

2018



FACTS & FIGURES
of the European chemical industry



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Disclaimer:

For the sake of data integrity, figures within Cefic's Facts & Figures publications are compiled and updated on a regular basis from public statistical sources (Eurostat, EU Commission, EEA, ...). These sources regularly review their previous years' data and at times retroactively amend it. As a result of these updates, the comparison of annual Cefic Facts & Figures editions is not necessarily consistent over time.

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Foreword

Our industry is a valuable part of Europe's economy. We aim to provide innovative solutions for achieving a competitive, low carbon and circular economy, both within Europe and beyond its frontiers.

A favourable business environment, stimulating innovation and investment in Europe can help us to deliver these solutions. If we are to keep delivering, the Commission should develop a future industrial policy, to ensure that Europe can continue to vie globally with its competitors. A continued ambitious trade policy is just as important: free trade agreements like the trade agreement between the EU and Canada, CETA, and the recently signed EU-Japan Economic Partnership Agreement – do much to boost trade and economic growth. And all the more important in an increasingly uncertain trade environment.

The recently launched EU Research & Innovation Framework programme, Horizon Europe has the ambition to make Europe an unparalleled global innovation hub. As the chemical industry is a significant contributor to solving global challenges through innovative solutions and products, we support the new framework.

The regulatory environment, too, should foster innovation. That said, when doing business and operating our facilities, safety will always be the number one priority. REACH, the EU's pioneering chemicals legislation, is designed to ensure the safety of chemicals throughout Europe. It is one of the most advanced pieces of chemical legislation in the world. The Commission has created an appropriate, clear and consistent legal and regulatory framework, and the institutions, the member states and our industry now need to make it work. The chemical industry is committed to ensuring compliance with REACH.

Given the right framework conditions in the EU, we can play a big part in building a better, sustainable future for Europe and its people. We are ready to cooperate closely with the institutions in bringing this about.

Profile

Trade

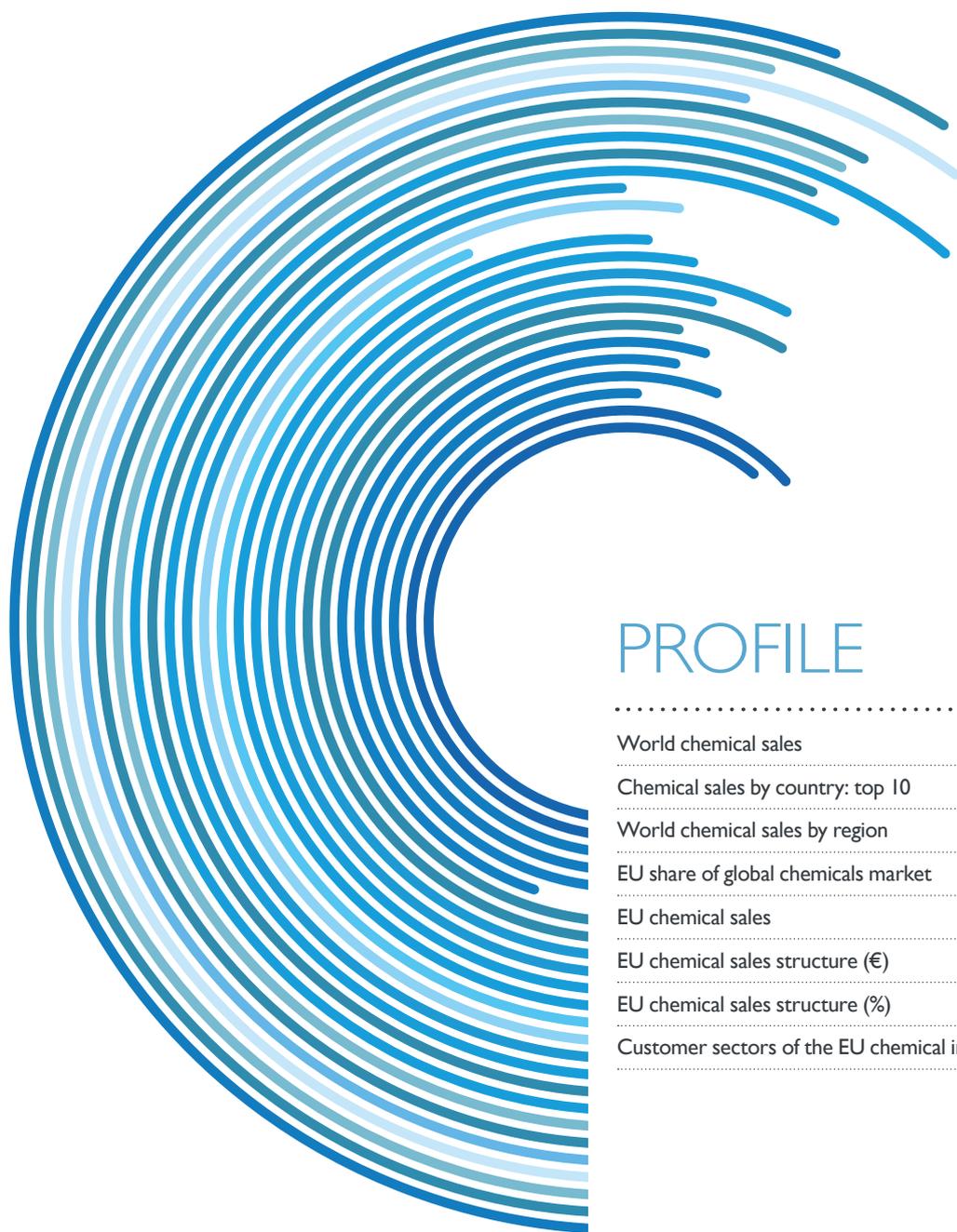
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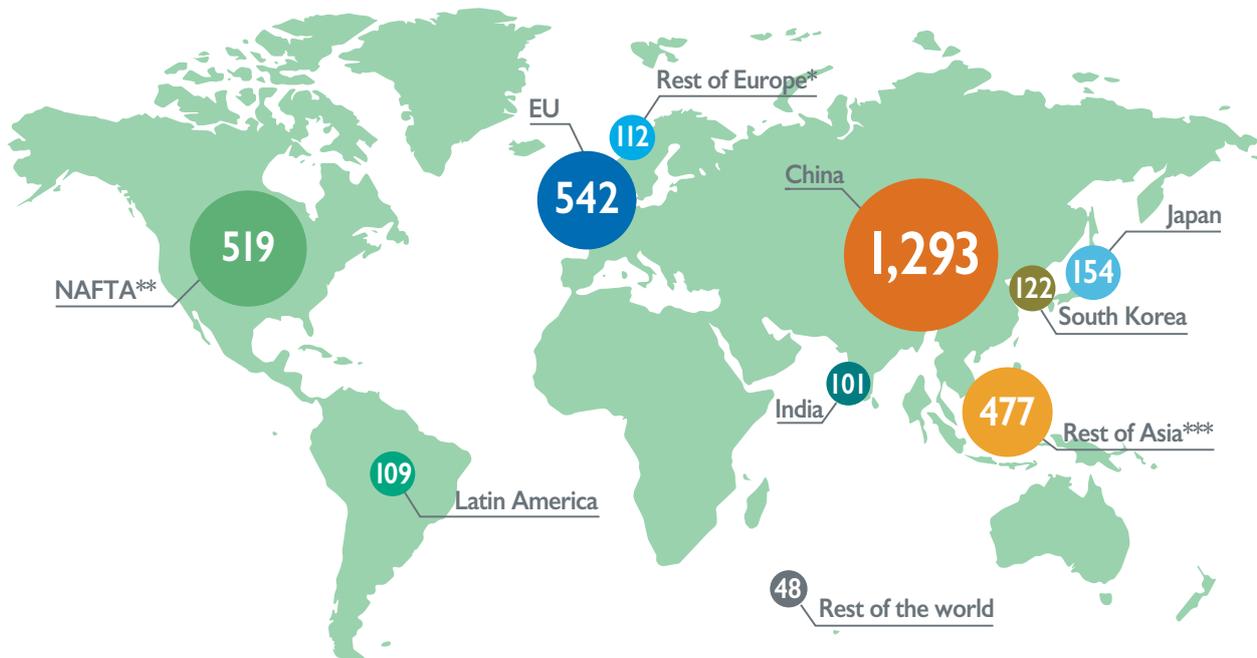
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Europe is the second largest chemicals producer in the world

World chemical sales (€3,475 billion)



Source: Cefic Chemdata International 2018

* Rest of Europe covers Switzerland, Norway, Turkey, Russia and Ukraine

** North American Free Trade Agreement

*** Asia excluding China, India, Japan and South Korea

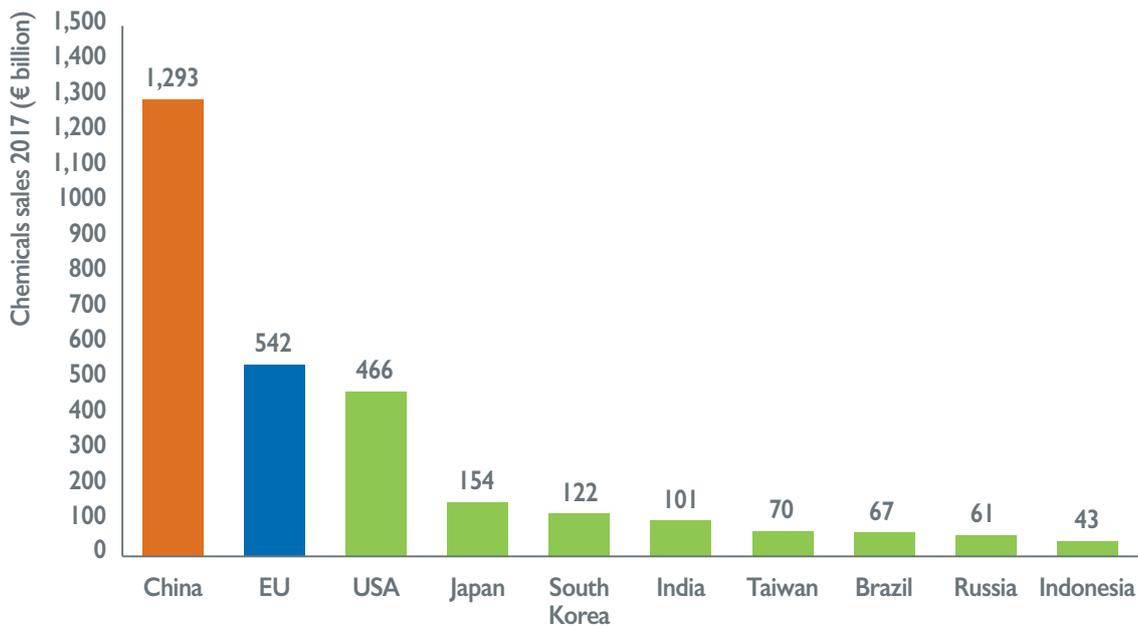
Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- World chemicals turnover was valued at €3,475 billion in 2017. Global sales grew by 4.6% from €3,323 billion in 2016 to €3,475 billion in 2017. With €1,293 billion in 2017, China is still the largest chemical producer in the world, contributing 37.2% of global chemical sales in 2017.
- With 15.6%, the EU chemical industry ranks second, along with the United States (13.4%), in total sales. Worldwide competition has changed significantly over the last ten years, as China now holds the top ranking in sales – a position once firmly held by Europe.
- The analysis shows that the BRICS countries (Brazil, Russia, India, China and South Africa) together accounted for 44.1% of global chemical sales in 2017. Nearly ¾ of global chemical sales were attributable to BRICS, the EU and the USA together in 2017. The remaining ¼ of global chemical sales were generated mainly by the emerging countries in Asia, including the Middle East.

China dominates chemical sales world ranking

Chemical sales by country: top 10



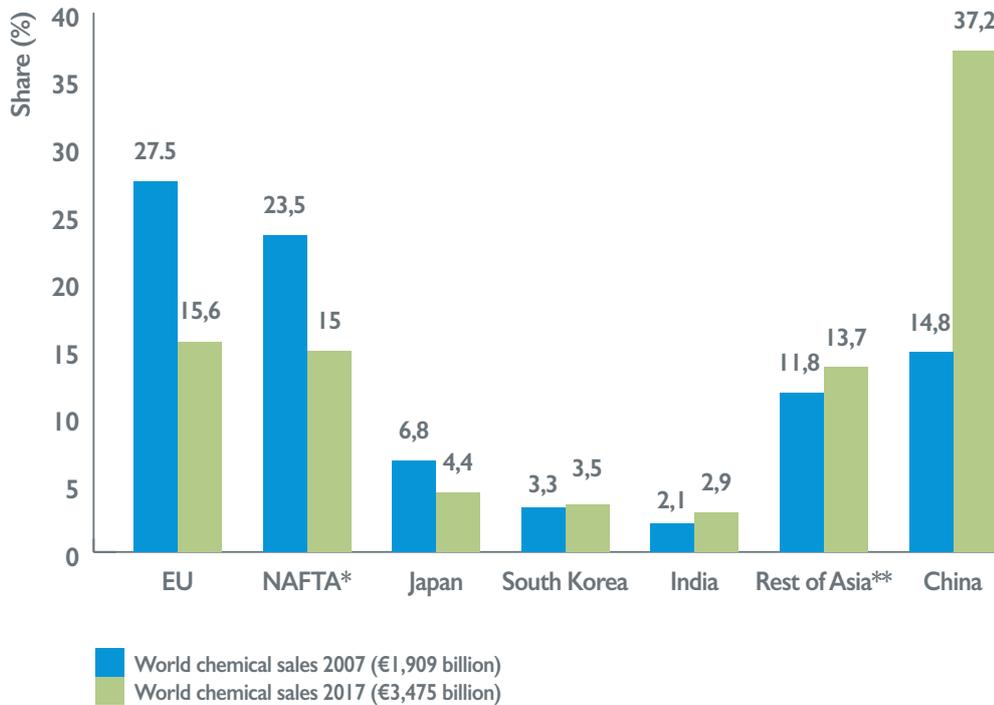
Source: Cefic Chemdata International 2018

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- China continues to dominate the world ranking. China sales levels are higher than the next nine countries combined – as much as the NAFTA and EU markets put together.
- In 2017, the 30 largest chemical-producing countries had a combined turnover of €3,133 billion, together accounting for 90.2% of global chemical sales. Twelve of the top 30 biggest producers are Asian, generating chemical sales of €1,945 billion – 56.0% of the world market.
- Twelve of the top 30 are European producers, generating sales revenue of €574 billion (16.5%). Five of the top 30 are American producers, generating chemical sales of €599 billion (17.2%). Finally, Australia contributed 0.4%.
- The world landscape of the chemical industry is changing rapidly. China is planning an ambitious industrial policy strategy to take its chemical industry to the next stage of development. This strategy is outlined in the “13th Five-Year Plan” for the Chinese petroleum and chemical industry and fits with the long-term vision of the Made in China 2025 strategy. China is looking to move from “following the lead” to “taking the lead” and from a “big country” to a “great power” of the petroleum and chemical industry, leading on technology innovation and trade and prevailing in international markets.

World chemical sales nearly double as emerging markets shares surge

World chemical sales by region



Source: Cefic Chemdata International 2018

* North American Free Trade Agreement

** Asia excluding China, India, Japan and South Korea

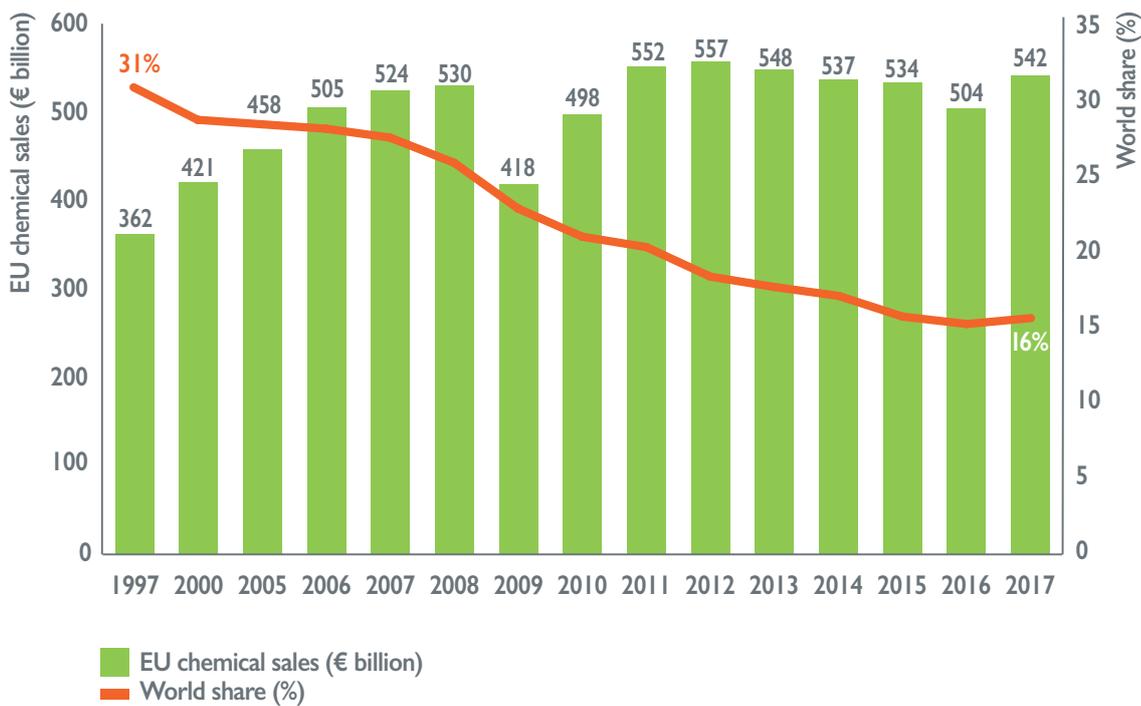
Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- The total value of sales in the European Union has been growing continuously. Overall world chemical sales have outpaced that rate of growth. China's share of world chemicals market sales in 2017 swelled to 37.2%. China is the world's biggest chemical producer.
- The European Union gradually lost its top spot in world chemical sales to China and the rest of Asia (excluding Japan). The EU contribution to world chemical sales dropped by 11.9 percentage points – from 27.5% in 2007 to 15.6% in 2017.
- The European chemical industry is still a world leader, and a highly innovative sector. With 90% of GDP growth taking place outside Europe in the coming decades, the challenge is to stay competitive. Taking advantage of emerging market opportunities will require EU leadership in creating attractive framework conditions that enhance the global position of European chemicals.

EU world market share of EU chemical sales halves

EU share of global chemicals market



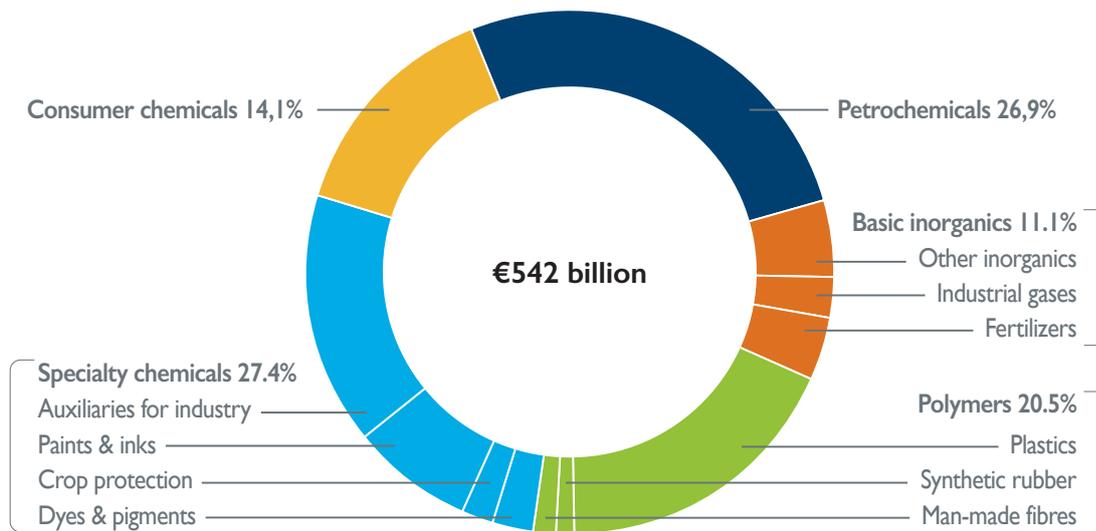
Source: Cefic Chemdata International 2018

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- In 1997, the EU posted sales of €362 billion, making up 30.8% of world chemical sales in value terms. Chemical sales have been growing continuously since then, reaching nearly 50% expansion in value terms.
- Global sales posted an impressive increase from €1172 billion in 1997 to €3475 billion in 2017. As a consequence of such steep global chemicals market growth, the EU chemicals market relative share nearly halved in 20 years, down from 30.8% to 15.6%.
- This is a trend expected to continue in the future. Data analysis showed strong chemical demand growth in China, and other emerging countries and low growth in Europe and North America, where Europe sells most of its chemicals.
- Overall growth of chemicals demand and production as well as faster growth in emerging regions is a continuing future trend. Growth in Europe remains low, mainly due to mature markets and an ageing population while EU's trade surplus remains high.
- Besides increased competition from other regions there are other potential reasons for this relative decline, including comparably high energy prices, lagging innovation, currency appreciation, high labour costs, regulatory and tax burdens. Sector R&D intensity, energy prices and the exchange rate have strong quantitative links to competitiveness.

Petrochemicals and specialty chemicals account for half of EU chemical sales

EU chemical sales 2017 (€ 542 billion)



Source: Cefic Chemdata International 2018

Unless specified, chemical industry excludes pharmaceuticals
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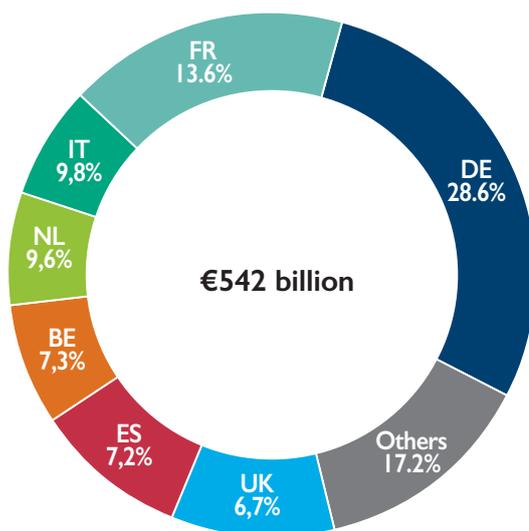
- Output from the EU chemical industry covers three broad product areas: base chemicals, specialty chemicals and consumer chemicals. Base chemicals, also known as commodity chemicals, covers petrochemicals and their derivatives along with basic inorganics. They are produced in large volumes and sold in the chemical industry itself or to other industries.
- Base chemicals in 2017 represented 58.5% of total EU chemical sales. The inorganic basic chemicals subsector includes production of chemical elements, inorganic acids such as sulphuric acid, bases such as caustic soda, alkalis and other inorganic compounds such as chlorine. The petrochemicals subsector covers manufacturing of chemicals using basic processes, such as thermal cracking

and distillation. Polymers in primary forms is in most cases integrated into petrochemicals sites. Plastics in primary forms embraces the manufacture of resins, plastic materials and elastomers.

- Specialty chemicals covers areas such as paints and inks, crop protection, dyes and pigments. Specialty chemicals are produced in small volumes but they nevertheless made up 27.4% of total EU chemical sales in 2017. Consumer chemicals are sold to final consumers, such as soaps and detergents as well as perfumes and cosmetics. They represented 14.1% of total EU chemical sales in 2017. Petrochemicals and specialty chemicals accounted for the majority – 54.3% – of EU chemical sales in that year.

More than 80% of EU chemical sales generated in seven EU Member States

EU chemical sales 2017 (€542 billion)



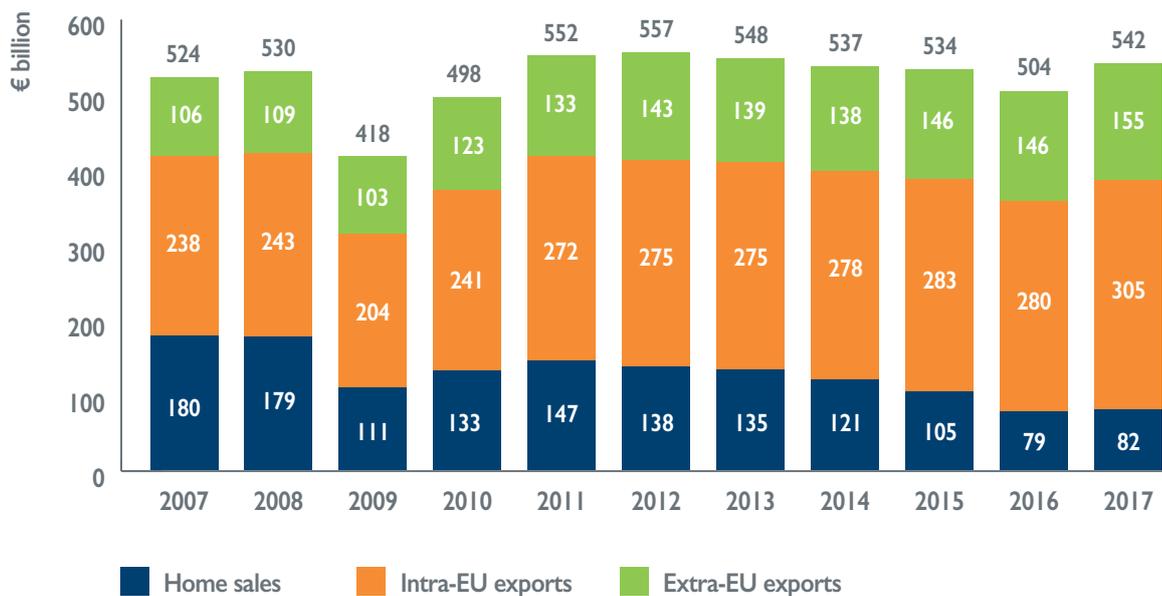
Source: Cefic Chemdata International 2018

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 Unless specified, EU refers to EU 28

- Germany and France are the two largest chemical producers in Europe, followed by Italy and the Netherlands. These four countries together accounted for 61.6% of EU chemical sales in 2017, valued at €334.1 billion.
- The share rises to 82.9%, or €449.2 billion, when including Belgium, Spain and the United Kingdom. The remaining EU Member States accounted for 17.1% of EU chemical sales in 2017 to which Austria and Poland are the two largest contributors.

Internal market drives EU chemical sales

EU chemical sales structure (€ billion)



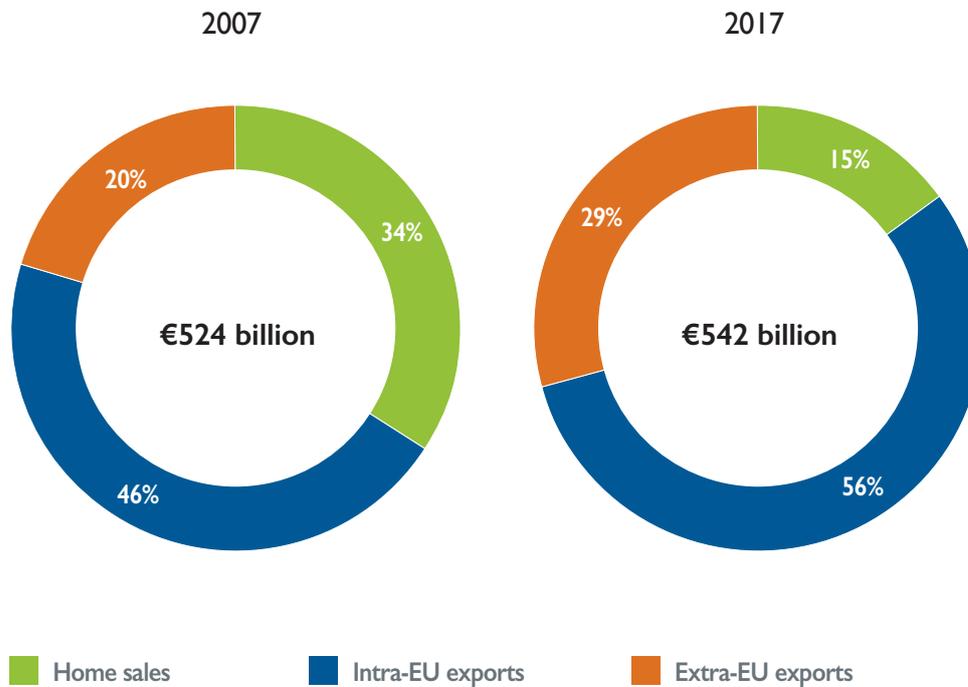
Source: Cefic Chemdata International 2018

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- Total sales of the EU chemicals sector cover three categories: home sales, intra-EU sales and extra-EU exports. The chart illustrates the dramatic declines that occurred in EU chemical total sales levels during the 2009 economic downturn. The industry suffered from the spillover effects of the economic and financial crisis. In 2009, sales revenue lost more than one fifth of its original value of 2008. The year 2010 was the year of the recovery, and the chemicals sector has been following a gradual upturn. Sales in 2017 were the highest since 2013.
- **Home sales:** they represent chemicals revenue generated by EU chemical companies from selling into their home country market (e.g. French companies selling their chemical products in France...). During the period from 2007 to 2017, EU chemicals home sales decreased on average by 7.6% per annum. Home sales in 2017 lost more than half of their original value posted in 2007.
- **Intra-EU sales:** they cover chemicals revenue generated by EU chemical companies from selling in the EU single market but not into their home country market, (e.g. French companies selling their chemicals products in Belgium or Germany...). Removing both trade and non-trade barriers inside the European Union with the Single Market helped boost growth and competitiveness in the EU chemical industry increasing the number of chemical transport operations across EU borders. Intra-EU sales (marked as "intra-EU exports" on the graph) climbed from €238 billion in 2007 to €305 billion in 2017.
- **Extra-EU exports:** the European chemical industry is an exporting industry, exporting nearly 30% of its production outside the EU. During the period from 2007 to 2017, EU chemical exports outside the EU single market increased on average by 3.9% per annum. The chemical industry needs to continue to be globally competitive to sustain its existing capacity and grow in line with global demand.

