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A sector group of Cefic

Results of the second 2011-2020 Programme and introduction to the third 2021-2030 Programme

The Euro Chlor Sustainability Programme

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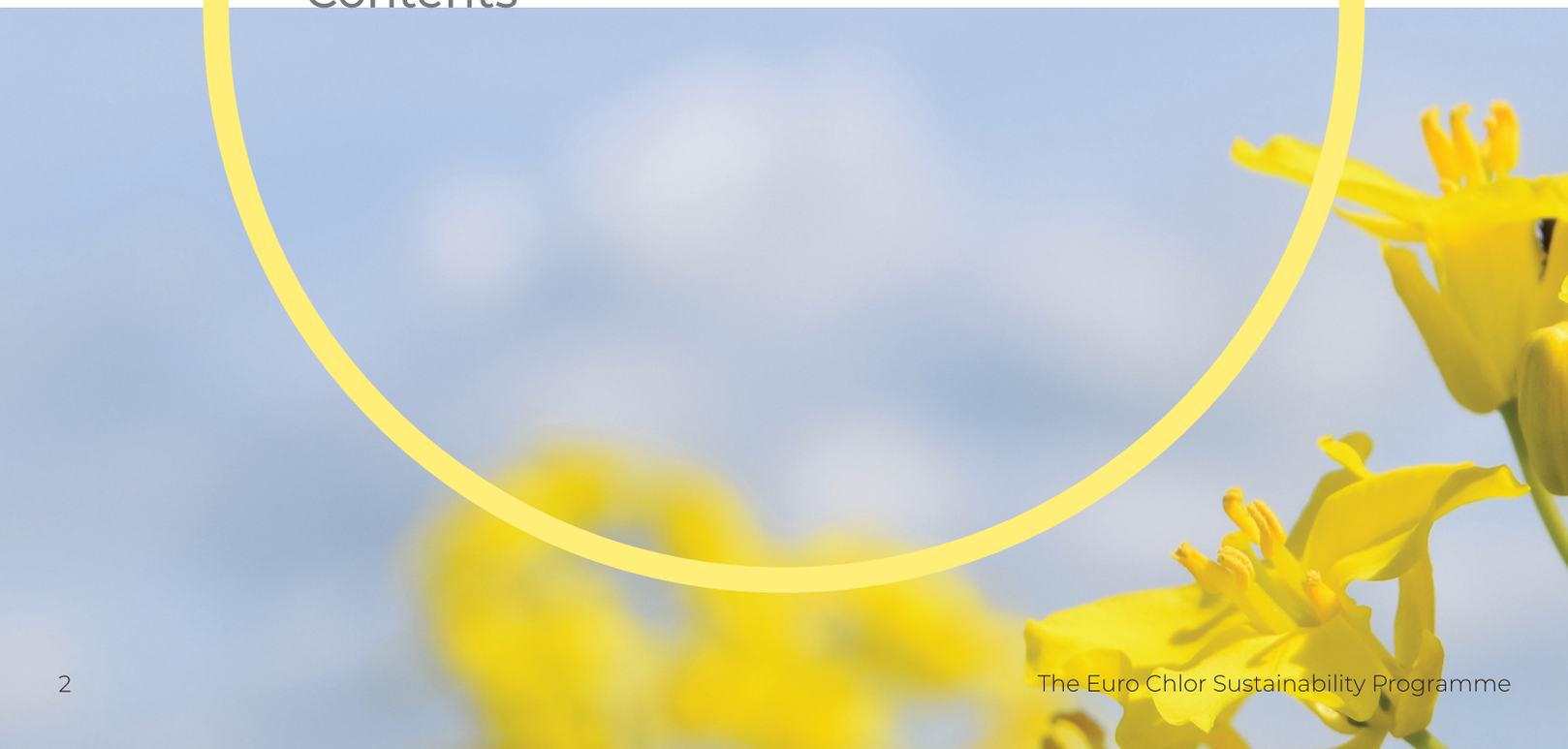

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Chairman's Foreword

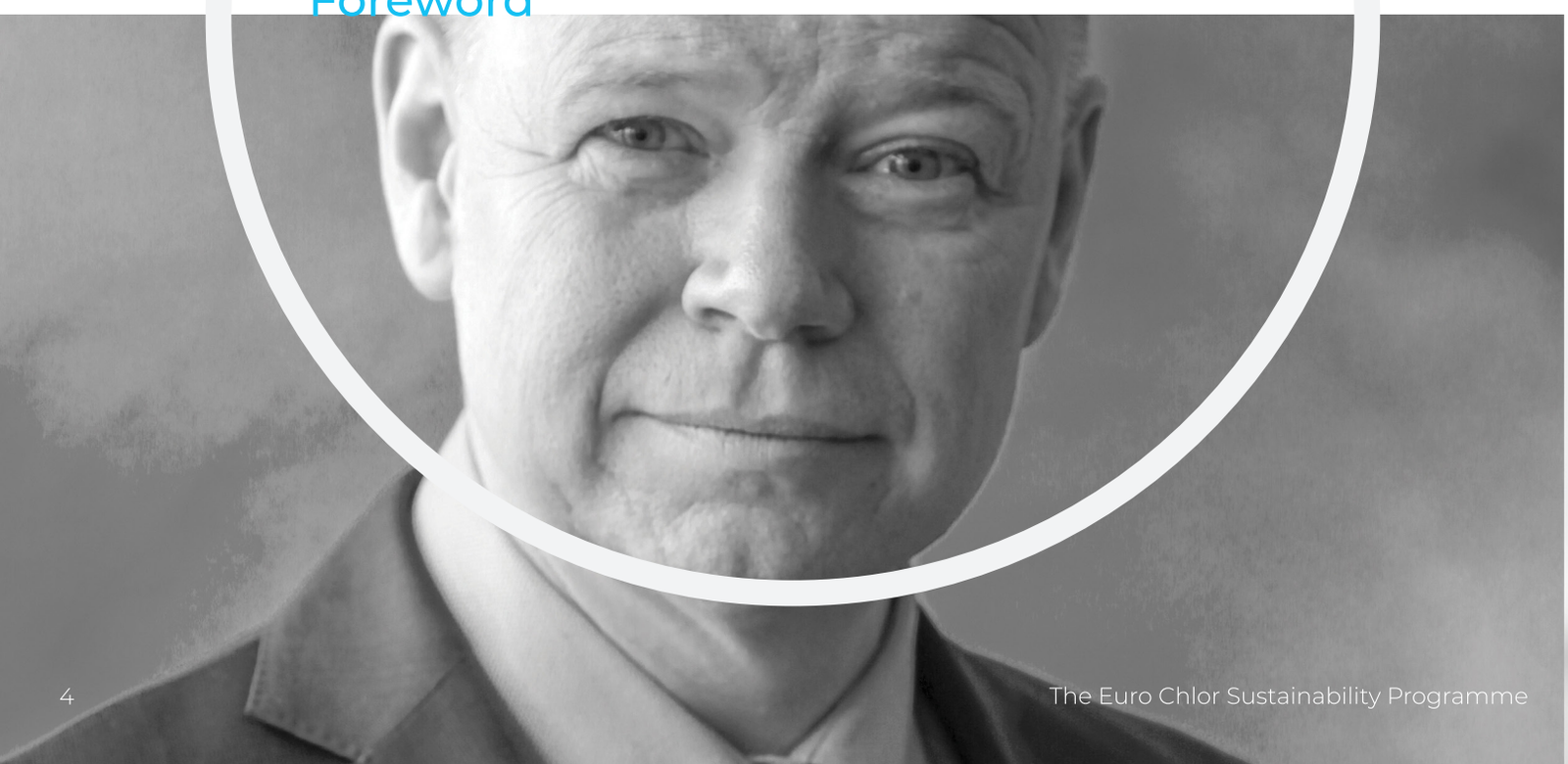
The chlor-alkali industry has invested more than 20 years in extensive data collection with a clear focus on sustainability. Over the past years, we noted increased societal interest in the areas of safeguarding human health, environmental protection and preventing climate change. As these topics have always been high on our agenda, we feel fortunate to be able to present 20 years of objective data to cover them. As you can read on page 6, Euro Chlor was one of the first in the chemical industry to launch a 10-year sustainability programme in 2001 using measurable indicators. Agreeing on these indicators was an important step in our industry's strategy to improve performance. For this first programme, the focus was on environmental protection and safety, with progress reported annually ever since in our Chlor-Alkali Industry Review. With the second Programme, which forms a large part of this report, we introduced some new Key Performance Indicators (KPIs), already moving into the area of climate change too. The results reflect our intensive efforts to ensure that our people are safe, our environmental impact is minimised and our energy consumption reduced.

