Data here will be used to further develop guidance on managing inhalation response for all stakeholders.

Highlights at:
<https://chlorineindustryreview.com/safety>

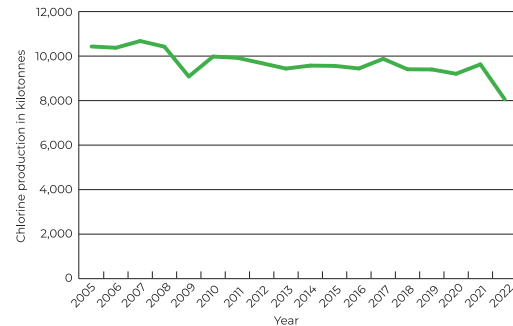


Changes to members and partners

Euro Chlor welcomed eight new partners over the past year. There have also been some changes to members, with International Chemical Investors Group (ICIG), who own Vynova, also taking over French member MSSA as well as Evonik's site in Lülisdorf, Germany. We regularly report on member and partner news on the news section of the Euro Chlor website.

2022 Chlorine production

According to figures reported by our members to Cefic, 8,069 kilotonnes of chlorine were produced in 2022; 16.5% lower than 2021. This is most likely due to the decline in economic activity, combined with our loss in competitiveness caused by the increase in energy prices in Europe compared to the rest of the world (initiated by our higher CO₂/energy costs and aggravated by the Russian war). Utilisation rate, meanwhile, decreased from 82.5% in 2021 to 68.5% in 2022, while installed capacity increased by almost 1% over the past year.



Lowest chlorine production levels in 20 years.

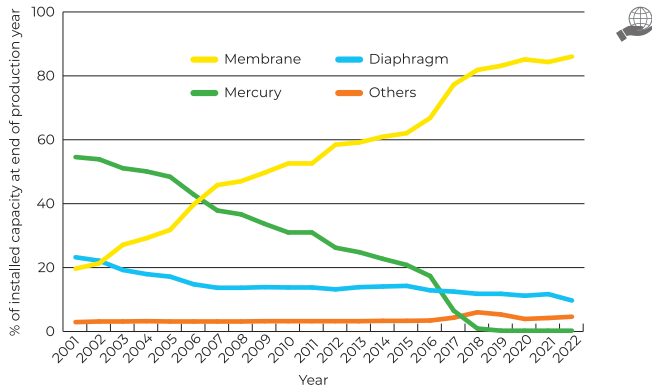
Chlorine production and utilisation rates have plummeted. Our competitiveness is at stake as caustic imports increased and downstream product exports decreased, while utilisation rates in competing regions remained normal.

Johan Van Den Broeck, Chairman of the Management Committee

Manufacturing technology

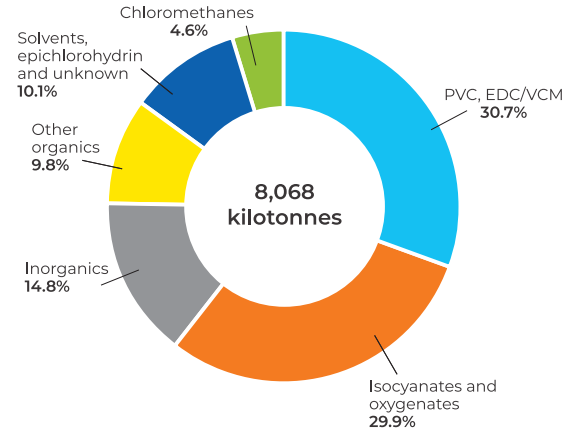
Membrane remains the dominant technology to produce chlor-alkali in Europe, representing 86.2% of installed EU capacity. Diaphragm technology, meanwhile, represents 9.5% of capacity and the remaining 4.4% covers chlorine-alcoholate production, hydrochloric acid conversion to chlorine, metal production and chlorine and caustic production without hydrogen as a by-product.

Chlorine manufacturing processes

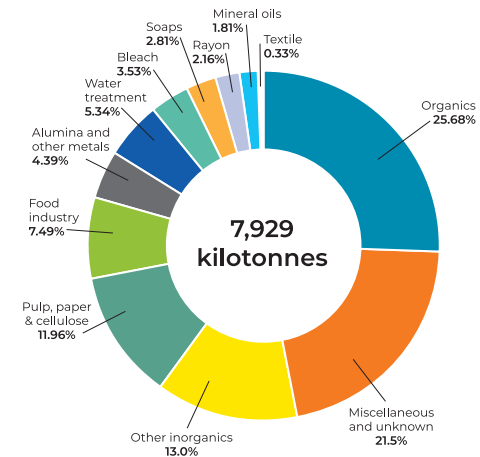


86.2% of European chlor-alkali uses membrane-based production technology.

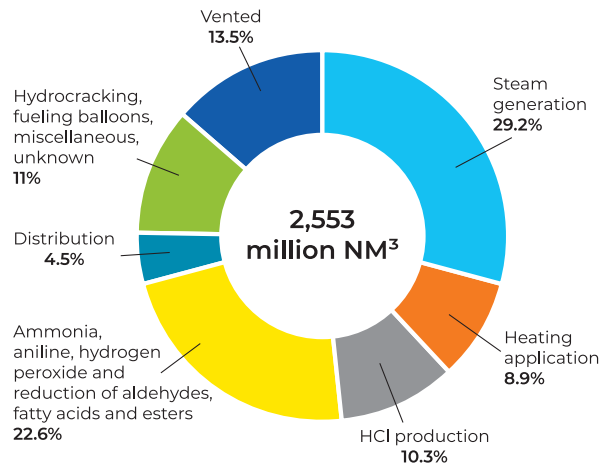
European chlorine applications 2022



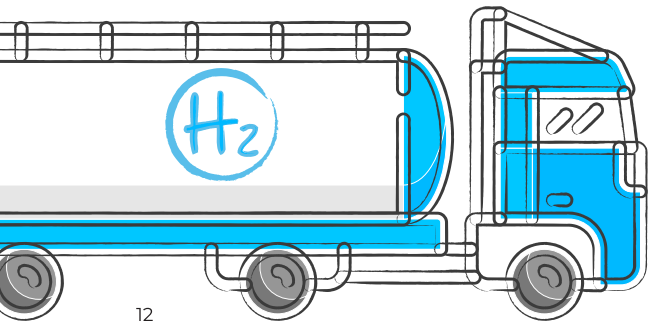
European caustic soda applications 2022



European hydrogen applications 2022



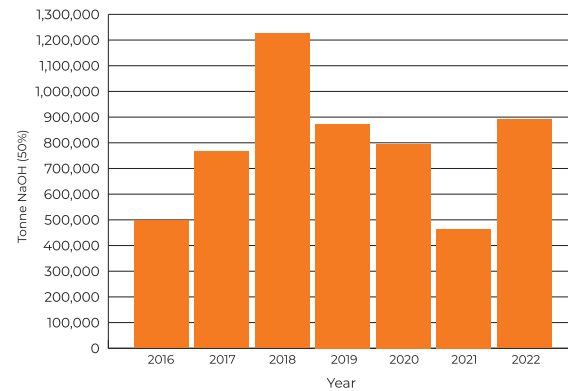
Note: Figure for vented hydrogen varies from that on page 22 due to difference in products covered and different reporting lines.



Net caustic soda imports

The level of net import of caustic soda (as 50%) into the EU is another new competitiveness metric implemented by Euro Chlor. This had been decreasing since 2018, but in 2022 the trend reversed and net imports started to increase again. The peak in 2018 was mainly caused by the completion of the last mercury conversion projects.

