

**Accelerating
Europe towards a
sustainable future**



Chemistry creates and inspires solutions and innovation for a sustainable future.

The chemical industry has an important part to play in maintaining our growth and prosperity, and in our transition to a sustainable society.

We are committed to this role.
Chemistry CAN.

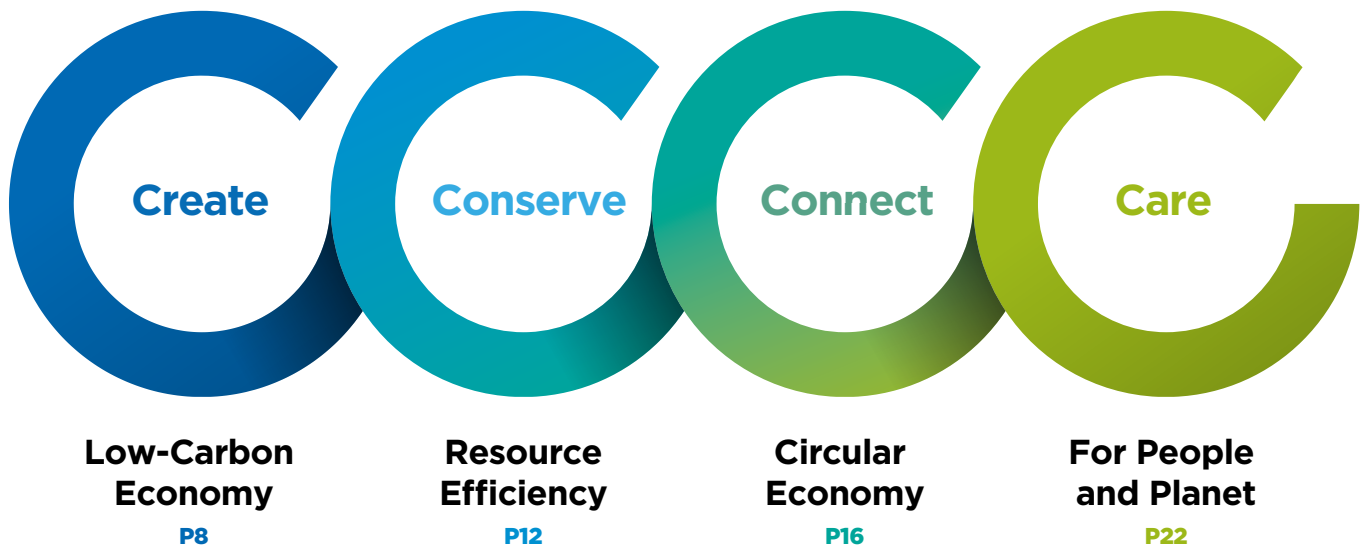


“The world around us is changing. The Paris Climate Agreement and the UN Sustainable Development Goals have set a clear direction for a more sustainable society. The chemical industry can contribute significantly in reaching these global goals.”

Thierry Vanlancker
CEO AkzoNobel and Chair of
Cefic's Sustainability Programme
Council (PC)



Chemistry CAN



Europe is a hub for leading chemical companies, and a front-runner in chemistry research and development. And across industries – from health, hygiene, construction and mobility to agriculture and energy supply – chemicals are an essential ingredient, vital to a competitive business landscape, and an important part of the transition to a sustainable society.

The European chemical industry is strongly committed to the global framework consisting of the UN2030 Agenda for sustainable development and the Paris Climate Agreement. Together they provide a global framework for action that goes beyond regional borders.

This new global framework is an ambitious one, and meaningful progress requires a big shift in both mindset and innovation, as well as a greater recognition of the economic opportunities on offer.

Cefic has formalised our commitment to this framework in the Cefic Sustainability Charter.

How our Sustainability Charter can accelerate progress

The European chemical industry has a long history of acting on sustainability issues, building on the Responsible Care Programme and other sustainability initiatives. Our Charter, focusing on four pillars, serves as a pathway for change and a framework for cooperation. It will unify our actions and initiatives,

and accelerate collaboration across the entire value chain. In doing so it can demonstrate the crucial enabling role of chemistry.

Doing more with less can go hand in hand with building prosperous societies. By continuing to make improvements and breakthrough innovations, the chemical industry can create advanced product solutions that significantly accelerate the transition to a **resource efficient, low-carbon and circular economy.**

Furthermore, the European chemical industry also **cares for people and planet**, by not only meeting the most rigorous safety standards, but by going beyond legislation on Health, Safety, Security and the Environment (HSSE).

With these achievements and ambitions in mind, Cefic and its members will focus action and foster innovation in the four key inter-connected areas reflected in the Cefic Sustainability Charter, all of which are critical in the transition towards a sustainable society.

Q&A

Where is the European chemical industry heading?

The world we live in is in transition. With the adoption of the United Nations 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs) as well as the signing of the Paris Agreement, the world has taken a new pathway in action on climate change and the environment. The European chemical industry is fully committed to the Paris Agreement, and strongly believes that a thriving industry goes hand in hand with solutions to combat climate change.

A discussion with:
Hariolf Kottmann
CEO, Clariant and President, Cefic

Marco Mensink
Director General, Cefic

What's the current state of the chemical industry in Europe?

HK: In terms of economic performance, we're seeing a positive trend, with production levels growing. However, we cannot rest on our laurels in a time of global uncertainty while a shift towards a resource efficient, circular and low-carbon economy is necessary. To remain competitive, we must invest and continue to attract investments in cutting edge technology and infrastructure to support and strengthen our industry in Europe.

MM: Not only from an environmental point of view should Europe take a leading role in the transition to a more sustainable world, but also from an economic perspective as well. It offers unique growth opportunities for our companies in Europe and creates jobs and prosperity at the same time.



Marco Mensink
Director General, Cefic

What challenges does the European chemical industry face in meeting this more sustainable future?

HK: Without a doubt, sustainability challenges are right at the top of the lists in the priorities of our members. As solution provider for many other sectors downstream, the chemical industry will be a key player in achieving many of the SDGs. The Paris Agreement confirmed the challenges of managing climate change through carbon emission reduction and resource efficiency. By integrating the 2030 Agenda for Sustainable Development within its policy framework, the European Union is making its ambitious intentions clear. The European chemical industry stands ready to act.

MM: As an industry we have stated our commitment through the Cefic Sustainability Charter. The Charter describes our role as enabling billions of people to achieve a quality of life within our planetary boundaries and



is a framework for chemical companies in Europe to rally around to progress towards the vision for a sustainable Europe.

The Cefic Sustainability Charter sets out how we and our members will focus our resources and innovation in four areas:

- enabling the transition to a low-carbon economy;
- driving resource efficiency across global value chains and in our operations;
- promoting adoption of circular economy principles;
- preventing harm to humans and the environment throughout the entire life cycle.

You can read more about these focus areas and examples of innovation in this report.

HK: That's not to say that we have all the answers in place to achieve our intentions. There are still many challenges to overcome. Not least of these, is the fact that chemistry is an energy-intensive industry. We have managed to decouple energy consumption from production (reducing energy intensity by 61%

Hariolf Kottmann
CEO, Clariant and President, Cefic



since 1990 whilst production has increased 85%¹) while the need for breakthrough technologies that radically alter production processes is undeniable.

We are seeing some promising technological breakthroughs around alternative feedstock, e.g. Carbon Capture and Use (CCU), and increased use of biomass. But we also need others to scale technologies in production – such as hydrogen fuel cells – as well as in energy consumption.

What does the chemical industry need to overcome challenges?

MM: It's our strong belief that an EU industrial strategy needs to support an ambitious research and innovation agenda, and that more than ever we need collaboration and dialogue between public and private stakeholders. This means both a political determination to promote industrial growth, as well as powerful incentives to develop and implement new technology. Public-private partnerships not only help to share the risk, but also the knowledge; and facilitate rapid deployment and adoption of successful cases.

HK: We're also concentrating our attention on greater cross-sectorial collaboration – focusing on the products we deliver to our end users.

“Without a doubt, sustainability challenges are right at the top of the lists in the priorities of our members.”

Hariolf Kottmann
CEO, Clariant and President, Cefic

This enables us to not only focus on the innovations that society needs, but at the same time apply a customer focused product stewardship approach meaning that we work with our customers across the full value chain to deliver products that are safer, better performing and more sustainable across their life cycle.

What exciting developments do you expect to happen in the coming years?

MM: I believe that chemicals can fuel a resource efficient, low-carbon circular economy. Many of the potential solutions are within reach, from game-changing materials like graphene and carbon fibre, to exciting new technologies making chemicals from waste. On top of that, we need an exponential increase in breakthroughs that address the challenges ahead of us. For example a 10x improvement in carbon productivity – the value created per unit of carbon used – would simultaneously deliver a sustainable climate and prosperous world². While the potential is huge, it's also clear that the availability of significant capital investments and abundant low-carbon power at competitive prices will determine the speed to deliver. This is not just a challenge for one sector, we need all partners to work together, and the chemical industry is uniquely positioned to facilitate that collaboration.