To ensure continued responsible support to many essential industries across Europe in the future, our industry will now further work on its processes to enable a safe, competitive and green chlor-alkali sector. This is the focus of Euro Chlor's Mid-Century Strategy (MCS) for a Sustainable Chlor-Alkali Industry. Launched in 2020 for completion by 2050, the MCS aims at making sure that our sector remains a Safety Leader, Competitive Supplier, Circularity Champion and Climate Neutral Player. Our third Euro Chlor Sustainability Programme (from September 2021-2030) plays a key role by measuring parameters for these central MCS priorities, whilst building on the previous data collected from the past 20 years.

As Chairman, I am particularly proud of the progress we have made over the past 20 years and the continuous ambition of the membership to improve.

I look forwards to seeing how the MCS and the third Sustainability Programme develop and evolve in the coming years.

Wouter Bleukx,
Chairman of the Management Committee



Euro Chlor has a rich 32-year history, 20 years of which have included sustainability measurements. The extensive data presented in this report is a testament to the hard work of our Committees and Working Groups and the high quality of input from our members. Such data are essential and can only reinforce our position as a credible contributor of important data to the authorities.

Leading the secretariat of such an active Sector Group is a privilege. It is exciting to see how companies strive for continuous improvement at all levels. When reporting is too low, immediate action is initiated and members who did not contribute are informed. When incident rates develop in the wrong direction, the relevant Working Groups come together to develop training or improvement programmes. When members estimate that there are too many transport incidents, recommendations are written and commitments signed. Without hesitation, the Management Committee members agreed to invest in new initiatives such as the crafting of our Mid-Century Strategy or the development of an interactive safety game. With the dedicated support of the Euro Chlor team, all work hard to never lose sight of the topic of safeguarding human health, the environment and climate, as well as maintain the efforts required. Combined with the European Green Deal ambitions, this has led Euro Chlor's third Sustainability Programme to aim for a further reduction of our impact in areas such as energy consumption, carbon footprint and waste reduction. Safety remains a high priority, building on existing performance and ensuring the safe transport of all chlor-alkali products.

In this new programme, we have eight metrics that were in the past two programmes and nine new ones that reflect our climate and environmental protection priorities. Information from many of these parameters will also be essential in showing our industry's contribution to the global UN Sustainable Development Goals (SDGs), as explained at the end of this report.

I truly hope you enjoy your read!

Marleen Pauwels
Euro Chlor Managing Director

Drawing on 20 years of experience: the first two programmes

A word from the Euro Chlor Managing Director

The first Sustainability Programme (2001-2010)

At the end of the last century, all European chlorine manufacturing members of Euro Chlor agreed on an industry-wide strategy that focused on six voluntary commitments. At that time, it was one of the first such programmes within the chemical industry.

This first Programme was designed to ensure a united industry approach that addressed key sustainability concerns:

- Include environmental, social and economic factors in all strategic business decisions;
- Optimise energy efficiency in chlorine production;
- Reduce water usage through recycling;
- Continuously reduce polluting emissions of chlorinated organic compounds to water, air and land;
- Use more hydrogen generated by the industry as a raw material or fuel;
- Give high priority to safe transportation of chlorine.

Fifteen performance indicators were defined with six voluntary targets being set for 2010. The producers reported their progress to Euro Chlor for publication in our Chlor-Alkali Industry Review. The Euro Chlor Management Committee discussed the results on a regular basis and, together with the General Technical Committee, proved to be the driving force to bring the entire membership to the best possible outcome.

The 2001-2010 Programme succeeded in:

- Increasing members' trust in each other and in Euro Chlor to comfortably share data on incidents, energy consumption, etc.;
- Building an objective data set that triggered honest discussions amongst the membership and enabled Euro Chlor to measure progress;
- Creating a united approach that demonstrated our industry's commitment to address the three sustainability pillars (environmental, social and economic);
- Challenging and stimulating Euro Chlor member companies to improve their technology and health/ safety/ environmental performance;
- Providing important data for discussions with various stakeholders so that the impact of our industry, and efforts made to minimise the negative ones, could be understood.

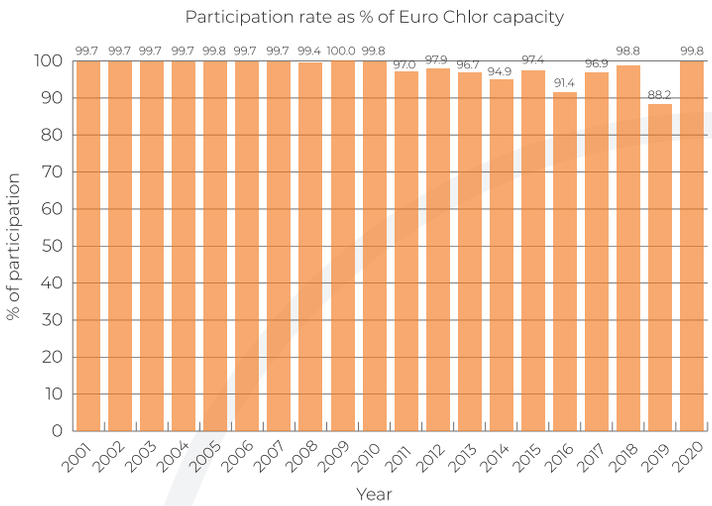
By the end of the previous decade though, not all indicators showed the same degree of progress. Significant improvement was noted, but more effort could still be invested in increasing hydrogen utilisation, reducing Lost Time Injuries and decreasing process incidents and losses. The lessons learned from this first 10-year exercise helped to shape the Second Programme which started in 2011.