Net caustic soda imports (as 50%) in the EU



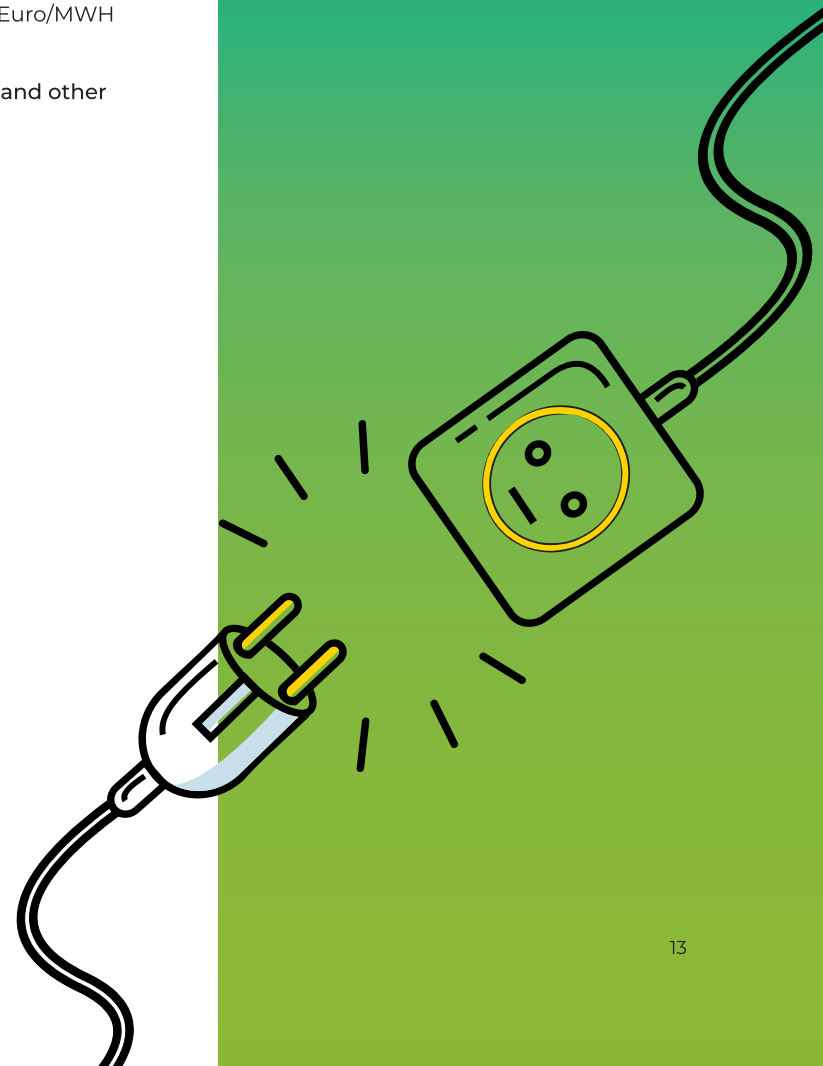
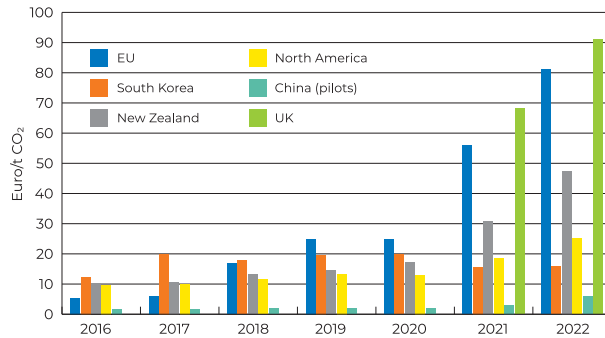
Electricity and CO₂ costs

To measure our competitiveness, in 2021 Euro Chlor started to publish available data on the cost of electricity in Europe compared to the USA and the cost of CO₂ in Europe compared to other regions in the world. During 2022, we saw a sharp increase in the delta of electricity costs (50 Euro/MWH compared to 9 Euro/MWH in 2021) between the USA and European averages.

Electricity price for consumers between 70-150 GWh/year 2020-2022 (excluding VAT and other recoverable taxes and levies)



CO₂ prices around the world



Chlorine production plants 1st January 2023 capacities

Process:

D = diaphragm

M = membrane

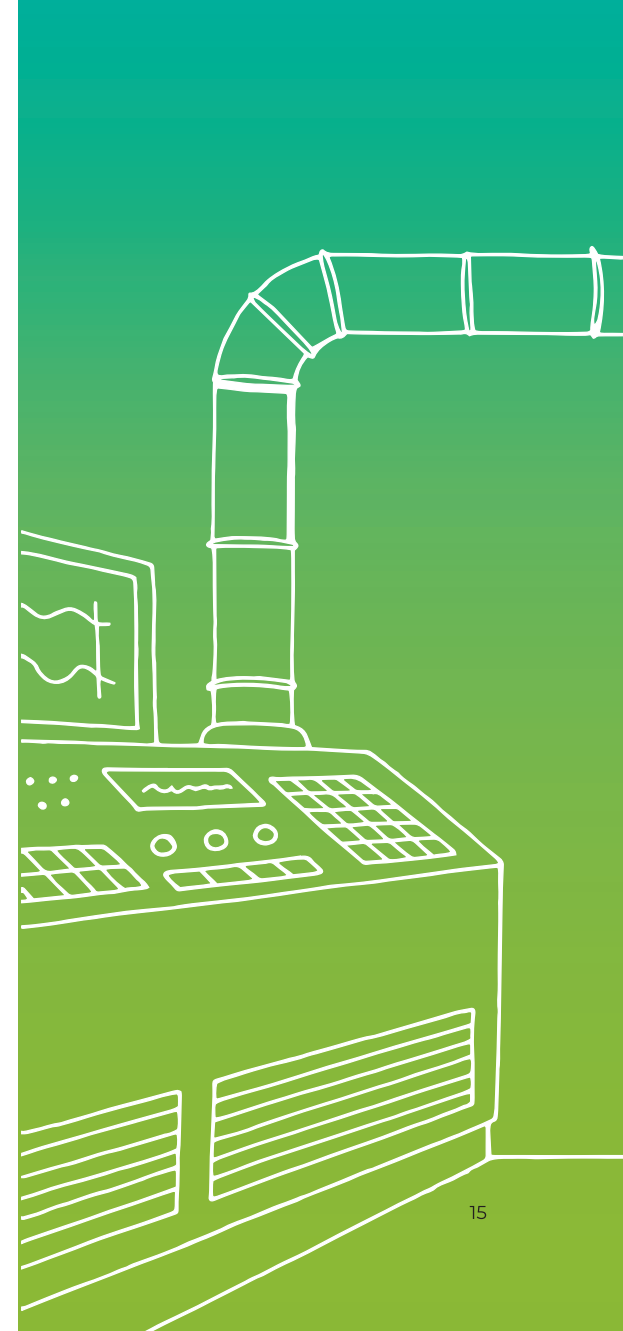
“**Others**” includes HCl electrolysis, ODC, molten salt electrolysis, alcoholates.

Non Euro Chlor members are indicated in italics.

