The European Chemical industry

A vital part of Europe's Future

SEII Conference-Sept 2022

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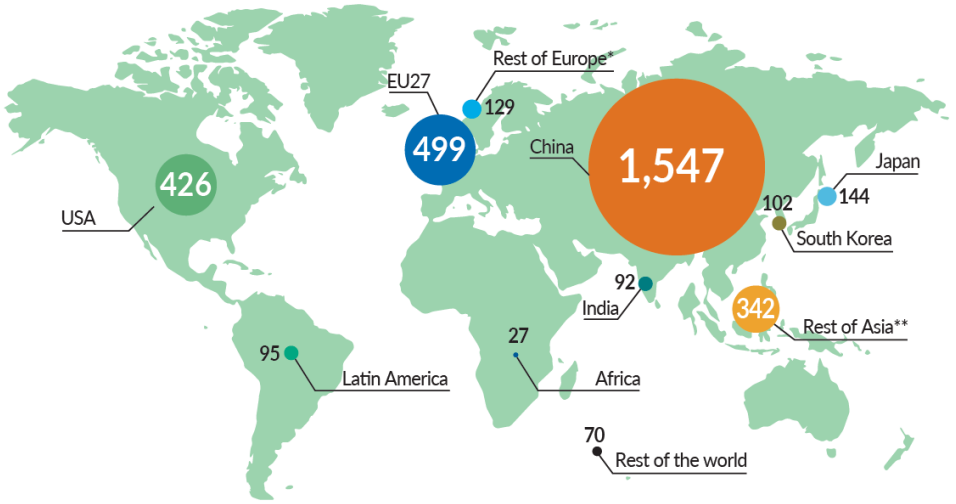
European and Global Insights

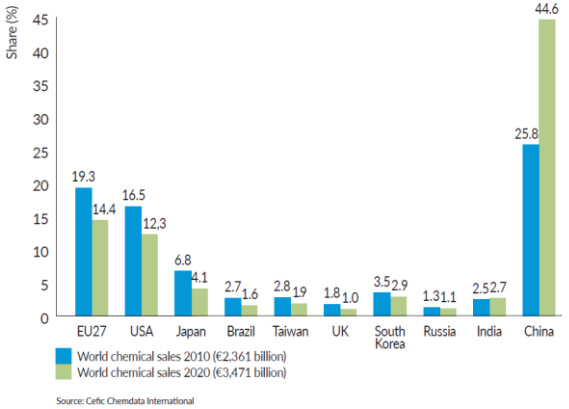
Europe is the second-largest chemicals producer in the world

World chemical sales (2020, €3,471 billion)



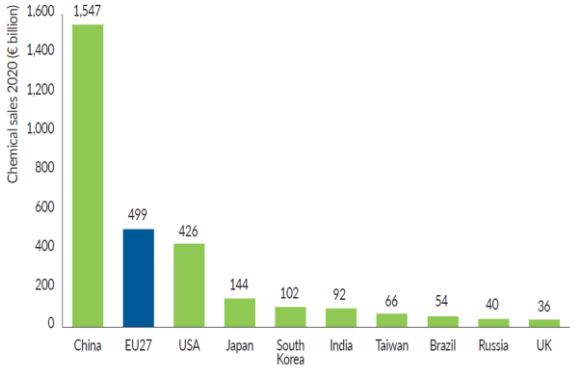
Source: Cefic Chemdata International
* Rest of Europe covers UK, Switzerland, Norway, Turkey, Russia and Ukraine
** Asia excluding China, India, Japan and South Korea