HK: As this report demonstrates, chemicals are so present in our daily lives. There is so much potential for them to continue to deliver tangible benefits to society and the vision for the sustainable future we need. We're committed to bringing these to fruition, whilst leading on overcoming the challenges that we also face.

¹ Cefic Facts & Figures 2017

² The carbon productivity challenge: Curbing climate change and sustaining economic growth. McKinsey Global Institute (2008)

Feature

Realising breakthrough innovation: it's all in the mind

Chemicals have always been a catalyst – not only for chemical reaction, but for transformational change in society. Think penicillin, potable drinking water through chlorine, packaging that extends food shelf life and countless other life-changing developments we now almost take for granted. So, what will it take to scale the next-generation of breakthroughs in chemistry – those that truly represent sustainable solutions on a global and transformational scale?



Patrick Thomas
CEO, Covestro



Richard Northcote
Chief Sustainability
Officer, Covestro

Certain conditions are required to realise chemistry's potential to support Europe becoming the global hub for implementing and scaling solutions to global challenges. Here we look closely at two ideas – carbon productivity and e-mobility.

An exponential mindset

By nature people think in a linear way, about continuous improvement and incremental change. But global challenges are exponential – for example climate change or food security – and to solve them we need breakthroughs. One big opportunity needing this approach is the catalytic conversion of CO₂ to CO to create a chemical feedstock, or the use of CO₂ itself as a feedstock replacing oil. This requires a change of mindset at many levels, but perhaps most importantly of all, at a societal level. “Society has demonised CO₂,” says Patrick Thomas, CEO of Covestro, “yet the chemical industry is essentially carbon based. Human beings and plants are a carbon-based life form. Trees and plants can't live without CO₂. Innovation should be about exponential change. Society needs to think of CO₂ as a solution, and a valuable source of carbon, not a problem. We can be sequestering greenhouse gases into useful polymers. And yet we essentially say CO₂ is evil and a form of waste.”

Elsewhere in this report breakthroughs that now use these sources of carbon are profiled: For example, those replacing oil with CO₂ as a feedstock in polyurethane foams for furniture and lightweight insulation; or those now using carbon from non-food biomass like agricultural waste to create aniline, a major intermediate chemical product, rather than burning the waste into CO₂.

Carbon productivity

To see carbon as a solution will require a shift in thinking, from decarbonisation to carbon productivity. “If you can find alternative sources of carbon,” Patrick explains, “you can think about how you invest them.” This is a way of talking in metrics that economists and financiers in other areas of industry or agriculture understand. That is, thinking about the productivity of carbon. To give an example, carbon in a polyurethane foam in a domestic fridge saves electricity, so reducing the CO₂ emitted. In the normal life of a fridge, it will pay back the carbon



invested in its manufacture 70 times over. **Return on carbon employed** would be remarkably familiar sounding to a banker, a more understandable metric, and more accessible language than talking about chemistry. But it takes a change of mindset.

A collaborative mindset

If innovation is about exponential change, and getting people in a mindset of striving to achieve what they think is impossible, then there is another mindset change required, which is to move from secrecy to collaboration. To be prepared to share good ideas and make them open source. It may not sound like good business, but getting ideas out in the open can be a vital stepping stone to a breakthrough innovation – **you can't bring about exponential change by working in secret.**

The way to do this is through licensing, alliances and partnerships. SusChem is a good example – a collaboration of small and large companies, scientists, universities and policymakers, and a major contributor to sustainable chemistry at the European level. “We have to use such alliances better, to be transparent as an industry,” says Richard Northcote, Covestro's Chief Sustainability Officer. “Also to **look at competition as not coming from within the industry, but from traditional materials we are trying to substitute.**” In effect, looking for the new markets and making an effort to substitute materials with new lighter or better materials, where chemistry is the enabler.

One such example is e-mobility, or electric vehicles running on batteries. “Batteries are mini chemical plants,” Patrick Thomas reminds us. Chemistry will contribute not just the very sophisticated technology needed for the batteries but, as the vehicles need to be super-light, the composite materials necessary for insulation, furnishings, glazing and so on. Of course the vehicles and the whole concept of transportation will be completely different by the time petrol and diesel vehicles are phased out. Autonomous vehicles may well be the norm, and the technology already exists. But accelerating the shift to the widespread adoption of e-mobility will require collaboration both within and across industries, as well as with policymakers.

An implementation mindset

While all this sounds perfectly plausible, there is another piece to the jigsaw if these and other sorts of breakthroughs are to scale to the level required. “Legislation needs to change to allow progress,” says Richard Northcote. At present, many European directives are designed to protect traditional materials and their industries – steel for cars, for example – which makes substitution of materials difficult. We mustn't forget that Europe, with its traditions of science and education, is still a leader in innovation.

Downstream from the chemical industry, Philips Lighting aims for 80% of its portfolio to be assured externally as sustainable products. “Innovation is central to this,” says Dr Nicola Kimm, Head of Sustainability, Environment, Health & Safety, “and our product designers document why products qualify as sustainable, in regard to energy use, circularity, substances, packaging, weight and materials, and social areas.”

The implementation of innovations requires a favourable environment. Currently, innovation in Europe is implemented in China or scaled-up in America. Last year, China produced more electric vehicles than the rest of the world put together. When there's a need, they find a way to get on with it quickly.

In other words, the chemical industry can be a catalyst for transformational change, but it needs even more cross-industry and cross-discipline collaboration. And while Europe is an innovation hub, **industry needs support from policymakers to take innovations rapidly from research to implementation.** But perhaps the most important enabler of all is a deep shift of mindset about what is possible, and how to go about achieving it.



SDGs

The chemical industry and the UN SDGs

Since 2015, the world has had a framework of goals and targets that set out how we can safeguard the environment, end poverty and deliver prosperity for everyone. These 17 Sustainable Development Goals (SDGs), are led by the United Nations but were developed by many contributors and achieving them is a responsibility for all.

Chemistry can make the UN SDGs a reality

Business and sustainability are inseparable. In this way, the UN's global SDGs, part of its 2030 agenda, are not just a guiding framework for the world and its member states, but for the industry too. The EU has reaffirmed its strong commitment to the SDGs and the full implementation of the Paris Agreement.

As one of the largest and most diversified industries in Europe, we play an important role in helping to achieve the UN's vision. More than 95% of all manufactured goods are touched by chemistry in some form. Our contributions to economic growth and innovation unlocks the potential of industry and society to

achieve greater economic gains, while at the same time contributing actively to the SDGs.

By providing a framework for action and dialogue, the Cefic Sustainability Charter will stimulate the mainstreaming of sustainability and contribute towards the UN sustainability agenda. In particular, we in the chemical industry have a significant contribution to make on SDG 7, 12 and 13 aligned with the four focus areas of the charter.

Beyond these, the European chemical industry is actively contributing, either directly or indirectly, in all 17 goals, with major contributions to SDG 2, 3 and 6.

\$12tr

achieving the SDGs could open up an estimated \$12 trillion a year of market opportunities by 2030 and generate up to 380 million new jobs by 2030¹.

¹ http://docs.wbcsd.org/2017/03/CEO_Guide_to_the_SDGs/English.pdf



2 ZERO HUNGER
End hunger, achieve food security and improved nutrition and promote sustainable agriculture.



3 GOOD HEALTH AND WELL-BEING
Ensure healthy lives and promote well-being for all at all ages.



6 CLEAN WATER AND SANITATION
Ensure access to water and sanitation for all.



7 AFFORDABLE AND CLEAN ENERGY
Ensure access to affordable, reliable, sustainable and modern energy for all.



12 RESPONSIBLE CONSUMPTION AND PRODUCTION
Ensure sustainable consumption and production patterns.



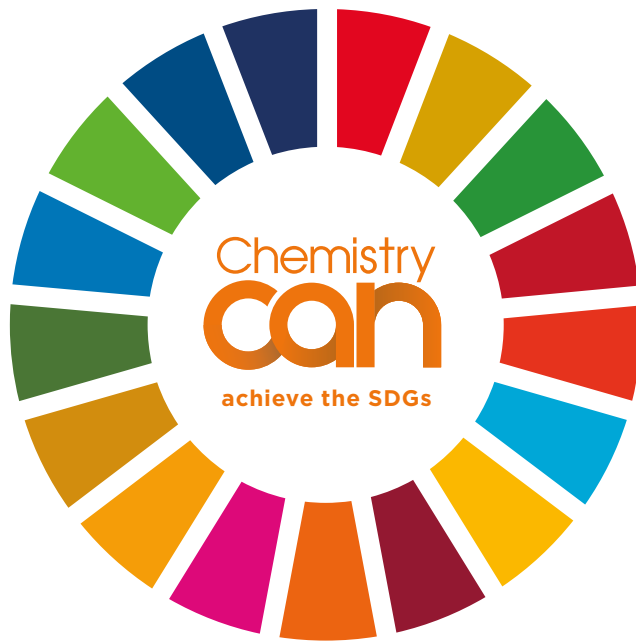
13 CLIMATE ACTION
Take urgent action to combat climate change and its impacts.