More than €155 billion is generated from selling chemicals outside the EU area

EU chemical sales structure (%)



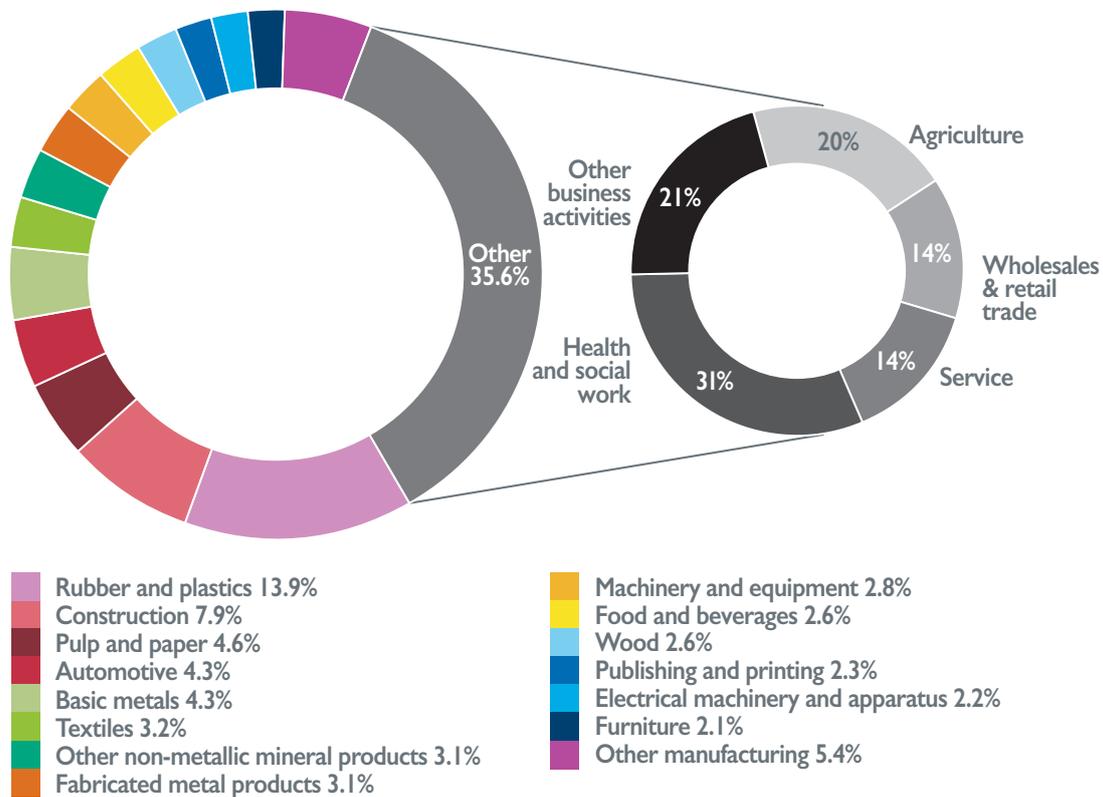
Source: Cefic Chemdata International 2018

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- **Home Sales:** in 2017, 15% of chemical sales revenue was generated from selling in the EU country home market.
- **Intra-EU Sales:** While “home sales” are declining, the importance of intra-EU sales is increasing. By 2017, intra-EU sales – excluding domestic receipts – accounted for 56% of total EU chemical sales, up from 46% in 2007. During the period from 2007 to 2017, EU intra-EU sales increased on average by 2.5% per annum.
- **Extra-EU Exports:** in 2017, 29% of chemical sales revenue was generated from selling in the non-EU chemicals market (exports), up from 20% in 2007. The three primary markets for EU chemical exports are Asia, the EU neighbour countries, and the NAFTA trade bloc.
- **Extra-EU Imports:** the European chemical industry is also an importing industry. While “home sales” are declining, the importance of extra-EU imports is increasing. The contribution of extra-EU chemicals imports to total consumption of the EU single market has been increasing. By 2017, extra-EU imports accounted for nearly 22%, far above the 15.2% posted in 2007.

Nearly two-thirds of EU chemicals are supplied to the industrial sector

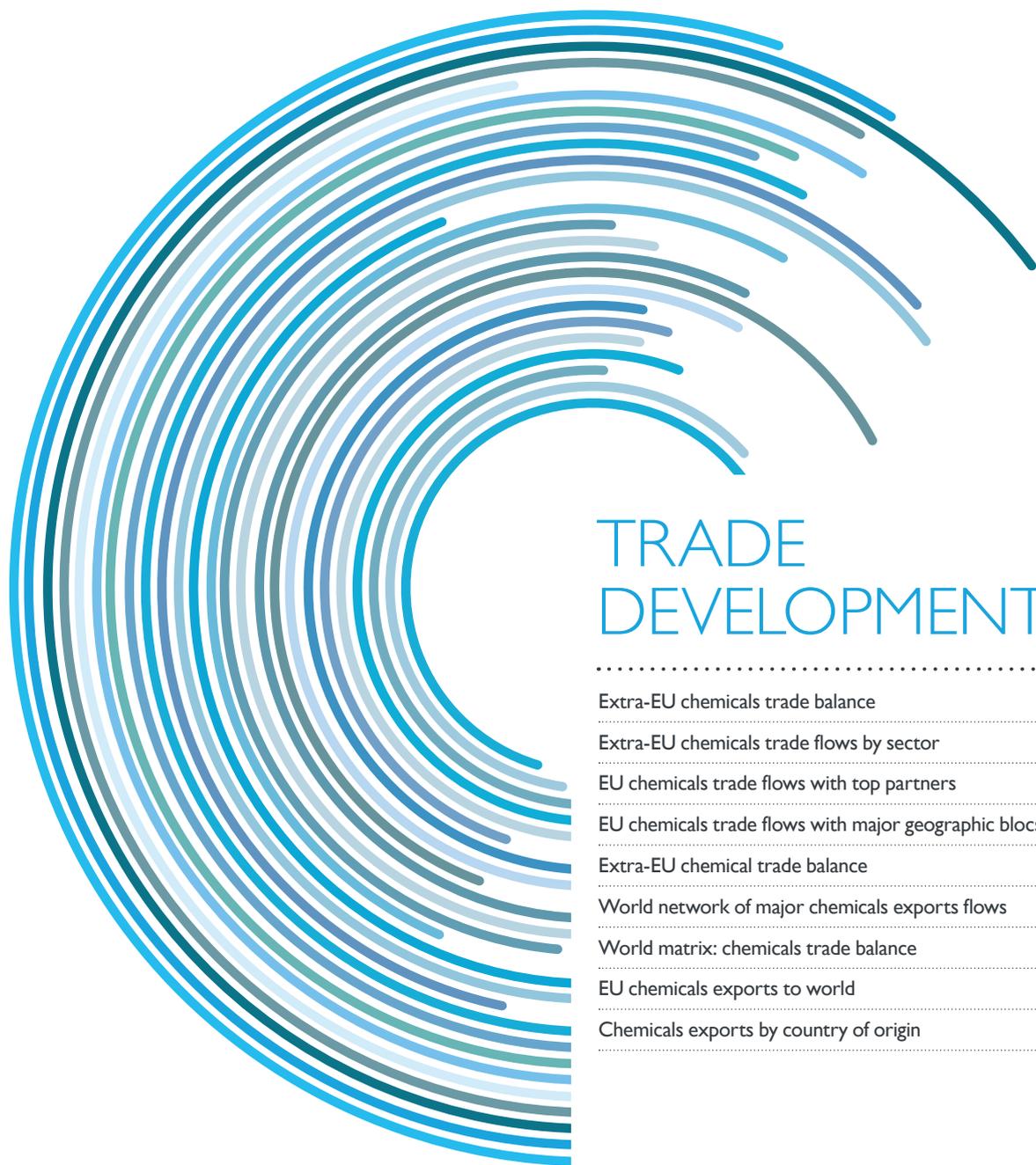
Customer sectors of the EU chemical industry



Sources: Eurostat data (Input-Output 2000) and Cefic analysis

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Unless specified, EU refers to EU 28

- The chemical industry supplies almost all sectors of the economy and its strategies impact directly on downstream chemicals users. The big industrial users of chemicals are rubber and plastics, construction, pulp and paper, and the automotive industry.
- Nearly two-thirds of EU chemicals are supplied to the EU industrial sector, including construction. More than one-third of chemicals go to other branches of the EU economy such as agriculture, services and other business activities.
- The chemical industry contribution to EU gross domestic product (GDP) amounts to 1.1%. This may seem small at first, but should be reassessed taking into consideration the shrinking contribution by manufacturing in many advanced economies, coupled with a rise in service sector output.



TRADE DEVELOPMENT

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EU chemicals trade surplus reaches a significant level

Extra-EU chemicals trade balance



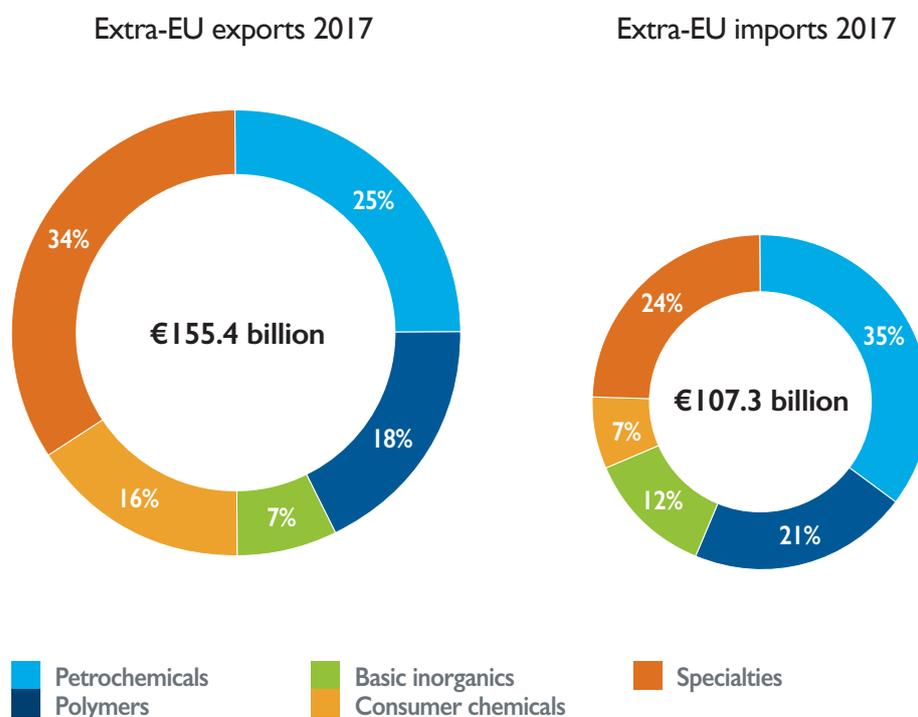
Source: Cefic Chemdata International 2018

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- Trading chemicals around the world stimulates competition, provides an incentive to develop new markets through innovation and stimulates production efficiency. Above all, it helps to improve the quality of human life.
- As a historically important player in the global chemicals market, the EU chemical industry continues to benefit from trade opportunities. Both chemical exports (6.4%, y-o-y) and imports (8.5%, y-o-y) recorded an increase in 2017 compared to one year ago. The EU chemicals trade surplus outside the European Union was valued at €48.1 billion in 2017. It is the second record level during the past ten years.
- More open competition and open markets would help generate more trade and benefits for all partners and citizens. Trade agreements with key partners will enable our industry to enhance efficiency and better exploit our technical strengths.

EU records trade surplus for most chemicals sectors

Extra-EU chemicals trade flows by sector (€ billion)



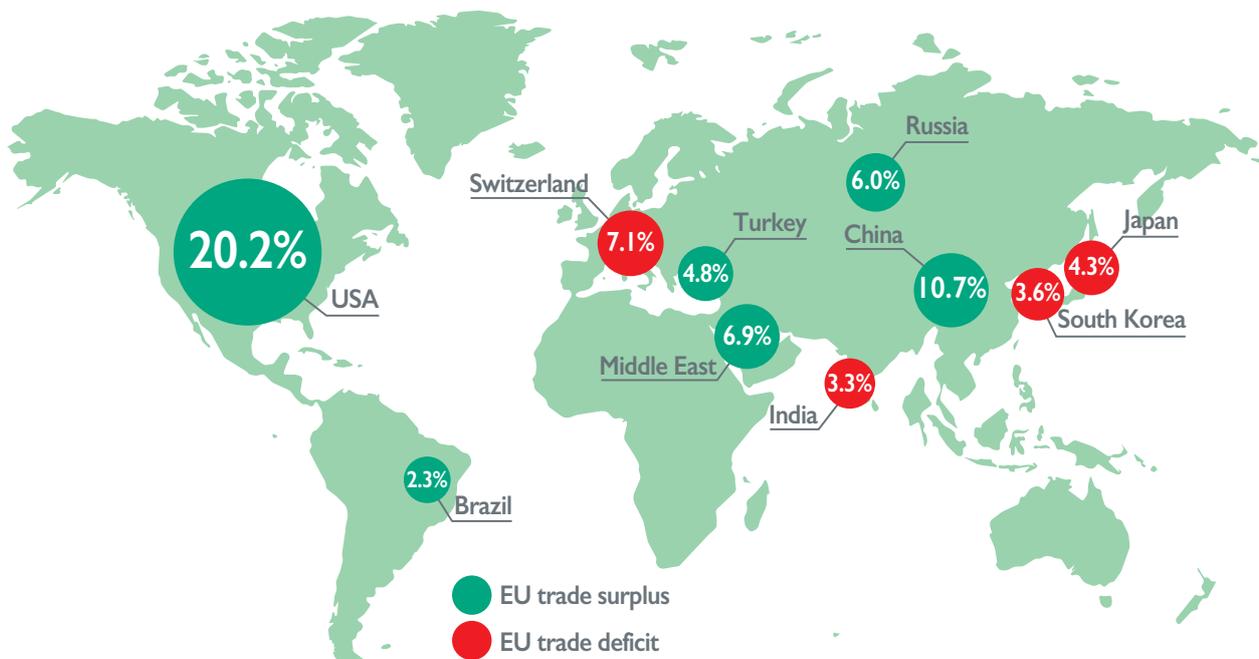
Source: Cefic Chemdata International 2018

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- EU chemical industry exports reached €155.4 billion in 2017. Specialty chemicals is the largest exporting sector, accounting for one third of total EU chemical exports in 2017. Petrochemicals was the second largest exporting sector, contributing 25% of total EU chemical exports, followed by the polymer sector which contributed 18% of total chemical exports. With 7%, basic inorganics was the smallest exporting sector.
- On the import side, EU chemicals imports from the non-EU area reached €107.3 billion in 2017. Petrochemicals was the largest chemicals importer in 2017 (35%). Next came specialty chemicals and polymers, contributing respectively 24% and 21% of total chemicals imports. With 7%, consumer chemicals was the smallest importing sector.
- The EU chemicals sector generated a trade surplus of €48.1 billion in 2017. Trade analysis indicates that the EU chemicals sector recorded a trade surplus in 2017 for specialty chemicals, consumer chemicals, polymers and petrochemicals. However, basic inorganics experienced a trade deficit during the same year.
- The chemical industry also depends on free trade and open markets, both for its raw materials and as outlets for its products. The industry relies increasingly on tightly interconnected clusters that in turn participate in global value chains.

Top 10 EU partners account for 70% of EU chemicals trade*

EU chemicals trade* flows with top partners



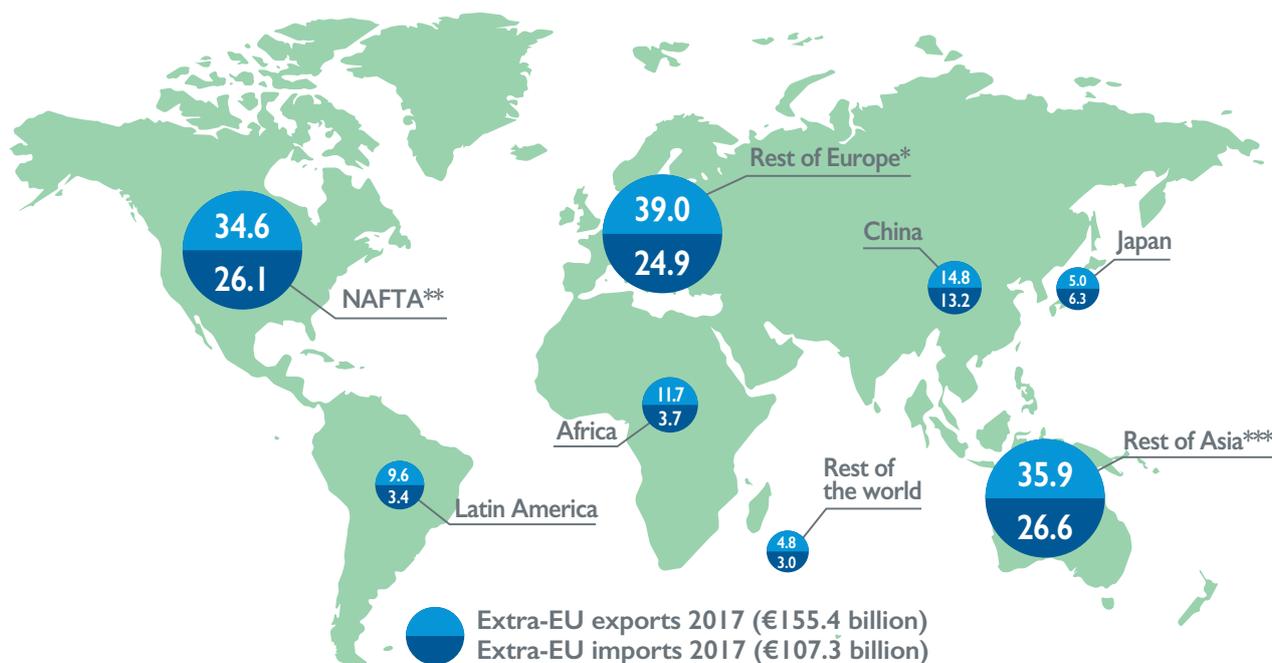
Source: Cefic Chemdata International 2018
* Trade = exports + imports

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Unless specified, EU refers to EU 28

- Extra-EU chemicals trade flow, calculated as total exports plus imports, was valued at nearly €245.2 billion in 2017. The top 10 EU partners accounted for 70% of extra-EU chemicals trade in the same year.
- The US was by far the EU's biggest trading partner in chemicals in 2017. It bought €28.9 billion of EU exports, whilst providing €24.1 billion of EU imports. The US contributed 20% of total EU chemicals trade in 2017. Transatlantic trade flows are expected to change considerably in the next five years. This is because the US shale gas boom has triggered a massive build-up of new chemicals production capacity there.
- Today China is the EU's second-biggest chemicals trading partner, accounting for 10.7% of EU chemicals trade. China has become the most important growth market for global chemical companies and a major investment location. Whilst Chinese chemical companies are gradually increasing their focus on specialty chemicals, the country will remain a major importer of commodity chemicals for some time to come. Chinese expansion does not necessarily imply Europe loses out. Rather, there are wins for both, and China offers many opportunities.

EU holds trade surplus with top competing markets

EU chemicals trade flows with major geographic blocs



Source: Cefic Chemdata International 2018

* Rest of Europe covers Switzerland, Norway, Turkey, Russia and Ukraine

** North American Free Trade Agreement

*** Asia excluding China, India, Japan and South Korea

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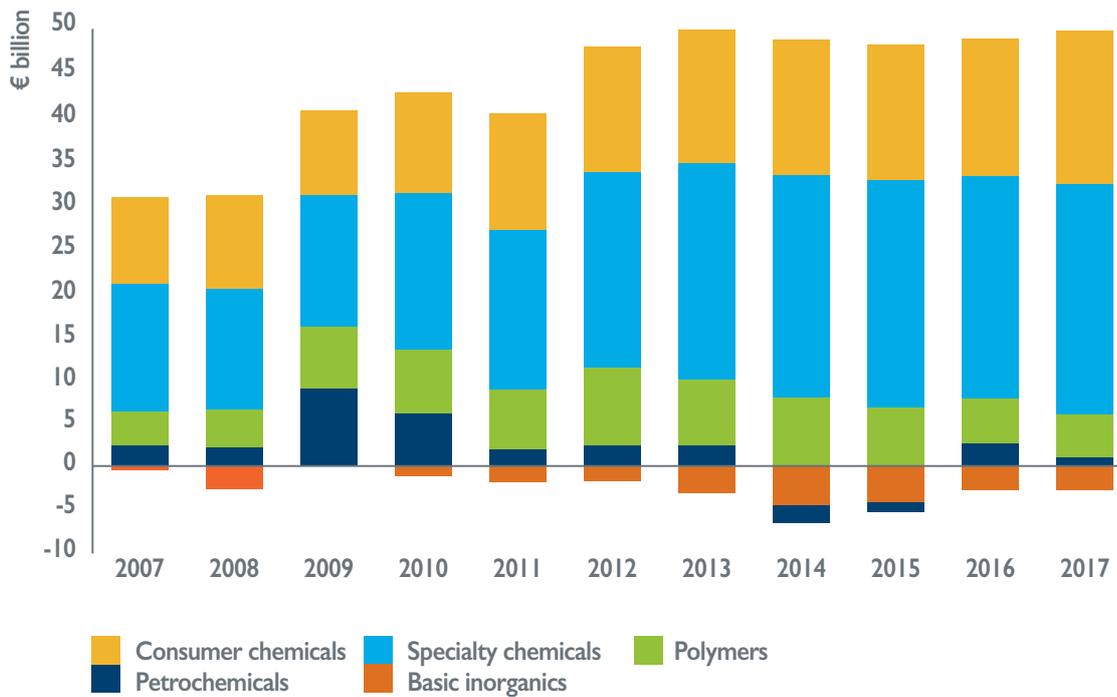
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A look at the 2017 EU chemicals trade balance with key countries and regions shows:

- The European Union has a trade surplus with all main trading regions – NAFTA, Asia, Latin America, Africa, and non-EU Europe. The two major geographic blocs trading with the European Union in 2017 have remained North America and the rest of Europe for several years.
- The European Union generated its largest chemicals trade surplus with the Rest of Europe, which covers Turkey, Switzerland, Russia, Norway and Ukraine. The EU surplus with Rest of Europe amounted to €14.0 billion in 2017, to which polymers and specialty chemicals contributed significantly.
- The EU generated a chemicals trade surplus of €4.8 billion with the United States, to which the EU petrochemicals trade surplus contributed greatly. This sector is sensitive to the developing US shale gas play. The US is the world's biggest producer of bioethanol, making around 54% of world production in 2013.
- The EU had a chemicals trade deficit with India, mainly reflecting the deficit that occurred in petrochemicals. India is the world's second largest emerging market, and the EU is playing a key role in that transformation as India's biggest source of foreign direct investment. The EU had a chemicals trade deficit with Japan, mainly due to the deficit occurring in polymers and specialty chemicals.

Specialty and consumer chemicals contribute most to EU chemicals trade surplus

Extra-EU chemical trade balance (€ billion)



Source: Cefic Chemdata International 2018

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- The EU chemicals trade surplus in 2017 reached €48.1 billion, 54.7% of which came from specialty chemicals. Consumer chemicals had the second strongest external trade performance, followed by polymers. Petrochemicals performed well for the second time in 2017, the sector registering a trade surplus of €1.0 billion after two consecutive years of trade deficit in 2014 and 2016. Basic inorganics experienced a trade deficit of €2.7 billion in 2017.

The EU is the largest chemicals exporting region in the world

World network of major chemicals exports flows (2016, € billion)

	EU	Rest of Asia*	United States	China	Middle East	Japan	Rest of Europe**	Latin America	Africa	Oceania	World
EU		30,4	30,4	12,2	10,3	5,0	26,5	9,0	11,0	2,2	142,2
Rest of Asia*	17,8		9,1	46,8	6,5	7,7	1,7	4,0	4,8	2,7	104,7
United States	24,2	19,4		10,7	2,7	6,4	1,4	15,6	1,8	2,1	123,6
China	11,1	40,2	8,7		3,4	6,0	2,3	6,2	4,0	2,2	86,0
Middle East	6,2	14,0	2,0	10,8		0,3	0,4	1,3	3,6	0,5	39,2
Japan	5,3	25,1	5,6	13,6	0,5		0,3	0,6	0,4	0,3	52,1
Rest of Europe**	17,0	6,1	2,8	2,0	0,6	0,4		2,7	0,6	0,1	32,7
Latin America	2,7	1,3	4,0	0,6	0,1	0,4	0,1		0,3	0,1	10,6
Africa	3,5	2,7	0,9	0,5	0,6	0,1	0,1	0,8		0,1	9,2
Oceania	0,3	1,2	0,4	0,3	0,1	0,3	0,0	0,1	0,0		2,8
World	89,7	142,4	84,0	98,8	24,8	26,8	32,8	43,8	26,5	10,4	632,4

Source: Cefic Chemdata International 2018

* Asia excluding China, Japan and Middle East

** Europe excluding EU; it covers Russia, Norway, Turkey, Switzerland and Ukraine

Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- This brief overview of world chemicals trade flows uses a trade matrix, where the world is divided into 10 geographical regions: the EU area, the USA, China, Middle East, Japan, Rest of Europe, Rest of Asia, Latin America, Africa and Oceania. Countries of "Rest of Europe" are mainly Switzerland, Russia, Norway, Turkey and Ukraine. The main countries in "Rest of Asia" are South Korea, India and other emerging countries in Asia (China, Japan and Middle East are excluded).
- **Trade matrix:** the matrix has been put together from export data in the chemicals sector (Nace 20). Exporting regions are presented in rows and importing regions are presented in columns. The intercept of row "i" and column "j" means exports from region "i" to region "j". The main diagonal of the matrix (shaded cells) represents intra-region trade (e.g. exports from EU countries to EU countries). For the purpose of trade performance analysis, intra-trade flows are excluded from the present section.
- **Intra-trade:** it is commonly known that trade between contiguous regions is significant (e.g. intra-EU trade); it reflects factors such as distance between trading partners, transport costs, and the existence of common borders. Proximity of the markets is a key factor stimulating intra-trade. Our trade analysis (including intra-trade) shows that chemicals trade within the EU internal market is

significant, since nearly 28% of total world chemicals trade takes place between EU countries. Compared to the other trading regions, the EU is also the largest chemicals exporting region in the world, accounting for 42% of world chemical exports. EU intra-trade is by far the largest intra-regional trade in the world.

The analysis of the major chemical exports flows between the main regions shows the following results:

- **The EU is the largest chemicals exporting region in the world:** EU chemical exports to the rest of the world (intra-EU trade excluded) amounted to €142.2 billion in 2016. The EU area accounts for 22% of world chemical exports. China is the fourth largest destination for EU chemical exports, followed by Africa, Middle East and Latin America. The top four largest chemicals exporting regions in the world are the EU, the USA, Rest of Asia* and China.
- **The EU is the third largest chemicals importing region in the world:** EU chemicals imports from the rest of the world excluding intra-EU imports were valued at €89.7 billion in 2016. The EU area contributed 14.2% of world chemicals imports. The three main import origin markets of the EU area are the USA, Rest of Asia* and Rest of Europe**.

The EU area is the largest destination market for US chemicals exports

World network of major chemicals exports flows (2016, top 5, %)

	Largest exporting market	Second largest exporting market	Third largest exporting market	Fourth largest exporting market	Fifth largest exporting market	Top 5
EU	United States	Rest of Asia*	Rest of Europe**	China	Africa	77.7%
United States	EU	Rest of Asia*	Latin America	China	Japan	61.8%
Rest of Asia*	China	EU	United States	Japan	Middle East	83.8%
China	Rest of Asia*	EU	United States	Latin America	Japan	84.0%
Japan	Rest of Asia*	China	United States	EU	Latin America	96.3%
Middle East	Rest of Asia*	China	EU	Africa	United States	93.2%
Rest of Europe**	EU	Rest of Asia*	United States	Latin America	China	93.6%
Latin America	United States	EU	Rest of Asia*	China	Japan	85.9%
Africa	EU	Rest of Asia*	United States	Middle East	China	89.0%
Oceania	Rest of Asia*	United States	EU	China	Japan	91.4%
World	Rest of Asia*	China	EU	United States	Latin America	72.5%

Source: Cefic Chemdata International 2018

* Asia excluding China, Japan and Middle East

** Europe excluding EU; it covers Russia, Norway, Turkey, Switzerland and Ukraine

Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

The summary results of the top five chemical export markets for the 10 geographical regions selected in the previous table are:

- **The EU area is the largest destination market for US exports:** nearly one fifth of US chemical exports are sold in the EU chemicals market. Rest of Asia (Japan, China and Middle East excluded) and Latin America are respectively the second and third largest exporting markets for the US chemicals sector. China is the fourth largest destination for US chemical exports, accounting for nearly 9% of total. The USA contributes nearly 20% of world chemical exports.

- **The EU area is the second largest destination for Chinese exports:** trade between China and its neighbours is very significant. As might be expected, the Rest of Asia* market is by far the largest destination for Chinese chemical exports (47%). The EU market area is the second largest destination for Chinese chemical exports. Thirteen percent of Chinese chemical exports are sold in the EU area. The EU chemicals market is therefore the most important market for China after the Asian market. The USA is the third main destination for Chinese chemical exports, accounting for about 10% of total exports of China. China accounts for 14% of world chemical exports.