World chemical sales by country: top 10



Source: Cefic Chemdata International

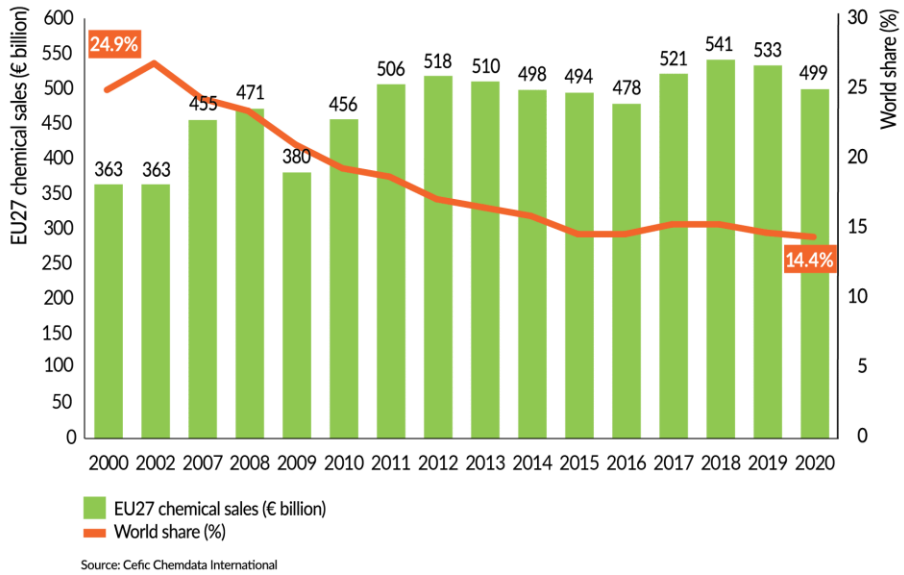
Chemical sales by country: top 10



Source: Cefic Chemdata International

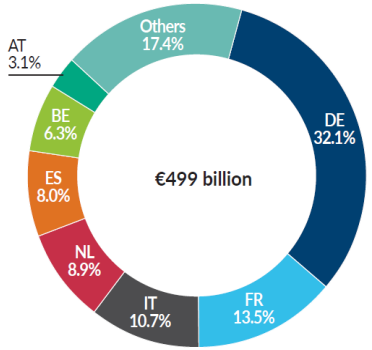
A very competitive global market, indispensable to four large European Members States' economies

EU27 share of global chemicals market



Source: Cefic Chemdata International

EU27 chemicals sales 2020



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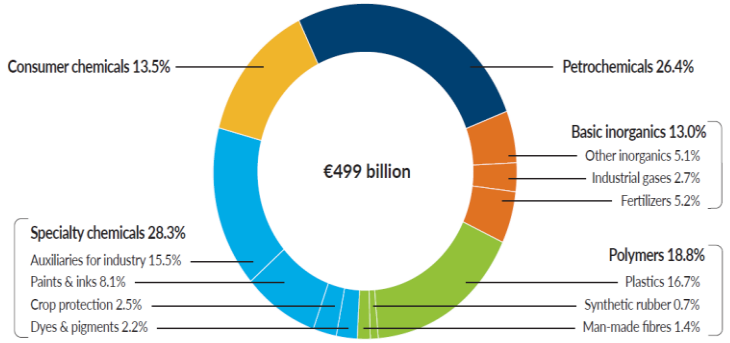
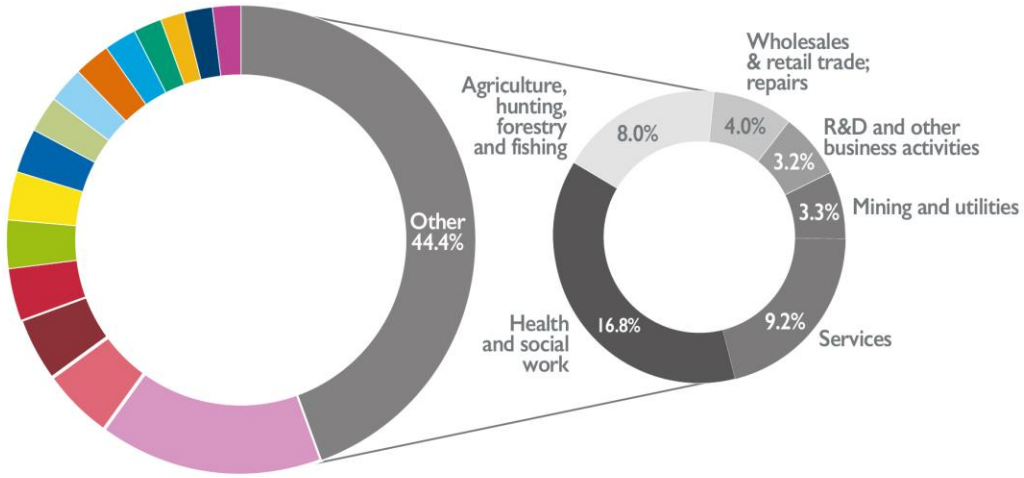
EU27 chemical sales 2020