	Country	Company	Site	Total (kt Cl ₂)	D	M	Others
1	Austria	Donau Chemie	Brückl	78		78	
Austria Total				78	0	78	0
3	Belgium	INEOS Inovyn	Lillo	500		500	
4	Belgium	INEOS Inovyn	Jemeppe	174		174	
5	Belgium	Vynova	Tessengerlo	400		400	
Belgium Total				1,074	0	1,074	0
7	Czech Republic	Spolek (Spolchemie)	Ústí nad Labem	78		78	
Czech Republic Total				78	0	78	0
9	Finland	Kemira	Joutseno	75		75	
Finland Total				75	0	75	0
10	France	Vynova PPC	Thann	42		42	
11	France	Vencorex	Pont de Claix	119		119	
12	France	KEM ONE	Fos	333	178	155	
13	France	Arkema	Jarrie	75		75	
14	France	KEM ONE	Lavera	341		341	
15	France	Arkema	Saint-Auban	20		20	
16	France	MSSA	Pomblière	42			42
18	France	INEOS Inovyn	Tavaux	370		370	
19	France	Kuhlmann France	Loos	38		38	
France Total				1,381	178	1,161	42
20	Germany	BASF	Ludwigshafen	595*			
21	Germany	Covestro	Dormagen	480		400	80
22	Germany	Covestro	Leverkusen	390		390	
23	Germany	Covestro	Krefeld-Ürdingen	290		290	
24	Germany	Covestro	Brunsbüttel	220			220
25	Germany	Dow	Schkopau	253		253	
26	Germany	Westlake Vinnolit	Hürth-Knapsack	250		250	
27	Germany	CABB GmbH	Gersthofen	57		55	2

*Distribution unknown

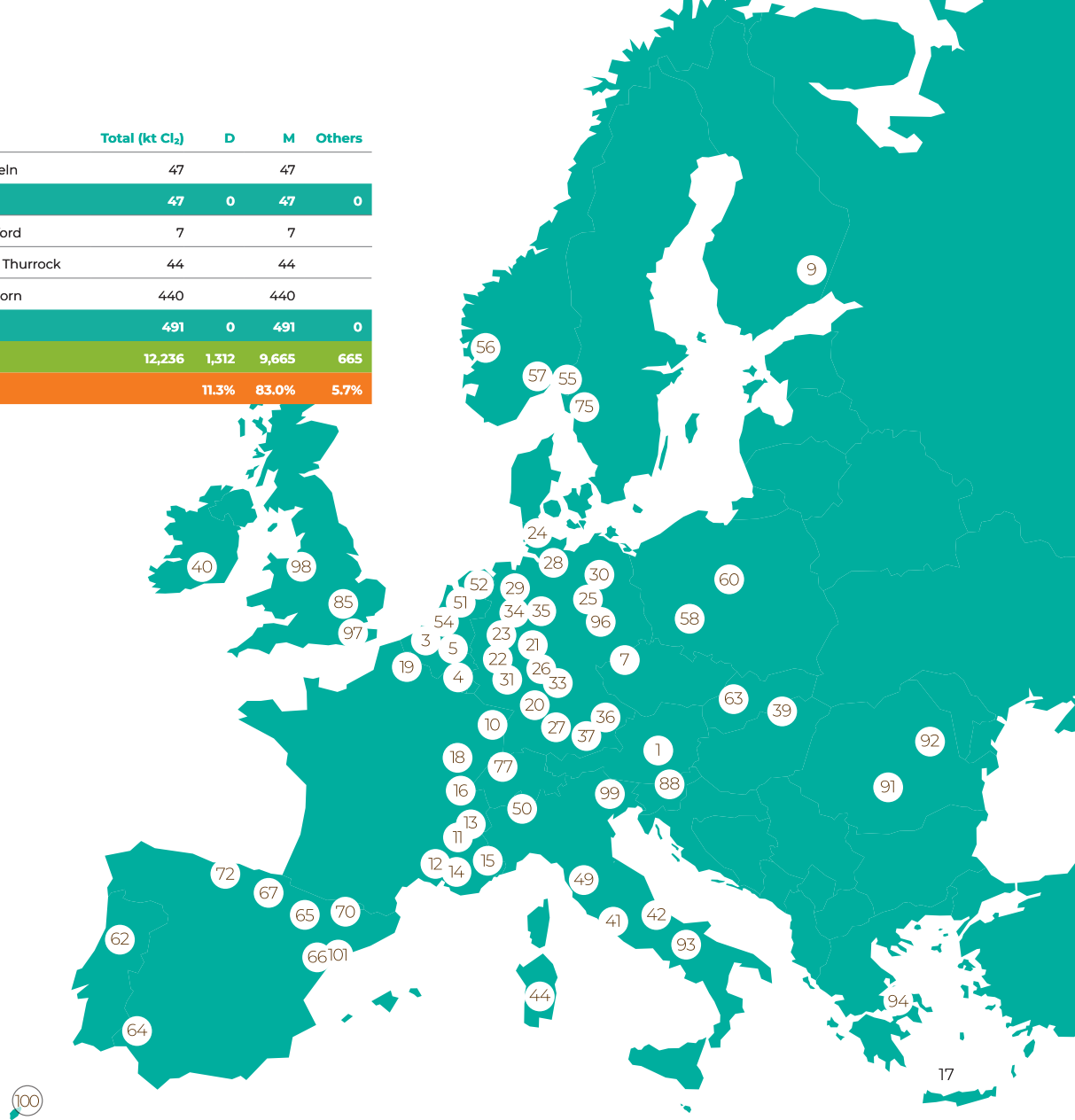
	Country	Company	Site	Total (kt Cl ₂)	D	M	Others
28	Germany	Dow	Stade	1,624	1,024	600	
29	Germany	Neolyse Ibbenbüren GmbH	Ibbenbüren	82		82	
30	Germany	Nobian	Bitterfeld	99		99	
31	Germany	Lülsdorf Functional Solutions	Lülsdorf	77			77
33	Germany	Nobian	Frankfurt	283		283	
34	Germany	INEOS Inovyn	Rheinberg	220	110	110	
35	Germany	VESTOLIT	Marl	260		260	
36	Germany	Westlake Vinnolit	Gendorf	205		205	
37	Germany	Wacker Chemie	Burghausen	60		60	
96	Germany	LEUNA-Harze	Leuna	15		15	
Germany Total				5,460	1,134	3,351	379
94	Greece	Kapachim	Inofita Viotias	10		10	
Greece Total				10	0	10	0
39	Hungary	BorsodChem	Kazincbarcika	480		384	96
Hungary Total				480	0	384	96
40	Ireland	Micro Bio	Fermoy	11		11	
Ireland Total				11	0	11	0
41	Italy	Altair Chimica (ESSECO GROUP)	Saline di Volterra	75		75	
42	Italy	Gestioni Industriali Group (GIG)	Bussi	18		18	
44	Italy	Gestioni Industriali Group (GIG)	Assemini	27		27	
49	Italy	INEOS Inovyn	Rosignano	150		150	
50	Italy	Hydrochem Italia (ESSECO GROUP)	Pieve Vergonte	42		42	
93	Italy	Fater	Campochiaro	20		20	
99	Italy	Gestioni Industriali Group (GIG)	Torviscosa	24		24	
Italy Total				356	0	356	0
51	The Netherlands	Nobian	Botlek	637		637	
52	The Netherlands	Nobian	Delfzijl	121		121	
54	The Netherlands	Sabic	Bergen op Zoom	89		89	
The Netherlands Total				847	0	847	0





	Country	Company	Site	Total (kt Cl ₂)	D	M	Others
55	Norway	Borregaard	Sarpsborg	45		45	
56	Norway	Elkem	Bremanger	11		11	
57	Norway	INOVYN	Rafnes	315		315	
Norway Total				371	0	371	0
58	Poland	PCC Rokita	Brzeg Dolny	210		210	
60	Poland	Anwil	Włocławek	195		195	
Poland Total				405	0	405	0
62	Portugal	Bondalti Chemicals	Estarreja	142		94	48
Portugal Total				142	0	94	48
91	Romania	Chimcomplex	Râmnicu Vâlcea	106		106	
92	Romania	Chimcomplex	Borzești	102		102	
Romania Total				208	0	208	0
63	Slovak Republic	Fortischem	Nováky	70		70	
Slovak Republic Total				70	0	70	0
88	Slovenia	TKI Hrastnik	Hrastnik	16		16	
Slovenia Total				16	0	16	0
64	Spain	Electroquímica Onubense	Huelva/Palos	44		44	
65	Spain	Ercros	Sabiñanigo	45		45	
66	Spain	Ercros	Vila-seca	172		172	
67	Spain	Electroquímica de Hernani	Hernani	30		30	
70	Spain	Química del Cinca	Monzón	60		60	
72	Spain	Bondalti Chemicals	Torrelavega	60		60	
100	Spain	Biomca Química	Santa Cruz de Tenerife	3		3	
101	Spain	Covestro	Tarragona	100			100
Spain Total				514	0	414	100
75	Sweden	INOVYN	Stenungsund	123		123	
Sweden Total				123	0	123	0