More details on this first Programme can be found in the sustainability section on the Euro Chlor website[1].

[1] *https://www.eurochlor.org/wp-content/uploads/2019/04/brochure_sustainability-final.pdf*

Learning from the first Programme, Euro Chlor members felt that more could still be done to further improve the sustainability results. Coordinated by the Euro Chlor General Technical Committee and inspired by many of the parameters from the first decade, all members once again committed to continue monitoring concrete sustainability parameters and reporting yearly on the trends. New types of data were also included as part of the second Programme, which forms the first main part of this report.

A first parameter we measure is member participation in the data collection. As shown in the graph below, participation in the second Programme was slightly less than in the first. This slight reduction had no significant influence on the data presented in this report, due to the aggregated nature of the KPIs that are based on production. The lowest participation rate was noted in 2019, potentially influenced by the COVID-19 pandemic. The Euro Chlor Management Committee took action and reminded the entire membership of the importance of the exercise and this succeeded in achieving a very high participation rate (>95%) of the Euro Chlor capacity in the 2020 data collection.



As you will read on the next pages, the 2011-2020 results show that there remains room for improvement. When such a programme runs over 20 years, it is normal that certain KPIs significantly improve during the first years to eventually plateau. Some values cannot further reduce at the same pace due to technical or physico-chemical limitations of the processes used. Others tend to level out because the investments and efforts made to further reduce imply disproportionate costs or impossible expectations from employees. It is, for example, absolutely necessary for us to aim for zero incidents, but no human being is perfect. This means that, whilst striving for continuous improvement, our industry needs to remain very ambitious, creative and flexible in finding new solutions to further increase environmental, social and economic performance.

That is why a third Programme has been agreed upon to cover the 2021-2030 period. More details on this are presented later in the report.

The second Sustainability Programme (2011-2020)

Safety is the primary focus of Euro Chlor. It is of utmost importance to the entire industry that every colleague returns home healthy and safe each day.

To get a more complete overview of injuries and incidents, activities began in the middle of the last decade to boost more detailed reporting on what went wrong and lessons learned from member companies. These reports are anonymised and shared in safety newsletters so that everyone can learn from any incident without judgement.

The knowledge and experience built up over the years has allowed the Euro Chlor secretariat to organise visits to member companies to discuss safety topics, the preparation of dedicated training materials, development of a safety training 'game' for operators and extensive online safety training sessions for colleagues in more recent years.

Such activities demonstrate how European chlor-alkali is contributing to the 2030 UN Sustainability Goal (SDG) 3 (3.9) on Good Health and Wellbeing by helping to reduce deaths and illnesses from hazardous chemicals.

Lost-time injuries (LTIs)

Comment: The Euro Chlor vision for lost time injuries remains zero. Whilst significant progress was made in the first Programme, progress in recent years has not continued at the same pace and has effectively levelled off. Efforts to reduce the LTIs among contractors (who are also measured) have shown to be successful, but more work is needed here to ensure that all remain safe. Whereas between 2001-2010 LTI data include many kinds of incidents, not only those specific to the chlor-alkali industry, the period 2011-2020 represents just chlor-alkali specific incidents.

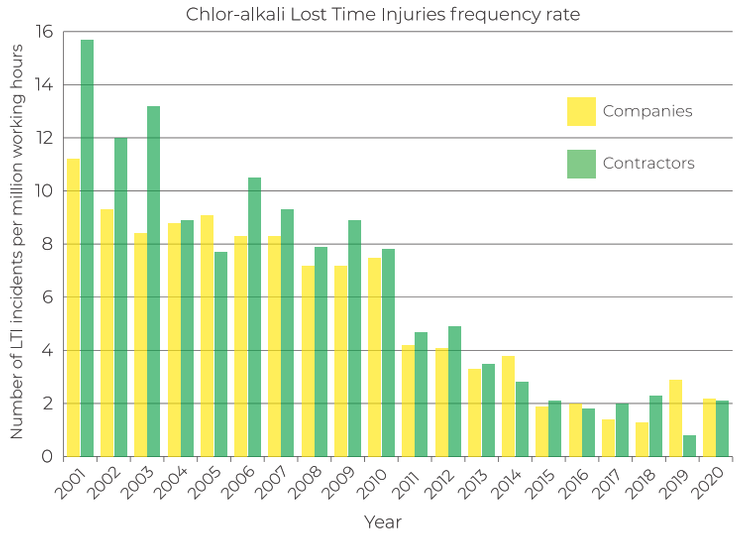
Background: An LTI refers to at least one day of absence from work. It is reported as the number of LTIs per million working hours. The figures from companies reporting on a three-day period of absence are converted to a "one day" equivalent using a Cefic correlation.

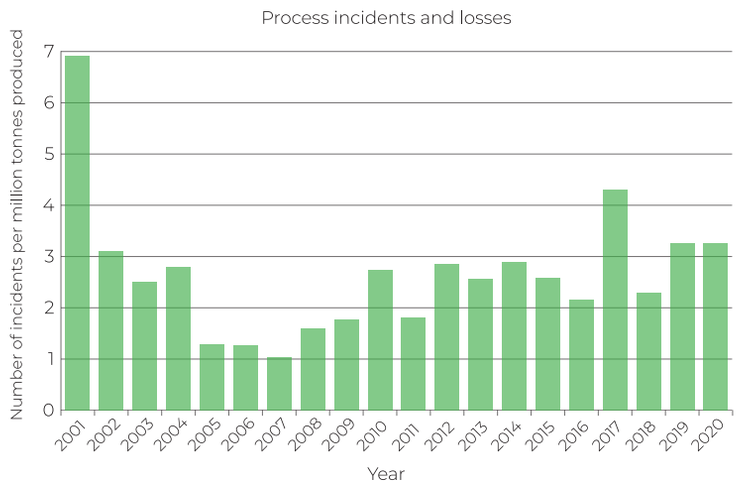
Assessing our safety and social progress