Source: Cefic Chemdata International

Customer sectors of the EU27+UK chemical industry (2017)



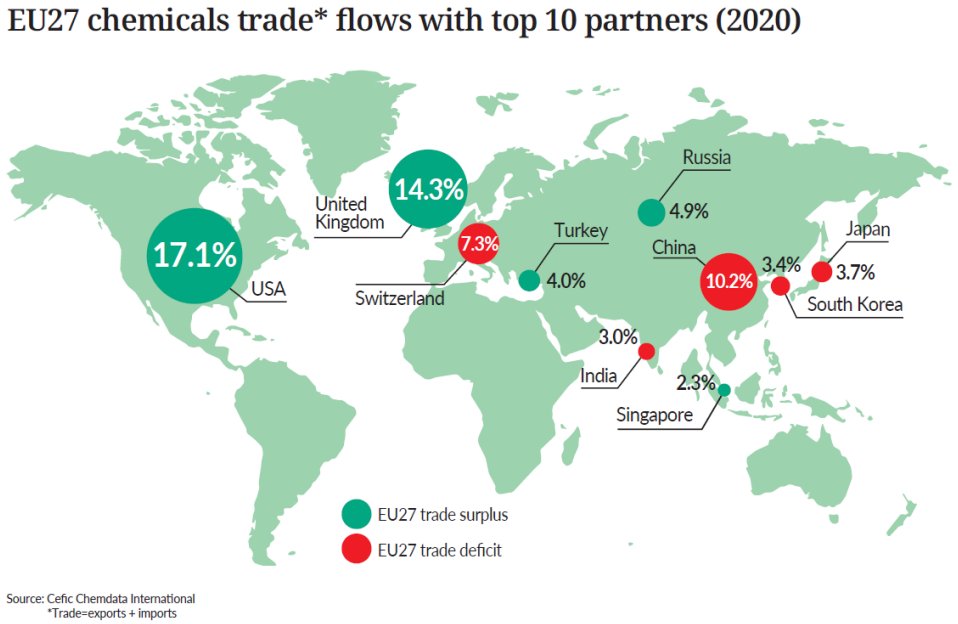
- Rubber and plastics products 15.5%
- Construction 5.1%
- Pulp, paper, paper products, printing and publishing 4.3%
- Coke, refined petroleum products and nuclear fuel 3.6%
- Textiles, textile products, leather and footwear 3.5%
- Food products, beverages and tobacco 3.3%
- Motor vehicles, trailers and semi-trailers 3.0%
- Basic metals 2.6%
- Computer, electronic and optical equipment 2.4%
- Fabricated metal products 2.4%
- Electrical machinery and apparatus, nec 2.2%
- Other non-metallic mineral products 2.0%
- Machinery and equipment, nec 1.8%
- Manufacturing nec; recycling 1.7%
- Other manufacturing 2.2%

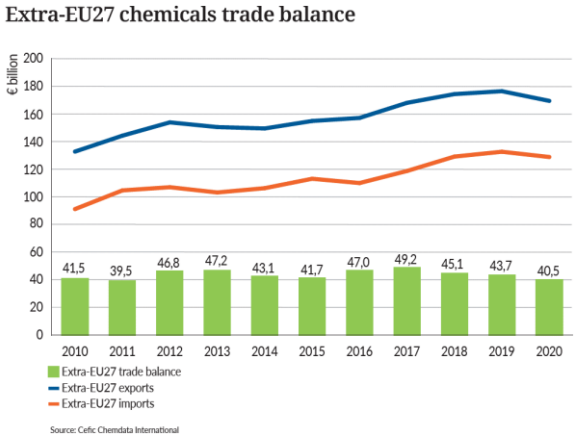
Sources: ICCA report 2019, Catalyzing Growth and Addressing Our World's Sustainability Challenges (Oxford Economics)