Working with WBCSD to accelerate performance in achieving the SDGs

The ambitious and time-bound agenda that the SDGs represent goes beyond business as usual. Realising the goals, and leveraging the business opportunities that they represent, will require collaboration between a critical mass of companies at the industry and whole system level.

With this in mind, the World Business Council for Sustainable Development (WBCSD) is supporting pioneering efforts among its Chemical Sector member companies who have come together with leading industry associations including Cefic to produce an SDG Roadmap for the sector.

This roadmap will look to articulate a common vision for how the sector has the potential to significantly contribute to the realisation of the SDG agenda and to establish a collective pathway to accelerate and optimise that level of contribution on the road to 2030.



“The pathway to business development and business growth is well aligned with the goals of Paris and the SDGs – creating a clear focus on long-term value creation in economic, environmental and social terms.”

Thierry Vanlancker
CEO AkzoNobel and Chair
of Cefic's Sustainability
Programme Council (PC)



10x
increase in carbon
productivity from
approximately \$740
to \$7,300 GDP per tonne
of CO₂ to achieve on the
goals of the Paris
Agreement².

² 2008 year of estimation. Taken from 'The carbon productivity challenge: Curbing climate change and sustaining economic growth.' McKinsey Global Institute (2008).

The chemical industry is a critical partner in the achievement of **SDG 7** and **SDG 13**. We are enabling the transition to a low-carbon economy by working hard to change to low-carbon emitting chemical production and by developing products that are playing a major role in enabling other sectors to reduce their own carbon footprints. Our advanced products and materials are making major contributions to increasing the share of the low-carbon energy. We have an excellent track record in using our energy in the most efficient way, and in helping other industries to also do so. Innovations within our industry are essential in helping to move towards circular and low-carbon emitting feedstocks, offering materials and energy solutions to our downstream customers based on carbon from waste, biomass and even CO₂ and CO from flue gases.

The chemical industry is also a critical partner in the achievement of **SDG 12**. Chemicals can be resource and energy intensive to produce, yet we in the chemical industry work on performance and resource efficiency for others. As we as a society seek to make more efficient use and re-use of our finite materials and energy sources, we can find some answers in an economy based on circular principles. By considering all material flows as potential resources, the chemical industry can help to achieve a more circular future, while also creating opportunities for companies and economies along the value chain.

The chemical industry has a long history of taking actions to minimise the risk of handling hazardous substances and preventing harm. This is the operational norm for our industry and is also applied to the safe use of substances further downstream. At a global level this commitment is being enacted through collaboration under the UN's Strategic Approach to International Chemicals Management (SAICM).



Focus area

Low-Carbon Economy

The European Union has ambitious goals to address climate change by moving towards a low-carbon economy – one that will minimise emissions of carbon dioxide (CO₂) and other greenhouse gases (GHGs). However, achieving the EU's target GHG reductions of 80-95% by 2050 will require considerable advances in products, materials, production processes and services across all sectors. We continue to work hard as a sector

to change to low-carbon chemical production and products. Chemicals can also play a major role in the production and storage of renewable energy and in enabling other sectors to reduce their carbon footprint. Now is the time to escalate that potential.

Chemistry CAN

Create
low-carbon
solutions

By investing in research and innovation, the chemical industry is developing breakthrough technologies and essential molecules that improve our own and others' energy efficiency. And we increasingly make use of low-carbon energy sources and alternative feedstock.

Handprint*: facilitating energy saving and enabling renewable energy

The chemical industry provides solutions for achieving major energy savings in many value chains, with benefits in CO₂ emission reductions and improved carbon productivity.

Buildings and housing

According to the International Energy Agency (IEA), nearly one-third of the world's energy is consumed by the buildings sector.

In housing, **chemical companies can contribute significantly** by providing products such as high-performance, durable insulation materials for walls, roofs and pipes, as well as high-performance sealants and window materials.

Transport

The European chemical industry already provides a range of solutions that make transport more energy efficient and therefore less carbon emitting. For example through the development of fuel additives such as AdBlue®. Advanced biofuels, hydrogen, renewable synthetic fuels and renewable electricity enable further progress towards deployment of low-emission mobility.

* Handprint is how we define the chemical industry's opportunity to help other industries reduce their footprints and develop solutions that enhance their positive impact on society.

Chemical potential for energy efficiency

A recent (2017) analysis by Accenture on the circular economy calculated that by 2030 it will be feasible to achieve a 20-fold increase in energy efficiency from today's baseline, through enabling technologies delivered by the chemical industry. Major contributions would include helping to increase the durability of goods, facilitating the sharing economy, and increasing energy efficiency. The analysis calculates that the most significant contributions will be achievable in the transportation sector, as well as in residential and commercial construction.

While the potential is huge, it's also clear that the capital expenditure required will be significant, and a clean, low-carbon future will rely on widespread collaboration.

“Advancements using silicones have made solar panels far more efficient, durable and affordable than ever before. Assembling and installing solar cells is also easier now, thanks to silicones. If we want Europe to be more energy efficient, we will need products of the chemical industry to do the job.”

Heinz Haller

Executive Vice President and President of Dow Europe, Middle East, Africa and India and Vice President, Cefic



Focus area

Low-Carbon Economy

9x

Products containing silicone materials can help save nine times the greenhouse gases required to manufacture them³.

Another exciting opportunity is the use of waste heat from heat generating sources such as vehicle engines to generate electricity. Today these technologies, known as thermoelectric generators (TEGs), are expensive and small scale but could potentially reduce fuel consumption in the automotive sector by 3-4%. Evonik has developed a novel manufacturing process to reduce the production cost of TEGs by up to 70%, making use of energy from exhaust heat more viable.

Additionally, composite materials can further help reduce emissions by helping to make vehicles lighter. When compared to metal materials, composites can offer important light weighting benefits (15-25% for glass fibre reinforced composites and 25-40% for carbon fibre reinforced composites).¹

The benefits of light weighting can be translated into potential savings of 8 million tonnes of CO₂ a year in the EU-wide vehicle fleet². Increasingly, R&D focuses on enhancing recyclability, reusability and prolonging use of light weight composites.

Enabling renewable energy

From its very beginnings, the chemical industry has been a key enabler for renewable, low-carbon energy production. This continues today with the development of ever-more advanced materials and processes that trigger a higher performance, where overall benefits outweigh costs. Chemistry is producing materials that enable photovoltaic electricity, wind energy, fuel cells and electricity storage, and is at the heart of the advanced biorefinery technologies becoming increasingly important in the production of bioenergy.

BASF has recently introduced additives in the form of hardeners for manufacturing large fibre composite structures which are of increasing interest to manufacturers of rotor blades for wind turbine systems.

This has the potential to reduce blade production times by up to 30%, so increasing productivity and contributing to state-of-the-art wind energy production.

DECHEMA scenario study

A study from DECHEMA on low-carbon energy and feedstock for the European chemical industry (2017) provides a detailed analysis of the technical options available to reduce CO₂ emissions during the production of the major chemical building blocks used by the industry (i.e. ammonia, methanol, ethylene, propylene, chlorine and the aromatics benzene, toluene and xylene).

The study evaluated the potential impacts of a number of measures along various scenarios. This included the implementation of further energy efficiency measures, the utilisation of alternative

carbon feedstock (i.e. biobased raw materials and CO₂), and electricity-based processes benefiting from a progressive decarbonisation of the power sector. The study predicts a very significant CO₂ emissions reduction potential by 2050 (up to 210 MT tCO₂ annually under maximum theoretical scenario), and highlights the conditions necessary to enable the transition of the European chemical industry to carbon neutrality including availability of low-carbon power at a competitive price and the significant levels of investment required.

For more see: <http://www.cefic.org/Documents/RESOURCES/Reports-and-Brochure/DECHEMA-Report-Low-carbon-energy-and-feedstock-for-the-chemical-industry.pdf>





Covestro has developed an alternative to well-established epoxy based composites, recently launching the first ever large polyurethane rotor blade. This enables wind blades to become lighter, yet longer, and therefore more cost-efficient than those made from conventional materials, further increasing the feasibility of wind as a low-carbon energy solution.

Footprint: low-carbon chemical production

While growth in chemical production has decoupled significantly from the GHG emissions, there is still room for improvement. **Innovation is needed to make the sector less energy intensive in production**, and opportunities to further scale the use of low-carbon energy sources and alternative feedstocks need to be identified. The latter is covered under the Circular Economy and Resource Efficiency section.

61%

decrease in GHG emissions in the chemical industry from 1990 until 2015, corresponding to an 85% increase in production for the same period.⁴

Chemical-industry-led consortium confirms support for sustainable energy

In the Netherlands, the government has agreed with industry to try to reduce CO₂ emissions through using 14% renewable energy by 2020, and aims to reduce CO₂ emissions to zero by 2050. To support this, **AkzoNobel, DSM, Google and Philips formed a consortium to collaborate** in buying energy from renewable sources, and to confirm

sustainable energy as part of their common long-term strategy. In 2017, **the consortium signed a multi-year contract to buy electricity from two Zeeland wind parks** which should be operational in early 2018. The parks have a total capacity of over 140 MW.