The EU has by far the largest chemicals surplus in the world

World matrix: chemicals trade balance (2016)

Partner ▶											
Declarant ▼	EU	Rest of Asia*	United States	China	Middle East	Japan	Rest of Europe**	Latin America	Africa	Oceania	World
EU		■	■	■	■	■	■	■	■	■	■
Rest of Asia*	■		■	■	■	■	■	■	■	■	■
United States	■	■		■	■	■	■	■	■	■	■
China	■	■	■		■	■	■	■	■	■	■
Middle East	■	■	■	■		■	■	■	■	■	■
Japan	■	■	■	■	■		■	■	■	■	■
Rest of Europe**	■	■	■	■	■	■		■	■	■	■
Latin America	■	■	■	■	■	■	■		■	■	■
Africa	■	■	■	■	■	■	■	■		■	■
Oceania	■	■	■	■	■	■	■	■	■		■
World	■	■	■	■	■	■	■	■	■	■	

■ Trade deficit
■ Trade surplus

Source: Cefic Chemdata International 2018

* Asia excluding China, Japan and Middle East

** Europe excluding EU; it covers Russia, Norway, Turkey, Switzerland and Ukraine

Unless specified, chemical industry excludes pharmaceuticals

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Following is a brief analysis of chemicals trade balance using the trade matrix. The chemicals trade balance is calculated for each region as total exports minus imports. Intra-trade is of course excluded.

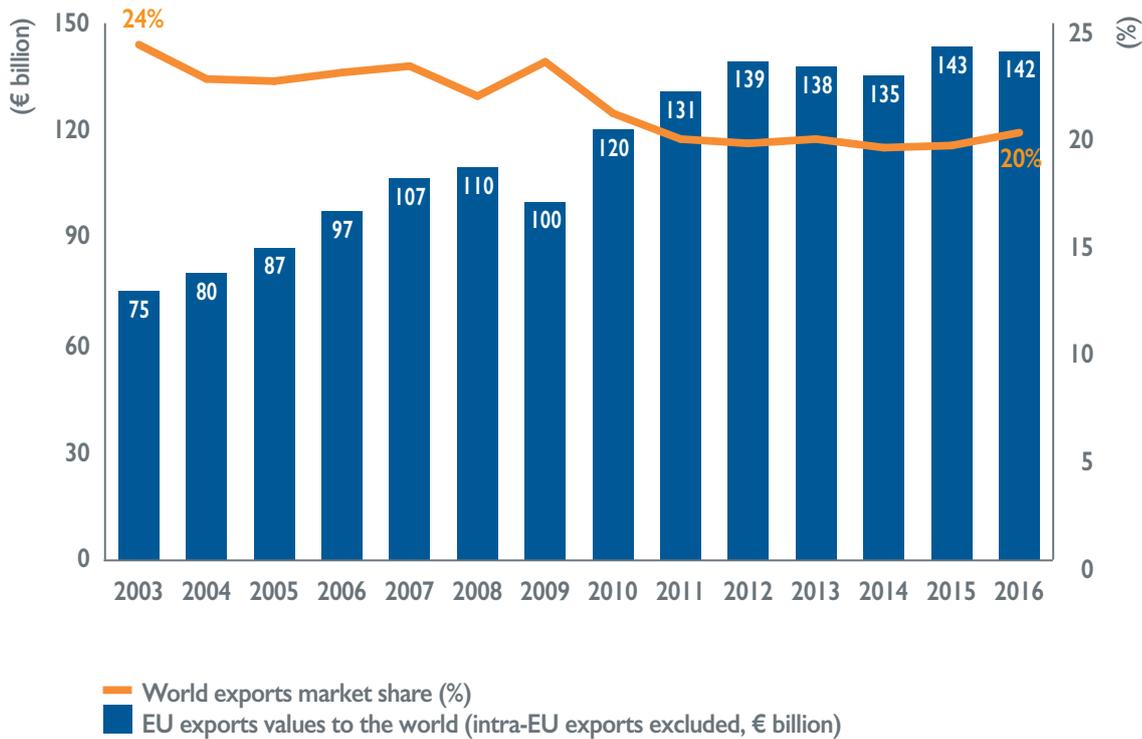
A look at the chemicals trade performance of each region shows the following:

- The EU area has by far the largest chemicals surplus in the world:** the European Union is the only region to have a trade surplus with all trading regions. The top five largest chemicals surpluses are generated for the EU by trading with Rest of Asia*, Rest of Europe**, Africa, Latin America, and the USA. Nearly 12% was generated by trading with Middle East and Oceania. Trading with China is however generating a small surplus for the EU area. The EU area has by far the largest chemicals surplus in the world, followed by the USA.

- USA chemicals sector generates the second largest trade surplus in the world:** five regions have performed well (export value higher than import value). Comparing the total chemicals trade balance for all regions, the analysis shows that only five regions have generated a chemicals surplus with the world: the EU area, the USA, Japan, Middle East and Rest of Europe**. These regions performed well since they have generated a net exports value. The largest export surplus was for the EU area, followed by the USA.
- The “Rest of Asia” has by far the largest chemicals deficit in the world:** the analysis reveals that five regions have a trade deficit (export value lower than import value): Rest of Asia*, China, Latin America, Africa and Oceania. The largest trade deficits are generated by Rest of Asia. China and Oceania generated respectively a trade deficit of €12.8 billion and €7.6 billion.

Growing EU chemicals exports

EU chemicals exports to world (€ billion, intra-EU trade excluded)



Source: Cefic Chemdata International 2018

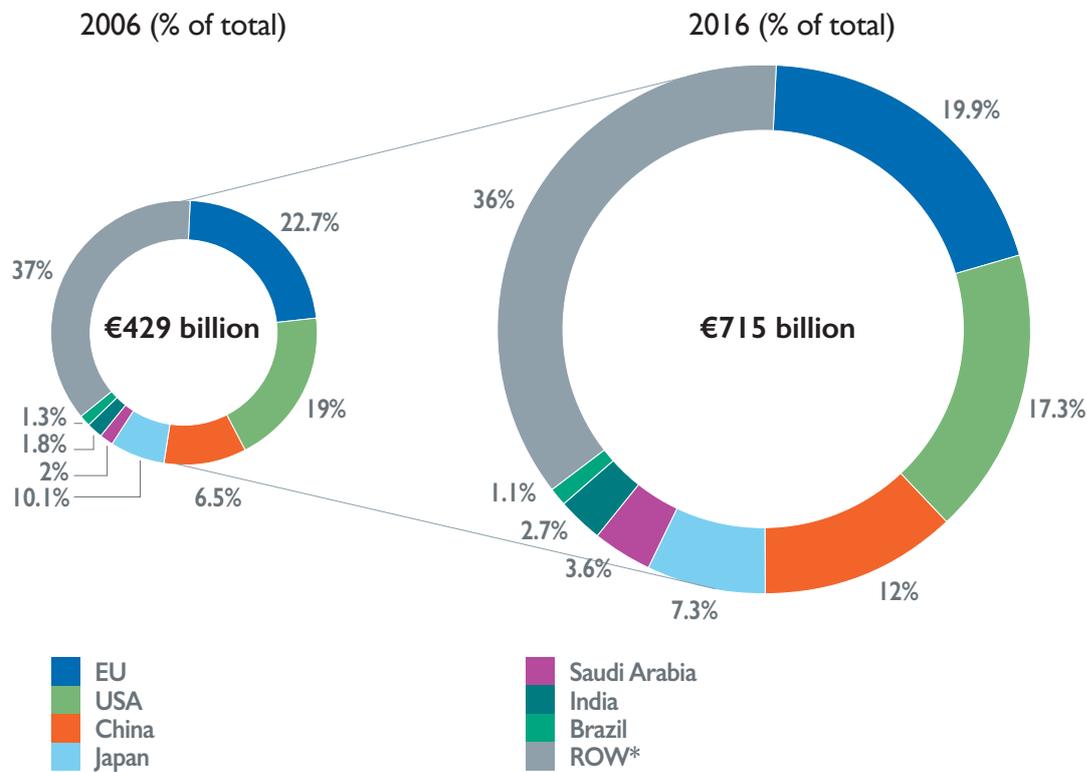
Unless specified, chemical industry excludes pharmaceuticals
 Unless specified, EU refers to EU 28

A look at EU chemicals exports during the years 2003-2016 shows the following results:

- World exports grew 6.6% per annum during the years 2003-2016. World exports amounted to €715 billion in 2016, up from €313.3 billion in 2003 (more than doubling in thirteen years).
- EU chemicals exports grew 5.0% per annum on average. Exports posted a substantial increase from €75.1 billion in 2003 to €142.2 billion in 2016. Exports in value terms rose significantly: they were 90% higher in 2016 than in 2003.
- EU Export values showed a positive and encouraging trend. However, the EU's world exports market share went down from 24% in 2003 to about 20% in 2016. The decline in EU exports competitiveness is in line with the falling EU sales market share.

Decreasing share of chemicals exports for the EU, USA and Japan

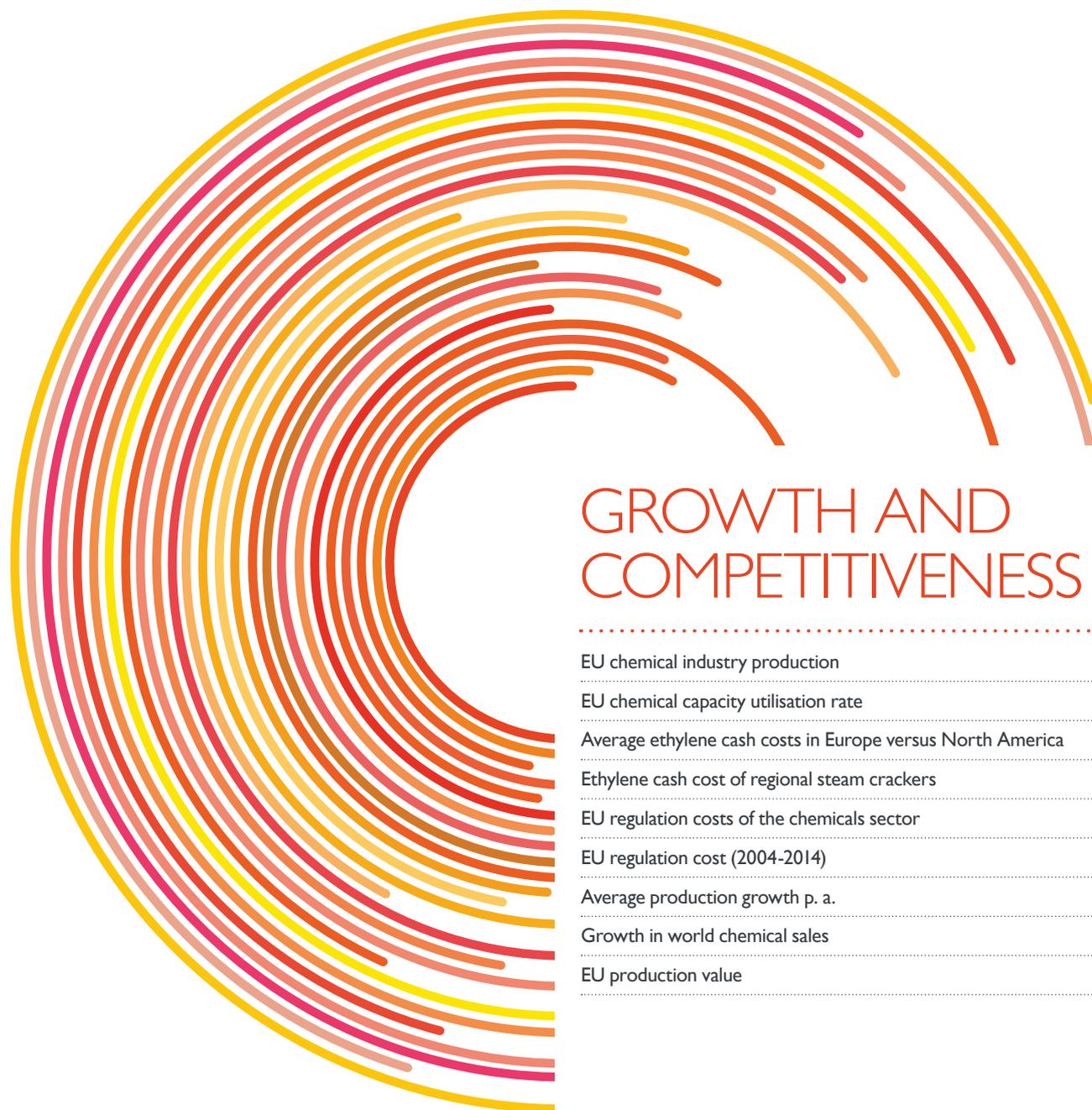
Chemicals exports by country of origin, 2016 vs 2006 (% of total)



Source: Cefic Chemdata International 2018
* Rest of the World, intra-EU trade excluded

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

- World exports reached the value of €715 billion in 2016, up from €428.9 billion ten years ago (67% higher).
- Europe is not the only region losing its export share. Other industrial regions are experiencing similar effects. The US export market share went down from 19.5% in 2006 to 17.3% in 2016, while Japan's export market share declined from 10.5% in 2006 to 7.3% in 2016.
- The emerging countries such as China and India have benefited more than industrial countries. Export values have increased substantially in China (3 times bigger in value in 2016 compared to ten years ago), and India (2.5 times higher during the same period). The export market share of China nearly tripled in 10 years – from 4.3% in 2006 to 12% in 2016.

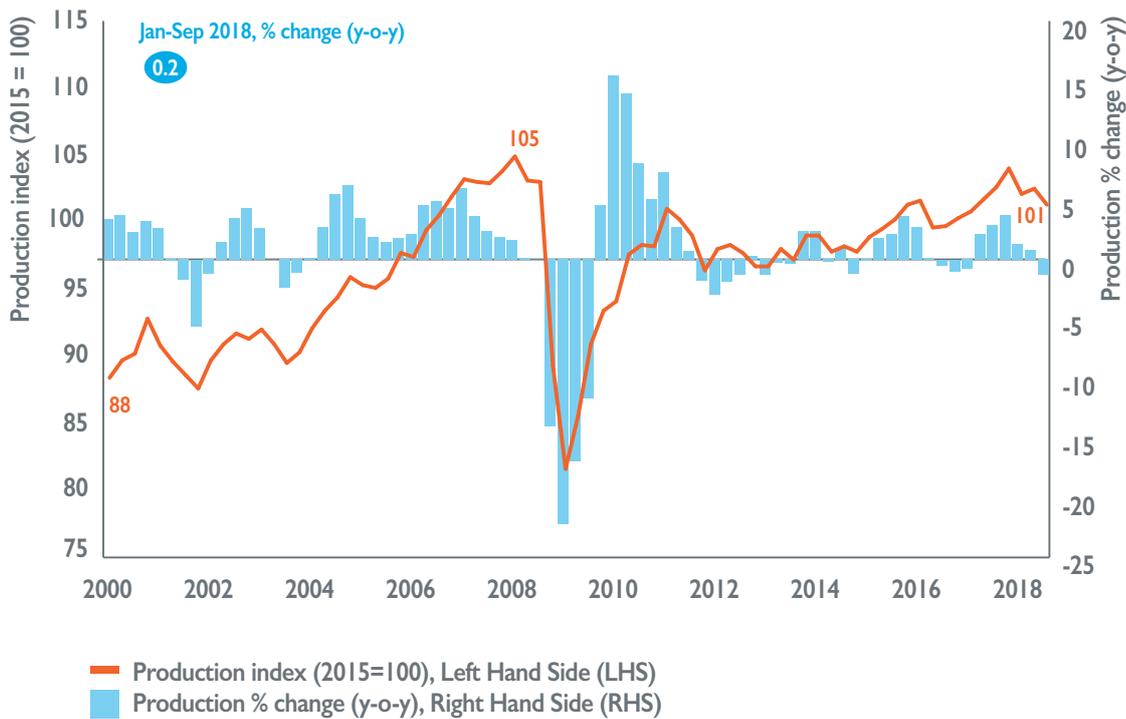


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EU chemical industry production	27
EU chemical capacity utilisation rate	28
Average ethylene cash costs in Europe versus North America	29
Ethylene cash cost of regional steam crackers	30
EU regulation costs of the chemicals sector	31
EU regulation cost (2004-2014)	32
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EU production value	35

EU chemicals still growing steadily

EU chemical industry production



Source: Cefic Chemdata International 2018

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

- The European chemical industry is in good shape. Everything is looking rosy for our industry in the short term.
- Production in the EU chemicals sector grew 0.2% from January to September 2018 compared to the same period of 2017. Apart from consumers chemicals (2.9%), most chemicals sectors reported a decline during the first three quarters of 2018. Base chemicals were most affected compared to other sectors. Consumer chemicals performed well, far outpacing the other chemicals sectors.
- Producer prices were above the previous year's level, growing 3.6% in the EU chemicals sector from January to September 2018 (y-o-y). Petrochemicals (5.4%), basic inorganics (5.3%), and polymers (4.2%) posted significant growth in prices compared to the other sectors.
- Sales in the EU chemicals business were 4% above the previous year's level, mainly due to higher producer prices during the same period. In Q3-2018, prices in the chemicals business reached their highest level in five years. Driving this trend are the increasing oil prices registered during the same period.
- Clearly at first sight this is not a sector in difficulties facing an urgent need of protection or requiring action.

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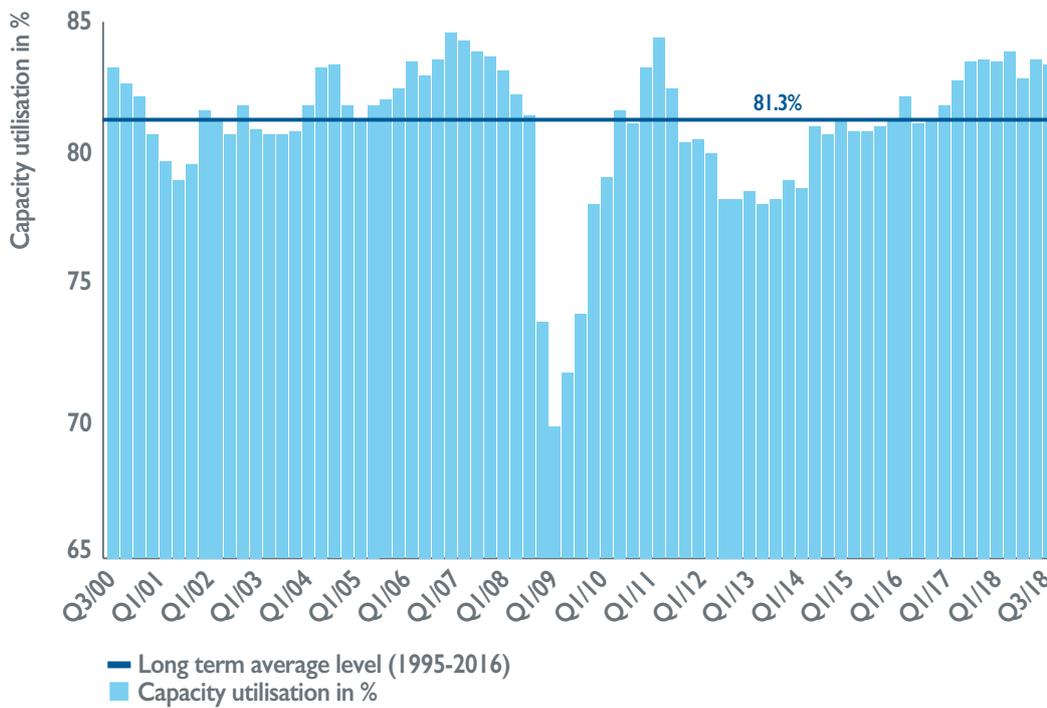
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EU capacity utilisation is above its long-term average

EU chemical capacity utilisation rate (%)



Source: Cefic Chemdata International 2018

Unless specified, chemical industry excludes pharmaceuticals
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- According to EU Commission Business Survey data, capacity utilisation in the EU chemicals sector reached the value of 83.4% in the third quarter of 2018, down from 83.6% reached in the second quarter of the same year. Capacity utilisation was 0.2% below the previous year's level (Q3-2018 vs Q3-2017). Chemicals capacity is 2.6% above the long-term average (2005-2016).

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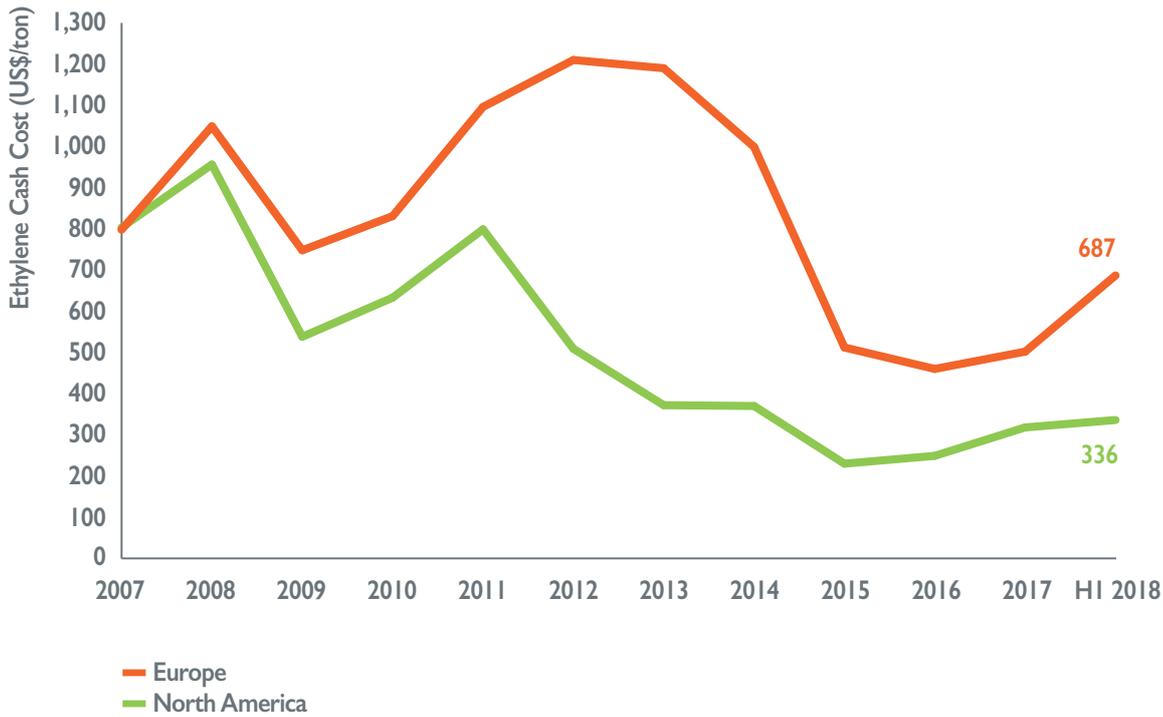
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Energy costs are the European industry's Achilles' heel

Average ethylene cash costs in Europe versus North America (US\$/ton)



Source: ICIS and Cefic analysis 2018

Unless specified, chemical industry excludes pharmaceuticals
 Unless specified, EU refers to EU 28

- The chemical industry is an energy-intensive industry competing globally. Increases in energy costs in Europe relative to our competitors might impact competitiveness.
- Ethylene is the highest volume building block in the chemical industry globally. It is the basic feedstock for the production of plastics, detergents and coatings, amongst many other materials.
- Energy costs are the European industry's Achilles' heel, especially compared to the United States, riding on a shale gas boom. Advantageous energy and feedstock prices are a clear enabler of competitiveness. The shale gas boom in the United States has greatly reduced energy and feedstock costs. A clear indicator of this situation is the cost of producing ethylene.

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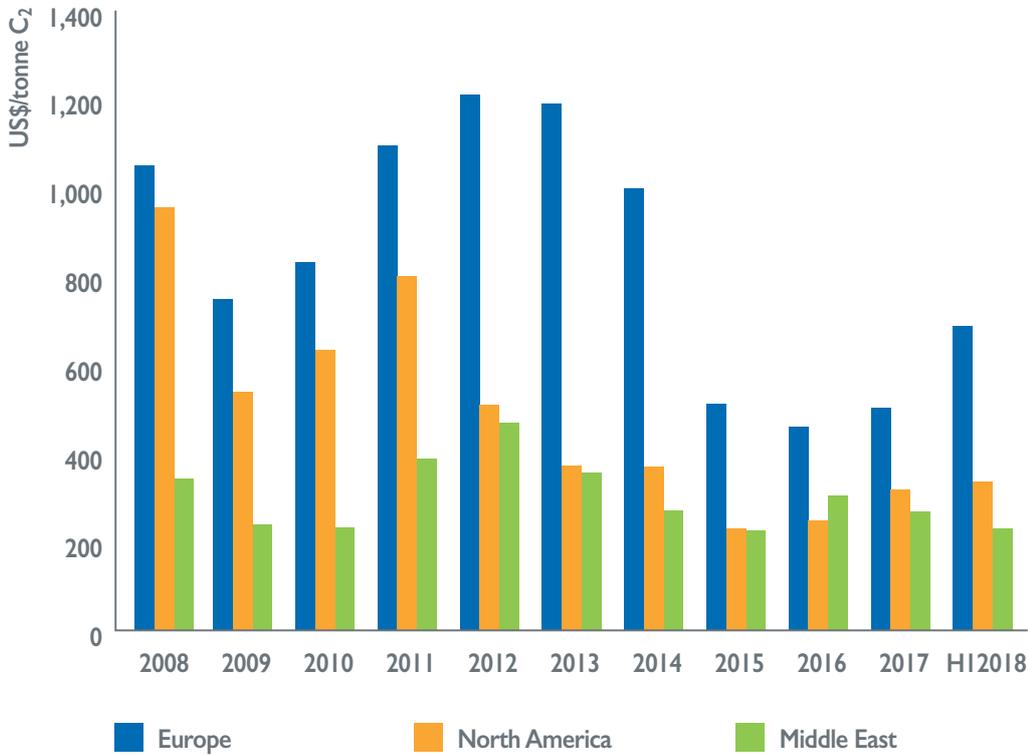
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Europe's relative competitive disadvantage reduced compared to US and Middle East

Ethylene cash cost of regional steam crackers



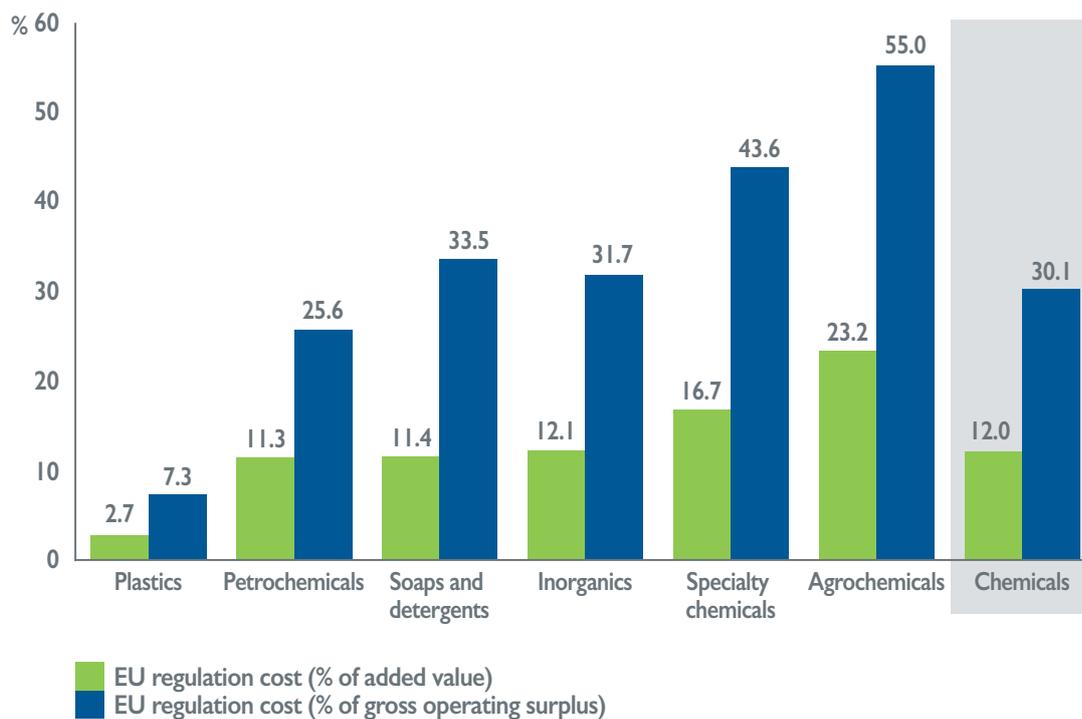
Source: ICIS and Cefic analysis 2018

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- Making ethylene in Europe was three times more expensive than in the US in 2013 (due to the shale gas boom). Europe's competitive disadvantage vis-à-vis its rivals has been reduced.
- The year 2017 shows a significant increase of the ethylene cash cost in Europe compared to 2016. A more substantial rise was observed in the USA during the same period. The cost difference between the USA and Europe diminished further in 2017 compared to 2016. However, Europe still has a competitive disadvantage compared to the USA.
- The global picture for 2017 carried a clear message: Europe still has a competitive disadvantage compared to Middle East. Europe generated the highest ethylene cash cost in 2017.