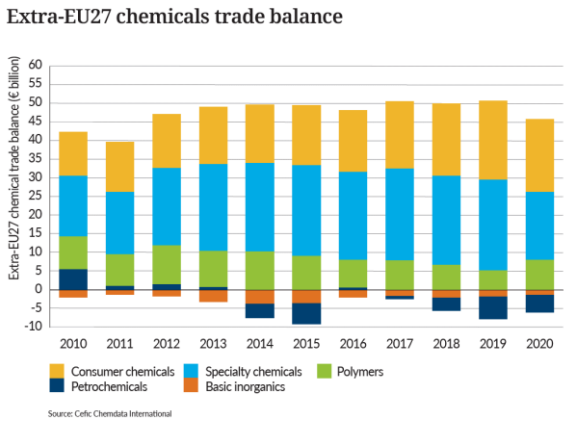
Unless specified, chemical industry excludes pharmaceuticals

Thriving European value chains depend on chemicals

EU27 chemicals trade surplus contributes to Europe's GDP



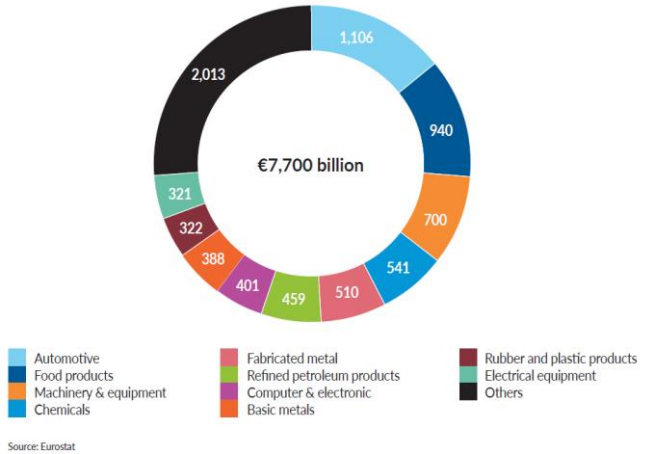




Chemicals in EU27:

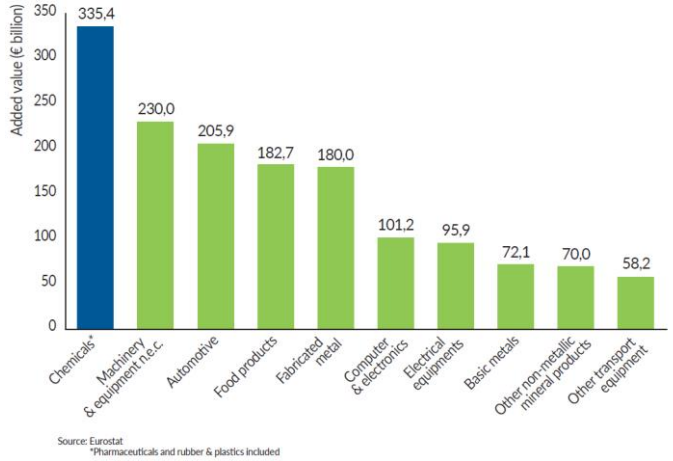
4th largest turnover
1st in added value
2nd largest Employer
1st in investment

Top 10 sectors: turnover (€ billion, 2018)



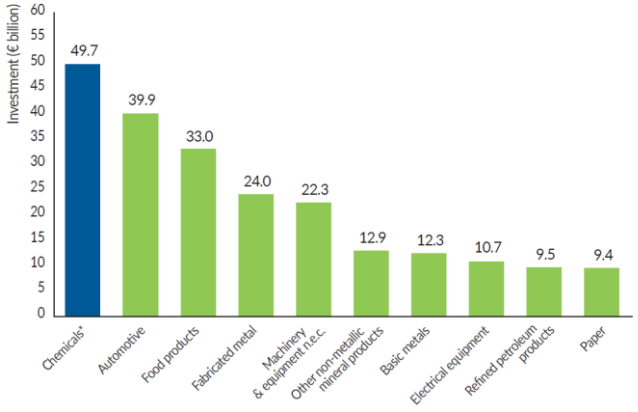
Source: Eurostat

Top 10 Sectors: added value (€ billion, 2018)