¹ Polymer composites for automotive sustainability. SusChem (2017).

² CO₂ Emissions From Fuel Combustion Highlights 2016 http://www.iea.org/publications/freepublications/publication/CO2EmissionsfromFuelCombustion_Highlights_2016.pdf

³ <http://globalsilicones.org/sustainability/carbon-balance>

⁴ Cefic Facts & Figures 2017.

More data and information is available at: <http://www.cefic.org/Facts-and-Figures/>

Focus area

Resource Efficiency

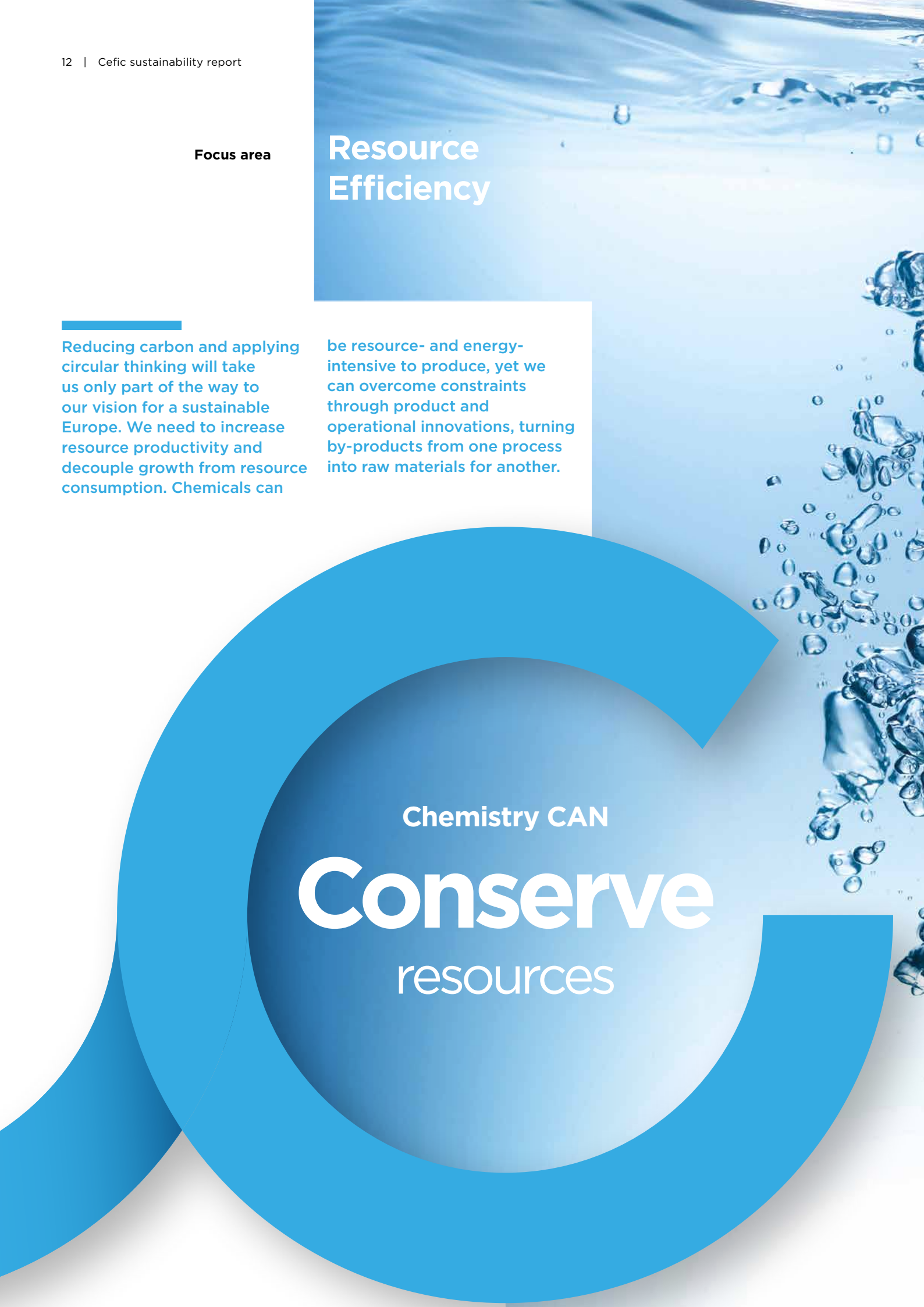
Reducing carbon and applying circular thinking will take us only part of the way to our vision for a sustainable Europe. We need to increase resource productivity and decouple growth from resource consumption. Chemicals can

be resource- and energy-intensive to produce, yet we can overcome constraints through product and operational innovations, turning by-products from one process into raw materials for another.

Chemistry CAN

Conserve

resources



Growing demands on the world's natural resources underlines the critical importance of resource productivity; that is doing more with less. We work on performance efficiency in our own manufacturing – our footprint. And by using molecules in the most efficient way and by designing products with durability, material re-use and recovery in mind, chemistry can help minimise the use of finite resources – our handprint.

Handprint: resource efficiency through our products

Chemical products can help our customers use resources more efficiently. The industry is innovating to improve raw material efficiency, developing products that use less materials while delivering the same or superior performance. We are also innovating in ways that help support recycling of materials and recycling opportunities in the value chain. Some companies take a very holistic approach to this, integrating resource efficiency closely into their decision-making processes. Solvay systematically assesses its products and the markets they serve regarding their contribution to sustainable development. Resource efficiency is rigorously quantified via a monetised approach and this aspect is then combined with factual and unbiased assessments of the positive – or negative – contribution of Solvay's portfolio to harmful substances, and circular economy. The following examples illustrate the huge range of applications where resource efficiency is being applied at the product level, and the innovative thinking that is involved.

Designing for resource saving products

Deinking removes ink and dirt from fibres – a critical step when manufacturing paper from recycled paper or board. A new technology launched by Kemira helps enhance the removal of ink while eliminating the

need to use hydrogen peroxide and caustic soda during the process. It is estimated that the resulting deinking sludge output can be reduced by between 13%-20%.

The International Association for Soaps, Detergents and Maintenance Products (A.I.S.E.), has launched a new compaction initiative, aiming at more cleaning power and better performance with less cleaning product, for household liquid laundry detergents. A similar project, completed in 2011, achieved a reduction of over 300,000 tonnes of product, 12,400 tonnes of primary packaging and 15,400 fewer truck journeys.

When it comes to building insulation chemical companies are consistently looking for higher performance, with less raw material. For example, Evonik has managed to reduce the thickness of insulation material by up to half, while still achieving very low thermal conductivity.

Innovation to preserve fish stocks

Royal DSM and Evonik have managed to produce omega-3 fatty acids without using fish oil from wild-caught fish, which is a limited resource. They use sustainable, fermentation processes on naturally occurring marine algae. Fish oil is mostly used to feed fish in aquaculture, and this new omega-3 source will initially be used for this as well as in pet food.

Reducing food waste through packaging innovation

Food waste is a major issue and a complex one, both in Europe and across the world. Plastic packaging helps reduce food waste, by extending the shelf life of products, and protecting against contamination and damage. Just 1.5 grams of plastic can keep a cucumber – which would otherwise spoil in three days – fresh for 14 days¹.

¹ Plastic Packaging: Born to protect. Plastics Europe (2012).

Focus area

Resource Efficiency

“Resource efficiency combined with climate policy could at the same time stabilise global resource use by 2050 and boost incomes and economic growth.”

UNEP (2016): Report on Resource Efficiency¹

Further areas of food packaging research include nanosensors which change colour when leaks, temperature variations or microbial growth are detected. Or ‘active’ packaging that releases preservatives only when food starts to spoil.

Footprint: resource efficiency in our own operations

When developing and manufacturing our products, we rely on efficient processes. This pays off for both the industry and the environment; we achieve higher product yields in our plants, use fewer resources and reduce both emissions and waste. For these reasons **the chemical industry also invests in a range of different approaches to improve resource efficiency in its own operations.**

Industrial symbiosis

This is where industrial companies or facilities work together to use the waste or by-products of one production process as the raw materials for another.

BASF uses the concept of Verbund – the intelligent interlinking of production plants, energy flows and infrastructure – to do this. BASF realises worldwide annual savings of more than €1 billion, also saving 3.8 million metric tonnes of CO₂, equivalent to more than 400,000 households’ annual energy use. It also generates ecological benefits through efficient processes and reduced transport impact.

Using by-products from firms on the same site has become a successful strategy in the chemical industry. In two coagulant plants, Kemira produces their entire range of aluminum-based coagulants for water treatment using by-products from Covestro as raw material. In 2016, approximately 27% of raw materials across all Kemira business segments were industrial by-products from other industries.