Country	Company	Site	Total (kt Cl ₂)	D	M	Others
77	Switzerland	CABB AG	Pratteln	47		47
Switzerland Total			47	0	47	0
85	UK	Brenntag	Thetford	7		7
97	UK	Industrial Chemicals Ltd	West Thurrock	44		44
98	UK	Runcorn MCP	Runcorn	440		440
UK Total			491	0	491	0
Grand Total			12,236	1,312	9,665	665
Per process				11.3%	83.0%	5.7%



New Cost Competitiveness Study finalised

At the end of 2022, Euro Chlor selected Argus Media to carry out a study on the cost competitiveness of the European chlor-alkali industry. The main objective of this study was to determine the impact of the costs of electricity, other raw materials and emissions on the production costs of chlorine and its main derivatives. It also aimed to identify how the differences between these costs in several regions of the world impact the cost competitiveness of our industry.

The report, finalised in March 2023, showed that in 2015 we were already at a cost disadvantage for chlor-alkali and its main downstream products compared to other regions. This was mostly due to electricity prices and the costs of “fossil-based” raw materials, which all further increased dramatically during the recent energy crisis. Whilst the disadvantage may reduce slightly by 2030, it is expected to remain higher compared to 2015. Our reduced competitiveness is also reflected in the rising number of caustic imports and the declining export of our downstream products. In addition, our production utilisation remains at significantly low levels, while in other regions of the world capacity utilisation is normal.

The results are being used as input for the Electricity Market Design review and the Carbon Border Adjustment Mechanism (CBAM) files. The key learning from this is that our sector requires abundant low carbon/ renewable power that is competitively priced. Euro Chlor will work towards securing this via its dedicated Committees.

Intermediate chlorine benchmark solution available

Maintaining compensation for indirect costs coming from the EU Emission Trade System (ETS) is a priority for Euro Chlor as electricity is one of the key 'ingredients' for chlor-alkali production. The ETS Directive that forms the basis for this indirect compensation (which uses the chlorine benchmark) has been subject to revision but used ODC technology as the reference. This led to a lower benchmark and thus lower possible compensation. It has put additional pressure on our industry at a time when its competitiveness both within and outside of Europe is at stake.

Over the past 18 months, Euro Chlor held regular meetings with key stakeholders to resolve the issue. A practical solution was mentioned during a Cefic/ Euro Chlor high-level meeting with the Directorate General for Competition (DG COMP) of the European Commission in December 2022. DG COMP referred to a French ETS case clearly mentioning the possibility to compensate the chlor-alkali industry separately (on top of the compensation for chlorine/ caustic) for their produced hydrogen.

Even though this appeared promising, several Member States hesitate in applying it. They are not clear what the French ETS case really means for compensation of their local chlor-alkali industry. Some States seek more information that the compensation is happening in practice in other countries, whilst others require further clarification from DG COMP. Euro Chlor has provided detailed information for members and national associations to clarify the situation at their local level.

News about the Carbon Border Adjustment Mechanism (CBAM)

CBAM aims to maintain European competitiveness while mitigating the risks of carbon leakage as industries leave Europe to find what they believe to be more competitive locations as far as greenhouse gas (GHG) emission costs are concerned. CBAM enters its transition period, consisting of a reporting phase, in October 2023. It covers a first group of sectors, namely steel, cement, aluminium, fertilisers, electricity and hydrogen. For the next phase, which is now under investigation, chemicals may be included. As such Euro Chlor is following up with Cefic on what the implications of CBAM could be for ourselves and our downstream products, as they will also need to be protected.

Euro Chlor contributes to Electricity Market Design consultation

The review of the Electricity Market Design will have an impact on those regulations aiming to secure European energy supplies whilst obtaining climate neutrality. In early 2023, Euro Chlor's Energy Task Force contributed to the Cefic position, pointing out that access to competitive, abundant, renewable and low-carbon energy is critical to the competitiveness of European industry.

Via the review, the European Commission is also pushing the use of PPAs and two-way Contracts for Difference (CfDs) in an attempt to increase the supply of renewable and low-carbon energy. Cefic has several recommendations regarding the further implementation of these tools and used our chlor-alkali experience with barriers to renewable PPAs.

Highlights at:

<https://chlorineindustryreview.com/competitiveness>





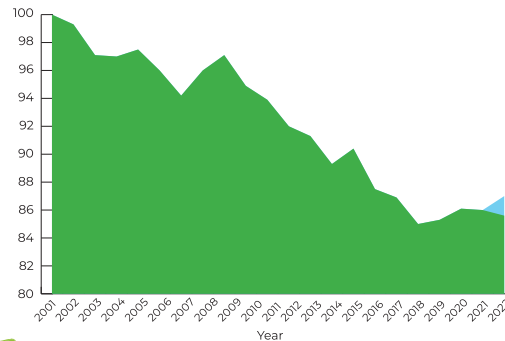
Energy consumption

Primary energy consumption remained at roughly the same level as 2021 (85.6% in 2022 compared to 86.0% in 2021), taking 2001 as the reference year. However, if we compensate for the extremely low level of production in 2022, compared to previous years energy consumption would have increased to around 87.0% compared to 2001 (as indicated by the blue section in the graph).

Electricity and steam consumption

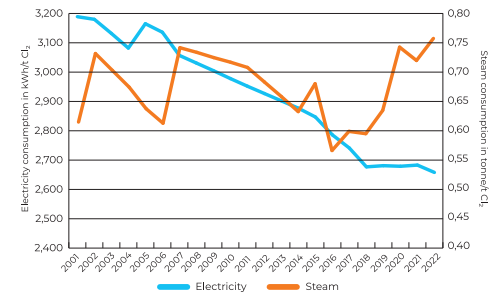
The weighted average electricity consumption declined compared to 2021 levels. However, this electricity consumption would have increased had we compared it to the same production utilisation rate as 2021.

Primary fuel energy consumption (% compared to 2001)



Increase when comparing against same utilisation rates.

Electricity and steam consumption per tonne of chlorine



Decrease in weighted average electricity consumption.

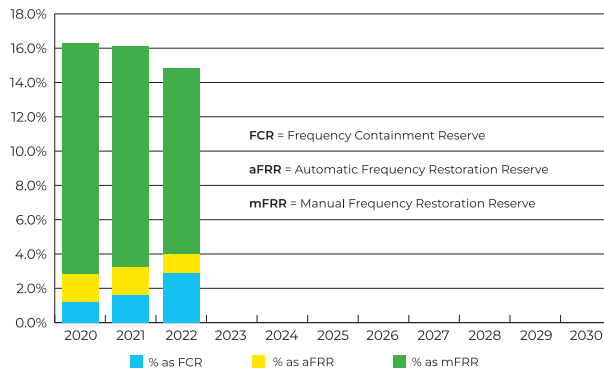
Grid balancing

Euro Chlor looks into the role we play in balancing the electricity grid. Increasing (volatile) renewable electricity production with wind and solar means that more solutions are needed to maintain stability in the electricity grid and thus prevent blackouts. Chlor-alkali production units can partly contribute to balancing, but this capability is limited by the product needs of customers and the limited legal possibility to store chlorine.