Source: Eurostat
*Pharmaceuticals and rubber & plastics included

Top 10 sectors: investment (€ billion, 2018)

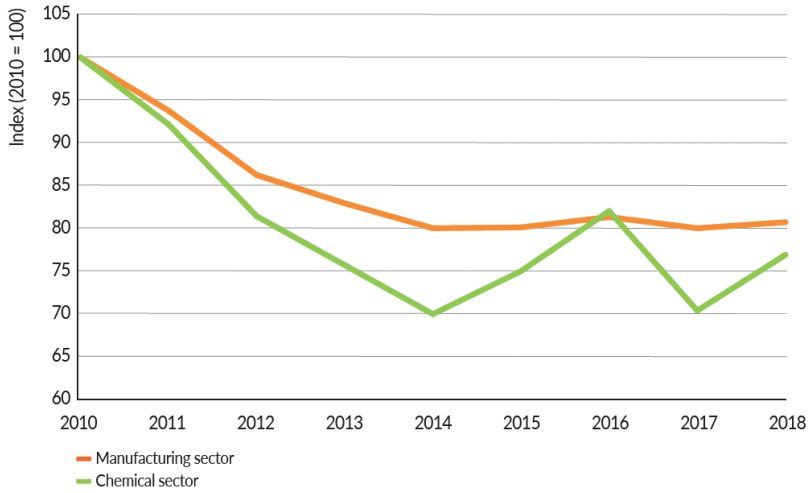


Source: Eurostat
*Pharmaceuticals and rubber & plastics included

OSH & E Performances

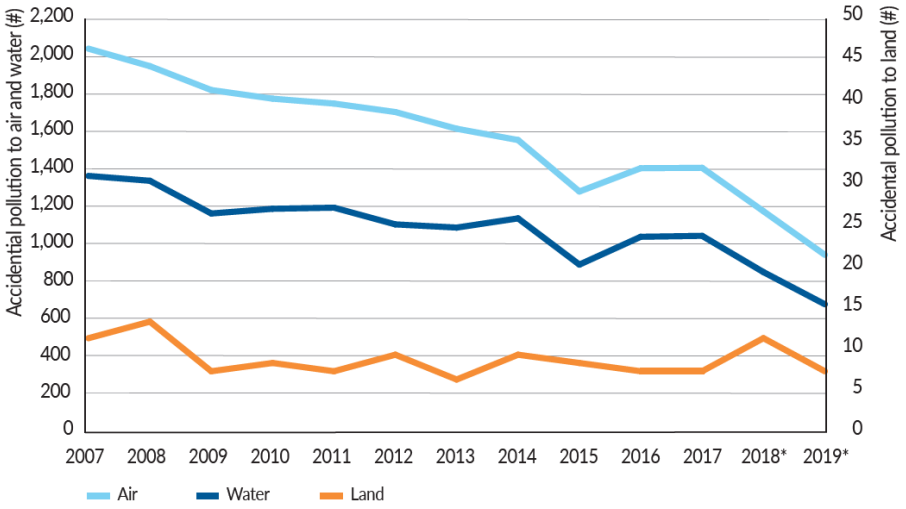
Occupational Safety accidents and Environmental releases in decline since 2010

EU27 number of accidents* at work: chemicals versus manufacturing



Source: Eurostat
*Data include only fatal and non-fatal accidents involving more than 3 calendar days of absence from work.
A fatal accident at work is defined as an accident which leads to the death of a victim within one year of the accident.
The incidence rate of non-fatal or fatal accidents at work is the number of serious or fatal accidents per 100,000 persons in employment.