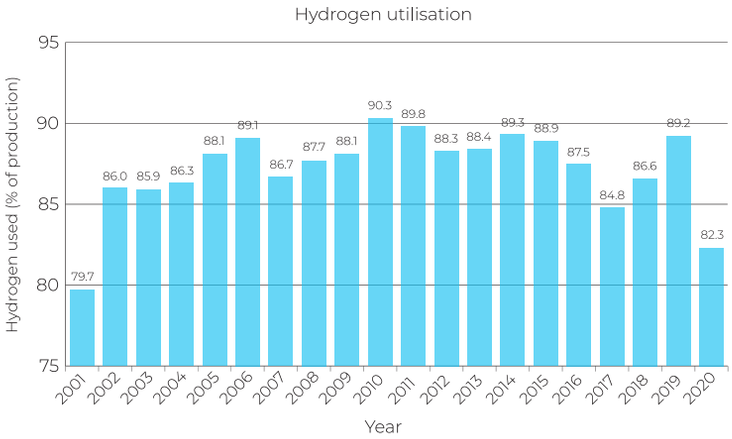
Process Incidents

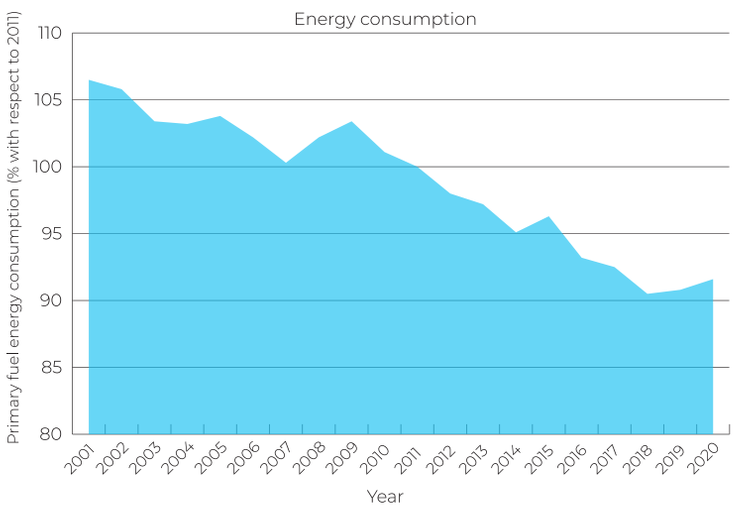
Comment: As for LTIs, the Euro Chlor vision for process incidents and losses remains zero. After a steady decline in the 2001-2010 period, an increasing/ stabilising trend was seen between 2011-2020. One of the explanations for this is that companies improved the reporting of their process incidents (especially those incidents that are borderline under the definition). In addition to the reporting of the number of incidents, efforts have been made to improve member company returns on more detailed incident reports that allow Euro Chlor to enhance its technical document library.

Background: Incidents are classified as those involving a fire, explosion or the release of chlorine, hydrochloric acid, sulphuric acid, sodium hypochlorite (bleach) or caustic soda, which cause a fatality, serious injury or property damage exceeding €100,000. Losses include any of the above chemical spills in air, water or land, which impact human health or the environment, property or result in evacuation.









Hydrogen utilisation

Comment: Data from those Euro Chlor member companies that produce hydrogen show that there remains a large proportion of the hydrogen produced that is not used (i.e. it is vented). In 2020, the amount of unused hydrogen was equivalent to the annual energy requirements of 0.7 million homes. In the first Sustainability Programme, a target of 95% utilisation was not met and today, more still remains to be done to meet this target. Hydrogen is seen as an important contributor in reaching carbon neutrality. Vented hydrogen from chlor-alkali production in 2020 equalled the amount generated by a 320MW water electrolyser.

Background: High-quality hydrogen is co-produced with chlorine and caustic soda during the electrolysis of brine. This can be used as a raw material for other processes or as fuel to produce steam or for local electricity production in fuel cells.

Energy use

Comment: Between 2011 and 2020, primary energy consumption fell by 9% (compared to 2001), almost double the decline seen in the first 10-year period (-5.1%). This could mainly be attributed to the conversion of mercury to membrane technology or, to a lesser extent, modernisation of older membrane installations and conversion of diaphragm to membrane. Further improvement is welcome, but due to fundamental physicochemical laws, there is an absolute minimum amount of electricity that is needed to split the salt and water into the three end products. Whilst some technologies and equipment may be more efficient than others, they will always be at the mercy of this limit.

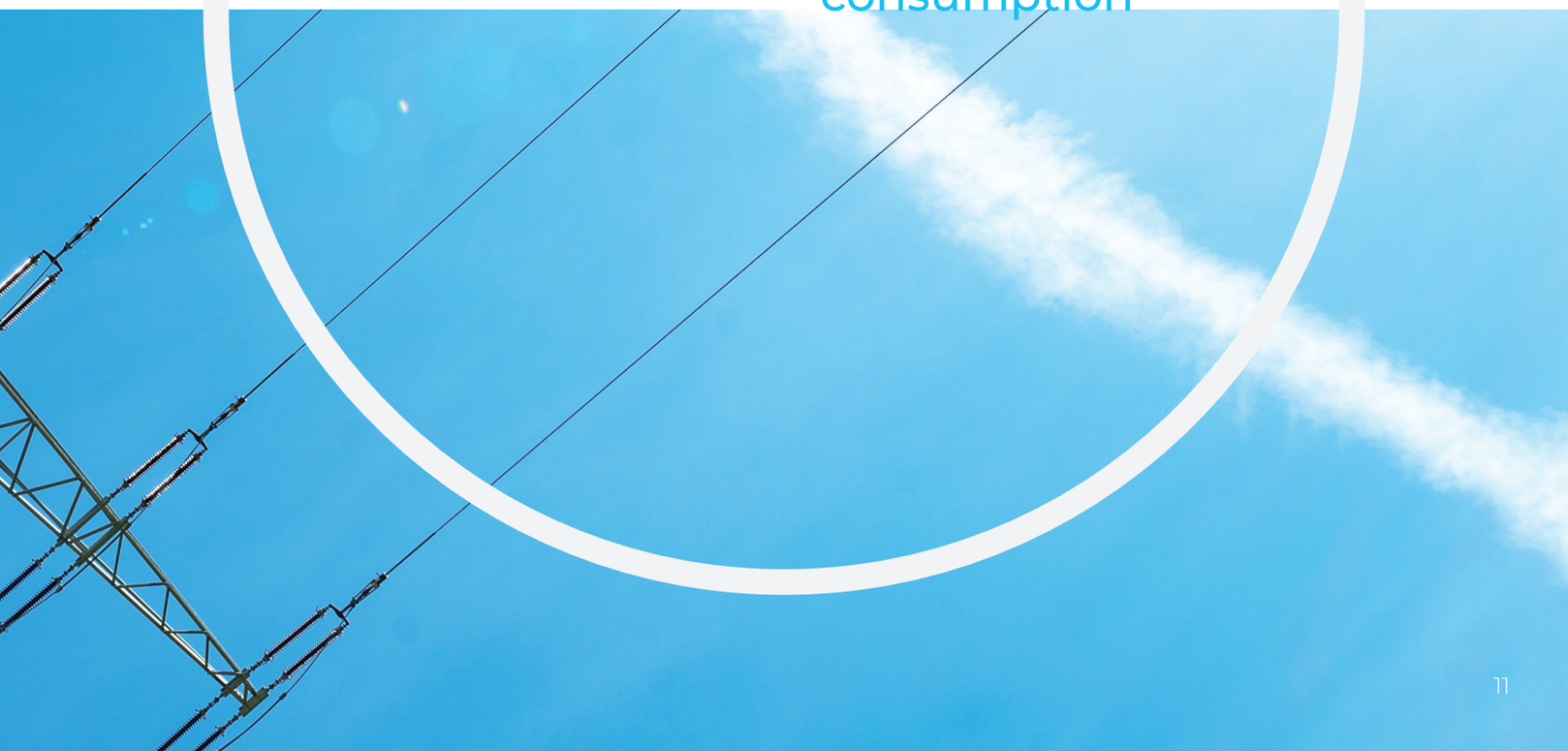
Background: Electricity is an indispensable raw material of the chlor-alkali production process. The energy indicator is weight-averaged across all producers and based on steam and electricity. Electricity is mainly used for electrolysis and for illumination and motor power (pumps, compressors, centrifuges, etc.). Steam is used mainly for caustic soda concentration to 50% and for minor utility purposes (e.g. heating).