In our third Sustainability Programme, we report on the grid balancing support delivered by members as a percentage of the total installed electricity demand capacity. In 2022, 14.8% of that capacity was available for grid balancing, which is a decrease from the 2021 level of 16.0%.

Euro Chlor is supporting the inclusion of more options to valorise flexible consumers in the recent review of the Electricity Market Design (see page 19) and seeking ways of increasing flexibility.

Percentage of electrical capacity reserved for grid balancing



Decrease compared to 2021 levels.

Euro Chlor investigates how to increase flexible operations

Chlor-alkali producers, as one of the large electricity consumers, are stimulated to investigate options, not only to increase their capability to balance the electricity grid, but also to mitigate any increased volatility of electricity production that results from increasing wind/ solar energy sources. The available options to increase flexible operations for chlor-alkali production installations have been discussed at length by the General Technical Committee (GTC) throughout the past year.

During these discussions, it has become clear that the solution is complex. Euro Chlor members already play a role today in keeping the electricity grids stable by slightly varying their production level when needed. However, when operating completely on wind and solar electricity, a completely new way of thinking is required, and multiple options need to be considered. These include storing electricity in batteries and/ or as hydrogen, increasing the flexibility of own production as well as that of downstream users, and increasing the storage volumes of own and downstream produced products. There is no single solution to the issue and all options will increase costs and decrease overall energy efficiency. More work is needed to study the most optimal solutions, which may vary from location to location.

This year we are proud of reducing our greenhouse gas emissions but we still need to focus on increasing our hydrogen use.

Kristof May

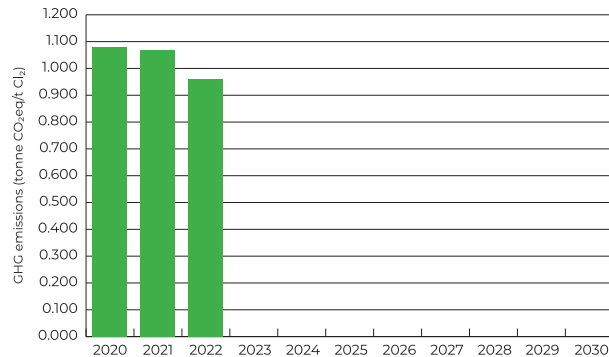
Energy & Regulatory Affairs Manager

Carbon footprint reduction

The EU has the ambition to become climate neutral by 2050. The reduction of our carbon footprint (presented in our Eco-profile), is monitored as part of our third Sustainability Programme. Here we report the scope 1 and 2 emissions of CO₂ from member production units for chlor-alkali and hydrogen.

In 2022, GHG emissions reduced by around 10% compared to 2021. This is a huge step towards carbon neutrality. The largest contribution comes from members who switched from fossil-based electricity to carbon neutral electricity. It should be noted, however, that a remaining part of the carbon footprint reduction was achieved by the lower utilisation rate in 2022.

Carbon footprint of Euro Chlor members production

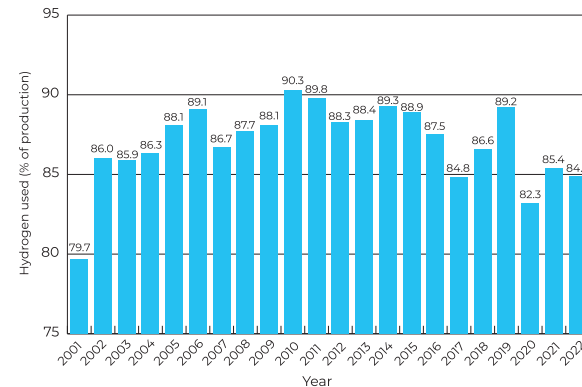


Large reduction in greenhouse gas emissions.

Hydrogen use

Euro Chlor produces an average of around 270,000 tonnes/year of hydrogen. This year though, hydrogen utilisation slightly decreased from 85.4% in 2021 to 84.9% in 2022, demonstrating that it remains difficult to reach our MCS goal of 100% utilisation. We will continue our efforts towards this since chlor-alkali hydrogen has a low GHG profile and comes from a non-fossil source; two key priorities for Europe.

Hydrogen utilisation



0.5% decrease in hydrogen use compared to 2021.

Note: Figure for vented hydrogen varies from that on page 12 due to difference in products covered and different reporting lines.

Euro Chlor Hydrogen Day aimed to kick-start the hydrogen economy

To find solutions to achieve full utilisation of our hydrogen, Euro Chlor held its first 'Hydrogen Day' in Brussels on 7 March 2023. This face-to-face event brought together more than 80 Euro Chlor members, partners, hydrogen technology vendors and policy makers to address the challenges in achieving full and optimal utilisation.

Cefic Director-General Marco Mensink kicked off the event outlining the importance of hydrogen to the chemical industry. This was followed by Tim Hard of Argus who gave a general overview of the developments in the hydrogen market. A high-level panel session on 'Opportunities and challenges for hydrogen towards climate neutrality' then covered the overall policy framework and market expectations for hydrogen in general, which is also relevant to chlor-alkali. Moderated by Nicola Rega of Cefic, the discussion featured Ruud Kempener of Directorate General for Energy (DG ENER, European Commission), Dieter Schnepel of Dow Chemical Company, Tobias Bühnen of Gas Infrastructure Europe, Stefano Miriello of RE-Source Platform and Kenneth Bruninx of TU Delft. Interestingly, Ruud Kempener recognised the role of chlor-alkali's production of hydrogen and encouraged our industry to lead the way and take our experience to other industries.

Following this panel, two Euro Chlor members, Nobian and Bondalti, presented their case studies on how they are reducing their carbon footprint and five technology vendors set out their new technologies for hydrogen production and application. A poster session was also held to explain various challenges and technical solutions for hydrogen.

To close the day, two parallel sessions discussed elements crucial to kick-start Europe's hydrogen economy. The first session covered PPAs and the further development of a commodity hydrogen market. Meanwhile a session on the certification of hydrogen took place to describe more procedural aspects to full utilisation. The presentations in these final sessions were particularly relevant to chlor-alkali as Euro Chlor is seeking recognition and a clear role for its pure hydrogen by-product with a low carbon footprint. This event will be repeated in the future together with the Euro Chlor Technology Conference and Exhibition (next one planned in 2025).



Update on Renewable Energy Directives (RED) II and III

Euro Chlor investigated whether chlor-alkali hydrogen could be eligible to be called a 'Renewable Fuel of Non Biological Origin' (RFNBO). According to the current legal texts, our hydrogen would need to be produced under specific conditions. Firstly, the renewable electricity and hydrogen production need to occur within a limited timeframe (defined by law). Secondly, both productions need to occur within a defined geographic area. These requirements could be covered by adequate PPAs, but these are not sufficiently available to cover current demand. This means that not all our hydrogen will be allowed to be called 'renewable'.

Where these RFNBO criteria are not met, chlor-alkali hydrogen can still be considered 'low-carbon'. This concept was introduced in another legislation (the Gas Package) and defines a specific GHG value that can be attributed to any product to be labelled as 'low-carbon'. To calculate the GHG value attributed to hydrogen, the emissions linked to the electricity we use need to be divided amongst the products we produce (typically chlorine, caustic and hydrogen). In theory, this can be done according to several methods, of which economic allocation (linking GHG value with market prices, a dynamic system) and mass allocation (linking GHG value to the chemical mass of products, a fixed system) are frequently used. As Euro Chlor has always used mass allocation in its Eco-profile calculations and as economic allocation leads to a non-predictable variable output (not linked to actual emission levels), Euro Chlor has always advocated for mass allocation.