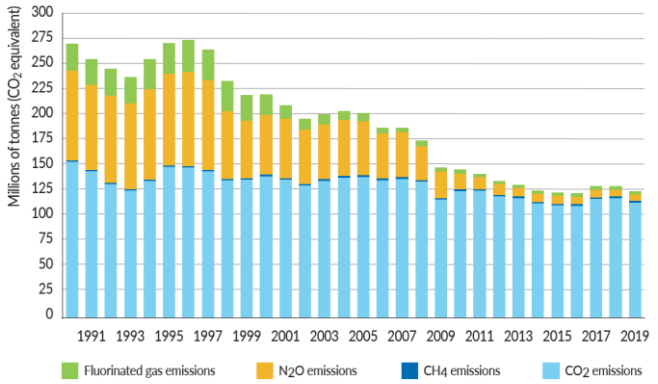
Accidental pollutant releases by the EU27 chemicals industry



Source: European Pollutant Release and Transfer Register (E-PRTR)
* Slovakia did not report data under the EU Registry. Data for Germany, Latvia, Lithuania, Liechtenstein, Lithuania, and Portugal are incomplete for 2018 and 2019. Data for Italy, Malta and Switzerland are incomplete for the year 2019.

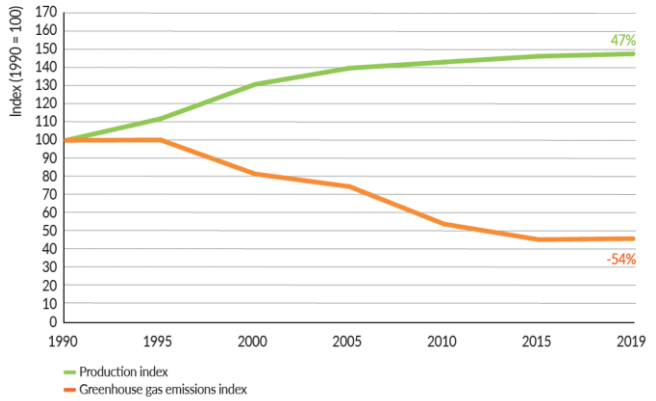
Emissions to Air decoupled from Chemicals production since 1990

Total scope 1 GHG emissions* by the EU27 chemical industry per type of GHG



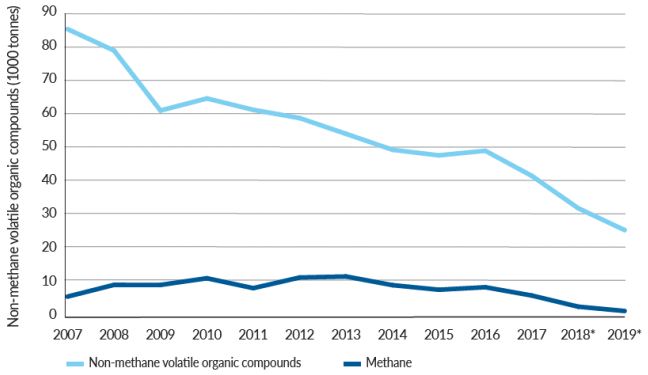
Source: European Environment Agency (EEA), *Germany and Malta did not separately report GHG emissions from combustion of fuels in the chemical sector.

GHG emission and production by the EU27 chemical industry



Source: European Environment Agency (EEA)

EU27 methane and non-methane volatile organic compound (NM-VOCs) emissions to air