Regulatory costs* potentially affect the competitiveness of the EU chemicals sector

EU regulation costs* of the chemicals sector



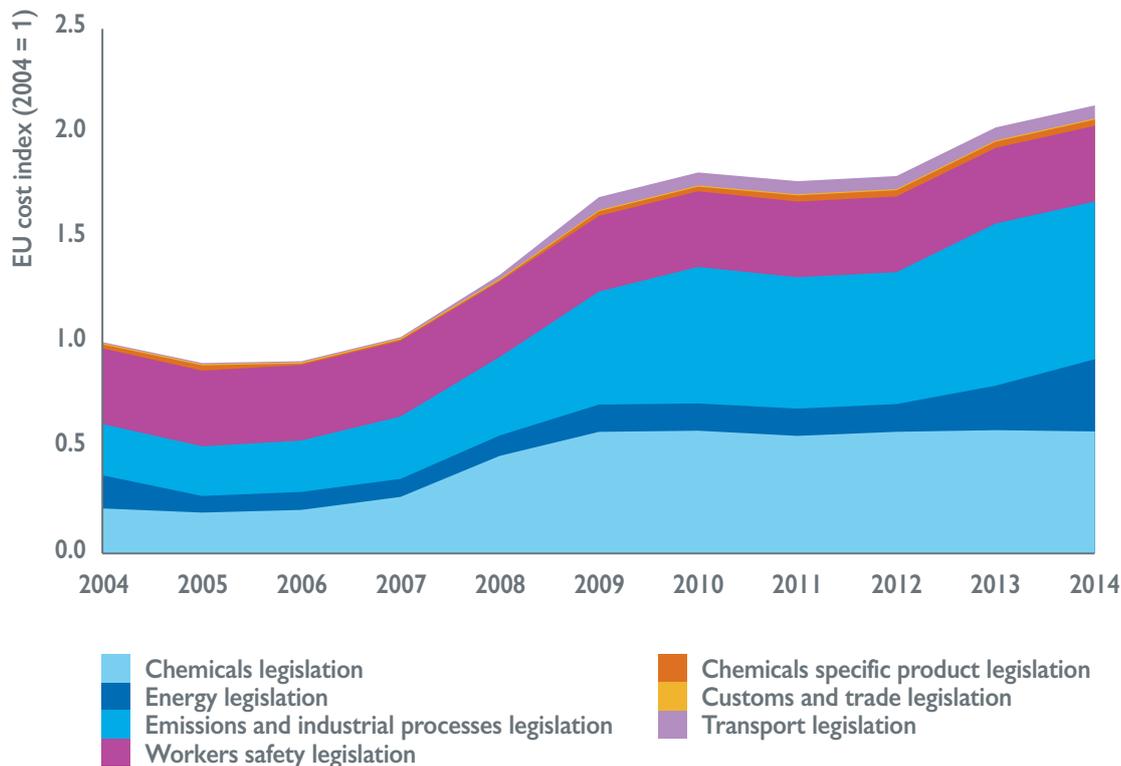
Source: EU Commission Report, "Cumulative Cost Assessment (CCA) for the EU Chemical Industry" (11 July 2016)
 * Average cost per year (2004-2014)

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- Existing EU legislation induces a wide variety of costs for the European chemical industry. Better regulation can help bring these costs down, improving the industry's ability to compete on a global scale.
- Under the REFIT Programme, the European Commission undertook a Cumulative Cost Assessment (CCA) to have a better understanding of how costs induced by EU legislation affect the sector's international competitiveness, complementing the evidence-base for future policy-making decisions (Source: EU Commission Report, "Cumulative Cost Assessment, (CCA) for the EU Chemical Industry", 11 July 2016).
- According to final results of the CCA: the total cost of legislation that companies from the six subsectors had to bear amounts to €10 billion per year. When compared to value added, which represents the value generated by the industry, the share of regulatory costs increases to 12% of the value added. Compared to Gross Operational Surplus (GOS), which can be used as a proxy for profit, the cost reaches 30%, indicating that legislation cost is among the important factors shaping the profitability of the chemical industry. Among the legislation packages, the three main drivers of regulatory cost are industrial emissions (33%), chemicals (30%) and workers safety (24%) – amounting to 88% of total regulatory costs.

EU regulatory cost has doubled from 2004 to 2014

EU regulation cost (2004-2014)



Source: EU Commission Report, "Cumulative Cost Assessment (CCA) for the EU Chemical Industry" (11 July 2016)

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- The chart illustrates well the rising legislation cost during the period 2004-2014, with major milestones being the introduction of REACH and CLP in 2007 and 2008 respectively and the investment of companies after 2009, in anticipation of the enforcement of Seveso III in 2012 and ETS Phase 3 in 2013. Energy legislation also contributes to the rising cost, especially after 2012.
- The chemical industry will face an increasing cost of complying with stricter emission limit values, more ambitious CO₂ emission reduction targets and energy efficiency objectives. One can expect that REACH costs will decrease after 2018, while the cost of compliance with biocidal product and plant protection product regulations will continue to expand. Costs of compliance with workers' safety and transport legislation should remain stable.
- The CCA work is not a deregulation exercise but a tool to identify where problems occur, without reducing levels of health, safety and environmental protection. The cumulative cost assessment models (Phase I and II) are key tools to demonstrate how big the regulatory costs are of chemical legislation, in absolute terms as well as in comparison with other regions in the world.
- It helped us to identify where the costs of European chemicals legislation impact significantly on the competitiveness of EU chemical companies and how costs or administrative burden can be reduced without touching health, safety and environment standards. We consider the CCA study as a tool to develop a cost-effective chemicals regulatory framework that is fit for purpose and which does not adversely impact the sector's competitiveness versus other regions.

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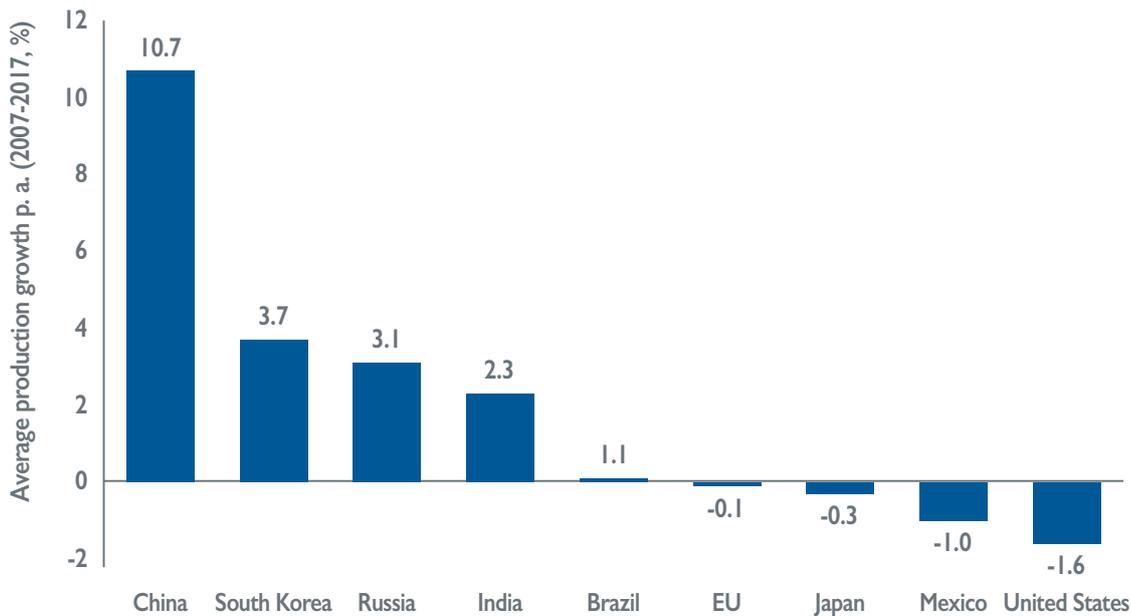
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Emerging economies outpace industrial countries in chemicals production

Average production growth p. a. (2007-2017, %)



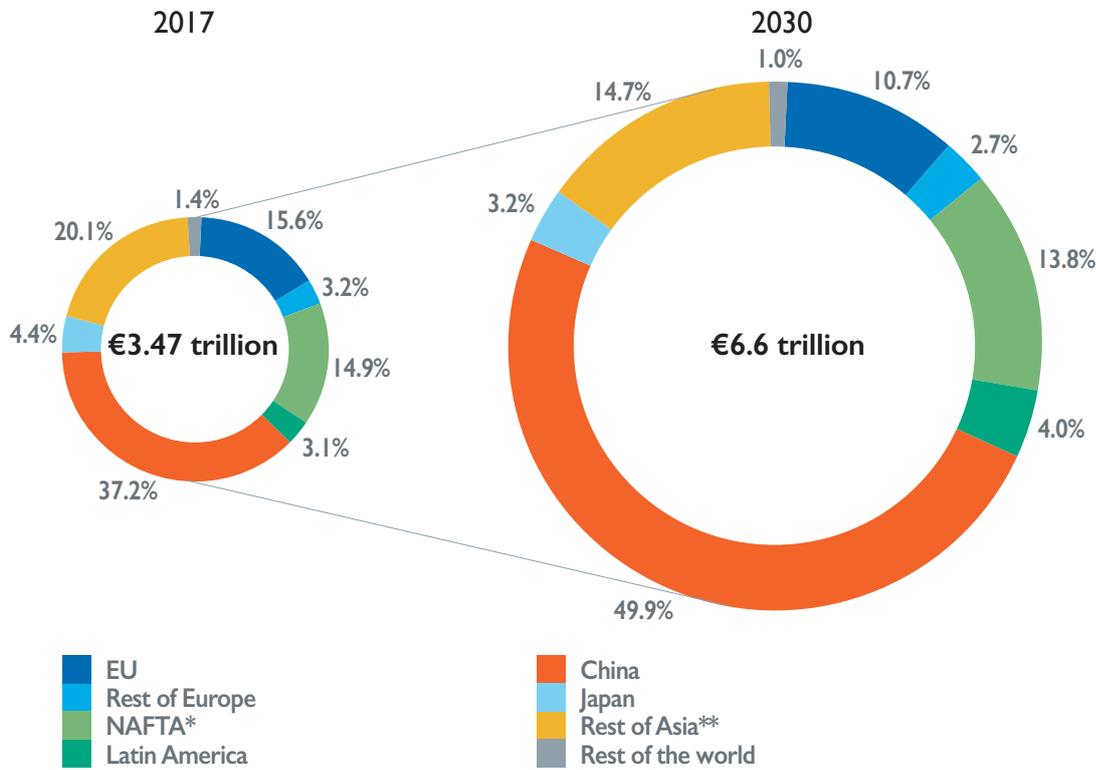
Source: Cefic Chemdata International 2018

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- During the 11-year period from 2007 to 2017, the EU chemical industry had a negative weak growth rate. Production in China swelled from 2007 to 2017, attaining 10.7% average annual growth. China is far and away outpacing other emerging economies such as South Korea (3.7%), Russia (3.1%), and India (2.3%).
- Emerging economies are outpacing industrial countries in chemicals production. They pushed up the average growth rate of world chemicals production during the 2007-2017-time period. The European Union is still lagging behind the main regions in Asia.
- The shift of manufacturing to Asia and associated higher chemicals output growth there, an ageing population in Europe and the shift of petrochemicals production to resource-rich countries are a few examples. They all point to a declining share of the Europe based chemical industry in global sales. In absolute terms, the industry may continue to grow, but only at a slower pace.

Trends in overall growth expected to continue

Growth in world chemical sales 2017-2030



Source: Cefic Chemdata International 2018
 * North American Free Trade Agreement
 ** Asia excluding China and Japan

Unless specified, chemical industry excludes pharmaceuticals
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- Long-term analysis shows that overall growth of chemicals demand and production as well as faster growth in emerging regions is a trend that is expected to continue in the future. World chemical sales are expected to reach the level of €6.3 trillion in 2030.
- The EU chemical industry is expected to rank third. With 44% of world market share, China will continue to hold the top ranking in sales, a position once firmly held by Europe. The graph shows chemical sales in Asia have grown to more than double those of the European Union.
- Although competition in China's chemicals market is currently intensifying and demand growth is weaker than in the past, China still offers a huge and attractive market, both for chemical suppliers and their customer industries. In the mid-term, European chemical producers – due to their high technological capabilities and innovative products – are expected to benefit from a robust growth trend in China, both in increased exports or via local investments. To what extent depends on the competitive situation in each market segment and the development of final customer markets that rely on the chemical industry – for example consumer chemicals, automotive, electronics, food and nutrition, etc.

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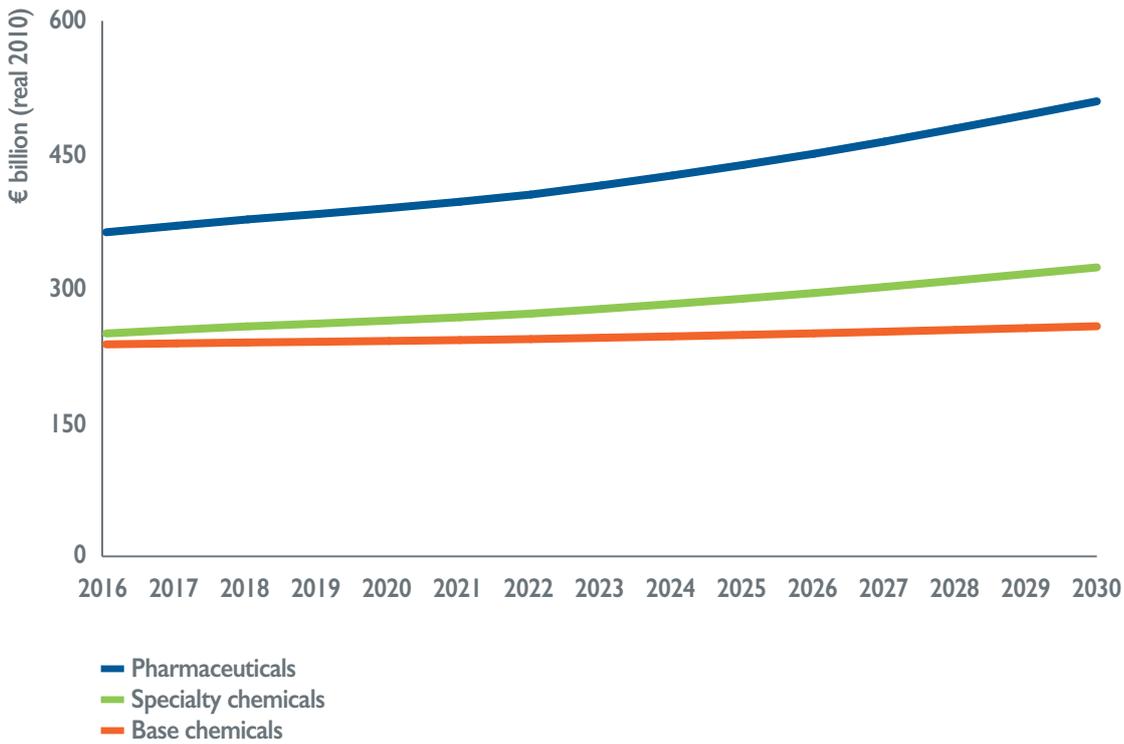
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Europe leads in specialty chemicals

EU production value (real 2010, € billion)



Source: Prognos model results and Cefic analysis 2018

Unless specified, chemical industry excludes pharmaceuticals
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- On a segment level, the chemical industry in Europe is characterised by high market share in specialty chemicals and pharma ingredients, which is expected to continue to grow in the future. Future growth will be driven by innovation and diversification in materials and components across the manufacturing and construction sectors, as well as consumer goods.
- The speed of innovation and transformation is expected to pick up, due to the introduction of Industry 4.0 technologies.

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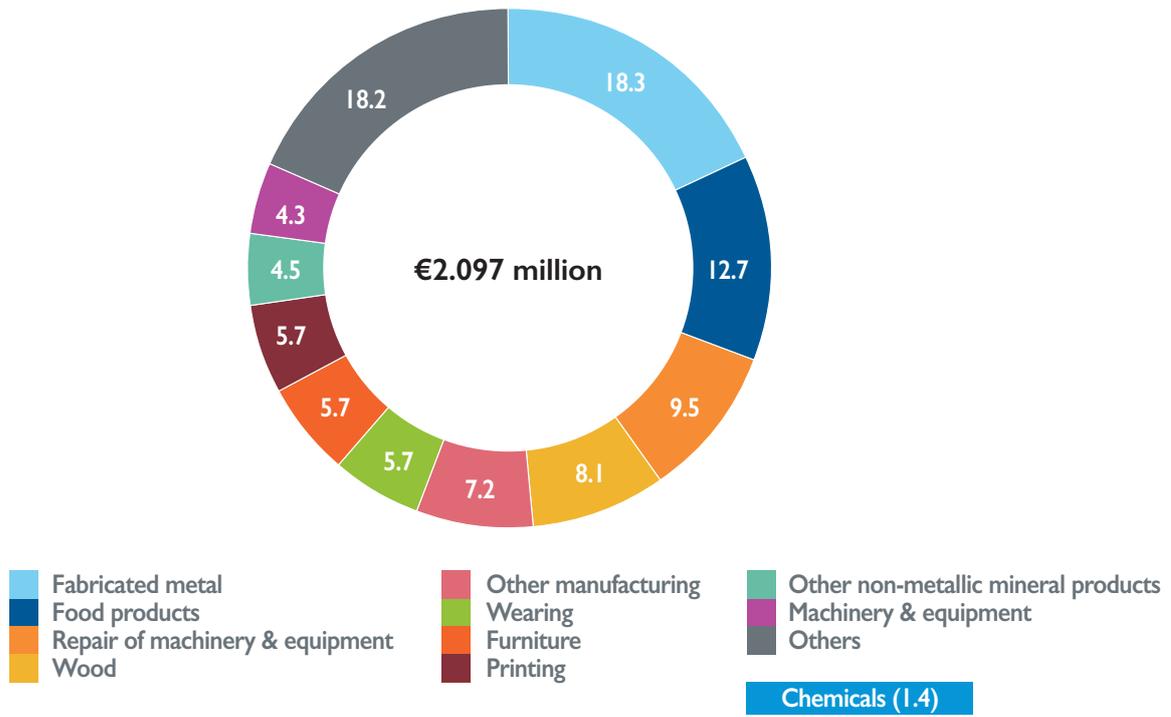


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Top 10 sectors account for 82% of total EU manufacturing enterprises*

Top 10 sectors: number of enterprises (% , 2015)



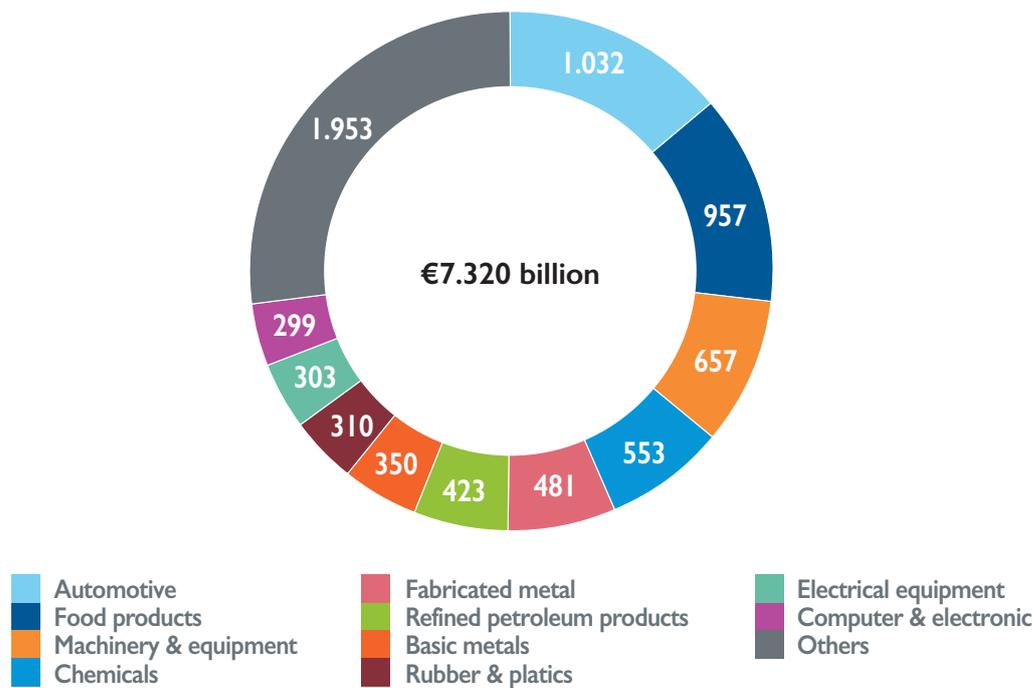
Source: Eurostat SBS Data 2015 and Cefic analysis 2018
* Eurostat code, V11110

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

- There are 2,097 million enterprises in the EU manufacturing sector. Fabricated metal products is the largest sector, accounting for 18.3% of all enterprises operating in the EU manufacturing industry, followed by food industry (12.7%).
- Top 10 sectors account for 82% of total EU manufacturing enterprises. There are 28 thousand companies operating in the EU chemicals sector. It accounts for 1.4% of the total number of enterprises in the EU manufacturing sector (see Eurostat code, V11110).

Chemicals is the fourth largest producer* in EU manufacturing

Top 10 sectors: turnover (€ billion, 2015)



Source: Eurostat SBS Data 2015 and Cefic analysis 2018
 * Eurostat code, V12110

Unless specified, chemical industry excludes pharmaceuticals
 Unless specified, EU refers to EU 28

- Turnover comprises the totals invoiced by the unit during the reference period. It includes all duties and taxes on the goods or services invoiced by the unit with the exception of the VAT invoiced by the unit to its customer and other similar deductible taxes directly linked to turnover; it also includes all other charges (transport, packaging, etc.) passed on to the customer. Price reductions, rebates and discounts as well as the value of returned packing must be deducted (see Eurostat code, V12110).
- Top 10 sectors account for 73% of EU manufacturing turnover: Automotive and food products are the two largest sectors in the EU manufacturing industry, accounting for more than one fourth of all turnover (27.2%).
- With €533 billion, chemicals is the fourth leading sector: Chemicals accounts for 7.6% of EU manufacturing turnover.

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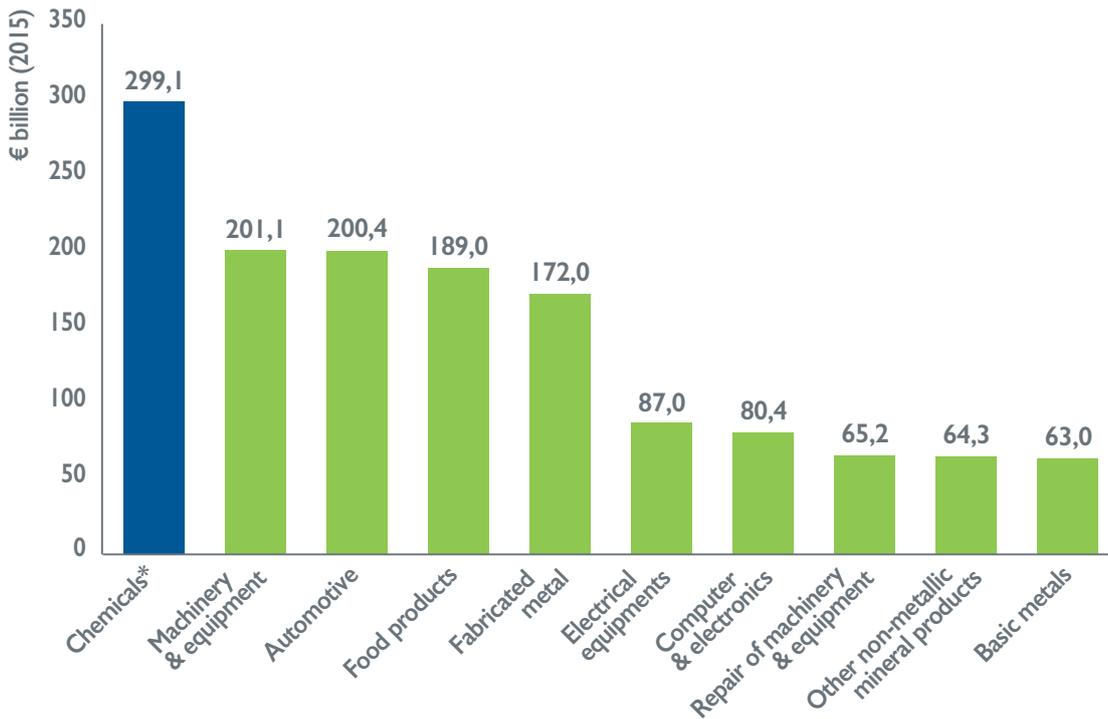
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Chemicals* is the leading sector, accounting for 16% of added value

Top 10 sectors: added value (€ billion, 2015)



Source: Eurostat SBS Data 2015 and Cefic analysis 2018
 * Pharmaceuticals and rubber & plastics included, Eurostat code, V12150

Unless specified, chemical industry excludes pharmaceuticals
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- Value added at factor costs is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. Value adjustments (such as depreciation) are not subtracted (see Eurostat code, V12150).

- Top 10 sectors account for 75% of EU manufacturing added value. The chemicals sector (including pharmaceuticals and rubber and plastics) is the largest sector in the EU manufacturing industry, accounting for about 16% of added value.

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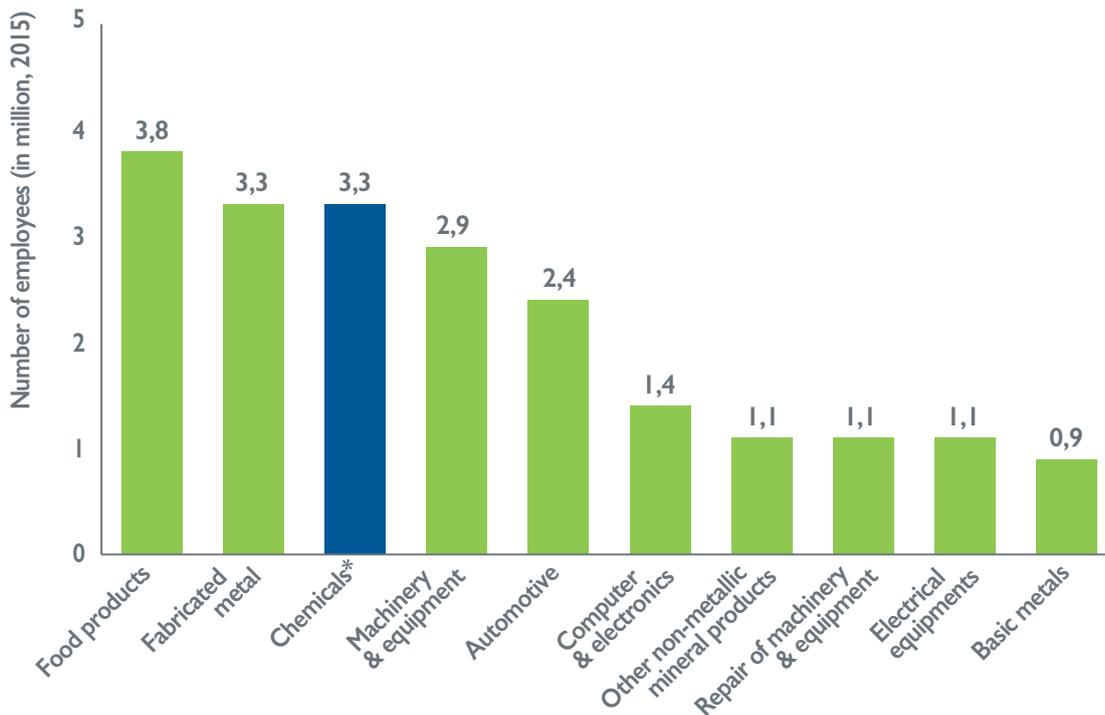
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The chemicals* sector contributes 12% of EU manufacturing employment

Top 10 sectors: number of employees (in million, 2015)



Source: Eurostat SBS Data 2015 and Cefic analysis 2018

* Pharmaceuticals and rubber & plastics included, Eurostat code, VI6130

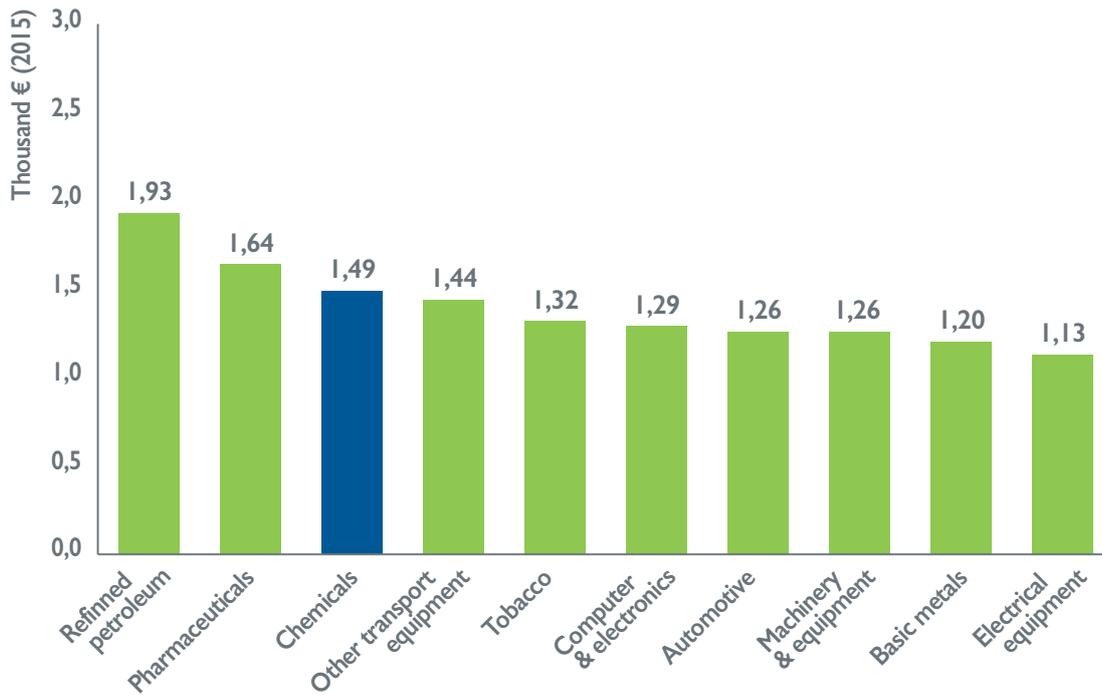
Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- Number of employees is defined as those persons who work for an employer and who have a contract of employment and receive compensation in the form of wages, salaries, fees, gratuities, piecework pay or remuneration in kind. A worker from an employment agency is considered to be an employee of that temporary employment agency and not of the unit (customer) in which they work (see Eurostat code, VI6130).
- There are 28.3 million people directly employed in the EU manufacturing sector (data 2015). Top 10 sectors account for 75% of EU manufacturing employment. Food products and fabricated metals are the two largest sectors in the EU manufacturing industry, accounting for one fourth of all employment (25.2%).
- Chemicals (including pharmaceuticals and rubber and plastics) is the third largest sector (3.3 million people). It contributes 11.6% of EU manufacturing employment. The sector generated an even greater number of indirect jobs – up to three times higher than through direct employment.
- According to Eurostat data, employment in the EU chemical industry (without pharmaceuticals and rubber and plastics) is particularly high in five subsectors – petrochemicals; paints, varnishes and similar coatings; printing ink and mastics; plastics in primary forms; perfumes and toilet preparations; soap and detergents, cleaning and polishing preparations – all sectors with a significant presence in the EU.