Highlights at:
<https://chlorineindustryreview.com/climateneutrality>

Climate Neutral Player  Chlor-alkali industry review 2022-2023

Euro Chlor digs deeper into the PFAS restriction

In 2021, following societal concerns that per- and polyfluoroalkyl substances (PFAS) persist in the environment and/or may have negative health impacts, Euro Chlor set up a PFAS Working Group as part of its General Technical Committee (GTC). This group has identified that fluorine-containing substances (that meet the EU definition of a PFAS) may be present in a range of key materials that are used in the production of chlor-alkali. These include materials used in membranes, diaphragms, greases, filter packing materials (etc.). Building on this, and to investigate if the use of such materials is leading to trace level environmental emissions, Euro Chlor is working with a laboratory to enable its membership to collect information on the presence of any 'PFAS' in the incoming raw materials, outgoing wastewater streams and some key liquid products.

In early February 2023, the European Chemicals Agency (ECHA) released the draft restriction proposal for PFAS and launched a six-month public consultation to obtain more data on these substances. To support this, Cefic has launched a broader assessment of the industrial use of PFAS across the entire chemical industry. Without a derogation, the use of fluorinated substances in chemical industry equipment could be banned 18 months after the restriction enters into force. This has added new impetus to work on emission monitoring and alternatives' assessment by the GTC with support from the newly named Advocacy and Regulatory Affairs Committee (ARAC).

Euro Chlor is now considering how best to inform the consultation and the GTC is preparing a report that could be used as input on the use of PFAS in our production installations. This report includes the options for alternative PFAS materials, the end-of-life solutions for them and socio-economic data on our industry.

Alongside this, meetings have been held with downstream user and sister organisations to discuss the common challenges faced. Meetings have also been held with international membrane suppliers to learn about responsible manufacture, and our role in the correct use and end-of-life of PFAS-containing materials. The results of these discussions are helping to inform Euro Chlor's investigations into PFAS.

Together with its members, the Euro Chlor team is investigating the use of fluorinated materials, along with their potential alternatives and waste management, to contribute to Europe's action on PFAS.

Richy Mariner
Science & Regulatory Affairs Director



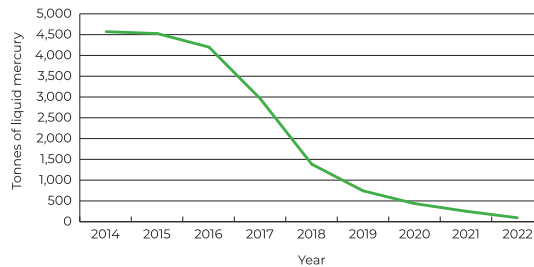
Euro Chlor members approaching end of mercury conversion

Following the phase-out of mercury technology by the end of 2017, any remaining liquid mercury should have been converted to mercury sulfide and stored in a salt mine by 31 December 2022. On that date, approximately 80 tonnes (of the ± 4,500 tonnes in 2014) of liquid mercury was still present on the sites.

Waste from the production process

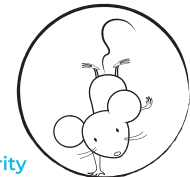
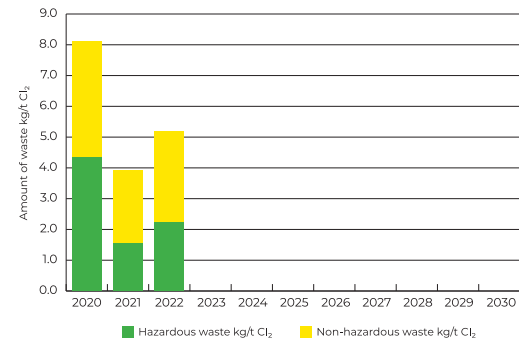
From our third Sustainability Programme, we report on the amount of waste generated by members. The amount of hazardous waste increased in 2022 from 1.5 kg per tonne of chlorine to 2.2 kg. Non-hazardous waste increased from 2.4 kg per tonne of chlorine to 3.0 kg per tonne of chlorine.

Liquid mercury present on chlor-alkali production sites



Note: Mercury for alcoholate production is not included in these figures.

Waste from the production process



Highlights at:
<https://chlorineindustryreview.com/circularity>

We continued to collaborate with, and communicate to, members, partners and key downstream user associations.

Catherine Potter
Communications Manager

Over the past year, Euro Chlor's Working Groups and Committees have welcomed new members to help develop the key activities described throughout this Industry Review. Additionally, the Management Committee has welcomed James Allman from INEOS Inovyn and Dirk Röttger from Lülisdorf Functional Solutions (former Evonik) to its ranks.

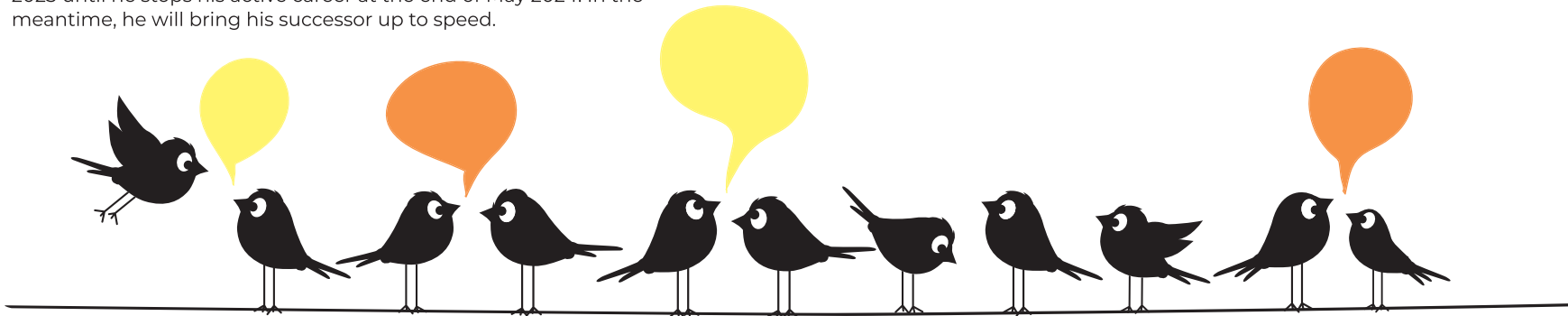
The Euro Chlor team itself also underwent some changes with Maud Bertolino joining the team in September 2022 after eight years in the Cefic Innovation team and valuable experience in event management. She already organised the Euro Chlor Hydrogen Day, as well as the 2023 Annual General Assembly. In April 2023, Richy Mariner was promoted to Science & Regulatory Affairs Director and Ton Manders, Technical & Safety Director, decided to reduce his workload from November 2023 until he stops his active career at the end of May 2024. In the meantime, he will bring his successor up to speed.

Connecting with our downstream stakeholders

This past year, we also kept developing our connections with our downstream stakeholders, most notably in meetings with the European Council of Vinyl Manufacturers (ECVM) and the European Diisocyanate & Polyol Producers Association (ISOPA).

A joint strategic meeting was held late-2022 between ECVM and Euro Chlor to discuss cooperation and potential synergies in communication and collaboration on items such as ECHA's ongoing investigation into PVC. Members of the team also helped ECVM with their survey of equipment in VCM/PVC plants made of fluorinated materials and supported their VinylPlus Communications Committee, Environmental Footprint Committee (EFC) Meeting and Sustainability Forum.

Meanwhile, collaboration increased with ISOPA with members of the Euro Chlor team discussing with ISOPA team members topics such as PFAS and how to communicate the benefits of our chemistry to society.



New video shows how safe and healthy water is a Chlorine Thing

In the latest of the Chlorine Things series, Euro Chlor released a new video at <https://www.eurochlor.org/news/new-video-shows-how-safe-and-healthy-water-is-a-chlorine-thing> that details how chlor-alkali chemistry is important in making water safe to drink, bathe and play in.