The improvement of processes extends to those of our customers too. BASF developed an optimised recycling procedure for N-dimethylacetamide (DMAC), used as a solvent in the production of spandex fibres. The procedure makes it possible to recover DMAC at a high quality and minimises solvent losses.

The next steps for industrial symbiosis is in **the exchange of valuable resources with surrounding companies from other sectors.** The project EPOS is a cross-sectoral symbiosis initiative launched under the public private partnership SPIRE. EPOS receives funding from the European Union’s Horizon 2020 research and innovation programme.

The most advanced example of cross-sectoral symbiosis in EPOS can be found in Hull, UK, where CEMEX, a cement company, can use liquid waste from INEOS, a petrochemicals company. It could also take chalk reject material from OMYA, a producer of industrial minerals and return its cement kiln dust to OMYA for land reclamation of their quarry.

Symbiosis between partners can also take completely different forms. Aurubis, a sulphuric acid producer, shares its waste production heat with the city of Hamburg, saving the city yearly around 140,000 tCO₂ – equivalent to around 15,000 households’ yearly energy use – or 0.8% of the city’s population. Similarly, Shell will supply the Rotterdam region with residual heat released from its Pernis refinery. This should generate enough energy to meet the heating needs of 16,000 households.



Coagulants help to unlock access to a critical resource

Coagulants are a large-volume product, principally made from recycled raw materials. In Europe 70% of coagulants are manufactured using other industries' by-products as raw materials. And each year 4 million tonnes of coagulants are used by waterworks to create safe drinking water, and to treat waste water.

This is a great resource efficiency story in itself. But coagulants can also open the door to recycling one of life's most important elements, phosphorus. Coagulants are very efficient at capturing the excess of phosphates in our cities' waste waters (which would otherwise damage the environment if released into rivers and lakes).

The phosphorus in phosphates is a key resource – for example in agriculture – and one that Europe has to import from other continents.

Recovering this phosphorus could provide up to one-third of Europe's needs, providing a threefold benefit in the process:

- less reliance on industrial phosphate imports;
- providing phosphate in a form which minimises leakages into ground waters;
- reliably protecting our surface water from eutrophication.

Process efficiency

The chemical industry has long been making the most of resources by continuously improving the efficiency of production processes as a way of reducing costs.

With the high volumes the chemical industry produces, each percentage point of improvement means a high saving in feedstock by measuring and visualising energy and resource efficiency, and by providing decision support to plant operators. Methods to measure and predict efficiency through tools and software such as those developed by the EU-funded MORE project can provide considerable improvements. This is why the chemical industry aims to be at the forefront of applying the latest analytical technologies to increase resource productivity.

The ongoing sustainability performance of a chemical production process is determined largely by decisions taken during process and plant design. Software platforms using simulation tools for digital engineering now enable decision-making along the whole life cycle of a plant. This can cover process development, basic and detailed plant engineering, procurement, construction, commissioning, plant operation, as well as extensions, modifications and reuse of plants for new products.

Total has introduced predictive analytics software in its refining and chemicals activities to increase productivity and plant availability. And BASF is expanding its ability to run virtual experiments using supercomputers – an ambitious undertaking for a private company. While these are impressive investments, replicating challenging innovation questions as they arise within the chemical industry is highly complex, and further reductions in simulation time are still required.

Water efficiency in production

The chemical industry provides solid potential for increasing eco-efficiency in industrial water management, as demonstrated in the EU-funded E4Water project. Designed to give a major boost to the water efficiency of the European chemical industry, E4Water aims for an integrated, cost and energy efficient water management. Six pilot cases were conducted, demonstrating a range of potential benefits including a reduction of 3 million m³ of freshwater use per year and the avoidance of 4 million m³ of waste water. These benefits can be multiplied if the recommendations are adopted by more companies. Continuing the work, INSPIREWATER, a cross-sectoral consortium between steel

and chemical industries aims to demonstrate solutions which will increase water and resource efficiency by 20-30%.

Preventing and minimising waste

Citric acid is the most widely used organic acid, with applications in food, beverage, pharmaceuticals and detergents. Leaving no waste discharge at all, Citrique Belge's chemical process – fermentation and downstream processing of molasses – each year creates 120,000 tonnes of citric acid crystals and 265,000 tonnes of other by-products for use in feeds, fertilisers and construction.

Essenscia, our Belgian federation, has developed an indicator for resource productivity based on the fossil feedstock uses. These figures show clearly that an increasing amount of value is being created per quantity of raw material used. Over the past decade, the production index for the chemicals, plastics and life sciences industry increased by 45% while the proportion of energy used as a raw material grew by only 3%.

¹ Resource Efficiency: Potential and economic implications: Summary for policy makers, UNEP (2016).

Focus area

Circular Economy

As we seek to make more efficient use and re-use of our finite material and energy resources, and make use of alternative sources of energy, we can find some answers in an economy based on circular principles. This could replace our traditional linear approach of 'take, make, dispose'.

A circular economy aims to maintain the value of products, materials and resources in the economy for as

long as possible, and to minimise the generation of waste. By considering all material flows as potential resources, we can achieve this circular future, while also creating opportunities for companies and economies along the value chain.

Chemistry CAN

Connect the circle

The chemical industry can contribute in two critical ways to a transition to a circular economy; enabling the circular economy in downstream industries and circulating molecules to close the loop. The journey towards such an economy will mean developing new business models, products and solutions that look beyond the concept of using a product just once and that look for longer loops through, say, improved durability. In making this happen there is also the challenge of minimising the energy needs required and increasing the use of biobased and alternative feedstock.

Moving towards a circular economy can bring society many benefits, but will require time, effort and investments. Above all, **it will require close collaboration between all stakeholders in society**; business, civil society, academia, policymakers. No single party can accomplish this huge endeavour alone.

Footprint: moving towards a 'circular feedstock'

Over time, chemical companies will be able to draw on a mix of feedstocks, with different options evolving over time as innovations succeed. However, all will involve large-scale investment in R&D and conversion of assets.

Increasing biobased feedstock

The bioeconomy is offering an opportunity for the chemical industry to diversify its raw materials base. Chemistry and biotechnology enable the entire bioeconomy value chain, from fertilisers, crop protection to biorefining biomass into biobased chemicals and materials that could go into food, feed, plastics, paints, adhesives, fuels and energy, lubricants, cosmetics, detergents and cleaning products, pharmaceuticals and many more applications.

For example, Clariant has developed a technically and commercially viable process for producing bioethanol from agricultural residues, such as straw from cereal production.

Covestro's innovation in producing aniline for the first time entirely from biobased raw materials – straw and wood – is an exciting development. The production of aniline traditionally relies heavily on fossil-based raw materials and its main use is in manufacturing rigid polyurethane foam.

SABIC offers renewable polyethylene and polypropylene products made from using waste from the food, paper and forestry industries. These chemical building blocks have an identical performance to fossil-based equivalents and meet an increasing customer demand.

CO₂ as a feedstock

CO₂ and CO from industrial flue gases can be used as an alternative carbon source for the production of chemicals through various processes. One route is producing major chemical building blocks starting from CO₂ and H₂ (see DECHEMA study, page 10). To keep the goal of a low-carbon economy, this would rely on sufficient availability of, and cost-competitive access to, low-carbon electricity from a progressively decarbonising power sector.

Covestro is working with partners on a number of **projects to turn CO₂ into a raw material that can replace petroleum** for some polymers. The first step is the launch of CO₂-based foams for use in furniture and automotive parts, with 20% of the foam made from captured carbon.

Focus area

Circular Economy



Increasing use of waste raw materials

The Waste2Chemistry initiative, a consortium initiated under the leadership of amongst others AkzoNobel, aims to use a new technology from Enerkem to produce waste-based methanol, an important base chemical, from municipal waste. Europe's first plant of this kind, planned for Rotterdam, will supply the Dutch chemical industry with this low-carbon feedstock. The plant will reduce the industry's emissions by 135 kTonne, equivalent to 53,000 households.

Handprint: enabling circularity in downstream industries

Waste as a feedstock

Indaver is recovering valuable molecules from hazardous or complex industrial waste, so they can be used again as primary resource. It manages 5 million tonnes of waste a year, safely recovering chlorine, sulphuric acid, fluorine, iodine and valuable metals. Total is pushing the limits to provide the customers with high-density polyethylene containing up to 50% of post-consumer recyclates for household and industrial liquid applications that match virgin materials properties.

Design for recyclability

Beyond optimal recycling on chemical production sites the chemical industry looks at solutions for customers along the value chain to place end-of-life products back into the cycle. For example, DuPont is providing products that allow the recycling of used bottles in agricultural packaging, items that are typically difficult to recycle.

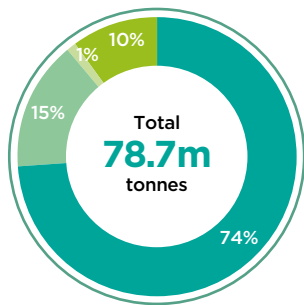
Arkema is developing additives for road asphalt, which increase the aggregate recycling rate by 10%-15% compared to conventional techniques. More challenging is their new innovative resin for the production of recyclable thermoplastic composite materials for the automotive industry and for wind turbine blades, to replace those that are harder to recycle.