Economic development reports (statistics reports)

Comment: Euro Chlor reports monthly, quarterly and annually on the European production of chlorine and caustic soda. This includes utilisation rates, caustic stocks, capacity and technology by plants and applications. In 2010, Euro Chlor continued to publish on its website and distribute to the media, figures for monthly chlorine production and caustic soda stocks. The annual Chlor-Alkali Industry Review[2] includes a map of Europe showing the location of all plants and a table indicating the location, ownership, technology and capacity of each plant.

[2] *https://www.chlorineindustryreview.com*

Assessing our energy consumption



Even though chlorine transport is reduced to a minimum, Euro Chlor has continued its investigations into safe transport due to reported incidents involving improper mixing of non-compatible chemicals and an increasing number of incidents during loading activities. The latter not only involved the transport of chlorine, but also other chlor-alkali products. It led to a new recommendation and commitment on safe loading and unloading of chemicals that has been signed by all Euro Chlor members. It is being published in several languages to share best practice as widely as possible across Europe. Part of this will also include a new transport related KPI in the third Sustainability Programme (detailed later in this report).

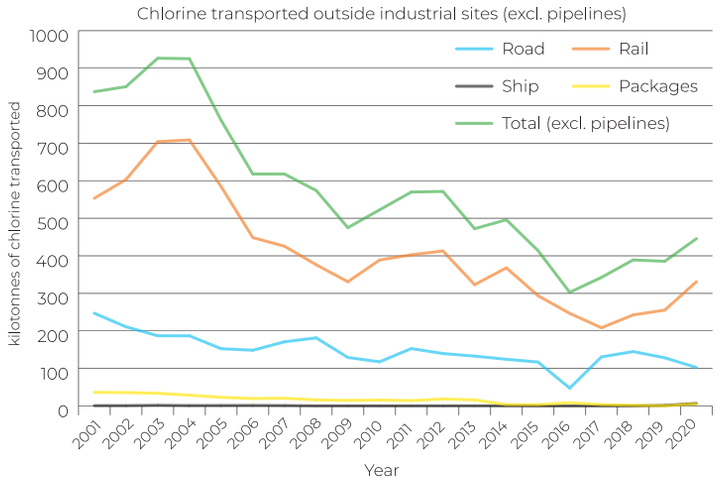
Further to this, Euro Chlor has been helping other global regions to improve their transport safety. In 2018, for example, Euro Chlor met with Indian producers to share best practices on transport of chlorine in pipes.

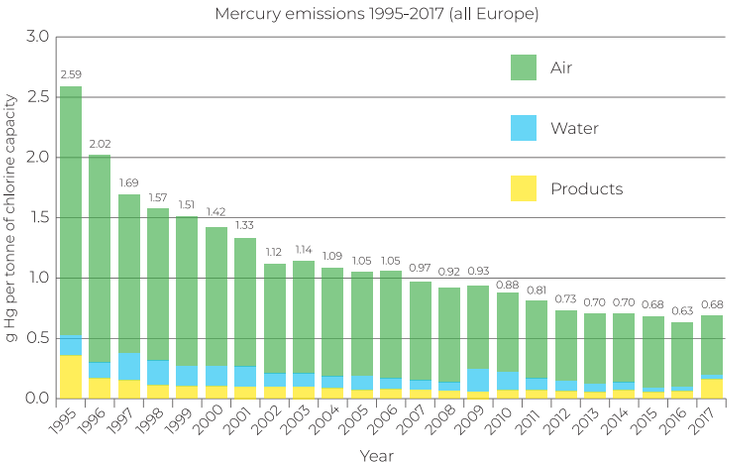
Assessing our transportation

Transportation

Comment: Euro Chlor monitors the tonnage of chlorine transported annually, as well as the mode of transport involved. Transport incidents are also recorded. Euro Chlor members aim, as far as possible, to minimise the amount of chlorine transported. This is not because chlorine transport cannot be done in a safe way, but because it is better to avoid if possible. In the second Sustainability Programme, the amount of chlorine transported by pipe (i.e. not by road or rail) decreased from the first Programme. No incidents involving chlorine transport were reported between 2011-2020.

Background: A "chlorine transport incident" is one which either involves death or injury, a spill/ leak of more than 5 kg, substantial property damage, public disruption of more than one hour or the intervention of emergency services or media coverage. The amount of chlorine transported in Europe by rail and road has decreased by approximately 14% during the past decade. The larger decline between 2015-2019 is mainly because not all companies contributed to the Sustainability Programme in that period.





Mercury emissions

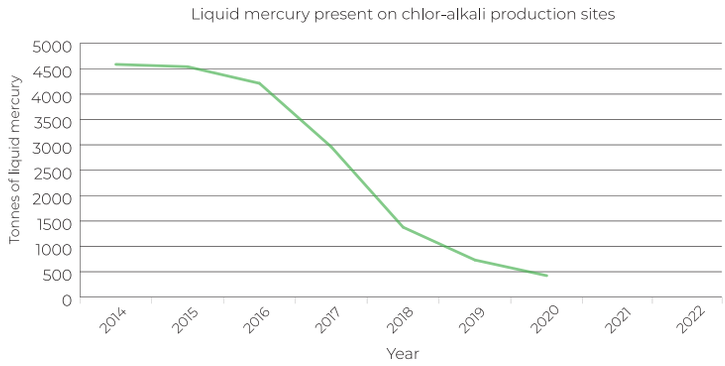
Target: <1.5 g Hg/T.

Background: Plants that had high mercury emissions showed noticeable improvement during the second Sustainability Programme, particularly as the 2017 phase-out deadline approached. Mercury emissions decreased due to further improvements and sharing of best practices via Euro Chlor recommendations and training sessions. Reporting ceased in 2017 due to the phase-out of the mercury technology by the end of that year.