Two new 17 Chlor-Alkali Careers videos

Taking '17' as our inspiration (from chlorine's position on the chemical Periodic Table of elements), Euro Chlor's 17 Chlor-Alkali Careers programme presents 17 real Europeans, whose work contributes to producing chlor-alkali chemicals. Over the past year, Euro Chlor launched two new 17 Careers videos at <https://www.eurochlor.org/17careers>. These feature Emmanuelle from Vynova and Alexander from CABB, bringing the total so far to seven, with more planned for the coming year.

New Hydrogen Tree and video of Hydrogen Day launched

At its Hydrogen Day event (see page 23), Euro Chlor launched a new tree for hydrogen at <https://trees.eurochlor.org/products-of-hydrogen>. This comprehensive resource, available in digital and print format, shows the rich diversity of hydrogen applications and end-products. A video of the Hydrogen Day can also be found on the Euro Chlor YouTube channel.



Highlights at:
<https://chlorineindustryreview.com/collaboration>

New Euro Chlor Instagram account

Over the past year, we launched a new Instagram account at <https://www.instagram.com/eurochlor> to reach out to wider audiences.

We also updated our website <https://www.eurochlor.org> regularly, as well as our social media.



2x

Increase in people engaging with our posts on Twitter in the last 12 months.



2,023

followers - our biggest source of audiences from social media to our website.

New project to show the benefits of chlor-alkali products along our value chain

Following a request from the Management Committee to display the benefits of all products in our value chain, the Communications Committee have now kicked off a new online campaign. Due to start in autumn 2023, it is aimed at EU decision makers and young people. This activity will reinforce the work of communications consultant DoubleDouble, who has been retained to build on some 'Chlorine Things' videos they made several years ago.

Workshops were held in June 2023 to outline the strategy of the campaign, tools to boost the overall awareness of Euro Chlor via online Search Engine Advertising (SEA) and how to use existing content and tools and integrate this project in our over-arching communications. The result will be 12 new animations that can be seen in the upcoming months on our social media channels and website.

First Mr C video launched

To complement this renewed benefits project, Euro Chlor has developed the first in a series of animated 'Mr C' videos that show how modern life has evolved due to chlor-alkali products. This will premiere at the Annual General Assembly in early September 2023 and is aimed at engaging young people on the benefits of chlor-alkali chemistry.



Halogens

Cefic Industry Sector 

This past year saw a step change in the synergies between the 10 Halogens Industry Sector Groups (see <https://www.halogens.eu>) as they faced common EU regulatory challenges such as the Industrial Emissions Directive (IED) and the BREF, the Chemical Strategy for Sustainability (CSS) and REACH Revision and PFAS.

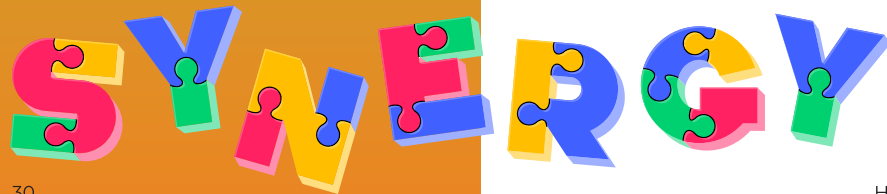
On the PFAS file, in April 2023, Maria Chiara Detragiache joined the Halogens team as PA Manager to help strengthen synergies between Sector Groups and the Cefic policy departments on PFAS.

Third Halogens Industry Sector Board

On 9 June 2023, the third Halogens Industry Sector Board took place for the 10 Halogens Sector Group (SG) Chairs and the Halogens Coordination Group (HCG) members.

The meeting covered many topics of relevance by Cefic colleagues to the members, including the Cefic Transition Pathway, Climate Change and Energy and PFAS updates, the Chemical Strategy for Sustainability and REACH Revision, and the Net Zero Industry Act and Critical Raw Material Act. Following the meeting, Euro Chlor Chair Johan Van Den Broeck was voted as the new Chair to replace Jacques Sturm of Vynova.

To ensure full representation of Halogens Sector Groups in high level Cefic discussions, members of the HCG held regular meetings to update on the key highlights from the Cefic Programme Councils (PCs) and Fora.





Fluorinated Products and PFAS for Europe (FPP4EU) collaborates with Euro Chlor

FPP4EU was set up two years ago to represent the views of producers, importers, and users of fluorinated products and PFAS in Europe.

Whilst FPP4EU does not represent individual PFAS substances, it covers these substances as a whole and has been collaborating with Euro Chlor to exchange information on the regulatory situation and provide perspectives on the uses of fluorinated materials in chlor-alkali. It has also been informing authorities on those uses which are missed in the PFAS restriction proposal via the FPP4EU Collaboration Platform, assembling an impressive number of PFAS downstream user sectors. See <https://www.fpp4eu.eu> for more details.



ECSA nominates new Management Committee Chair

The European Chlorinated Solvents Association (ECSA) nominated a new Chair at its Management Committee meeting in September 2022. Jan Votava of Spolchemie replaced Isabelle Gourdon of Kem One, who had been the Chair for the past year. Meanwhile, at the General Technical Working Group (GTWG) and Management Committee meetings of 1-2 June 2023, members discussed the various ongoing regulatory activities and ECSA communications. See <https://www.chlorinated-solvents.eu> for more details.

Synergy between the 10 Halogens Industry Sector groups and within the Cefic policy departments significantly increased this past year.

Marleen Pauwels, Executive Director, Halogens

Highlights from other Halogens Sector groups

Information on the other Halogens Sector Groups can be found on their websites:

- Chloro Alkanes Sector Group - <https://www.halogens.eu/about-us/casg>
- Chloroformates Sector Group - <https://www.chloroformates.eu>
- European FluoroCarbons Technical Committee (EFCTC) - <https://www.fluorocarbons.org>
- Eurofluor (CTEF, Comité Technique Européen du Fluor) - <https://www.eurofluor.org>
- European Sulphuric Acid Association (ESA) - <https://www.sulphuric-acid.eu>
- Fluorinated Products and PFAS for Europe (FPP4EU) - <https://www.fpp4eu.eu>
- Potassium Sector Group - <https://www.halogens.eu/about-us/psg>
- Sodium Chlorate Sector Group - <https://www.halogens.eu/about-us/scsg>

Highlights at:

<https://chlorineindustryreview.com/halogens-news>



Members

Altair Chimica SpA

Anwil SA

Arkema S.A.

BASF SE

Biomca Química SL

Bondalti Chemicals SA

Borregaard AS

BorsodChem Zrt.

Brenntag UK Ltd

CABB AG

CABB GmbH

Caffaro Green Chemicals Srl

Covestro AG

Donau Chemie AG

Dow Deutschland Anlagengesellschaft mbH

Electroquímica de Hernani

Electroquímica Onubense, S.L.

Ercros SA

Fater S.p.A.

Industrial Chemicals Limited (ICL)

INEOS Inovyn

Kapachim SA

Kemira Oyj

KEM ONE

Kuhlmann Europe

Lülsdorf Functional Solutions GmbH

Micro Bio (Irl.) Ltd.

MSSA SAS

Nobian

PCC Rokita SA

Química del Cinca SLU

Società Chimica Assemini Srl

Società Chimica Bussi S.p.A.