Higher salaries*: 50% higher in chemicals than manufacturing average

Top 10 sectors: labour costs per employee (€ thousand, 2015)



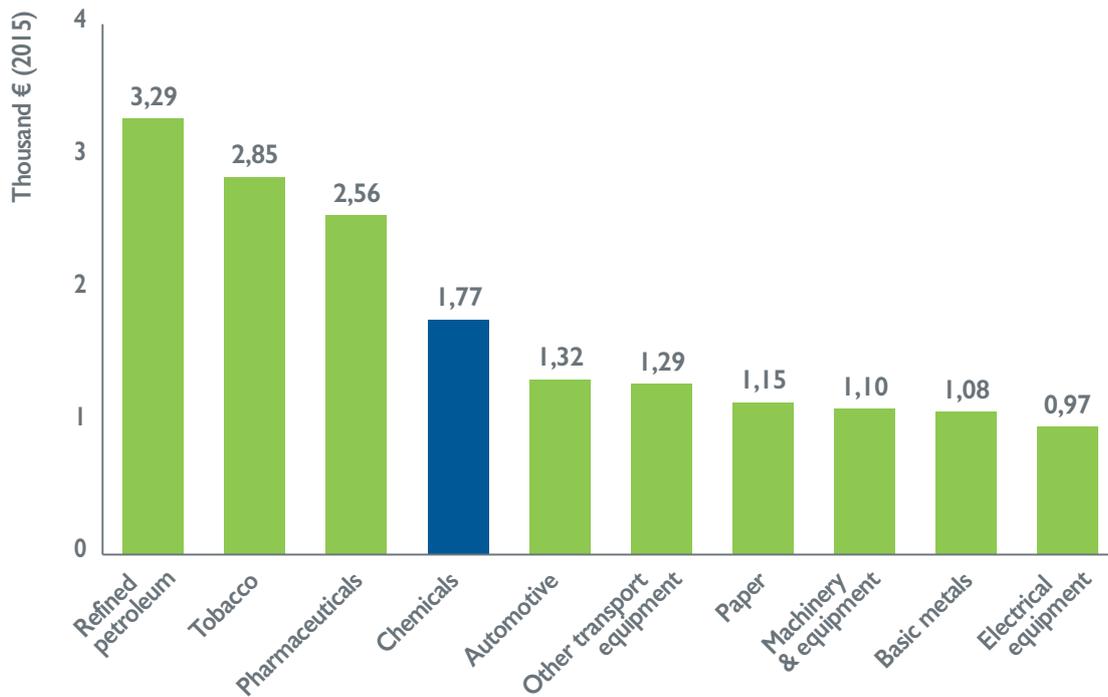
Source: Eurostat SBS Data 2015 and Cefic analysis 2018
* Eurostat code, V91210-Average personnel costs

Unless specified, chemical industry excludes pharmaceuticals
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- Personnel costs defined as the total remuneration, in cash or in kind, payable by an employer to an employee (regular and temporary employees as well as home workers) in return for work done by the latter during the reference period. Personnel costs also include taxes and employees' social security contributions retained by the unit as well as the employer's compulsory and voluntary social contributions. Personnel costs are made up of wages and salaries and employers' social security costs (see Eurostat code, V91210).
- Personnel costs amounted €1 140 billion in the EU manufacturing sector. Top 10 sectors account for 73.1% of EU manufacturing personnel cost. Machinery equipment and Automotive are the two largest sectors in the EU manufacturing industry, accounting for nearly one fourth of all personnel costs (23.6%). Chemicals is the fifth largest sector (€66 billion). Chemicals accounts for 6% of EU manufacturing personnel costs.
- According to Eurostat data, the chemicals subsectors with the highest personnel costs at the EU-aggregate level are organic basic chemicals, plastics and paints. However, the analysis indicates that some subsectors with very low absolute value at EU-aggregate level appear to have the highest costs per employee, such as synthetic rubber or pesticides/nitrogen.
- Concerning the personnel costs per employee, chemicals is the third leading sector. Refined petroleum, pharmaceuticals and chemicals generated the three highest costs per employee.

Labour productivity* 77% higher in chemicals than manufacturing average

Top 10 sectors: Apparent labour productivity (ALP in manufacturing = 1, data 2015)



Source: Eurostat SBS Data 2015 and Cefic analysis 2018

* Eurostat code, V91110

Apparent labour productivity (Gross value added per person employed) - thousand euro

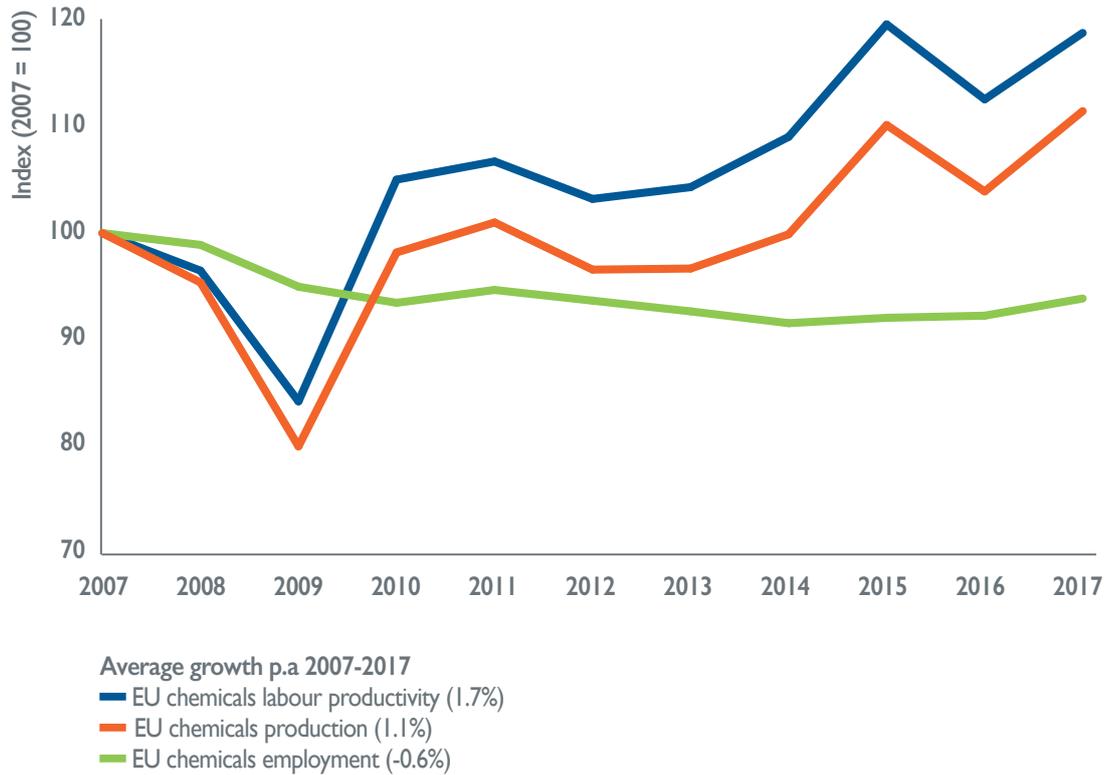
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- Apparent labour productivity (Gross value added per person employed) - thousand euros. Number of persons employed is defined as the total number of persons who work in the observation unit (inclusive of working proprietors, partners working regularly in the unit and unpaid family workers), as well as persons who work outside the unit who belong to it and are paid by it (e.g. sales representatives, delivery personnel, repair and maintenance teams). It excludes manpower supplied to the unit by other enterprises, persons carrying out repair and maintenance work in the enquiry unit on behalf of other enterprises, as well as those on compulsory military service (see Eurostat code, V91110).

- Apparent labour productivity (ALP)*: chemicals is the fourth leading sector. Apparent labour productivity (ALP)*: 77% higher in chemicals than the manufacturing average.

Labour productivity rate grows at 1.7%

Energy intensity: chemicals versus total industry



Source: Cefic Chemdata International 2018

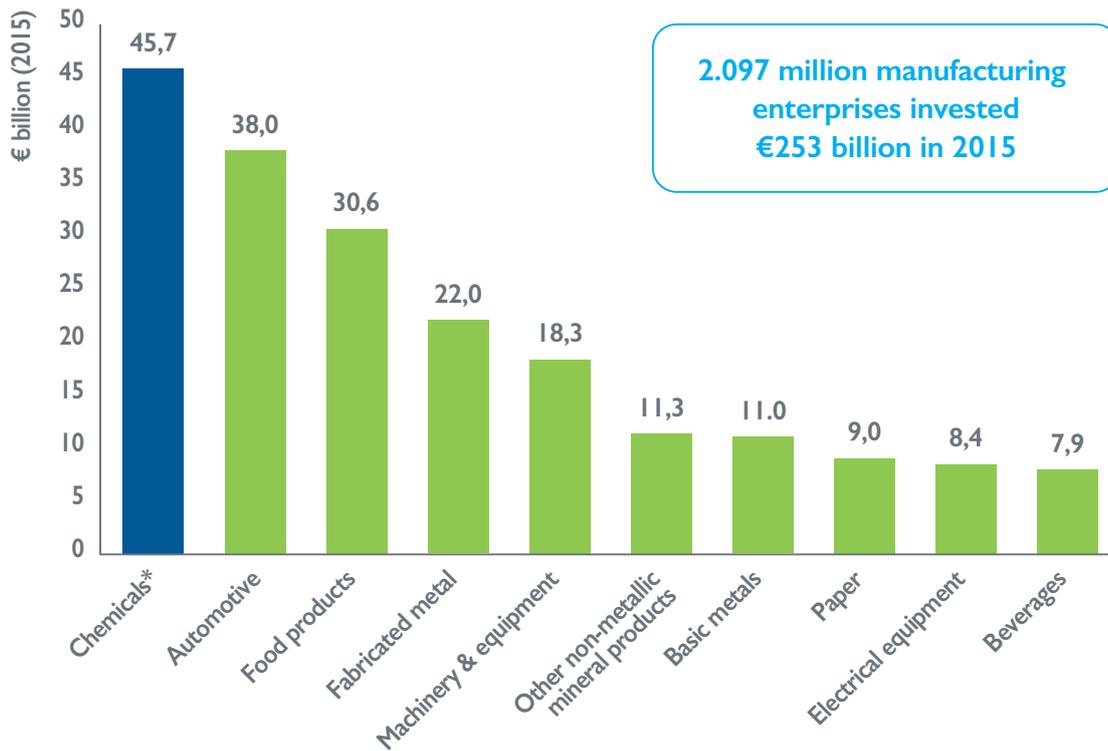
Unless specified, chemical industry excludes pharmaceuticals
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- Highly educated and trained employees, coupled with continuously high investments in the workforce, have turned the EU chemicals sector into a leading industry in terms of high labour productivity. Between 2007 and 2017, labour productivity in the EU chemical industry rose at an average annual rate of 1.7%.

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Chemicals* is the largest investor in EU manufacturing

Top 10 sectors: investment (€ billion, 2015)



Source: Eurostat SBS Data 2015 and Cefic analysis 2018

* Pharmaceuticals and rubber & plastics included, Eurostat code, V15110

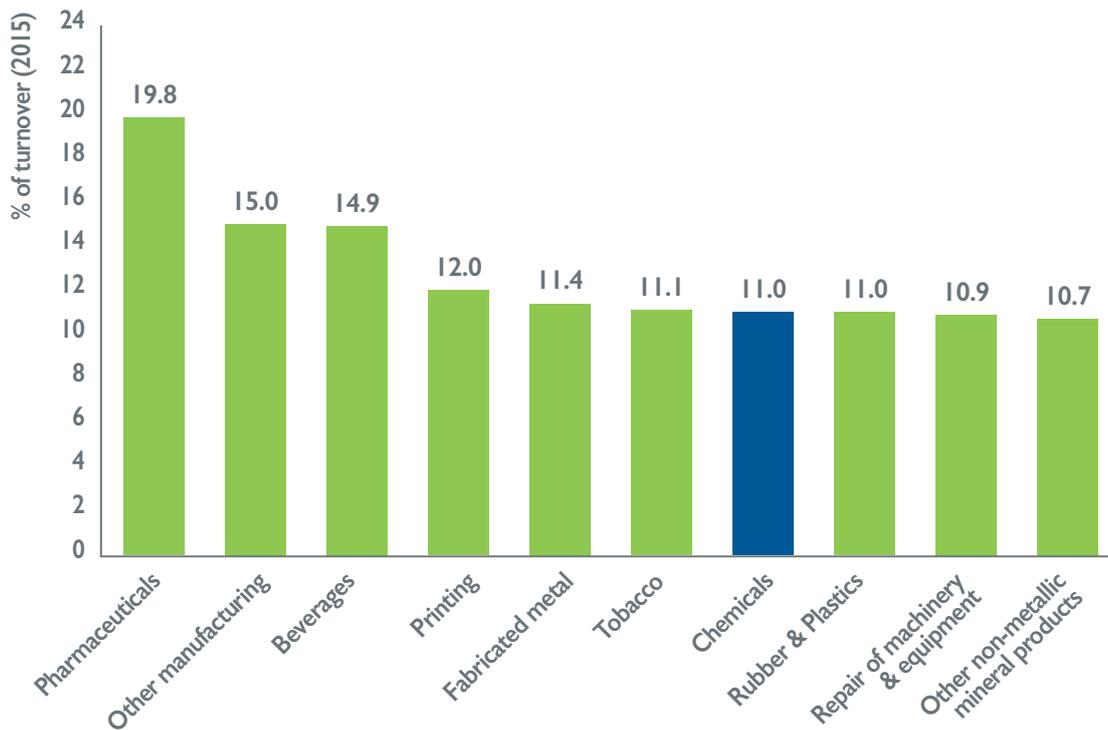
Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- Gross investment in tangible goods is defined as investment during the reference period in all tangible goods. Included are new and existing tangible capital goods, whether bought from third parties or produced for own use (i.e. capitalised production of tangible capital goods), having a useful life of more than one year including non-produced tangible goods such as land. Investments in intangible and financial assets excluded (see Eurostat code, V15110).
- Investment rate (intensity)* in chemicals is far above the manufacturing average. Investment rate (intensity) amounted to the value of 14% in the EU manufacturing sector.
- There are 2097 million enterprises operating in the EU manufacturing sector. They invested about €253 billion in 2015. Chemicals (including pharmaceuticals and rubber and plastics) is the largest investor in EU manufacturing, accounting for 18.1% of total investment, followed by Automotive and Food are the two largest sectors.

GOS* in chemicals accounts for 11% of turnover

Top 10 sectors: gross operating surplus (% of turnover, 2015)

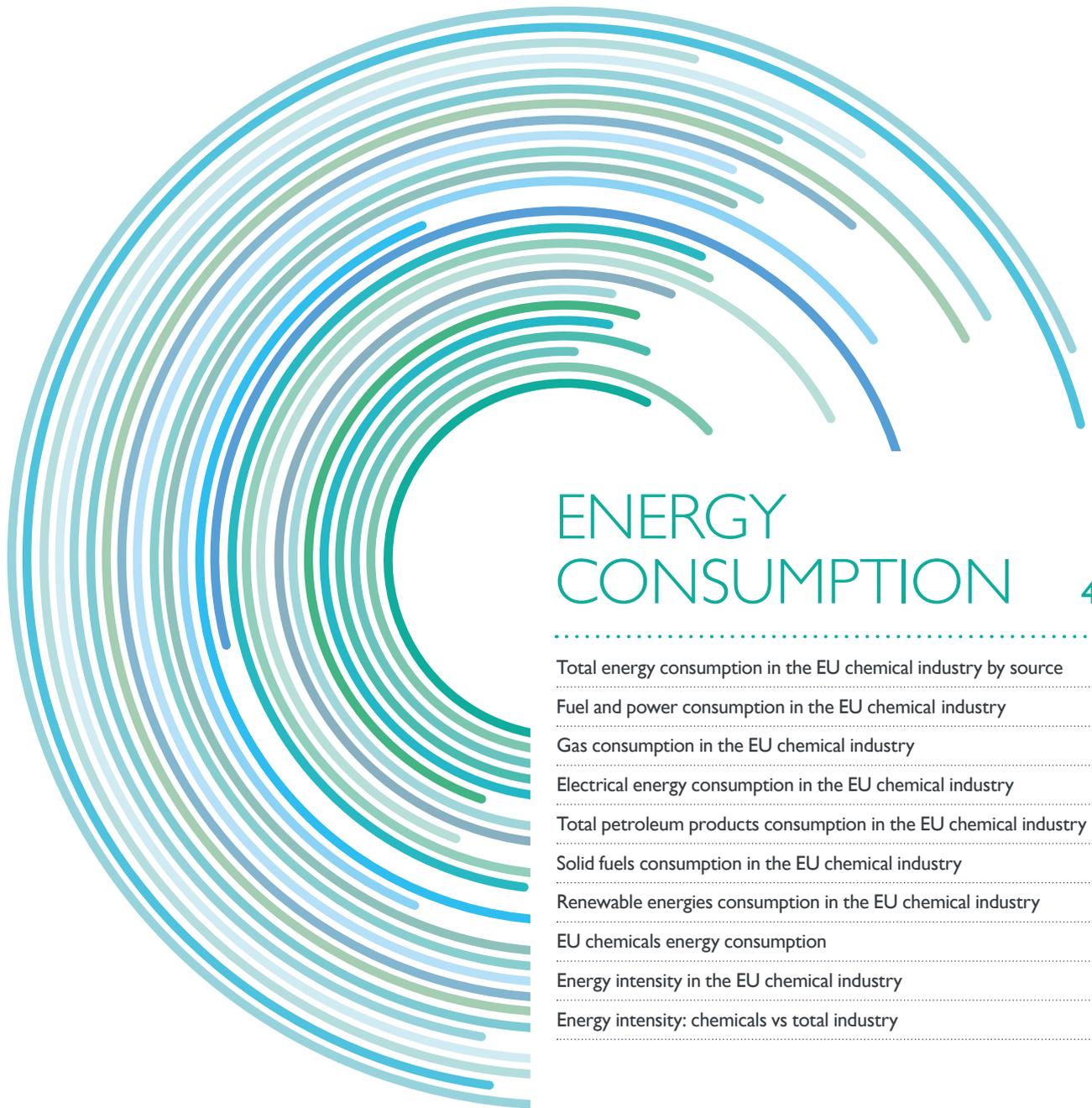


Source: Eurostat SBS Data 2015 and Cefic analysis 2018
 * Eurostat code, V92113

Unless specified, chemical industry excludes pharmaceuticals
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- Gross operating surplus (GOS) or profits is defined as value added minus personnel costs. It is the surplus generated by operating activities after the labour factor input has been compensated for. GOS in Chemicals accounts for 11% of turnover (see Eurostat code V92113).

- With regard to its gross operating profit, chemicals compares favourably to other manufacturing sectors as well. The ratio of gross operating profits to turnover is the seventh highest in industry and is well above the manufacturing average.

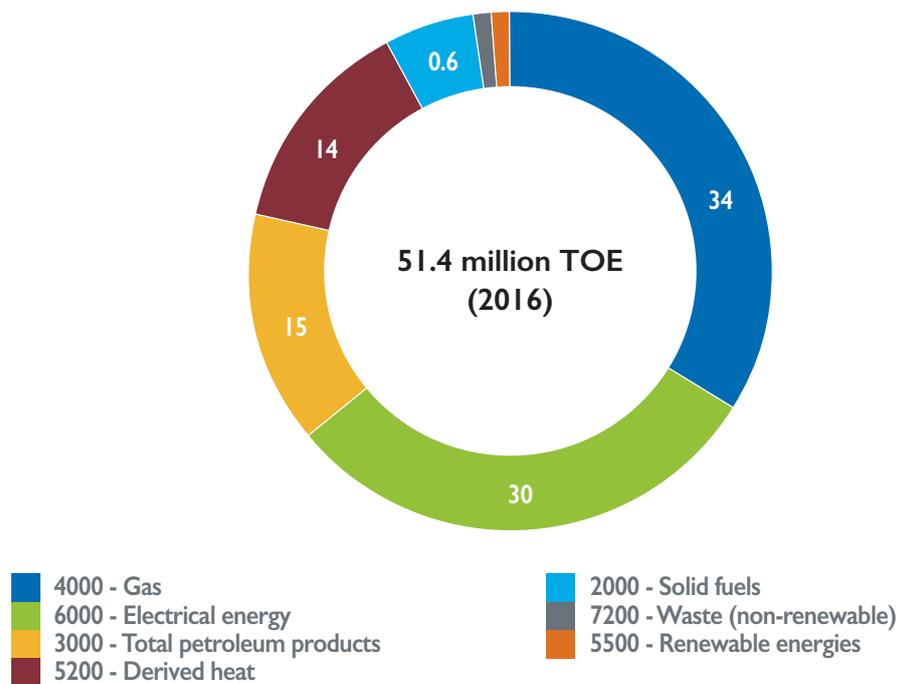


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Gas and electricity account for nearly 2/3 of total energy consumption*

Total energy consumption* in the EU chemical industry by source



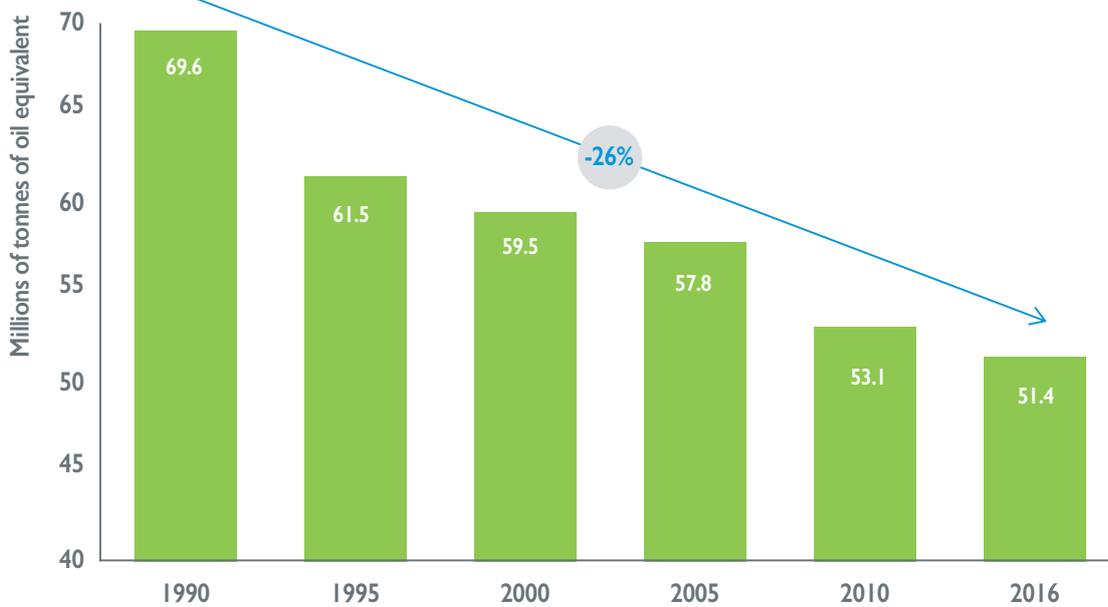
Source: Eurostat and Cefic analysis 2018
* Chemicals and pharmaceuticals, data 2016, fuel and power consumption

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

- Energy all products: it consists of solid fuels (such as hard coal and derivatives, lignite and derivatives, peat and derivatives), total petroleum products (such as liquefied petroleum gas, refinery gas, motor spirit, kerosene, gas/diesel oil, residual fuel oil), gas (such as natural gas, and manufactured gases), derived heat, renewable energies (such as hydro power, thermal solar and photovoltaic power, wind energy, solid and liquid biofuels, renewable wastes, geothermal energy, tide, wave and ocean), electrical energy, nuclear heat and waste (non-renewable).
- The chemical industry transforms energy and raw materials into products required by other industrial sectors as well as by final consumers. The cost of energy and raw materials is a major factor in determining the competitiveness of the EU chemical industry on the global market.
- In 2016, the fuel and power consumption of the EU chemical industry, including pharmaceuticals, amounted to 51.4 million tonnes of oil equivalent (TOE). The EU chemical industry, including pharmaceuticals, significantly reduced its fuel and power consumption during the period from 1990 to 2016. Most of the energy used by the chemical industry as feedstock is stored in products and can still be recycled. Regarding other raw materials, the chemical industry also uses a wide variety of natural and processed feedstocks, including metals, minerals and agricultural raw materials such as sugar, starch and fats.

Fuel and power consumption* falls 26% since 1990

Fuel and power consumption* in the EU chemical industry



Source: Eurostat and Cefic analysis 2018

* Chemicals and pharmaceuticals, fuel and power consumption

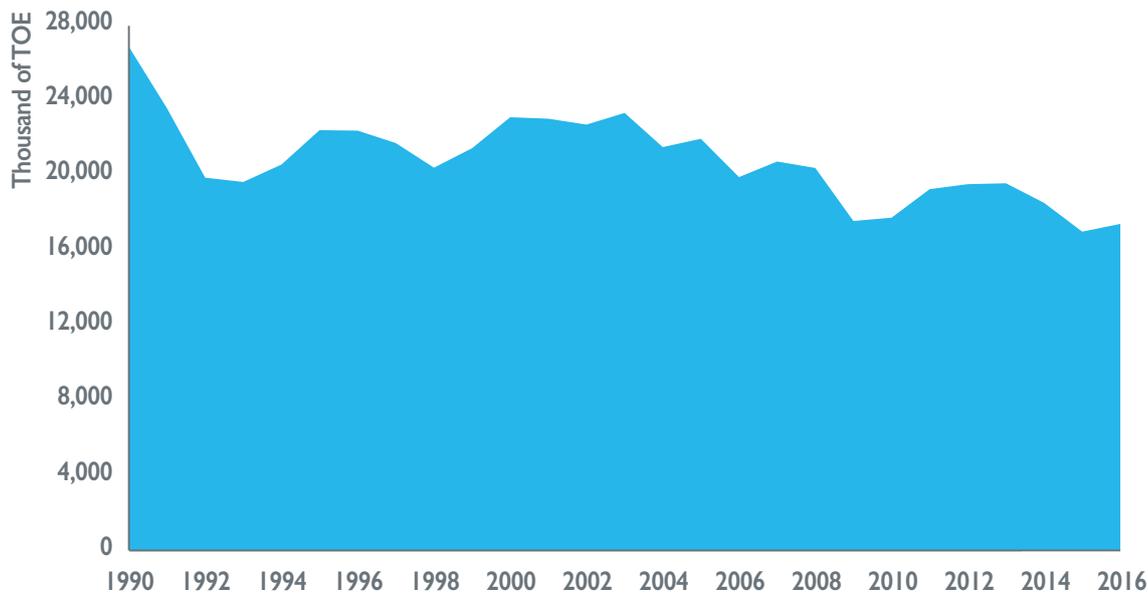
Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- Total energy consumption in the EU chemicals sector was valued at 51.4 million tonnes of oil equivalent in 2016, down from 69.6 million tonnes in 1990 (26% less). Energy consumption in the EU chemicals sector went down 1.2% per annum on average during the years 1990-2016. Energy consumption in chemicals accounted in 2016 for 18.6% of total industry energy consumption (18.8% in 1990).
- In 1990, the fuel and power consumption of the EU manufacturing industry amounted to 370.8 million tonnes of oil equivalent (TOE). The sector considerably decreased its fuel and power consumption during the period from 1990 to 2016: by 91.1 million tonnes of oil equivalent. The amount of energy consumed in 2016 was 25% less than in 1990.