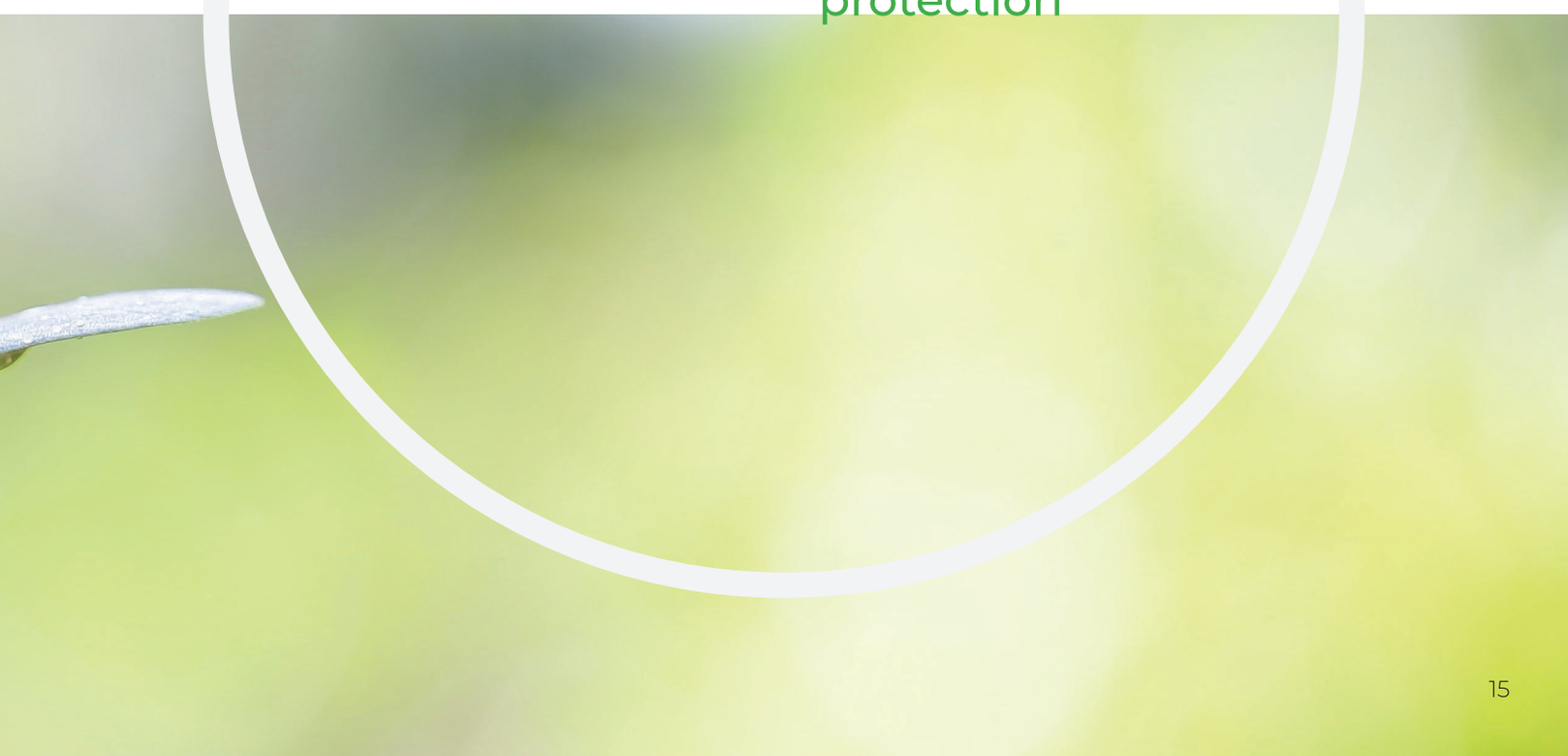
Targets on the emission to air and water of various wastes as well as environmental accreditation were realised in the first Sustainability Programme thanks to efforts of Euro Chlor members. The biggest environmental protection topic for the second Sustainability Programme was therefore on reducing mercury emissions. Whilst all other mercury-related deadlines were for 2010, European chlor-alkali decided to maintain an earlier 1998 commitment to achieve by 2007 an emission target of 1.5 g Hg/tonne chlorine capacity for each individual plant. In the last Programme, overall European emissions in 2010 amounted to 0.88 g Hg/tonne chlorine capacity, with even more improvements being seen as the industry headed towards the phase-out date.

With the 2017 phase-out of mercury-based production technology (see next page), activities turned to decommissioning old sites and converting liquid mercury to solid mercury sulfide by the end of 2022. This will be part of a new KPI in the third Sustainability Programme (see later in this report) with reporting on this starting as of 2014.

Activities are also taking place to assist other global regions in their phase-out of mercury-based chlor-alkali production technology. Euro Chlor are providing training sessions and guidelines to ensure that decommissioning personnel remain safe and the environment is protected around the world.



Assessing our environmental protection



The 2017 phase-out of mercury from European chlor-alkali

Liquid mercury was previously used as the cathode (negative electrode) in one of the three chlor-alkali production technologies. In 2001, the European chlor-alkali sector voluntarily committed to phase-out mercury cell technology by 2020. Meanwhile however, under the Industrial Emissions Directive, the BAT (Best Available Techniques) conclusions became legally binding. This meant that mercury-based production technology should cease by 11 December 2017.

As a result, those European chlor-alkali producers using mercury technology converted or dismantled such facilities. Any resulting mercury-containing wastes were also addressed. Regulation (EU) 2017/852 on mercury set rules for safe temporary storage and subsequent permanent disposal of mercury and mercury compounds. Elemental mercury, no longer used in chlor-alkali mercury cells ('excess mercury'), could be stored temporarily under specific conditions, before being converted into mercury sulfide for permanent disposal (e.g. in salt mines).

The European chlor-alkali industry has a long history of safe and responsible handling and storage of liquid mercury. Their experience is documented in several Guidance Documents in Euro Chlor's technical library.

Euro Chlor's activities on mercury also contribute to the 2030 UN SDG 3 (3.9) on Good Health and Wellbeing by helping to reduce deaths and illnesses from hazardous chemicals.

With global challenges related to climate change and environmental degradation, Euro Chlor's third Sustainability Programme will focus on topics related to further reducing our impact. Monitoring of energy consumption, carbon footprints and waste reduction will be vital in helping to meet Europe's Green Deal priorities and tackling global challenges. Safety will also remain high on the agenda with efforts to improve existing performance as well as monitoring transport safety of all chlor-alkali products, not just chlorine.

To realise actions here, the Euro Chlor Mid-Century Strategy has identified key measures to ensure that a safe, competitive and green chlor-alkali will still be benefitting Europe in 2050 and beyond. More information on this can be found at **https://www.eurochlor.org/mcs** and on these pages.

Safety Leader

Safety remains the most important cornerstone of Euro Chlor activities. If we cannot guarantee a safe working environment for our people, contractors and neighbours then we do not deserve to remain operational. As such, in the Mid-Century Strategy we aim to remain a leader in safety by continuously delivering outstanding performance throughout the value chain, including contractors, transporters and customers.