Spolek pro chemickou a hutni výrobu, a.s. (Spolchemie)

Vencorex

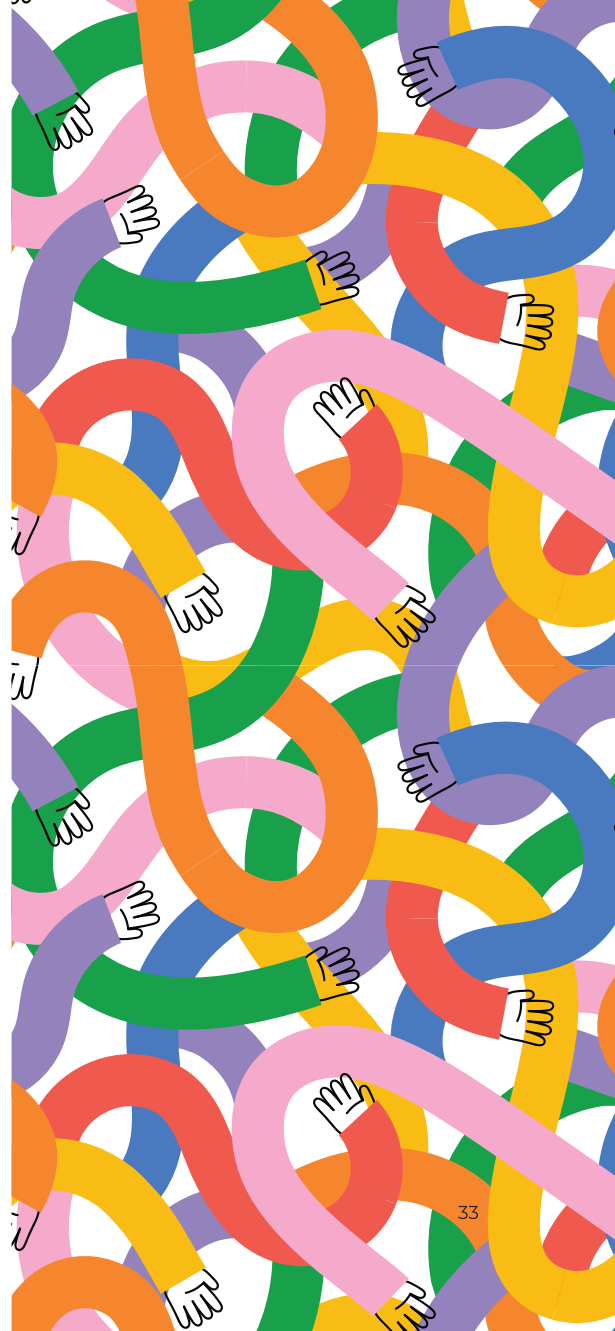
VESTOLIT GmbH (Orbia)

Vynova Group

Westlake Vinnolit GmbH & Co. KG

Partners

Adama Makhtshim Ltd
AGC Chemicals Europe Ltd.
Ak-Kim Kimya Sanayi ve Tic. A.S.
Al Kout Industrial Project Co
Al-Baha Company for Caustic and Chlorine Industry LLC
ANE - Asociación nacional de electroquímica
Angelini A.C.R.A.F. S.p.A.
Applitek NV/SA
AQUAGROUP AG
Armstrong Chemtec Group
Asahi Kasei Europe GmbH
Axiall, LLC - Westlake Chemical
Banner Chemicals Limited
BARCHEMICALS SRL
BELL-O-SEAL VALVES P. LIMITED
Bhiwadi Cylinders Pvt. Ltd.
Blackhall Engineering Limited
Bluestar (Beijing) Chemical Machinery Co., Ltd.
BOCHEMIE a.s.
CBee Europe Ltd - The Clorox Company
Charam Techno Chemical & Equipments (P) Ltd.
Chemieanlagenbau Chemnitz GmbH (C.A.C.)
Chemoform AG
CIA - Chemicals Industries Association Ltd
Coogee Chlor Alkali Pty Ltd
De Nora Deutschland GmbH
Descote
DSD Chemtech Projects & Services GmbH
DUPONT ASTURIAS, S.L.
Essencia ASBL
Eu Salt aisbl (European Salt Producers' Association)
Eynard Robin
Fariman Petrochemical Industries
FEDERCHIMICA - Federazione Nazionale dell' Industria Chimica
Fluidra S.A.
Forxar Industries Pvt Ltd.
Garlock GmbH, an EnPro Industries company
GEMÜ GEBR. MÜLLER APPARATEBAU GMBH & CO. KG





Partners

GHC Gerling, Holz & Co Handels GmbH
Groupe Gazechim
HELM AG
Hunt & Mitton Valve Company
Huntsman (Europe) BVBA
Hydrus Hygiene Ltd
IKEM - Innovation and Chemical Industries in Sweden
IMCHLO bv
IXOM
Jiangsu Ancan Technology Co., Ltd.
Jordan Bromine Company Limited - JBC
Kronos Worldwide, Inc.
Kurotec-KTS Kunststofftechnik Stade GmbH
LOMBARDA H Srl
Lonza Group AG
Lubrizol Deutschland GmbH
MAVESZ - Hungarian Chemical Industry Association
Mersen Pgy SAS
META Régénération
Metaltec Ltda
Nankai Chemical Co., Ltd.
Neeltran, Inc.
NEOM
Nirou Chlor Co.
NOVACID
Nuberg Engineering Limited
Olin Germany Upstream GmbH & Co. KG
Permascand AB
PHOENIX Armaturenwerke GmbH
Powell Fabrication & Manufacturing LLC.
Prince Rubber & Plastics Co., Inc.
Qatar Vinyl Company (QVC) Q.P.J.S.C.
Recherche 2000 Inc. - R2
Richter Chemie-Technik GmbH
SALINEN AUSTRIA AG
Sasol Chemicals, a division of Sasol South Africa (Pty) Ltd
SAVINO BARBERA Srl
SCHP - Association of Chemical Industry of the Czech Republic

Scienceindustries
Senior Aerospace Ermeto/ Ermeto Valves
SGL Carbon GmbH
Sibanye-Stillwater Sandouville Refinery
SIEM Supranite
Sinopec Europa GmbH
Sojitz Europe plc
SPOLANA s.r.o
STEULER-KCH GmbH
Sunresin New Materials Co. Ltd
Syngenta Crop Protection Monthey SA
Technip Energies France SAS
Teijin Aramid BV
thyssenkrupp Uhde Chlorine Engineers GmbH
Tosoh Corporation
Tronox Pigments (Holland) B.V.
Unilever Nederland B.V.
Valvosider S.r.l.
Van den Heuvel Watertechnologie bv
Vantage Leuna GmbH
VCI - Verband der Chemischen Industrie e.V.
Veltek Associates, Inc. - VAI®
VNCI - Vereniging van de Nederlandse Chemische Industrie
Westlake Epoxy B.V.
Wood Italiana S.r.l.
Xomox International GmbH & Co. OHG - Crane ChemPharma & Energy



<https://linkedin.com/company/eurochlor>



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Highlights of this report are available from:
<https://chlorineindustryreview.com>

Euro Chlor supports a safe, competitive and green chlor-alkali industry for Europe.

Chlor-alkali is an essential building block for the manufacture of numerous products that we rely on every day. Across Europe, millions of jobs are dependent on the availability of competitively priced chlor-alkali supplies.

Chlor-alkali chemistry is also vital for the development of the innovative materials we will need in the future.

Euro Chlor's 38 producing members operate 62 manufacturing locations in 19 European countries, representing 96% of all European production capacity.

Euro Chlor represents the interests of chlor-alkali producers in Europe; encourages best practices in safety, health and environmental protection and promotes the economic and social benefits of chlor-alkali and the many industries that rely on them.

Based in Brussels, Belgium, Euro Chlor is a Sector Group of Cefic (European Chemical Industry Council) within the Halogens Industry Sector.

Euro Chlor is a member of the World Chlorine Council, a global network of regional organisations that represents producers accounting for more than 85% of worldwide chlor-alkali production capacity.



A sector group of Cefic 

European Chemical Industry Council - Cefic aisbl
EU Transparency Register n° 64879142323-90

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<https://www.eurochlor.org>

2022
2023