Gas consumption* falls 35% since 1990

Gas consumption* in the EU chemical industry (thousand of TOE)



Source: Eurostat and Cefic analysis 2018

* Chemicals and pharmaceuticals, fuel and power consumption

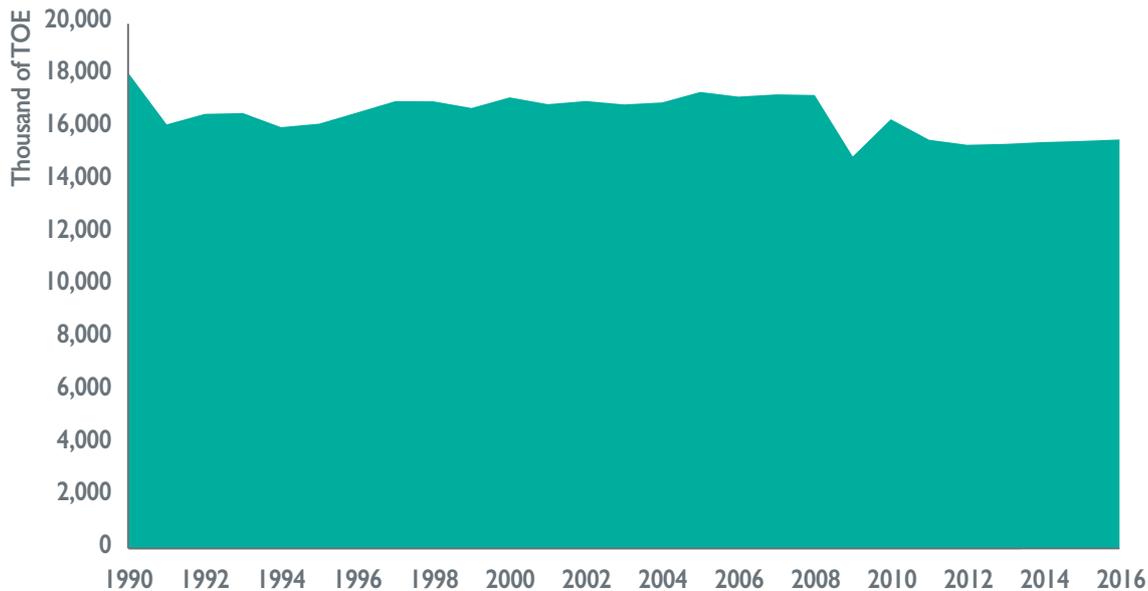
Unless specified, chemical industry excludes pharmaceuticals

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- 4000 – Gas is the sum of natural gas (Code 4100) and derived gas (Code 4200). 4100 Natural gas comprises gases occurring in underground deposits, whether liquefied or gaseous, consisting mainly of methane. 4200 Derived gases are manufactured gases, comprising coke-oven gas, blast furnace gas and gasworks gas.
- “Gas” consumption in the EU area was valued at 17.4 million tonnes of oil equivalent in 2016 (far below the 26.9 million reported in 1990). “Gas” consumption went down 1.7% per annum on average during the years 1990-2016. “Gas” consumption went down by 35% in 2016 compared to 1990.
- One third of total energy consumption in the EU chemicals sector is attributable to “Gas” (about 34% in 2016, down from 38.6% in 1990). Gas consumption in the EU chemicals sector accounts for 20.2% of total industry consumption (2016). Share of gas consumption to total industry went down from 23.5% in 1990 to 20.2% in 2016.

Electrical energy consumption* falls 14% since 1990

Electrical energy consumption* in the EU chemical industry (thousand of TOE)



Source: Eurostat and Cefic analysis 2018

* 6000-electrical energy, chemicals and pharmaceuticals, fuel and power consumption

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

- 6000 – Electrical energy covers electricity generated in all types of power plants (e.g. in nuclear, thermal, hydro, wind, photovoltaic or other plants) to be distributed to consumers through the grid or consumed locally.
- “Electrical energy” consumption in the EU chemicals business area was valued at 15.6 million tonnes of oil equivalent in 2016 (below the 18.1 million reported in 1990). “Electrical energy” consumption went down 0.6% per annum on average during the years 1990-2016. “Electrical energy” consumption went down by 14% in 2016 compared to 1990.
- “Electrical energy” consumption accounts for 30% of total energy consumption of the EU chemicals sector (year 2016, up from 26% in 1990). “Electrical energy” consumption in chemicals accounted in 2016 for 21.2% of total industry (up from 17.9% in 1990).

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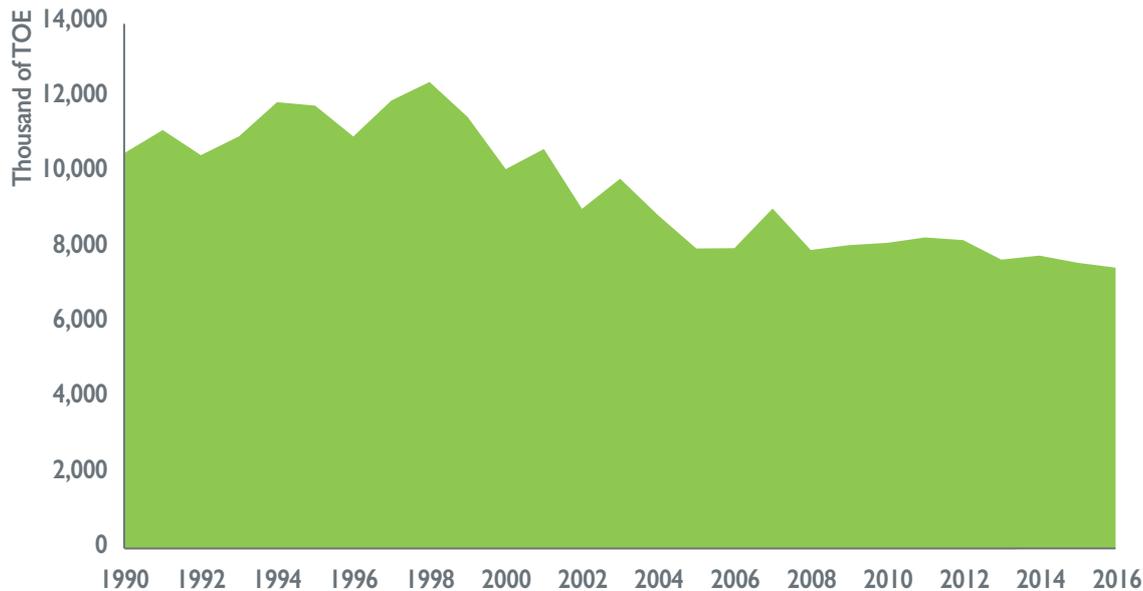
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Total petroleum consumption* falls 29% since 1990

Total petroleum products consumption* in the EU chemical industry (thousand of TOE)



Source: Eurostat and Cefic analysis 2018

* Chemicals and pharmaceuticals, fuel and power consumption

Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- 3000 Total petroleum products (without biofuels) covers Crude oil, Natural Gas Liquids (NGL), Refinery feedstocks, Additives-oxygenates and Other hydrocarbons as well as all petroleum products such as Refinery gas, Ethane, Liquefied petroleum gas, Naphtha, Motor gasoline, Aviation gasoline, Gasoline type jet fuel, Kerosenes (Kerosene type jet fuel and Other kerosene), Gas/diesel oil, Residual fuel oil, White spirit & SBP, Lubricants, Bitumen, Petroleum coke, Paraffin waxes and Other oil products.
- “Petroleum” consumption in the EU chemicals sector was valued at 7.5 million tonnes of oil equivalent in 2016, compared to the 10.5 million registered in 1990. “Petroleum” consumption went down 1.3% per annum on average during the years 1990-2016. “Petroleum” consumption fell by 29% in 2016 compared to 1990.
- “Petroleum” consumption accounted in 2016 for 14.6% of total energy consumption of the EU chemicals sector (slightly down from 15.1% in 1990). “Petroleum” consumption in the EU chemicals sector accounted for 27% of total industry petroleum consumption in 2016, compared to the 17% recorded in 1990.

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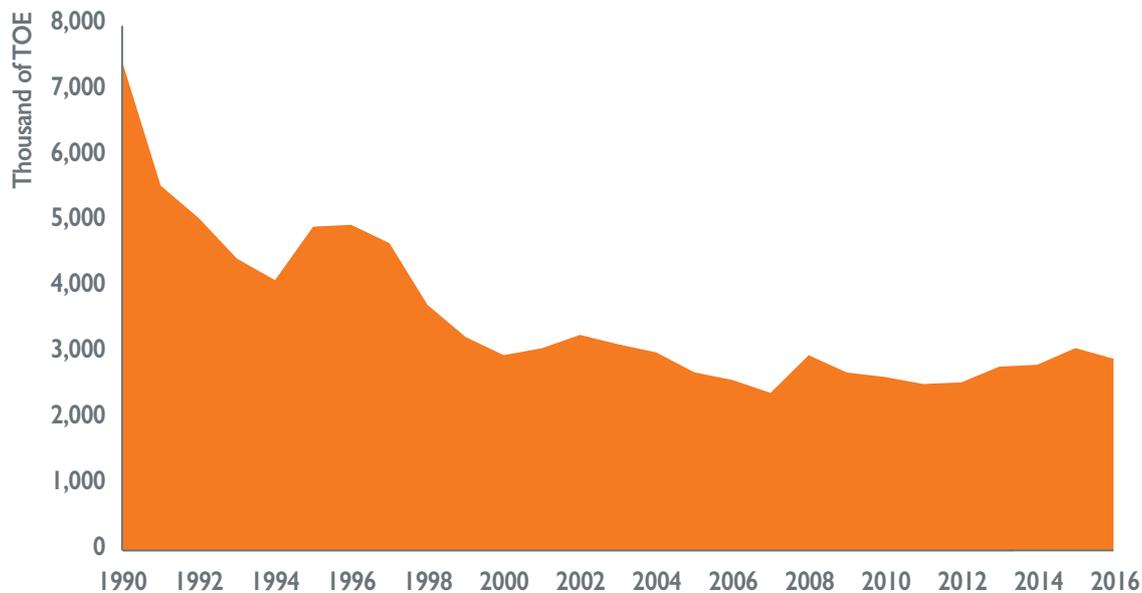
Energy

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Environment

Solid fuels consumption* falls 61% since 1990

Solid fuels consumption* in the EU chemical industry (thousand of TOE)



Source: Eurostat and Cefic analysis 2018

* Chemicals and pharmaceuticals, fuel and power consumption

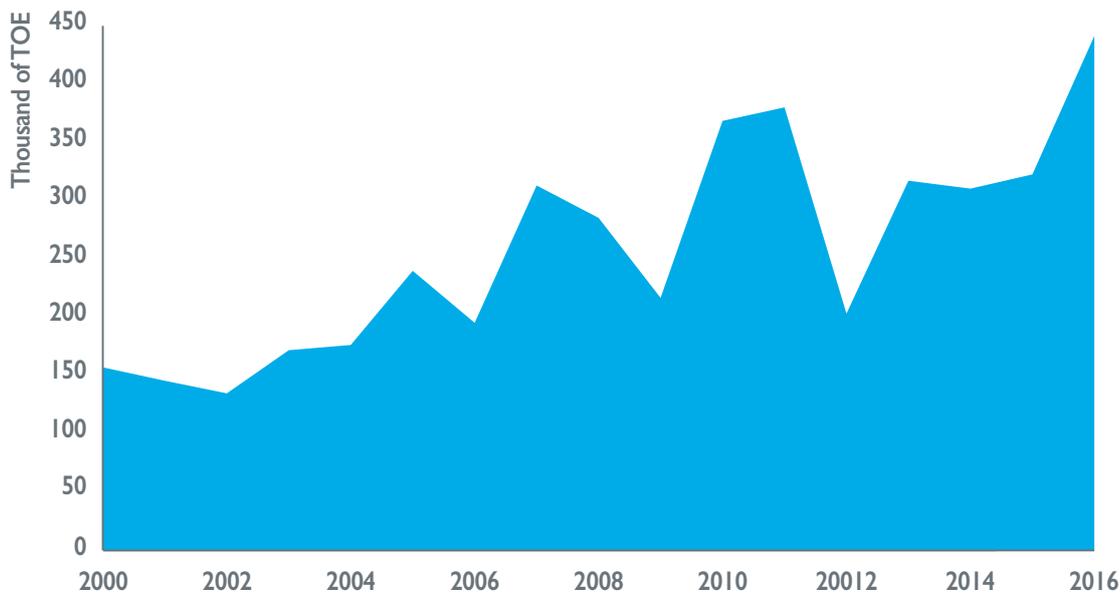
Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- 2000 Solid Fuels covers hard coal and derivatives (parent fuels, anthracite, coking coal, other bituminous coal, sub-bituminous coal, coke oven coke, gas coke, coal tar), lignite and derivatives (lignite/brown coal, BKB (brown coal briquettes), peat, peat products) and oil shale and oil sands. Solid fuels (Code 2000) = hard coal & derivatives (Code 2100) + lignite and derivatives (Code 2200) + Oil shale and oil sands (Code 2410).
- “Solid Fuels” consumption in the EU chemicals sector was valued at 2.9 million tonnes of oil equivalent in 2016, far below the 7.4 million registered in 1990. “Solid Fuels” consumption went down 3.5% per annum on average during the years 1990-2016. “Solid Fuels” consumption fell by 61% in 2016 compared to 1990.
- “Solid Fuels” consumption accounted for 5.7% of energy consumption of the EU chemicals sector in 2016, far below the 10.7% registered in 1990 (nearly halved). The share of “Solid Fuels” consumption in chemicals to total industry went down by 1% (from 10% in 1990 to nearly 9% in 2016).

Renewable energies consumption* has more than doubled since 2000

Renewable energies consumption* in the EU chemical industry (thousand of TOE)



Source: Eurostat and Cefic analysis 2018

* 5500-renewable energies, chemicals and pharmaceuticals, fuel and power consumption

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

- 5500 – Renewable energies covers hydro power, wind energy, solar energy, tide, wave and ocean, biomass and renewable wastes and geothermal energy. Renewable energies (Code 5500) are the sum of hydro power (Code 5510), wind energy (Code 5520), solar energy (Code 5530), tide, wave and ocean (Code 5535), biomass & renewable wastes (Code 5540) and geothermal energy (Code 5550).
- Renewable energy consumption in the EU area was valued at 441 thousand tonnes of oil equivalent in 2016, significantly up from 156.8 in 2000. Renewable energy consumption grew 6.7% per annum on average during the years 2000-2016. Renewable energy consumption was 1.8 times higher in 2016 compared to 2000.
- Share of renewable energy consumption in chemicals increased from 0.3% in 2000 to 0.9% in 2016. Share of renewable energy consumption in chemicals to total industry, doubled from 1.0% in 2000 to 2.0% in 2016.

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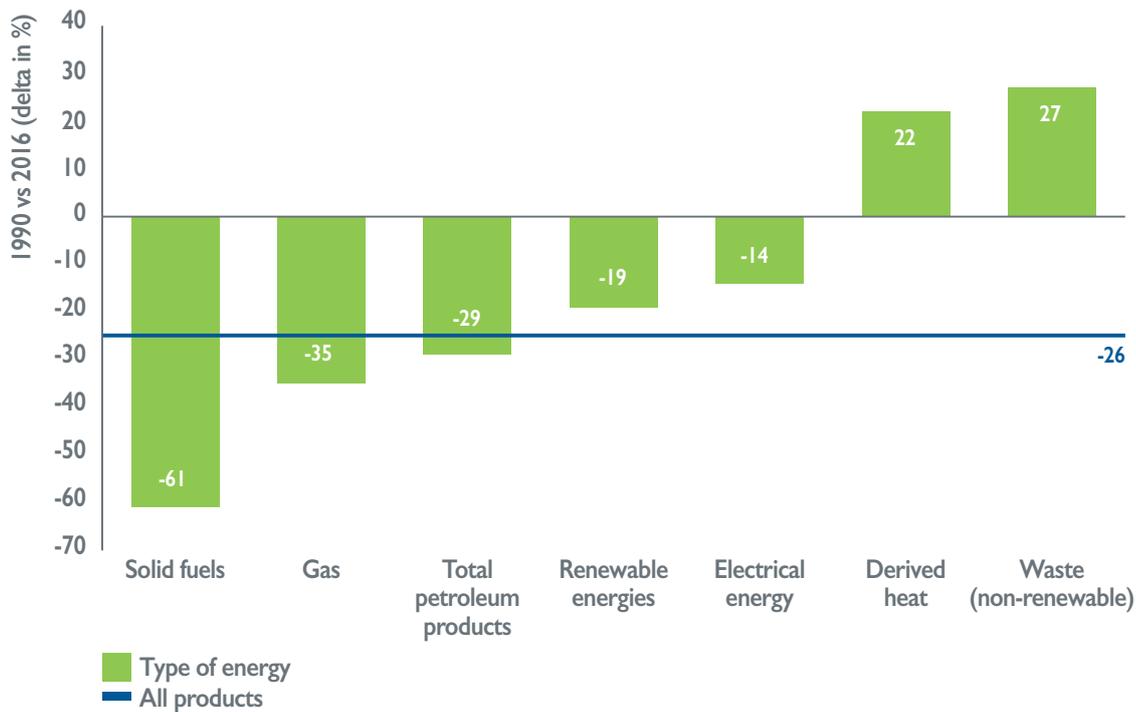
Energy

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Environment

A significant reduction in energy consumption* since 1990

EU chemicals energy consumption*: 2016 compared to 1990 (delta in %)



Source: Eurostat and Cefic analysis 2018

* Chemicals and pharmaceuticals, fuel and power consumption

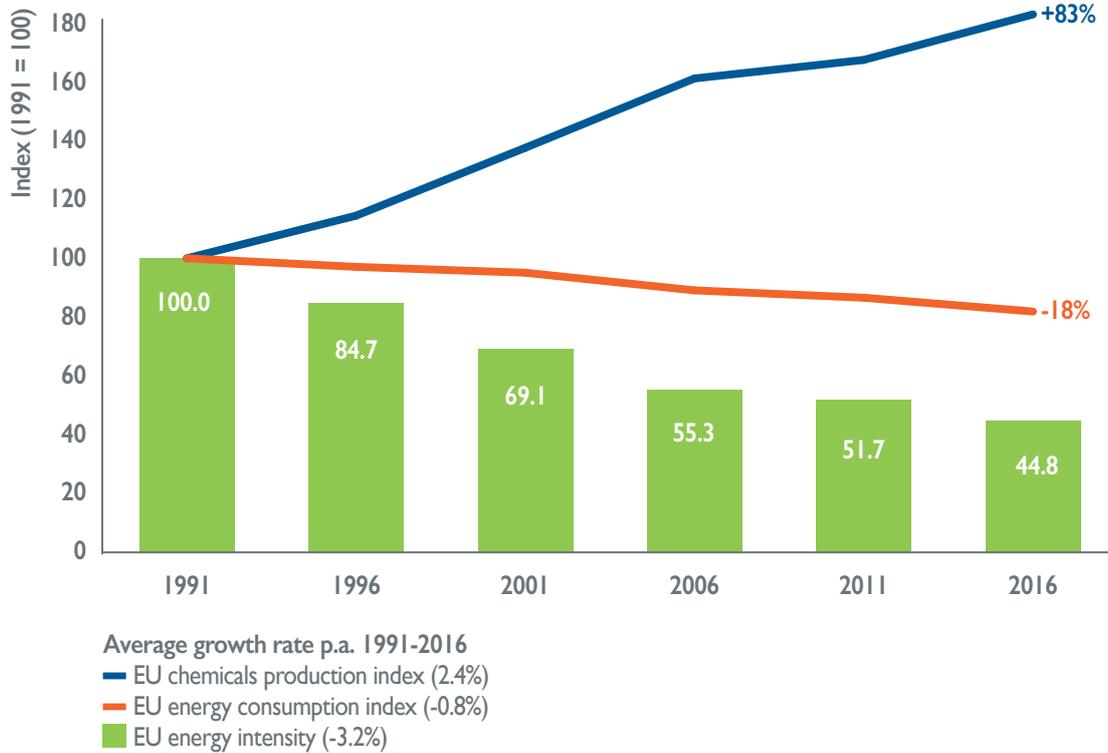
Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- In absolute terms, the EU chemical industry significantly reduced its fuel and power consumption by 18.3 million tonnes of oil equivalent from 1990 to 2016. More than half of this decline was driven by the reduction in gas consumption as a source of energy used by the EU chemical industry.
- Gas consumption amounted to 17.4 million tonnes of oil equivalent (TOE) in 2016, down from 26.9 million tonnes of oil equivalent (TOE) in 1990 (35%).
- The EU chemical industry dropped its consumption of solid fuels from 7.4 to 2.9 million tonnes of oil equivalent (TOE) between 1990 and 2016. The reduction of solid fuels looks impressive, with a nearly 60% decrease in 2016 compared to 1990. Finally, consumption of total petroleum products and electrical energy dropped by 3.1 and 2.5 million tonnes of oil equivalent (TOE) respectively during the same period.

Energy intensity* halved during 25 year period

Energy intensity* in the EU chemical industry



Source: Eurostat and Cefic analysis 2018

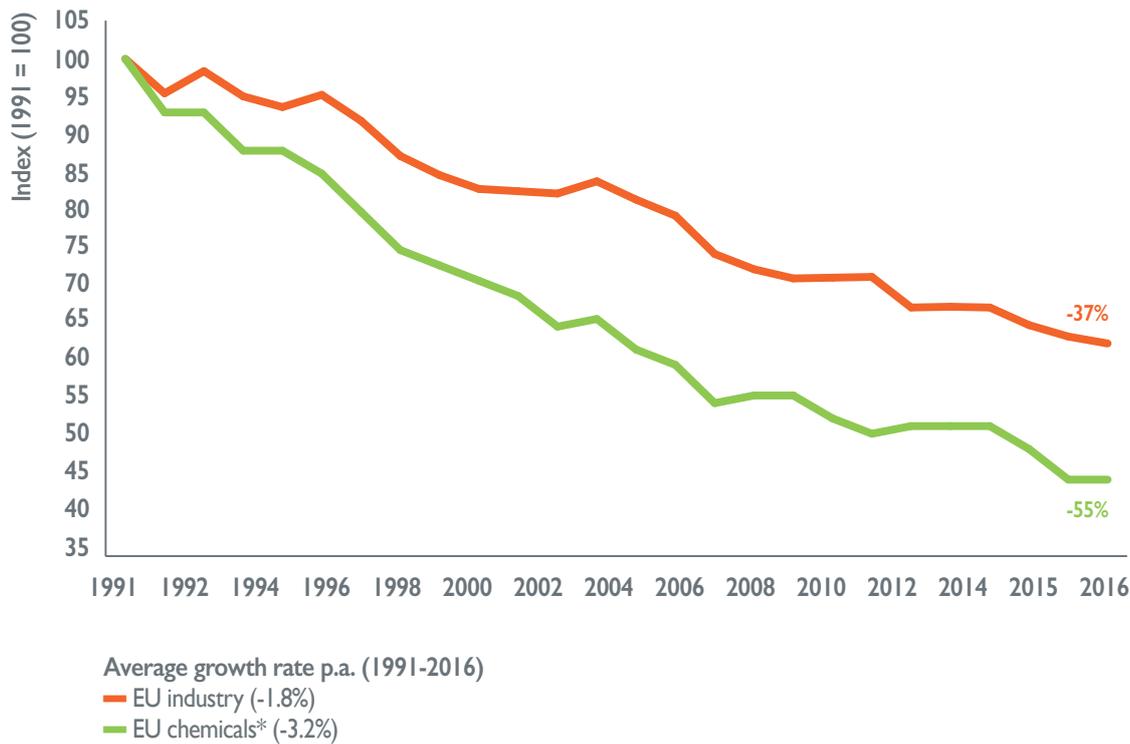
* Energy intensity is measured by energy input per unit of chemicals production (including pharmaceuticals)

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

- The EU chemicals sector has been a pioneer in energy efficiency. It recognised early that in order to be competitive in a global market, competitive advantages must be sought at every opportunity.
- As one of the most energy-intensive sectors, chemical companies have also had more scope for reduction than others. By making processes more efficient, including the construction of new facilities, the energy efficiency drive has been sustained over many years. Making any further significant improvements requires technological breakthroughs.
- For many years, the EU chemical industry, including pharmaceuticals, has made strenuous efforts to improve energy efficiency by reducing its fuel and power energy consumption per unit of production.
- By 2016, energy intensity – energy consumption per unit of production – in the chemical industry, including pharmaceuticals, was 55% lower than in 1991. Further improvements to energy efficiency are subject to decreasing returns, however. The chemical industry succeeded during the 25 years from 1991 to 2016 in continuously increasing its output while at the same time keeping its energy input relatively constant.
- As a result, the EU chemical industry has excelled in significantly lowering its energy intensity by an average of 3.2% per year. The analysis shows that the improvements in energy efficiency were spectacular during the first 15 years from 1991 to 2005. The past 10 years from 2005 to 2016 show a less significant performance.

Chemicals* sector is constantly performing better than overall industry

Energy intensity: chemicals vs total industry



Source: Eurostat and Cefic analysis 2018
* Including pharmaceuticals

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

- Energy intensity in the EU chemical industry decreased by an average of 3.2% per annum from 1990 to 2016. As for the whole of the EU manufacturing sector, energy intensity went down by 1.8% per year during the same period.
- Energy intensity in the EU chemical industry was 55% lower in 2016 compared with 25 years ago.



CAPITAL & R&I SPENDING

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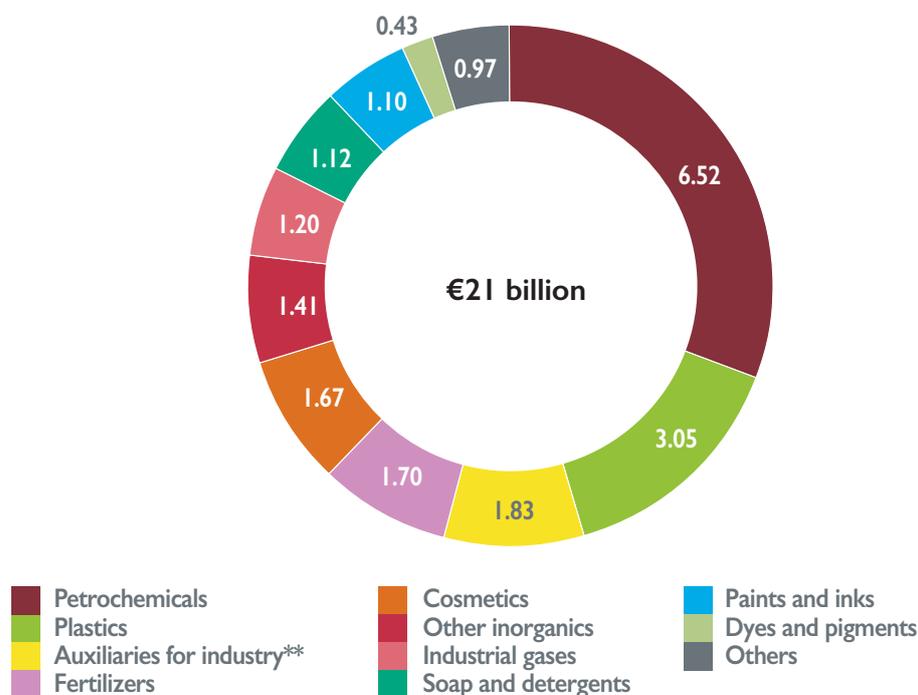
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Petrochemicals is the largest investor* in the EU chemicals sector

Capital spending in the EU chemical industry broken down by sub-sectors (€ billion)



Source: Eurostat SBS Data (2015) and Cefic analysis 2018

* Eurostat code V15110 - Gross investment in tangible goods

** Eurostat Nace code, 2059 other chemical products n.e.c.

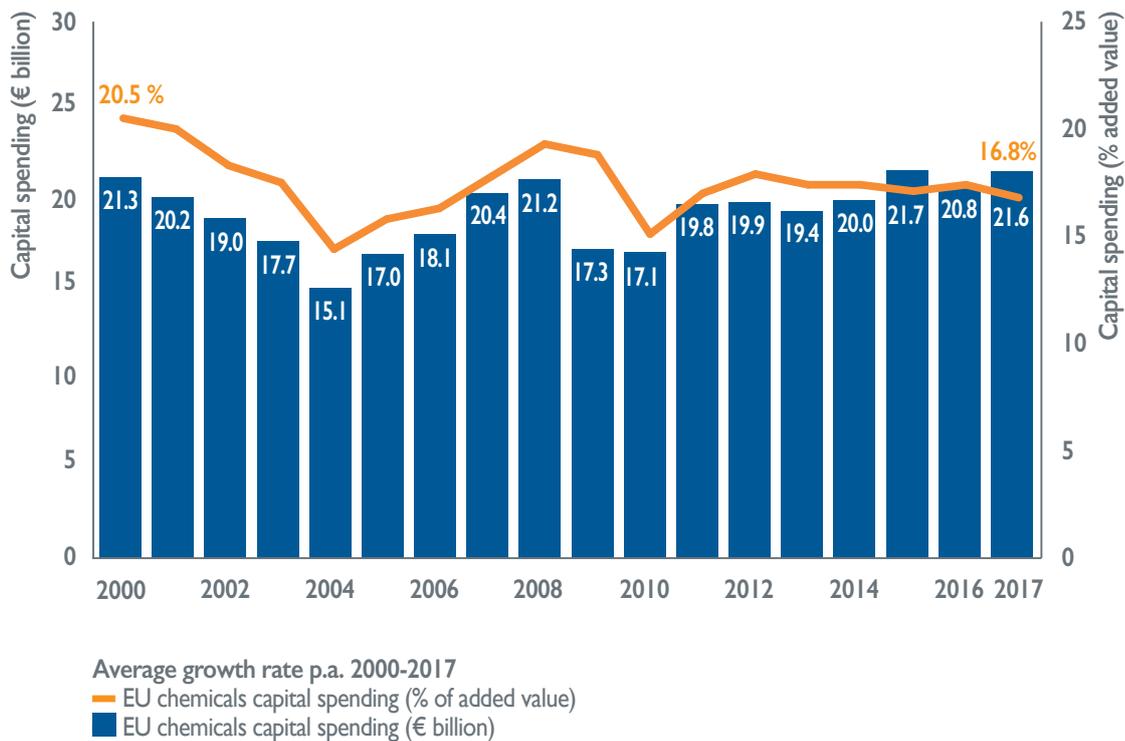
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- Gross investment in tangible goods is defined as investment during the reference period in all tangible goods. Included are new and existing tangible capital goods, whether bought from third parties or produced for own use (i.e. Capitalised production of tangible capital goods), having a useful life of more than one year including non-produced tangible goods such as land. Investments in intangible and financial assets are excluded (see Eurostat code, V15110).
- Nearly one third of EU chemicals investment is attributable to the petrochemicals business. With €6.5 billion, petrochemicals is the largest investor in the EU chemicals sector, followed by plastics and "auxiliary for industry".
- On the global scene, the European petrochemicals industry is still in challenging times. All regions are expanding their petrochemicals production bases. These investments are usually not intended as stand-alone plants, but as an initial step to generate huge chemical and, subsequently, manufacturing hubs.
- But, several major petrochemical projects, including the first steam cracker to be built in Europe in 20 years (ethane/ Ineos) and propane dehydrogenation plants, have been announced in 2017–18 for Europe.
- It is the first time in many years that Europe has seen capital-investment announcements in petrochemicals of this size. Why have conditions become favourable again for big petrochemical projects in this region? Over the past four years, the overall conditions for petrochemical producers in Europe have been easing up; the oil/gas ratio especially has improved, and margins have opened up for European cracker operators.
- Demand has also increased, based on renewed growth in the region. As far as the projected investments are concerned, most projects announced address company-specific balance adjustments within their integrated value chains.