Competitive Supplier

Our industry operates in a worldwide economic environment. Whilst chlorine is not traded globally, other downstream products (such as EDC or caustic) may well be. We need to competitively produce chlor-alkali in Europe compared to the rest of the world so that production and jobs remain here, and quality and safety are kept high. We want to continue to improve and even regain long-term international competitiveness.

Where do we go from here?

Climate Neutral Player

Europe has the ambition to become climate neutral by 2050. Euro Chlor and its members want to contribute to Europe's Green Deal through climate neutral production and by facilitating the energy transition. This can be realised in several ways such as purchasing carbon neutral electricity and steam, reducing energy consumption, using climate neutral raw materials and transport, or by contributing to electrical grid stability. However, our industry cannot do this alone and requires the support from all players in this market. The Mid-Century Strategy will investigate all the options here.

Circularity Champion

Another important part of reducing our environmental impact is minimising the usage of virgin raw materials due to potential resource scarcity. Under the Mid-Century Strategy we aim to facilitate cradle-to-cradle usage and 'recycling of the chlorine atom'. This will be done in collaboration with down-stream users and may involve the minimisation of wastes in our own production processes.

The four pillars of the Euro Chlor Mid-Century Strategy

As there remains potential for making further improvements with regard to our industry's sustainability, and to support the Euro Chlor Mid-Century Strategy, the Euro Chlor Management Committee has decided to initiate a third phase of the Sustainability Programme. This Programme will continue monitoring concrete parameters and reporting yearly on the trends. Such parameters are inspired by those from previous Programmes as well as launching new ones which reflect global climate and environmental protection priorities. These data will create a unique, 30-year data set of important sustainability parameters related to our sector.

The new Sustainability Programme will monitor, report and act as appropriate on 17 parameters, eight of which were already monitored in the second Programme. They fall into four categories which are reflected in the Euro Chlor Mid-Century Strategy.

Safety Leader

1. Lost Time Injuries (LTIs)
2. Loss of Primary Containment (LOPC)
3. Process Safety Incidents (PSIs)
4. Chlorine Transportation
5. Transportation incidents

Competitive Supplier

6. Key production volumes
7. Electricity price per region
8. CO_2 cost per region
9. Caustic imports to the EU

Climate Neutral Player

10. Energy consumption in chlorine production
11. Quantity of hydrogen used (or valorised)
12. Production capacity serving as grid balancing capacity
13. Carbon footprint of chlorine production
14. Caustic transportation

Circularity Champion

15. Membranes recycled
16. Mercury treated
17. Process waste ratio

Many of these metrics will also be essential in proving our contributions to the UN Sustainable Development Goals (SDGs). These include:

- SDG3 (3.9) on reducing illnesses from hazardous chemicals, by reducing LTI and LOPC events and safely converting mercury;
- SDG7 (7.1) on affordable and clean energy, by contributing to grid balancing and boosting hydrogen utilisation;
- SGD12 (12.2, 12.4, 12.5) on effective use of resources and reducing wastes, by investigating membrane recycling and monitoring process wastes;
- SDG13 on climate action, by activities on reducing our carbon footprint.

The third Sustainability Programme (2021-2030)

Lost Time Injuries (LTIs)

Injuries to colleagues are unacceptable. They are morally reprehensible and socially and economically unsustainable with improvements here only being made through the continued efforts of all colleagues. Unlike some measures to advance sustainability, a low injury rate in one year does not automatically translate into a low rate the next. Whilst progress is being made, many recorded injuries arise, not from anything specific to chlorine manufacture, but from everyday incidents that happen in both work and domestic situations (such as slips, trips and falls). Whilst our injury rates are lower than many other industrial activities, our vision remains zero LTIs for both personnel and contractors. Every year, we will report a weighted average for both contractor and personnel LTIs.

Loss of Primary Containment (LOPC)

Whilst our chemicals are vital for modern society, they can have negative impacts to the environment and human health when uncontrollably released. Every effort is made to prevent this, but accidents can still happen. LOPC refers to any spill or unplanned event that results in a loss of a chemicals to air, water or land. This could be chlorine (>5kg released), hydrogen chloride (>500kg), sulfuric acid (>500kg), hypochlorite (>500kg) or caustic (>500kg) and is a number per million tonnes of chlorine production. Naturally, the vision here is zero LOPCs, so every year we will report the number of LOPC incidents in absolute terms, as well as the percentage that are explained by an incident report.

Process safety incidents (PSIs)

Process Safety Incidents builds on our previous reporting of process incidents and losses. This metric now includes fatalities/ injuries, fire, explosion, evacuations or work stoppages in and around the plant, property damage and any incident that makes the news. Such incidents, like injuries to workers, are unacceptable. The effort to eliminate them continues with a vision of zero incidents. The absolute number and the number per million tonnes of chlorine produced will be published annually.

Chlorine transportation

As for previous Programmes, this includes the quantities of gaseous and liquid chlorine transported on a public area via the different transportation modes: rail, road, ships, pipelines and drums or cylinders. Chlorine is a highly hazardous gas with leaks of chlorine able to harm health or cause disruption to people living nearby. Recognising this, the industry has invested heavily in developing those techniques, procedures and equipment required to transport liquid chlorine safely. The tonnes of chlorine for each transport category will be reported annually. A new parameter, **amount of caustic transported** will be reported in a similar fashion. Building on this, Euro Chlor members will also report **transportation incidents**, another new sustainability metric for the third Programme. This covers situations when chlor-alkali and its related products have been released (or if

What will we measure in the third Sustainability Programme?

there was imminent risk of loss of product) and when injuries, material or environmental damage, or authority involvement occurs. The vision here is also zero incidents with annual reporting on the number of incidents per million tonnes of goods transported.

Key production volumes

With 20 years of data on this already, Euro Chlor will again return data each year on the absolute chlorine production per member, the amount produced by membrane/ diaphragm/ other technology, the chlorine capacities and the number of tonnes used in various applications of chlorine and caustic. This helps to provide a 'snapshot' of the relative 'economic health' of our industry.

Electricity price per region

Information will be collected here for stakeholders to see how electricity prices (which account for 70% of the costs of production) compare with other European countries and global regions (e.g. USA, India, China and the Middle East). This is collected for information only and will not be reported.

CO_2 cost per region

With necessary climate protection measures there is a real risk that less responsible producers may relocate to other global regions where there are lower costs due to poorer climate protection measures. Information will be collected here for members to see how CO_2 price compares globally (e.g. USA, India, China and the Middle East). This is collected for information only and will not be reported.

Caustic imports to the EU

One of the main products that can be transported between regions is caustic soda. Information will be collected here for members to see how CO_2 price compares globally (e.g. USA, India, China and the Middle East). This will again give an idea on how 'competitive' our industry and is collected for information only (i.e. will not be reported).