Many of these solutions need collaboration. One example is the joint venture between DSM and Niaga, focusing on a product redesign philosophy that ensures materials are recyclable. The technology used allows for full recovery after use – a promising first example being carpets which require 90% less energy and no water during manufacturing.



Organic raw materials use

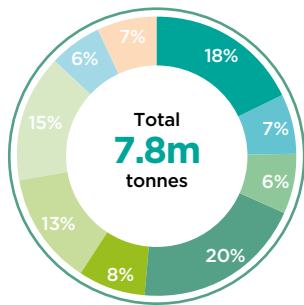
Shares in total organic raw materials – material (feedstock) use only. EU chemical industry, 2015.



- Mineral oil derivatives
- Natural Gas
- Coal
- Renewables

Renewable shares: detailed breakdown

Renewables shares in total renewables. EU chemical industry, 2015.



- Vegetable oil
- Animal fat
- Chemical pulp
- Starch and sugar
- Bioethanol
- Bioethanol for ETBE
- Natural rubber
- Glycerol
- Others

Design for durability

In buildings, silicones are used to protect, strengthen, preserve, and provide features such as insulation. A key benefit of silicones is that they resist high temperatures and UV light, and are less susceptible to mechanical fatigue and less prone to absorb water.

Other typical examples of design for durability are coatings. Maybe less known than the coatings used in shipping and building, are the transparent protective coatings used to improve the lives of drinking bottles by tripling the number of times they can be used.

Alternative business models

Circulating materials is a business model. For example, Ioniqa is launching a process for recycling PET polyester waste, taking out the colourant and producing virgin quality monomers cost-effectively.

Chemical leasing is an innovative service where companies sell chemicals not by volume, but by performance, such as by square metre cleaned, or lifetime needed. It's shown to maximise the efficiency of use and reduce consumption, for example enabling companies cleaning metal surfaces to reduce solvent consumption by up to 80%¹.

¹ <http://www.dow.com/en-us/news/news-detail/dow-consumer-care-safechem-wins-prestigious-cefic-award>

More data and information is available at: <http://www.cefic.org/Facts-and-Figures/>



Chemistry facilitates a circular economy concept for textiles

The RESYNTEX research project aims to create a new circular economy for the textile and chemical industries, by producing secondary raw materials from unwearable textile waste, much of which is simply thrown away by consumers rather than collected.

Within the project a pilot plant with the capability to recycle 500 tonnes of textiles a year will be built. The sorted textile waste will be chemically treated to extract resources such as protein-based fibres for producing wood-panel adhesives, and cellulosic fibres for producing bioethanol. Further recovery treatments also produce new chemicals and plastic bottles. RESYNTEX is a consortium of 20 project partners from across ten different EU member states, including industrial associations, corporations, SMEs and research institutes. RESYNTEX receives funding from the European Union's Horizon 2020 research and innovation programme.

Interviews
with expertsAchieving
Circularity

It's clear that the Circular Economy presents a whole range of opportunities, but also challenges. To understand the barriers to circularity, and what conditions are required for achieving it, Cefic spoke to experts from European policy and business.



Björn Hansen
Head of Unit,
Chemicals,
Biocides and
Nanomaterials,
DG Environment,
European
Commission



Antonia Gawel
Head of the
Circular Economy
initiative at the
World Economic
Forum



Dr. Nicola Kimm
Head of
Sustainability,
Environment,
Health & Safety
Philips Lighting



Janez Potočnik
Co-Chair UNEP
International
Resource Panel



Puneet Trehan
Material Innovation
& Development
Leader at IKEA
Group

What are the main barriers to Europe achieving a circular economic system?

BH: One of the main barriers is to understand what the real issue is. For most materials we have a linear economy, and we make small tweaks to increase the number of loops or the length of the loop. But the switch to a true circular model is not a continuous process, it's an abrupt shift. We shouldn't base our whole strategy on assuming that we can make a smooth transition.

JP: I would guess that political [barriers] are most difficult. It is about leadership and governance in the first place. On all the levels and including all stakeholders. Political barriers too many times involve and represent the prevailing voice of those most vocal for protecting status quo and existing interests and profits.

PT: There are quite a lot of opportunities and challenges in the recycling element of the Circular Economy. For example, with plastics the technology is there, it's more of an issue of the supply chain. With textiles, the infrastructure still has a long way to go. The technologies need to develop so that the system makes it economically viable.

What are the financial, technological and political conditions required for a circular economic system?

BH: The technology is the most important thing. That starts with designing for true circularity, then the ability to collect, separate, transport and recover all materials to their full quality.

You also need to have the political will, which I think we have, but it's going to be at a cost. We have to work out what the negative impacts are, such as the value of the materials you are recycling compared to the impacts of the pollutants of the material.

On the economic side, it's about reducing the risk for companies to invest. The way to do that is also for authorities to finance research. It's important that it's seen as a long-term investment, with a long-term strategy.

AG: Technology is an enabler that has supported some transformation already. But to scale the circular economy concept we need new policy approaches, and a closer look at potential financing models which blend public and private sector resources and capabilities. Often the incentives are misaligned and the financial models considered risky by traditional standards.

JP: First, we need the understanding that the way we produce and consume is not sustainable and that the transformation of the existing economic system is simply unavoidable. And secondly to see the circular economy as an opportunity rather than a problem. If we are sincere in our efforts for growth and jobs in the future, this is a way to go.

“Technology is an enabler that has supported some transformation already. But to scale the circular economy concept we need new policy approaches, and a closer look at potential financing models which blend public and private sector resources and capabilities.”

Antonia Gawel
Head of the Circular Economy initiative at the World Economic Forum



Who should be involved in discussions to bring about these conditions?

BH: You need a proper stakeholder forum: regulators, the chemical industry, their customers, science and research. The political risk is that you won't see tangible results within a normal political mandate of four to five years.

AG: Leadership has to come from business and government – and society, because we're asking consumers to alter their behaviour. Companies need to be at the table with government, otherwise you'll never have the critical mass needed for change. The European Commission is already leading some of the thinking and conversation, as are many European businesses. But we have to recognise that growth in infrastructure, population and consumption is very much outside of Europe.

How do we arrive at collaboration?

JP: There is no clear recipe. One can design the products in a different way, organise the production process more efficiently, influence more responsible consumer behaviour, change existing business models etc. For me probably the most efficient way is via eco-design and change of existing business models.

AG: You have to get quite practical and look at very specific sectors and cases, and really begin applying it in practice. You can't stay at a conceptual level. The same applies for financing. What are the specific challenges in financing it? Then start to address them individually.

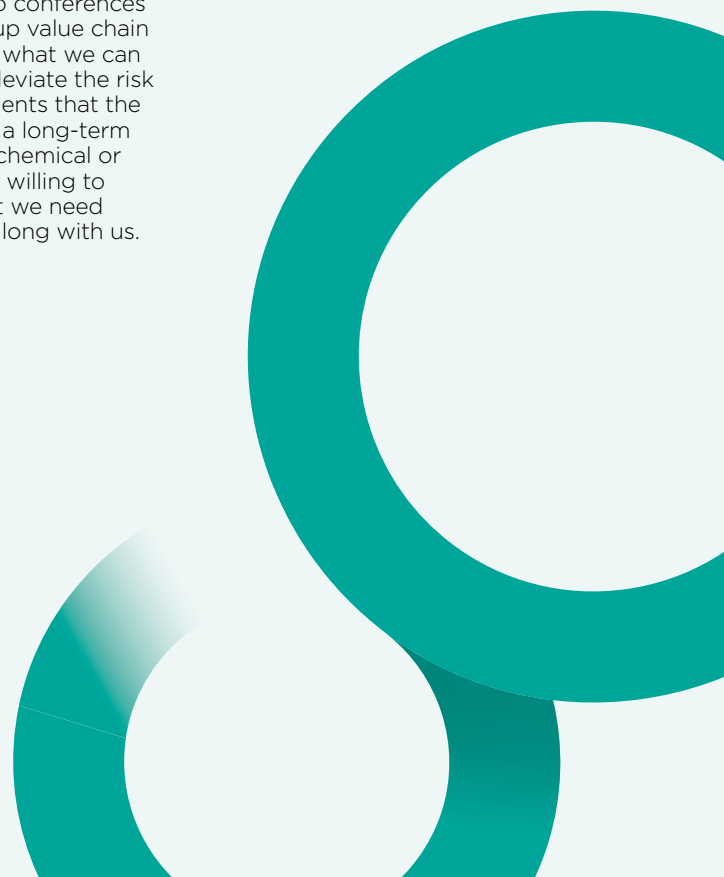
NK: We have exchanged knowledge with large chemical companies on circular economy with regard to polymers recycling and the phase out of certain substances. We are looking for ways to join forces to revolutionise the global shift toward the reuse and recycling of plastics and already designing products with recycling at end of life in mind.