EU capital spending reaches the second highest level since 2000

Capital spending in the EU chemical industry



Source: Cefic Chemdata International 2018

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

- Capital investment is a key factor in securing the future development of the chemical industry. And, in many cases, major equipment or plant renewals require long-term planning. Such investments are not only related to the improvement of productivity or introduction of new products but are also due to the need to comply with regulations or reduce operating costs.
- The chart illustrates clearly that investment (in absolute figures) in the European Union has been increasing. EU chemicals investment reached the value of €21.6 billion in 2017 – the second highest level of capital spending since 2000.
- In relative terms, the ratio of capital spending to added value, or capital intensity, of the chemical industry in the European Union has been increasing gradually since 2010, reaching the value of 16.8% in 2017. This is slightly below the long-term average intensity over the years 2000-2016.
- The European chemical industry continues to believe in the future. It needs to maintain investment in its existing infrastructure and in new production facilities to ensure the chemicals sector has a viable and vibrant future.

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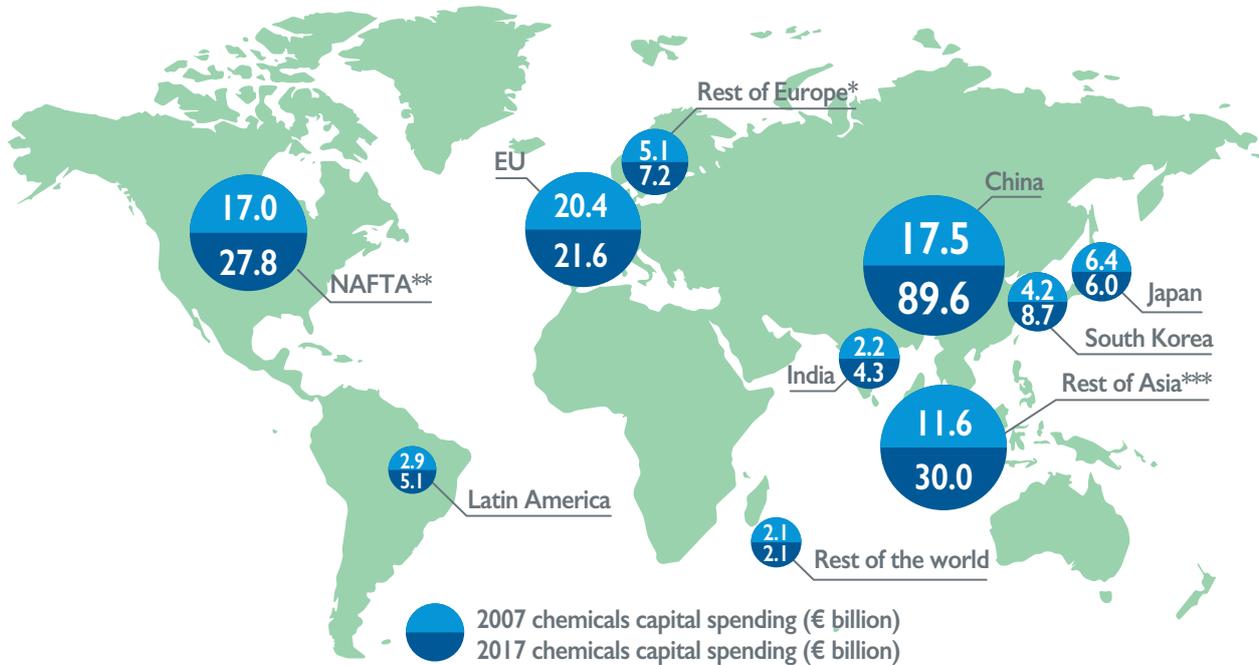
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China dominates world chemicals investment

Capital spending by region



Source: Cefic Chemdata International 2018

* Rest of Europe covers Switzerland, Norway, Turkey, Russia and Ukraine

** North American Free Trade Agreement

*** Asia excluding China, India, Japan and South Korea

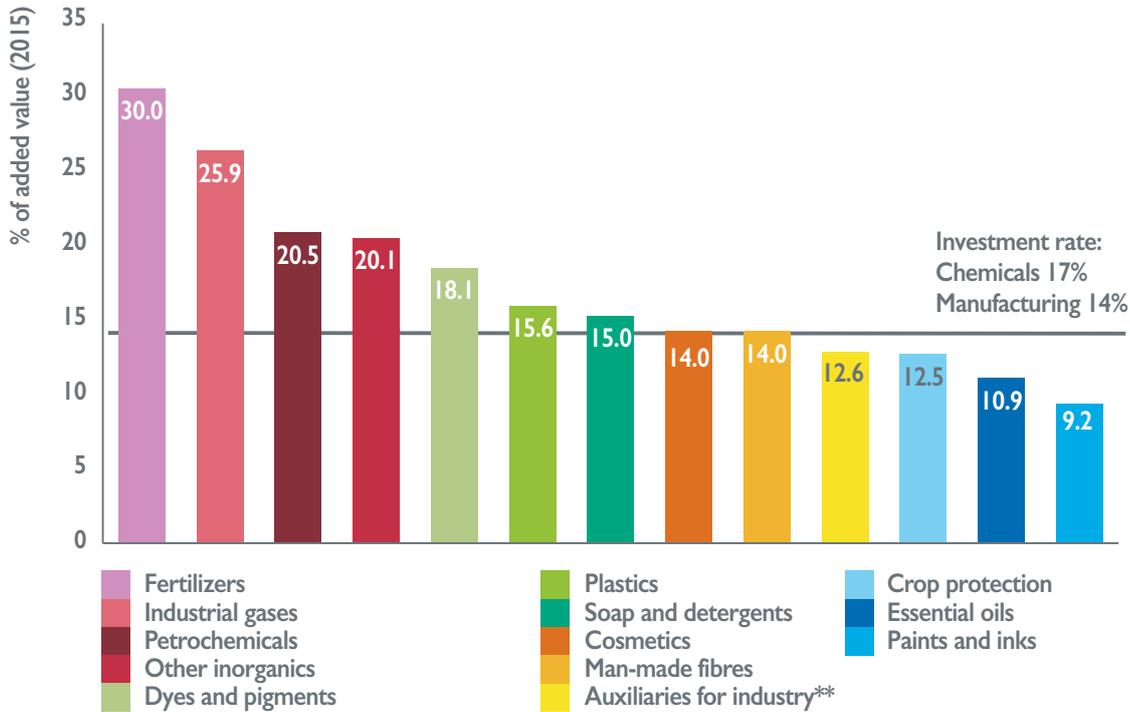
Unless specified, chemical industry excludes pharmaceuticals

Unless specified, EU refers to EU 28

- In absolute values, the level of world investment in the chemicals sector was 2.3 times higher in 2017 compared to ten years ago (€202.2 billion versus €89.5 billion). During the 11-year period from 2007 to 2017, global investment grew per annum about 8.5% on average. This is far below the Chinese investment growth during the same period (17.8%).
- In terms of growth, China is by far and away outpacing the other economies in the world such as Rest of Asia (10%), India (6.8%), South Korea (7.6%), Latin America (5.6%), North America (5.0%) and Rest of Europe countries (3.4%). In 2017, China contributed 44% of global investment, up from 19.5% in 2007.
- Europe (EU28 + Rest of Europe) is still lagging behind the main regions in the world when comparing 2017 to 2007. However, in absolute terms, Europe still ranks second, contributing 14.2% of global investment in 2017. NAFTA came next, accounting for 13.8% of global investment the same year.

Capital spending (% of sales): 21% higher in chemicals than manufacturing average

Capital intensity* in the EU chemical industry broken down by sub-sectors



Source: Eurostat SBS Data (2015) and Cefic analysis 2018

* Eurostat V15110 - Gross investment in tangible goods; intensity is defined as V94415 (investment/value added at factors cost)

** Nace code, 2059 other chemical products n.e.c.

Unless specified, chemical industry excludes pharmaceuticals
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- Data analysis compares capital spending in the EU chemicals business broken down by sub-sector. The metric used in the analysis is capital intensity, meaning capital spending expressed as percentage of added value.
- The analysis shows capital intensity is equal to 17% in the EU chemicals business, above the 14% registered in the EU manufacturing sector as a whole.
- The highest capital intensity is attributable to fertilizers and industrial gases, followed by petrochemicals, which is the largest investor in the EU chemicals business. The lowest intensity values are attributable to “crop protection” (12.5%), followed by “essential oils” (10.9%), and “paints and inks” (9.2%).

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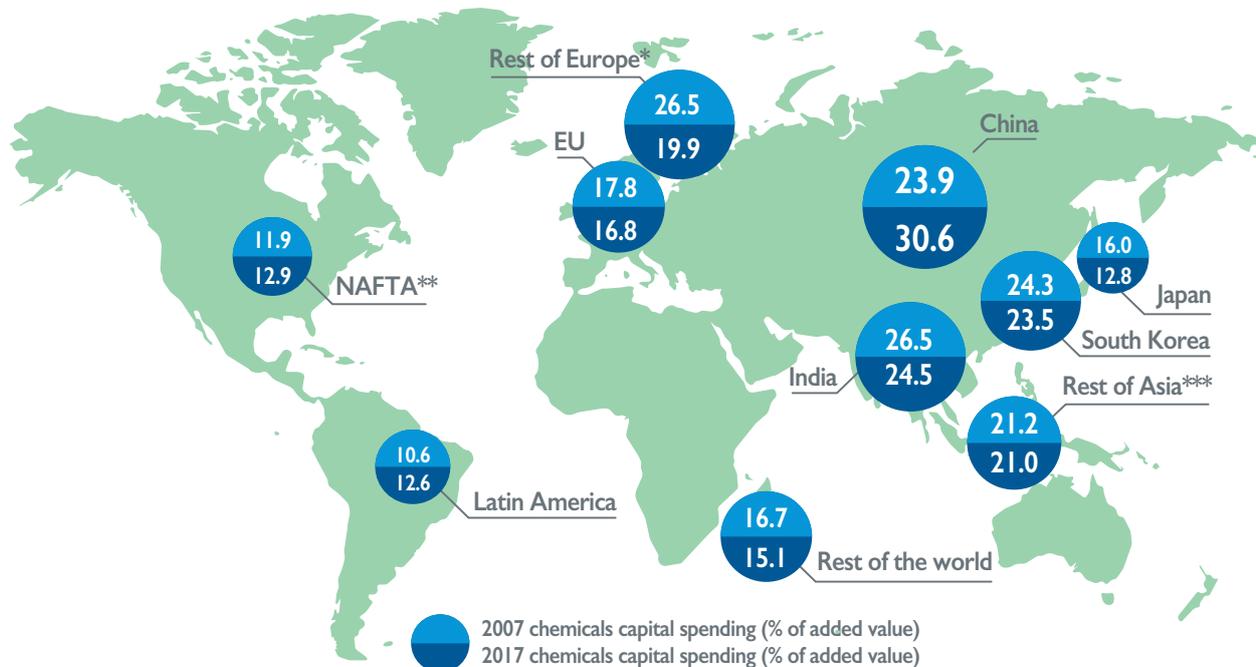
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EU capital intensity far below key emerging economies

Capital spending (% added value), 2007 versus 2017



Source: Cefic Chemdata International 2018

* Rest of Europe covers Switzerland, Norway, Turkey, Russia and Ukraine

** North American Free Trade Agreement

*** Asia excluding China, India, Japan and South Korea

Unless specified, chemical industry excludes pharmaceuticals

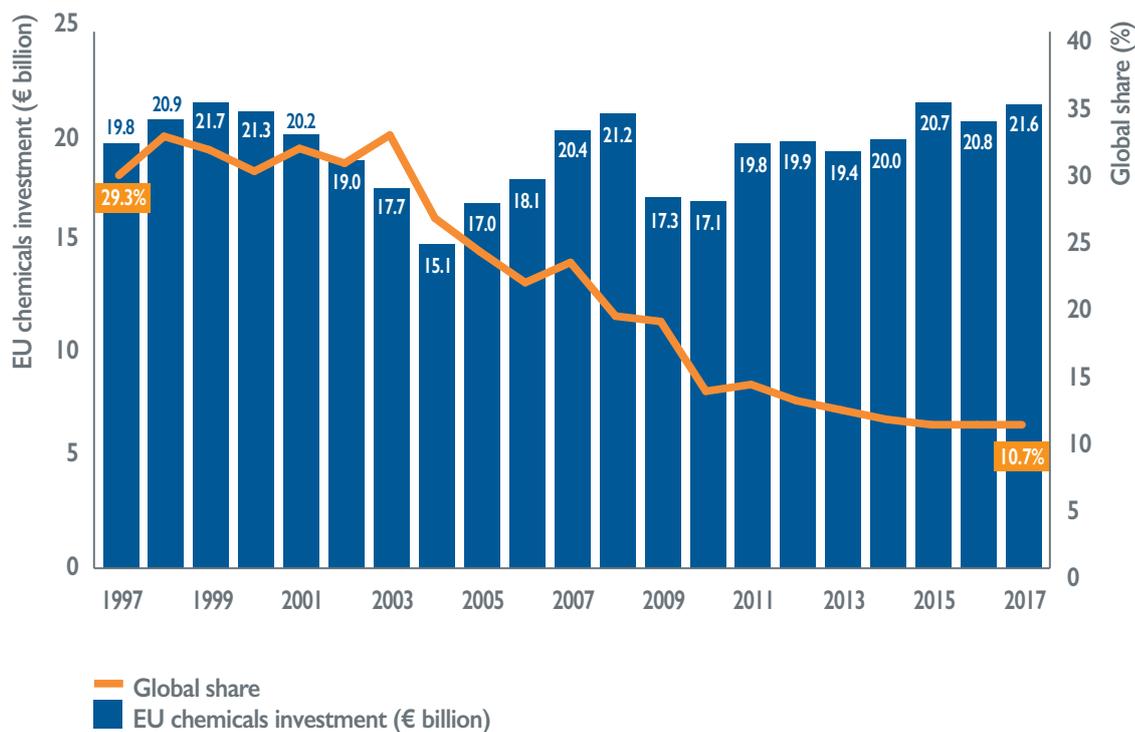
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- Capital spending intensity in China and India is far higher than in the rest of the world. Capital intensity for China increased significantly from 23.9% in 2007 to 30.6% in 2017. With 16.8% in 2017, the European Union is still behind the emerging-producing regions in Asia, and the European countries belonging to the non-EU area.

- Capital spending intensity is a key factor affecting competitiveness. It is both an indicator of loss of attractiveness as well a driver of future competitiveness: the more investment the more competitive the region becomes and vice versa. For example, there are nearly 200 chemical investment projects in the US, totalling nearly 130 billion US dollars, while China remains the key target of chemical investment.

EU loses 2/3 of its original market share during 20-year period

EU share of global chemicals investment



Source: Cefic Chemdata International 2018

Unless specified, chemical industry excludes pharmaceuticals
 Unless specified, EU refers to EU 28

- Developments during the last 20 years indicate that the European Union position has weakened. In 1997, the EU posted capital spending of €19.8 billion, making up 29.3% of global chemicals investment. The European Union at that time was by far the largest chemicals investor; dominating the chemicals world ranking.
- EU chemical spending has been growing modestly since 1997. By contrast, global investment posted an impressive increase from €67.5 billion in 1997 to €202.2 billion in 2017. Therefore, the EU investment market share has lost 2/3 of its original value in 20 years – down from 29.3% in 1997 to 10.7% in 2017.

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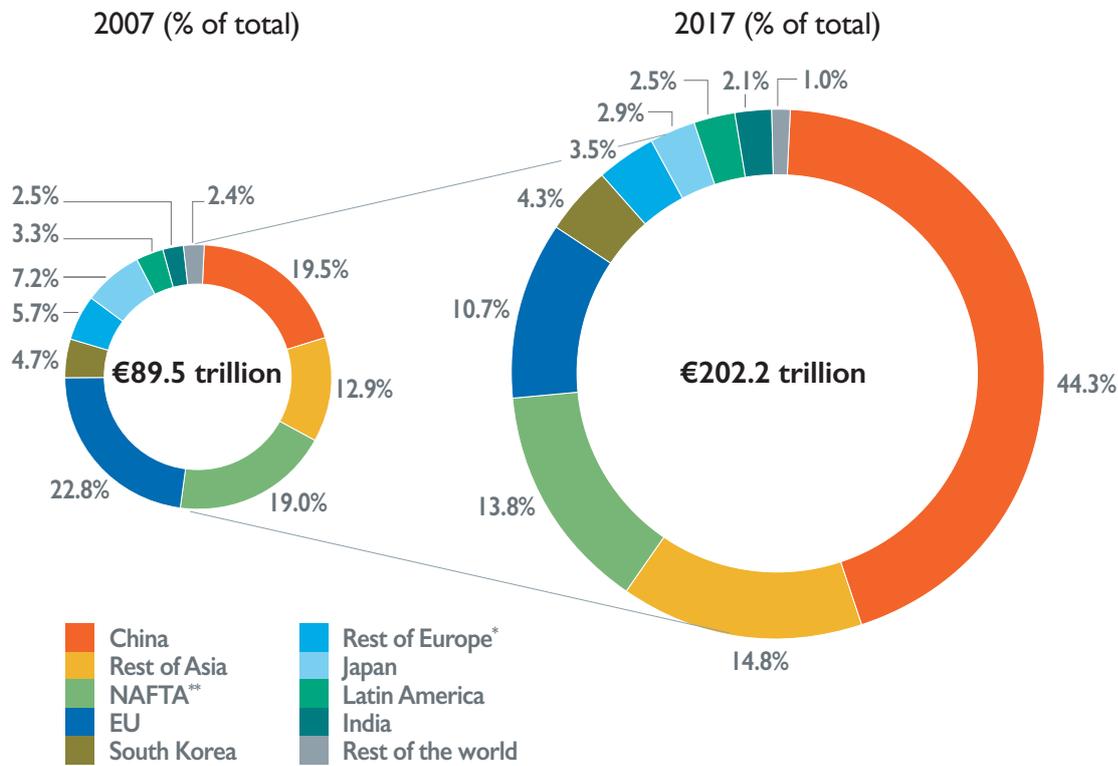
Energy

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Decreasing share of chemicals capital spending for the EU, NAFTA and Japan

Chemicals capital spending by country, 2017 (% of total)



Source: Cefic Chemdata International 2018

* Rest of Europe covers Switzerland, Norway, Turkey, Russia and Ukraine

** North American Free Trade Agreement

Unless specified, chemical industry excludes pharmaceuticals

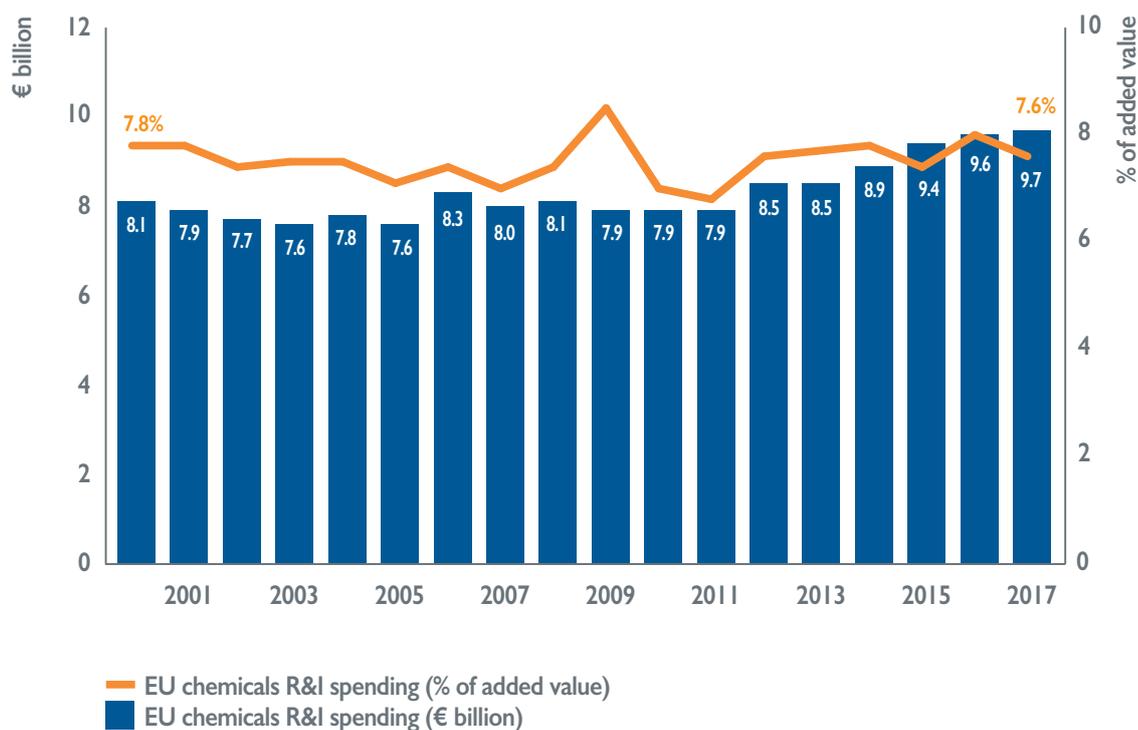
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A look at the global capital spending in the chemicals business shows the following:

- World capital spending posted the value of €202.2 billion in 2017, up from €89.5 billion in 2007. Investment around the world grew at 8.5% per annum on average during the years (2007-2017). It showed a very encouraging trend: chemical companies around the world have more than doubled their investment in ten years' time.
- The strong development in China and the other emerging countries in Asia drove the significant increase in global investment in the chemicals business. China accounted in 2017 for 44.3% of global investment, far above the 19.5% reported in 2007. The other emerging countries in Asia reported a similar results but less spectacular compared to China.
- The EU, NAFTA and Japan experienced a significant decline in their world market share during the years 2007-2017. The EU investment market share went down from 22.8% in 2007 to 10.7% in 2017. A similar result for NAFTA: 13.8% in 2017 down from 19.0% in 2007. Japan posted a more dramatic decline, from 7.2% in 2007 to 2.9% in 2017.

EU R&I spending reaches the highest level since 2000

R&D spending in the EU chemical industry



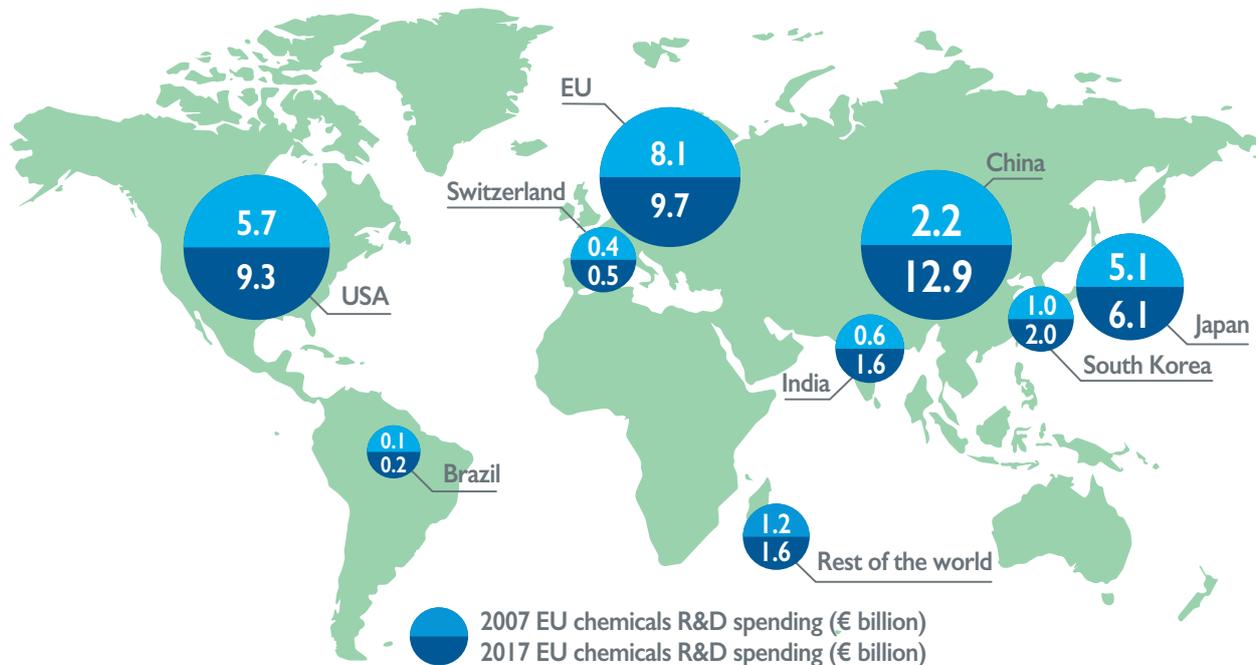
Source: Cefic Chemdata International 2018

Unless specified, chemical industry excludes pharmaceuticals
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- Investments in research and innovation (R&I) are key elements in securing the future of the chemical industry and needed to maintain/increase its strong contribution to solving societal challenges. Indeed, the chemical industry is an enabler of innovation in numerous downstream value chains through its products and technologies.
- Spending on research and development in the EU chemical industry was valued at an average annual level of €8.1 billion during the period from 2000 to 2017. In relative terms, the ratio of R&I spending to added value, or R&I intensity was valued at an average of 7.5% during the same period. Added value of the EU chemical industry had an average growth rate of 1.2% during the whole period 2000-2017. R&I spending grew by a similar growth rate (1.1%) during the same period. As a result, R&I intensity posted a similar value in 2017 compared to 2000.
- In 2017, R&I spending reached the highest value since 2000.

China outspends industrial and emerging countries in chemicals R&I

R&D spending by region



Source: Cefic Chemdata International 2018

Unless specified, chemical industry excludes pharmaceuticals
 Unless specified, EU refers to EU 28

- Global R&I spending in the chemicals sector reached the value of €43.95 billion in 2017, up from €24.43 billion in 2007. On a global basis, R&I spending was 80% higher in 2017 compared to ten years ago.
- During the 11-year period from 2007 to 2017, global R&I grew about 6.0% on average. This is far below Chinese R&I growth during the same period (19.3%). China is by far outpacing the other economies in the world.

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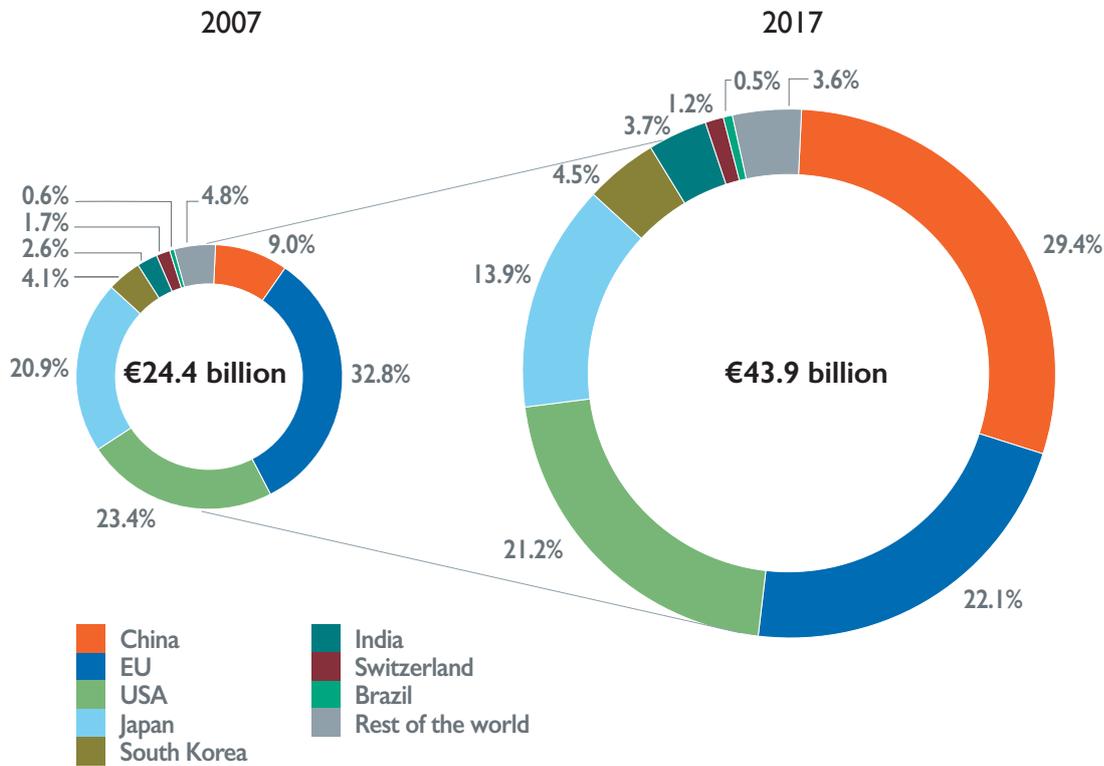
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Decreasing share of chemicals R&I spending for the EU, USA and Japan

Chemicals R&I spending by country, 2007 vs 2017 (% of total)



Source: Cefic Chemdata International 2018

Unless specified, chemical industry excludes pharmaceuticals
 Unless specified, EU refers to EU 28

- In 2017, China contributed nearly 30% of global investment, up from 9.0% in 2007. R&I spending in the European Union grew at a rate of 2.0% on average from 2007 to 2017. The European Union ranks second, contributing 22.1% of global investment in 2017. The USA came next, representing 21.2% of global investment in 2017, down from 23.4% in 2007.
- The results show a decreasing share of chemicals R&I spending for industrial regions. The EU area, the USA and Japan posted a decline of their market share over the past 10 years.
- The EU share of the global R&I spending went down from 32.8% in 2007 to 22.1% in 2017. A less spectacular result for the USA: 21.2% in 2017 down from 23.4% in 2007. Japan posted a more dramatic decline from 20.9% in 2007 to 13.9% in 2017.