Energy consumption in chlorine production

Sustainable energy supply is a major challenge both for society and industry. With activities to address climate change being substantially driven by emissions of carbon dioxide and other 'greenhouse gases', there is much interest in any CO_2 emissions that can arise from energy generation. Chlor-alkali production is energy intensive but most of the energy used is taken up in the electrochemical reaction and becomes stored as 'chemical energy' in the chlorine. This energy can be released again when chlorine is reacted to create other products.

Substantial progress in energy efficiency has also been noted but there is a limit to how much more improvement can be made. Data collection here will assess the electricity consumption per tonne chlorine both in the electrolyser and in the rest of the plant. Steam consumption will also be reported annually as a weighted average primary energy consumption.

Quantity of hydrogen used (or valorised)

When we make chlorine, we can also generate hydrogen as a by-product of the electrochemical reaction. When there are no direct consumers nearby, this can be flared. However, Europe-wide drives to increasingly use hydrogen as an energy carrier mean better use of this resource is vital. Hydrogen can be used as a chemical reagent (e.g. for ammonia, hydrogen peroxide or other productions), burned as a fuel with no CO_2 emission and even used indirectly to generate electricity. Our industry is aiming to use 100% of any by-produced hydrogen by 2030 and reporting will continue each year on the percentage of hydrogen from our sector that has been used.

Production capacity serving as grid balancing capacity

With the drive for renewable energy there comes a requirement to still have power when the sun does not shine or the wind does not blow. There will also be periods when energy availability is in excess. Electricity providers must carefully balance supply and demand and chlor-alkali production can be increased/ decreased to help here. Euro Chlor members will report the total capacity they have for such buffering every year in the Chlor-Alkali Industry Review.

Carbon footprint of chlorine production

Like many human activities, the emissions (either directly or indirectly) of Greenhouse Gases (GHG) need careful consideration. Such GHG have been linked to climate change. To help reduce our emissions, Euro Chlor members will now report GHG emissions per tonne of chlorine based on their energy consumption (electricity and steam). This will take place only for those plants producing chlorine, caustic and hydrogen. The aim is to achieve zero emissions by 2050 and a weighted average in CO_2-equivalent emissions per tonne of chlorine will be reported annually. This is a first for our sector.

Membranes recycled

Membranes are a key piece of safety technology designed to keep the products separate (chlorine and caustic). However, over time, membranes degrade, meaning they must be carefully disposed of. At present, there is no good method for membrane recycling and the majority goes to landfill. This new activity will assess what is possible and push for improvements here involving all stakeholders.

Mercury treated

With the phase-out of mercury-based production technology (see earlier in this report), activities are needed by 2022 to ensure that any liquid mercury is converted to solid mercury sulfide for safe disposal. As there is a regulatory requirement to report this to the European Commission, regular reports will be made. The goal is to have 100% of all liquid mercury converted by 2022.

Process waste ratio

This important new metric for the Sustainability Programme aims to see what improvements we can make in reducing wastes associated with our production. The amount of hazardous and non-hazardous waste produced by the chlor-alkali production as a ratio of the total chlorine production will be recorded and then published as a weighted average in the Chlor-Alkali Industry Review. Sludge from the brine treatment is excluded because of the range of different salt sources. Temporary demolition wastes and wastes from (large) construction/renovation projects will also be excluded.

2021-2030

In September 2015, the new UN Agenda for Sustainable Development was adopted, coming into force on 1 January 2016. Central to it are the 17 United Nation's Sustainable Development Goals (SDGs).

These SDGS and more can be achieved with help from chlor-alkali products. Discover more at **https://www.eurochlor.org/topics/sustainability/un-sdgs/**.

How does chlor-alkali contribute to the UN Sustainable Development Goals?

Chlor-alkali chemicals are essential in the production of modern medicines, including those to treat HIV/AIDS, cancer and heart disease. This chemistry also keeps medicines safe in tamper-resistant, sterile packaging (in the form of PVC or polyvinyl chloride). When used sensibly in communities, chlorine-based disinfectants have been protecting people from the impacts of the recent pandemic.

A 2016 report by the UN Secretary General suggests that by 2030, 663 million people could still not have access to an improved water source. Many diseases can be attributed to unsafe drinking water, but chlorine-based drinking water disinfectants can help to eliminate waterborne diseases such as cholera, typhoid and dysentery. Chlorine also helps to make PVC for use in durable pipes that help to minimise losses as water is distributed. This is vital in areas where drinking water is scarce; an increasing global challenge.

Chlor -alkali chemistry can purify silicon for solar panels and make resins to build strong yet flexible wind turbines. Electric vehicle motors powered by nickel metal hydride battery packs use potassium hydroxide as an electrolyte.

From PVC pipes that carry water and insulate cables to environmentally friendly refrigerants with low global warming potential, chlor-alkali chemistry is essential for SDG 9.

Polyurethane foam insulation and energy efficient PVC window frames increase the energy efficiency of home heating and air conditioning systems, reducing energy bills and conserving natural resources. Hydrogen, a valuable co-product of the chlor-alkali process, can be used as a fuel in buses and cars, promoting a cleaner living environment in cities.

Aluminium drink cans are recycled by bubbling chlorine gas through molten aluminium scrap to reduce impurities for reuse. Caustic can help recycle waste electronics, old paper and jewellery conserving resources and contributing to the circular economy.

Just three simple ingredients are needed to make chlor-alkali: salt, water, and electricity. From this, chlor-alkali chemistry leads to thousands of different products that make everyday life safe, healthy, and comfortable. These products are vital and varied, ranging from PVC construction materials, life-saving medical equipment and energy efficient polyurethane insulation to polycarbonate safety equipment, pharmaceutical ingredients, and disinfectants for healthy drinking water.

This essential chemistry will also help Europe achieve its Green Deal ambitions in many ways, for example through co-produced hydrogen and in contributing to renewable energy technologies such as solar panels and wind turbines.

Why do we need a chlor-alkali industry?

The Sustainability Programme remains a testament to the work and input from the Euro Chlor membership.

Several Euro Chlor members also nominated specialists to help define the parameters of the Programme as well as to assess the progress. Whilst the Euro Chlor Management Committee has provided direction to the project, the Euro Chlor General Technical Committee has been providing the detailed technical and practical support.

The Chairman of the Management Committee and the Secretariat wish to thank the following members for their input and contribution:

Euro Chlor Management Committee

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Wouter Bleukx	INOVYN
Hanno Brümmer	Covestro
Francisco España Maraver	Ercros
Pierre Fauvarque	KEM ONE
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The role of Euro Chlor members

Euro Chlor General Technical Committee

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https://linkedin.com/company/eurochlor

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https://facebook.com/eurochlor

Euro Chlor's 37 producer members operate 62 manufacturing locations in 19 European countries, representing 97% 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-alkalis and the many industries that rely on them.

Based in Brussels, Belgium, Euro Chlor is a sector group of Cefic (European Chemical Industry Council), which represents chemical companies across Europe.

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