PT: I've been in all the bio conferences around the world to set up value chain partnerships. We set out what we can offer at IKEA – we can alleviate the risk mitigation of the investments that the industry needs to do. It's a long-term process and we're not a chemical or polymer company. We're willing to make this investment but we need other partners to come along with us.

What kind of role do you see for the chemical industry in moving towards a circular economy?

JP: The chemical industry is clearly an essential part of the transition. It should lead and not wait for the time when those changes will be unavoidable – this is not how trust is built or how responsible, forward-looking business, will need to act.

PT: The chemical industry, if I'm being honest, is not really thinking in the end-consumer or the end product. A polymer company takes a polymer to make it a plastic and then that plastic company sells it to someone else who sells it to us – it's a long chain. It should be a much stronger partnership.



Focus area

Care for People and Planet

Safety is built into the DNA of the chemical industry, and applied from the first R&D, to managing materials at their end of use. In line with the Responsible Care programme, we must ensure that at all times we

augment this mindset with thorough Health, Safety, Security and Environment (HSSE) standards and product stewardship of chemicals throughout their life cycles.

Chemistry CAN

Care
for people
and planet

Chemistry will always be associated with the risk of handling hazardous substances. But we can minimise this risk, and prevent harm, through highly demanding operational management systems that are regularly evaluated and constantly improved. These include thorough emergency preparation and procedures, to cope with the potential consequences of accidents which could affect staff, local communities or the environment. These commitments are the standard for our industry, and also apply to safe use of substances.

Important advances

Since the REACH legislation came into force in 2007, a wealth of information has become available, as **substances are now covered by systematic safety data collection and dissemination**. This policy was designed to address societal concerns.

In their ten years of existence, the European Chemicals Agency (ECHA), using REACH, has worked closely with governments and companies to ensure 16,220 substances have been registered, and 174 substances of very high concern identified. Through significant input from the chemical industry, ECHA now has classification information on almost 130,000 chemicals. Cefic continues to work with ECHA to ensure REACH delivers on its goals to improve protection of human health and the environment and to reduce animal testing. We want to ensure the next registration deadline, 31 May 2018, that will affect many small- and medium-sized companies, works well.

The strength of the European chemical industry's safety record is now based on a **rigorous legal framework, close collaboration, and specific protection standards** for individual products. At every step, from the very first employee in the production, reuse and disposal chain to the end user in the value chain – namely the consumer – safety remains of the highest concern.

The industry also uses best available technology to minimise emissions from our production sites to the air and water.

Going beyond existing legislation

Europe has demanding chemicals and environmental regulations. But in parallel with meeting these, our sector has introduced practices which in certain cases go beyond the regulatory requirements.

The sector has for a long time supported the voluntary phasing out of mercury in the chlor-alkali sector by 2020, and VinylPlus, the voluntary phasing out of certain plastic additives by the European PVC industry. We also support a global initiative to ensure drug precursors are used only for bona fide industry purposes.

Cefic promotes and coordinates the global Responsible Care programme.

This commits companies along the supply chain to work through their national associations, to continuously improve their HSSE performance, and communicate about their products and processes.

Value chain outreach

In October 2016, Cefic took an important step towards enhancing communication for chemical safety, with a collaborative industry network which will develop effective tools to **identify good practices and foster communication throughout the supply chain**. We continue to encourage our members to provide information on using chemicals on set templates, called sector use maps, when updating registrations.

The sector's commitment is perfectly illustrated in the collaboration with the soap and detergent industry, where the use-maps cover over 80% of substances' uses by large and small companies, ensuring they can be used safely.

Focus area

For People and Planet



Together for Sustainability (TfS)

Striving for sustainability beyond a company's own operations has gained increasing importance. TfS, founded in 2011, has the purpose of assessing, auditing and improving the sustainability practices within the supply chains of the chemical industry. It is a voluntary commitment of 19 multinational companies who collaborate with their suppliers on improvements in Health & Safety, Environment and Social matters.

The TfS programme offers instruments for both the supplier and the buyer to identify strengths and improvement areas and to initiate concrete sustainability improvements. So far, **over 8,000 suppliers have participated in the TfS programme**. The approach was developed by building on established principles such as the Responsible Care Global Charter and the United Nations Global Compact (UNGC), among others.

TfS has been a partner company of Cefic from the start, and in 2016 also signed a strategic cooperation agreement with the China Petroleum and Chemical Industry Federation (CPCIF) to jointly promote the TfS programme in China.

The chemical industry also promotes excellence in related logistics operations through a variety of activities, such as Cefic's Safety and Quality Assessment System (SQAS) for evaluating the quality, safety, security and environmental performance of logistics service providers and chemical distributors.

Complementary to the very strict rules and regulations, the chemical industry's commitment to safety is demonstrated through the coordination of the Intervention in Chemical Transport Emergencies (ICE) network across Europe. The ICE centres create a round-the-clock network of assistance for national authorities in times of emergency response, by providing information, expert advice and specialised intervention teams. In 2015 there have been 1,705 activations of the ICE network across Europe.

Our current priorities to build on our achievements

Continuously improving safety of products and operations across our industry is a clear priority.

Worker health and safety is another absolute prerequisite to the success of our industry and vital to our 'licence to operate'.

The European Chemical Employers Group (ECEG) and IndustriAll European Trade Union joined forces to reinforce the social dialogue at EU level. They also signed a Memorandum of Understanding with Cefic on Responsible Care, aimed at ensuring close collaboration on a range of initiatives in the area of health, safety and security.

Cefic contributed closely to the development of the OECD guiding principles on chemical accident prevention, preparedness and response. Guiding principles on the change of ownership in hazardous facilities are under development. Another element of continuous improvement is the tracking of process and plant safety performance.

Ensuring the security of our industry is also of critical importance to society, and Cefic supports members in best practice security management. This includes risk analysis, audits and implementing the Responsible Care security code (available on cefic.org). We also provide a tool for logistics companies to help smaller companies identify and address risk.

Cefic is committed to making REACH a success. This means that the European chemical industry increasingly works with our customers across the value chain to develop safe, better performing products, and to consider the sustainability impact of chemical products throughout their full life cycle.

Beyond what is required by REACH and CLP, European companies, including Solvay, Clariant, BASF, DSM and AkzoNobel already apply sustainable portfolio analysis and management practices. Building on this, the World Business Council for Sustainable Development (WBCSD) is working with the chemical industry on a common approach to steer a chemical company's product portfolio towards improved sustainability performance, taking all environmental and social impacts into consideration.

Cefic is also acting at a global level under the UN's Strategic Approach to International Chemicals Management (SAICM), which aims to achieve the sound management of chemicals around the world by 2020. To meet this goal, **the chemical industry facilitates a stronger engagement with downstream industries**, to address the use of chemicals in the manufacture of products and throughout their

“The priorities you have put forward for your ambitious work will indeed be crucial in strengthening our social market economy. The chemical industry is a major asset for the European economy.”

Marianne Thyssen

European Commissioner for Employment, Social Affairs, Mobility and Skills at the Final Conference of the European Social Partners of Chemical Industry, June 2017.



life cycle, and for a more extensive approach to stewardship. To achieve this, the International Council of Chemical Associations (ICCA) is promoting common principles for communicating chemical safety downstream, encouraging open, proactive communication.

Understanding the full picture

As an industry, we support research to help us understand knowledge gaps, to progress risk assessment and safe management of chemicals. For example, there is growing concern about the possible negative effects of endocrine disruptors – which at certain levels can affect hormone systems – on human health and the environment.

Therefore, we contributed to a seven-step science-based guidance document for the identification of endocrine disrupting properties developed by the European Centre for Ecotoxicology and Toxicology of Chemicals (ECETOC).

The Cefic LRI (long-range research initiative) programme supports scientists around the world in looking at the implications of chemistry in the long term. LRI is a global industry programme aiming to improve methods used for the scientific assessment of the safety of chemicals, and better understand their potential health and environmental risks. In this respect, the LRI contributed to finding alternatives for animal testing and has also provided a tool – AMBIT – designed to support companies by facilitating chemical safety assessment. AMBIT is an open source software tool to help in the development of substances through modelling and simulation.

More data and information is available at: <http://www.cefic.org/Facts-and-Figures/>

Working to raise standards

Responsible Care is currently practised in 67 countries globally. Through building capacity in Eastern European and other markets of Asia and Africa, the sector is working collectively to spread best practices in responsible chemicals management and bring this standard to more countries.

The objective is to provide training that supports national associations and chemical companies in specifying their needs, and choosing activities that best fit their long-term strategy. Between the period of 2008–2015 ICCA held 21 capacity-building events in Europe, concentrating mainly in Eastern Europe, where Cefic is leading this agenda.



About Cefic

The chemical industry is one of the largest and most diversified industries in the world, and supplies virtually all sectors of the economy. Cefic is the voice of the chemical industry in Europe, which is the world's top exporter and importer of chemicals, generating €507 billion in sales and is the leading manufacturing sector by value added per employee. Our members directly provide around 1.4 million jobs and account for 17% of world chemical production.