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Total greenhouse gas (GHG) emissions* fall nearly 61% since 1990

Total greenhouse gas emissions* in the EU chemical industry



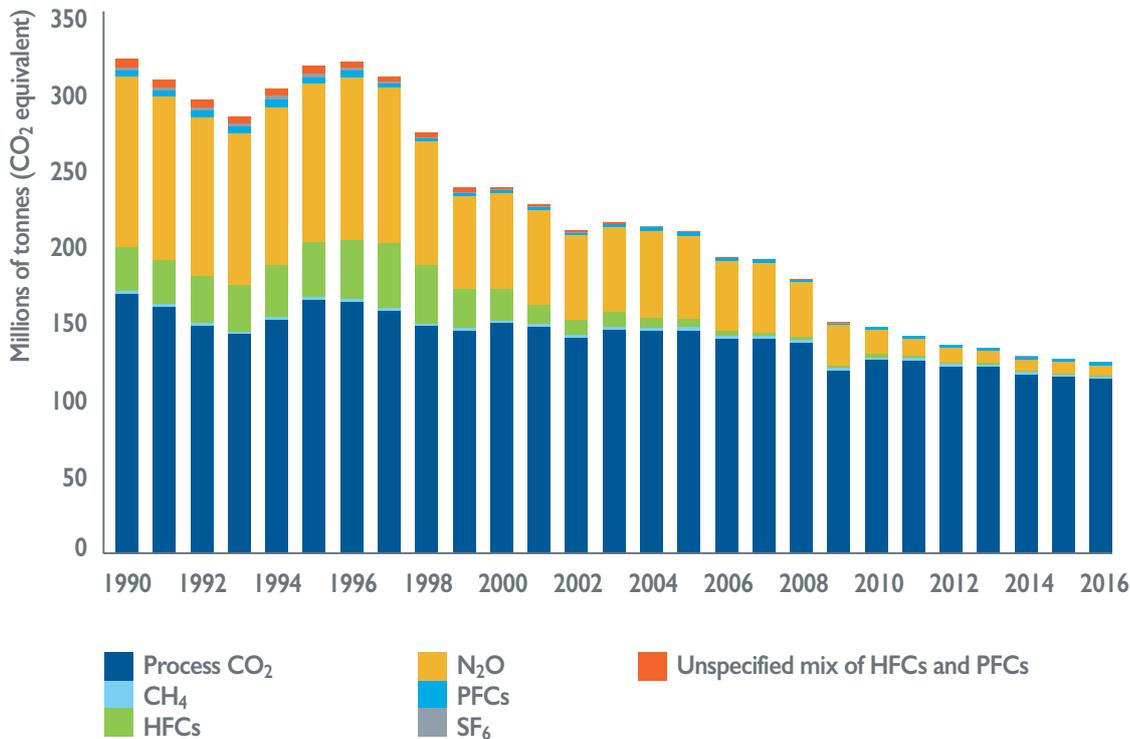
Source: European Environment Agency (EEA) and Cefic analysis 2018
* Energy (Fuel and Power CO₂) included

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- Long-term data gives evidence of the EU chemical industry, including pharmaceuticals, having a solid track record from 1990 to 2016 in reducing its greenhouse gas (GHG) emissions.
- According to the European Environmental Agency (EEA), the EU chemical industry, including pharmaceuticals, emitted a total of 126.0 million tonnes of CO₂ equivalent in 2016, down from a total of 325.1 million tonnes in 1990. This 61.2% decrease clearly illustrates how much importance the chemical industry attaches to reducing GHG emissions.
- Our industry's shift to less carbon-intensive energy sources has helped reduce GHG emissions. Much of the decline over the past 20 years is linked to abatement of nitrous oxide (N₂O), which has a higher global warming potential than carbon dioxide (CO₂) and is emitted by some chemical processes.

Total GHG emissions* fall by 199.1 million tonnes (CO₂) since 1990

Greenhouse gas emissions* in the EU chemicals sector, million of tonnes (CO₂ equivalent)



Source: European Environment Agency (EEA) and Cefic analysis 2018

* Energy (Fuel and Power CO₂) included

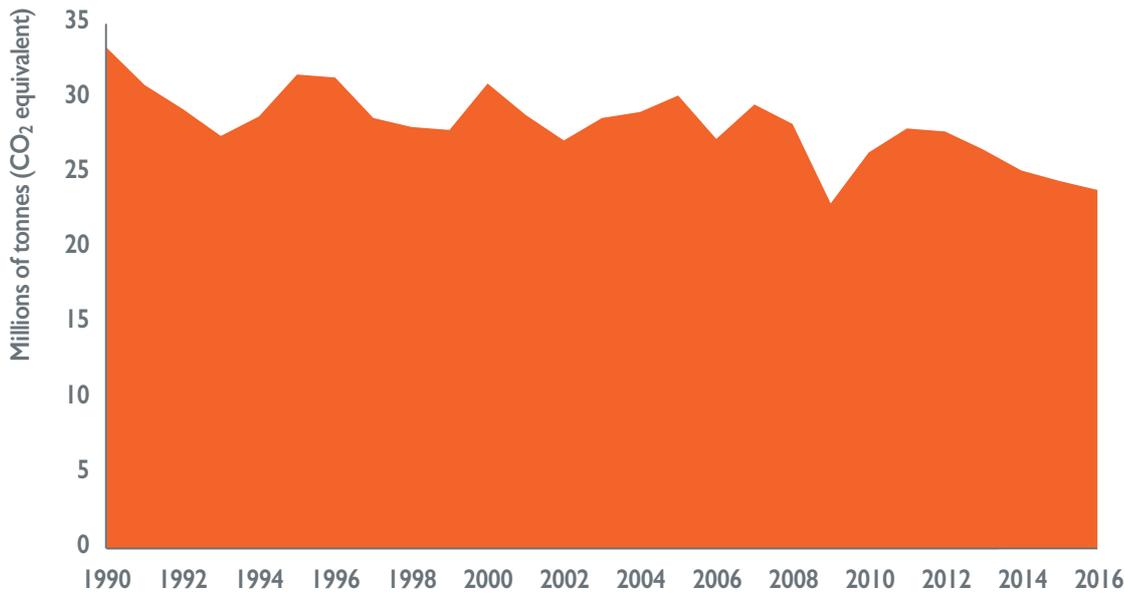
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- This chart gives an overview of the main trends in the EU chemical industry (including pharmaceuticals) GHG emissions for the period 1990–2016.
- According to the European Environmental Agency (EEA), the most important GHG is CO₂ for the EU chemical industry (including pharmaceuticals). It accounted for about 91% of total EU GHG emissions in 2016. In 2016, EU CO₂ emissions were 114.6 million tonnes, which was 33% below 1990 levels. Compared to 2015, CO₂ emissions decreased by 1.2%.
- The second most important GHG is N₂O, accounting for 5.3% of total EU GHG emission in 2016. EU N₂O emissions were 6.7 million tonnes, which was 94% below 1990 levels. Compared to 2015, N₂O emissions decreased by 12.1%.
- Total greenhouse gas emissions (GHG)* have fallen by 199.1 million tonnes (CO₂) since 1990. Data shows that emissions of CH₄ increased whereas emissions of the other GHG such as CO₂, HFCs, N₂O, SF₆, and PFCs decreased during the same period.

Ammonia: total GHG emissions* fall 28% since 1990

Ammonia production:
total greenhouse gas emissions*, million of tonnes (CO₂ equivalent)



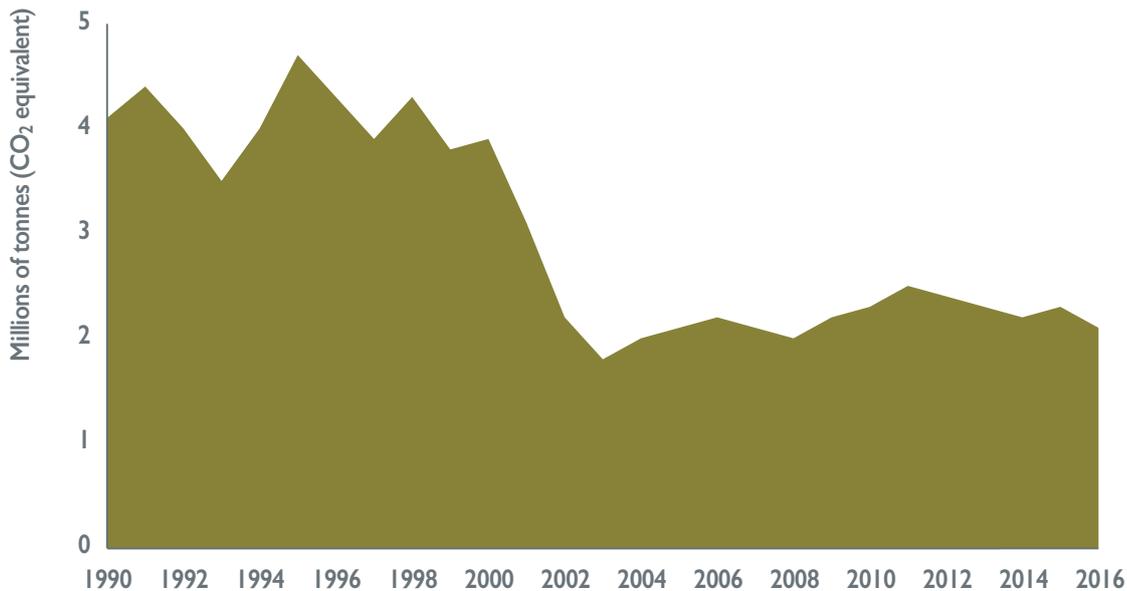
Source: European Environment Agency (EEA) and Cefic analysis 2018
* Energy (Fuel and Power CO₂) included

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- The long-term analysis shows a strong decline in greenhouse gas (GHG) emissions for the period 1990–2016. The chemical industry continues to devote much effort to reducing GHG emissions from ammonia production.
- According to the European Environmental Agency (EEA), EU production of ammonia by the EU chemical industry emitted a total of 23.9 million tonnes of CO₂ equivalent in 2016, down from a total of 33.4 million tonnes in 1990. Total GHG emissions from ammonia production went down 1.3% per annum on average during the years 1990-2016. More than one fifth of original emission values in 1990 are reduced (28%).
- In relative terms, more than one third (38%) of total GHG emissions are attributable to ammonia in 2016 (23.9 versus 62.5, million tonnes); this is far above the 15.7% posted in 1990 (33.4 versus 212.5, million tonnes).

Caprolactam, Glyoxal and Glyoxylic acid: total GHG emissions* fall 49% since 1990

Caprolactam, Glyoxal and Glyoxylic acid production:
total greenhouse gas emissions*, million of tonnes (CO₂ equivalent)



Source: European Environment Agency (EEA) and Cefic analysis 2018

* Energy (Fuel and Power CO₂) included

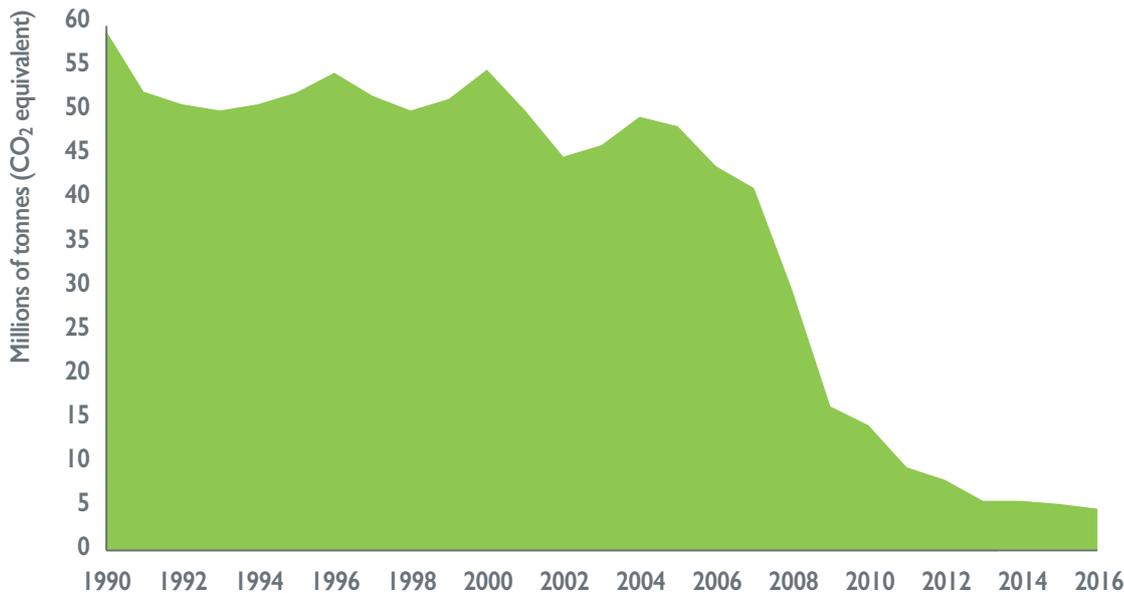
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- According to the European Environmental Agency (EEA), the EU production of CGGA, (Caprolactam, Glyoxal and Glyoxylic Acid) by the EU chemical industry emitted a total of 2.1 million tonnes of CO₂ equivalent in 2016, down from a total of 4.1 million tonnes in 1990. Total GHG emissions from CGGA production went down 2.6% per annum on average during the years 1990-2016. Half of the original emission values in 1990 are reduced.
- Long-term data shows a significant reduction of (GHG) emissions during the years 1990-2003. Total GHG emissions from CGGA production went down 11.5% per annum on average during the years (1990-2003). Since 2004, GHG emissions have been relatively flat.
- In relative terms, GHG emissions from producing CGGA accounted for 3-4% of total GHG emissions in the EU chemical industry in 2016 (2.1 versus 62.5, million tonnes).

Nitric acid: total GHG emissions* fall 92% since 1990

Nitric acid production:
total greenhouse gas emissions*, million of tonnes (CO₂ equivalent)



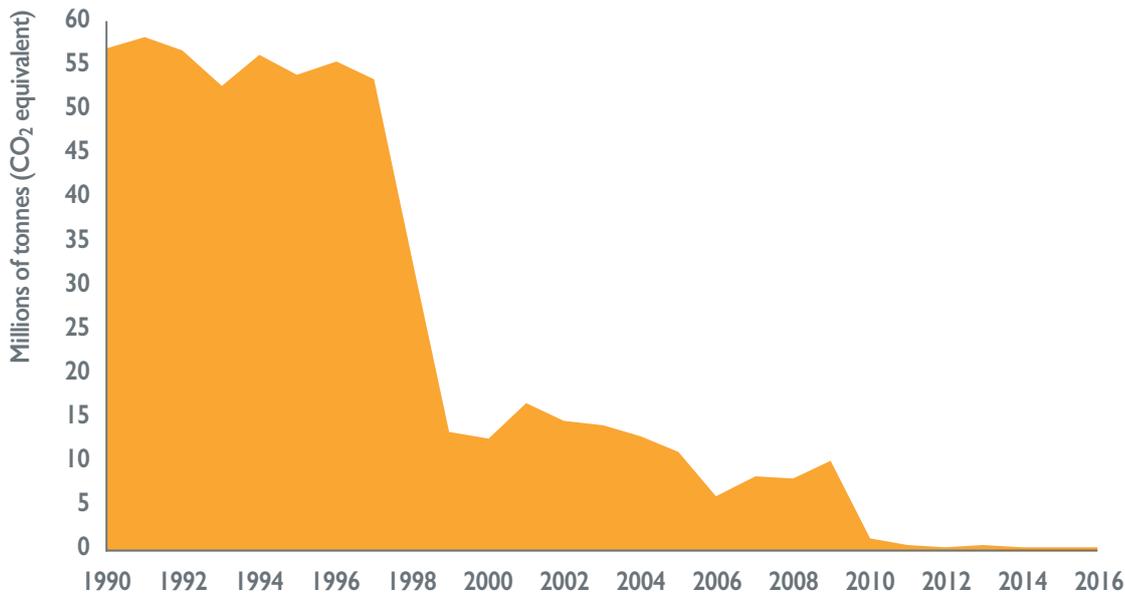
Source: European Environment Agency (EEA) and Cefic analysis 2018
* Energy (Fuel and Power CO₂) included

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- According to the European Environmental Agency (EEA), EU production of Nitric Acid by the EU chemical industry emitted a total of 3.95 million tonnes of CO₂ equivalent in 2016, down from a total of 49.6 million tonnes in 1990. Total GHG emissions from Nitric Acid production went down 9.3% per annum on average during the years 1990-2016. More than 90% of the original emission values in 1990 are reduced.
- Data shows a significant reduction of (GHG) emissions during the years 2006-2016. Total GHG emissions from CGGA production went down 20% per annum on average during the years 2006-2016. Since 2013, GHG emissions have been relatively flat.
- In relative terms, 6% of total GHG emissions are attributable to Nitric Acid in 2016 (3.95 versus 62.5, million tonnes); this is far below the 23% reported in 1990 (49.6 versus 212.5, million tonnes).

Adipic acid: total GHG emissions* fall nearly 100% since 1990

Adipic acid production:
total greenhouse gas emissions*, million of tonnes (CO₂ equivalent)



Source: European Environment Agency (EEA) and Cefic analysis 2018

* Energy (Fuel and Power CO₂) included

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- The long-term analysis shows a sharp decline in the greenhouse gas (GHG) emissions from 1990 to 2010. The chart shows an impressive reduction in total GHG emissions from Adipic Acid production between 1990 and 1999. This was followed by a gradual decline in GHG emissions during the years 1999-2009. Since 2010, there have been no significant changes.
- In relative terms, only 1% of total GHG emissions are attributable to Adipic Acid in 2016 (0.35 versus 62.5, million tonnes); this is far below the 27% posted in 1990 (57.6 versus 212.5, million tonnes).
- According to the European Environmental Agency (EEA), EU production of Adipic Acid by the EU chemical industry emitted a total of 0.35 million tonnes of CO₂ equivalent in 2016, down from a total of 57.6 million tonnes in 1990. Total GHG emissions from Adipic Acid production went down 17.8% per annum on average during the years 1990-2016. Nearly 99% of the original emission values in 1990 are reduced.

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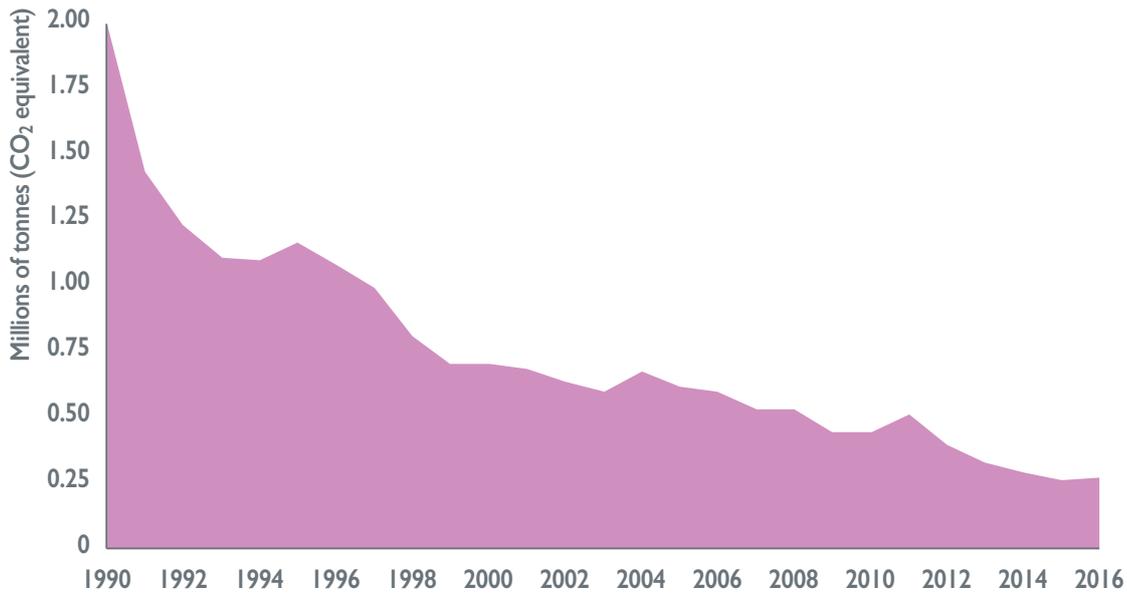
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Carbide: total GHG emissions* fall 86% since 1990

Carbide production:
total greenhouse gas emissions*, million of tonnes (CO₂ equivalent)



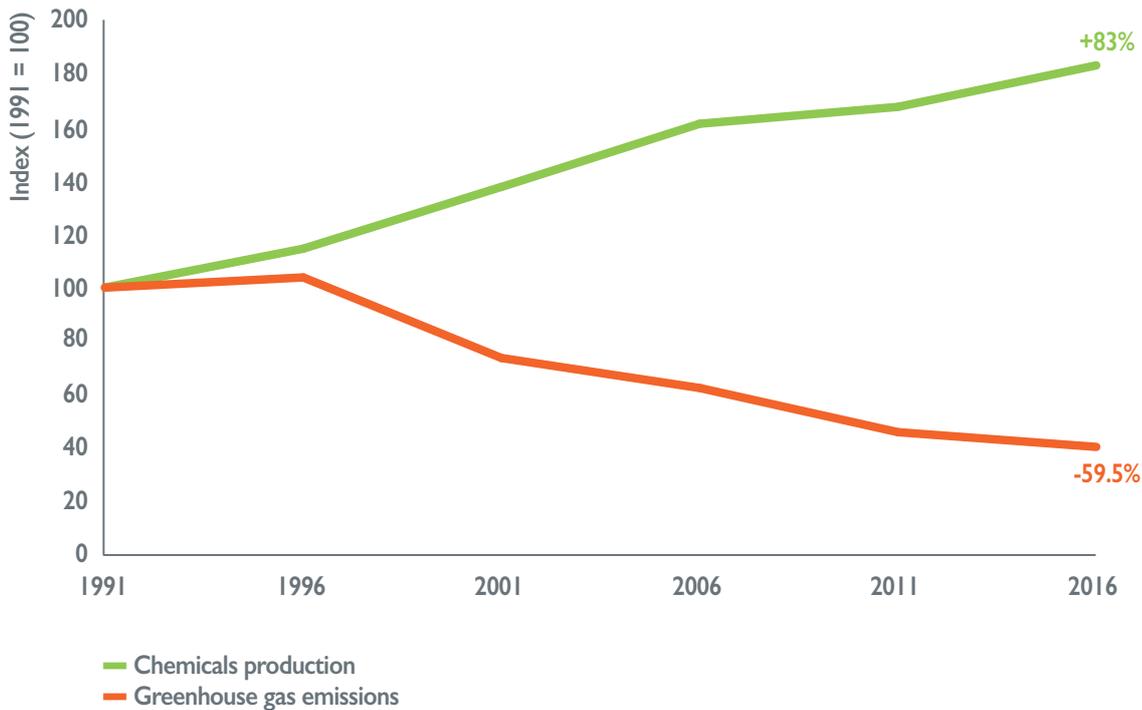
Source: European Environment Agency (EEA) and Cefic analysis 2018
* Energy (Fuel and Power CO₂) included

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- According to the European Environmental Agency (EEA), EU production of Carbide by the EU chemical industry emitted a total of 0.24 million tonnes of CO₂ equivalent in 2016, down from a total of 1.7 million tonnes in 1990.
- Total GHG emissions from Carbide production went down 7.4% per annum on average during the years 1990-2016. 86% of the original emission values in 1990 are reduced.
- In relative terms, less than 1% of total GHG emissions are attributable to Carbide in 2016 (0.24 versus 62.5, million tonnes).

Chemicals production**, greenhouse gas emissions*, decouple

Greenhouse gas emissions* and production**



Source: European Environment Agency (EEA) and Cefic analysis 2018

* Energy (Fuel and Power CO₂) included

** Including pharmaceuticals

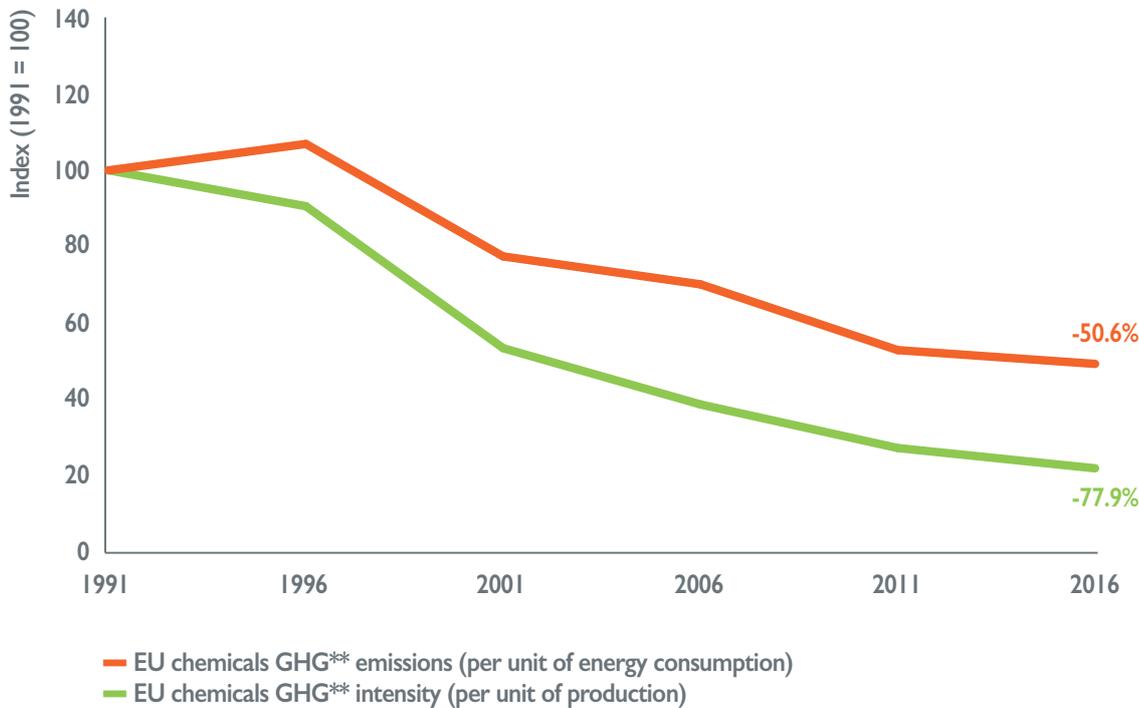
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- The 59.5% decrease from 1991 until 2016 in total GHG emissions is even more remarkable given that, at the same time, production in the EU chemical industry, including pharmaceuticals, expanded by 83.0%.
- This was achieved thanks to the chemical industry's conscious effort to develop cleaner technologies, and above all to increase energy efficiency. Besides increasing energy efficiency of its own processes, innovations in the chemical industry also help to increase the energy efficiency of downstream users and their products.
- Our products make a significant contribution to society's capacity to reduce GHG emissions. A study from the International Council of Chemical Associations (ICCA) entitled, "Innovations for Greenhouse Gas Reductions, 2009" found that the products of the chemical industry, over their lifecycle, save from 2.1 to 2.6 times the GHG emissions that are required to produce them. It also concluded that this ratio could increase to more than 4.1 by 2030.

Greenhouse gas intensity plummets 78% since 1991

Greenhouse gas emissions* per unit of energy consumption and per unit of production**



Source: European Environment Agency (EEA) and Cefic analysis 2018

* Energy (Fuel and Power CO₂) included
 ** Including pharmaceuticals

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- Over the last two decades, the chemical industry, including pharmaceuticals, has made an enormous effort to minimise the environmental impact of its production.
- Greenhouse gas (GHG) emissions per unit of energy consumption fell by 50.6% between 1991 and 2016. GHG intensity – GHG emissions per unit of production – fell by 77.9% from 1990 to 2016.

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Cefic, the European Chemical Industry Council, founded in 1972, is the voice of large, medium and small chemical companies across Europe, which provide 1.2 million jobs and account for 16% of world chemicals production.

Cefic members form one of the most active networks of the business community, complemented by partnerships with industry associations representing various sectors in the value chain. A full list of our members is available on the Cefic website: www.cefic.org/About-us

Cefic is an active member of the International Council of Chemical Associations (ICCA), which represents chemical manufacturers and producers all over the world and seeks to strengthen existing cooperation with global organisations such as UNEP and the OECD to improve chemicals management worldwide.

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