How Cefic delivers Chemistry CAN for the European chemical industry

Our role and our membership

At Cefic, we represent our members – large, medium and small chemical companies and national associations. We interact daily with EU institutions and policymakers, organisations such as the UN and OECD, as well as non-governmental organisations, media, and many other parties – ensuring the voice of the chemical industry is heard.

The Cefic Sustainability Charter

Building on the Responsible Care programme and our 2012 Sustainable Development Vision, which defined our common understanding on sustainability issues – we have

launched the Cefic Sustainability Charter. The Charter puts our vision into operation, defining the pathway to sustainability.

The Charter provides a framework through which Cefic facilitates dialogue with industry partners, society and governments, about how we can work together towards a sustainable future. It will inspire our activities by ensuring that we embed sustainability in all our programmes, that our objectives are aligned with societal and environmental needs, and by tracking and reporting on our progress.



“The Cefic Sustainability Charter describes our role as enabling billions to access decent living standards within our planetary boundaries and is a pillar around which chemicals companies in Europe can rally around to progress towards the vision for a sustainable Europe.”

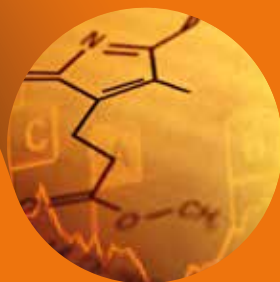
Hariolf Kottmann
CEO, Clariant and
President, Cefic



Many of our members are already integrating sustainability into their business strategy. **Through the Charter, we will continue to facilitate collaboration and sharing of best practice among our members,** encouraging more and more chemical companies to include sustainability as an integral part of their corporate strategies.

Cefic will increase engagement with EU policymakers and opinion leaders, using the Charter as a framework for dialogue, **to help policies take advantage of the full potential of the industry** in progressing towards a sustainable future.

Cefic provides a platform for members to develop strategies with sustainability at the core. Cefic encourages companies to review their products, services, business models and partnerships, and to evolve and develop strategies with sustainability in mind. This will help in developing **a forward-looking proactive agenda, with innovation at its heart,** as chemical companies contribute more and more to a sustainable society.



Chemistry: The industry of industries

The European Chemical sector comprises around 28,000 companies employing more than 1.4 million people and generating 1.1% of EU GDP.

The biggest customers of European chemicals are the rubber and plastics (14%) and healthcare (11%) sectors, but here you can see that chemicals are used in products we use every day in all areas of our lives. From technology in electrical devices, to cars, clothing, building materials and medicines – chemistry is all around us.

Turnover

€507bn¹

Number of companies

28,000²

Direct employees

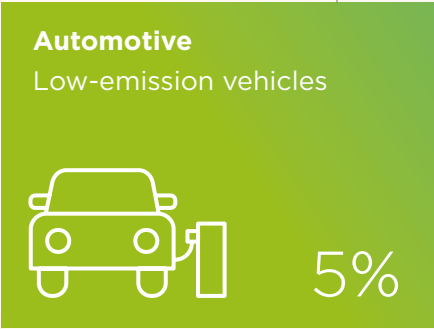
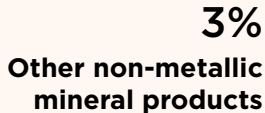
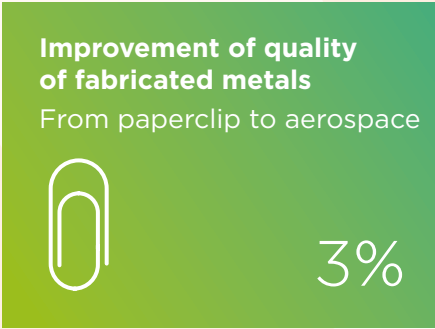
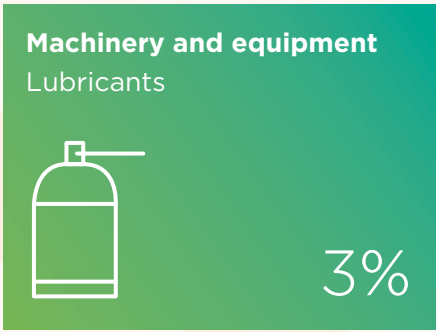
1.4 million¹

1.1%

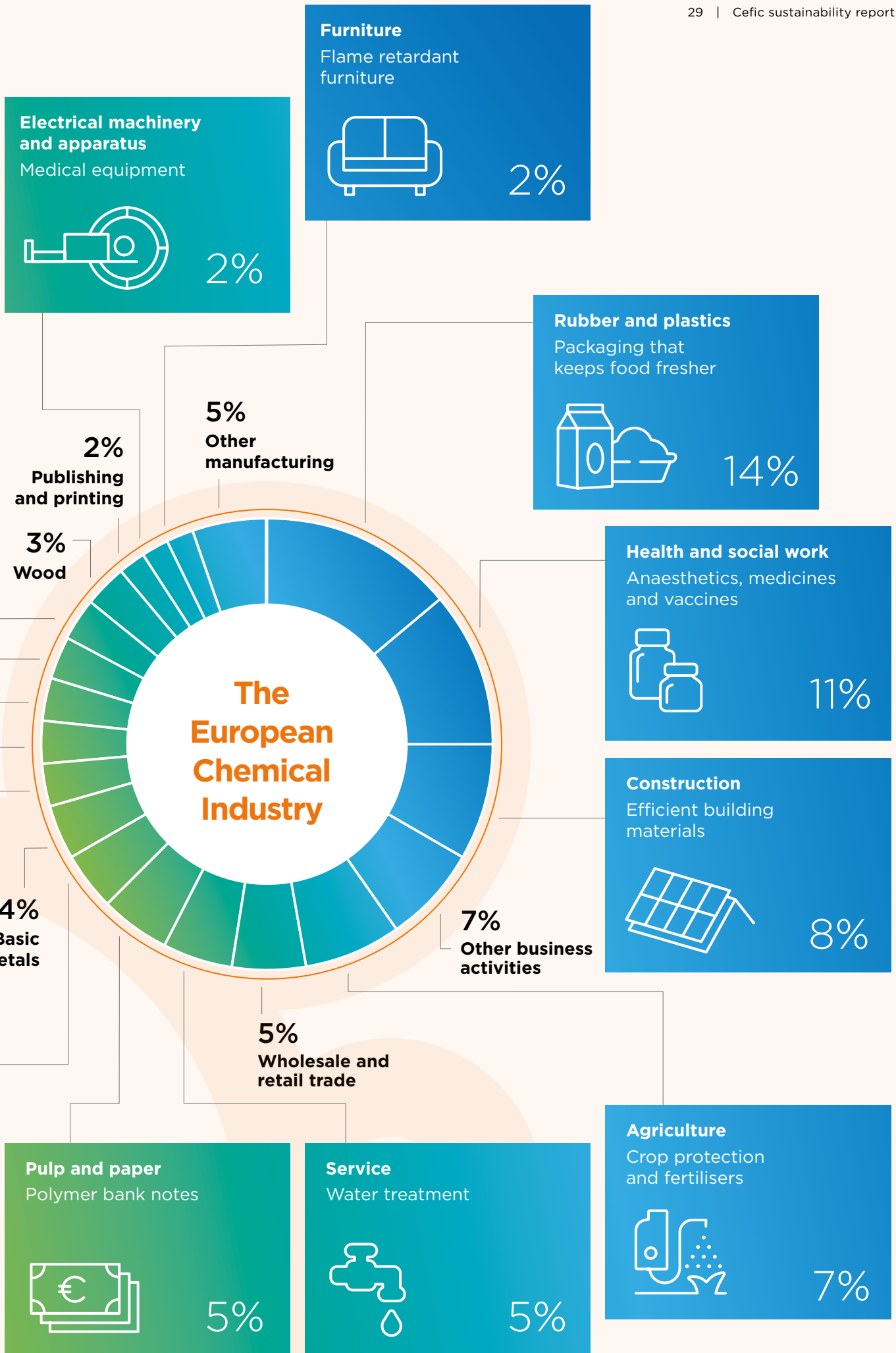
of EU gross domestic product (GDP) generated by the chemical industry³

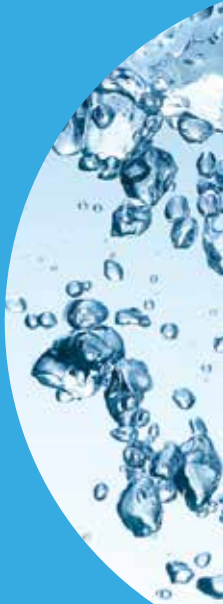
€21.7bn¹

investment in EU chemical industry in 2016



¹ Source: Cefic Facts & Figures 2017.
² Source: Eurostat.
³ Source: European Commission: https://ec.europa.eu/growth/sectors/chemicals_en





Chemistry making a world of difference

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