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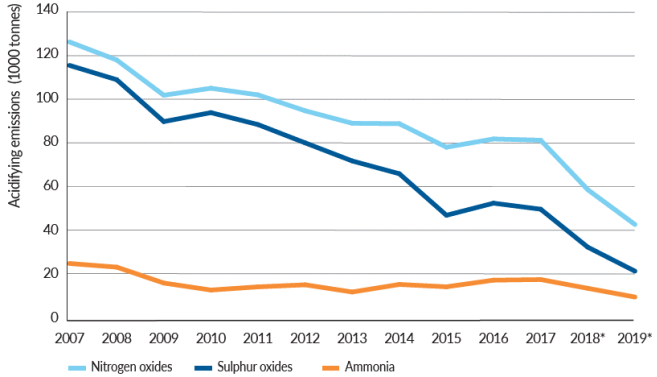
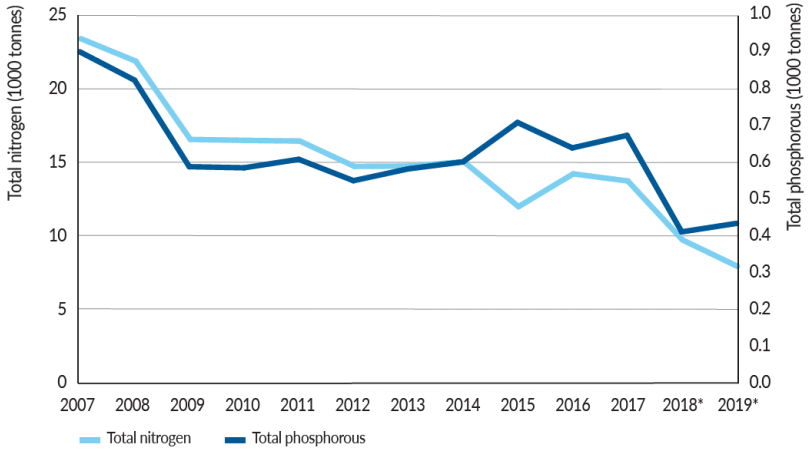
Acidifying emissions to air by the EU27 chemicals industry



Source: European Pollutant Release and Transfer Register (E-PRTR)
* Slovakia did not report data under the EU Registry. Data for Germany, Latvia, Lithuania, Liechtenstein, Lithuania, and Portugal are incomplete for 2018 and 2019. Data for Italy, Malta and Switzerland are incomplete for the year 2019.

Emissions to Water nearly halved since 2007

Total Nitrogen & Phosphorous emissions to water by the EU27 chemicals industry



Source: European Pollutant Release and Transfer Register (E-PRTR)
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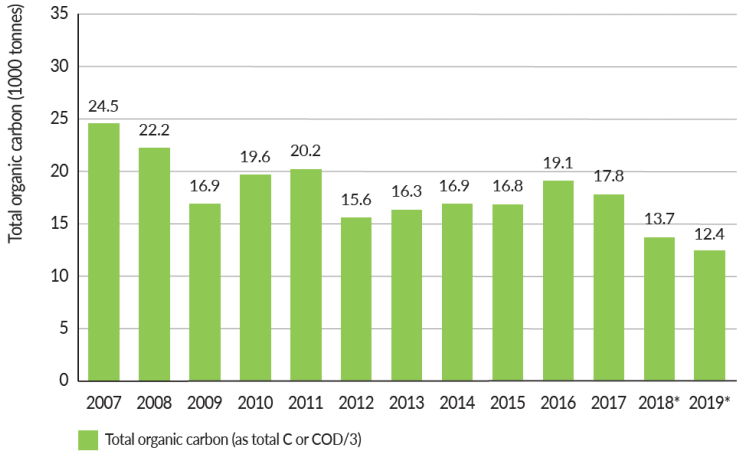
Total organic carbon emissions to water by the EU27 chemicals industry



Source: European Pollutant Release and Transfer Register (E-PRTR)
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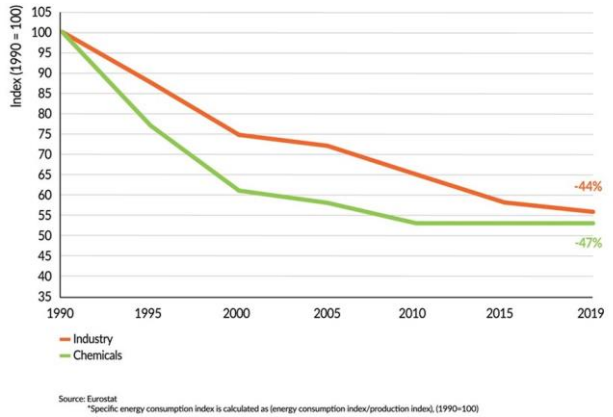
Dependencies

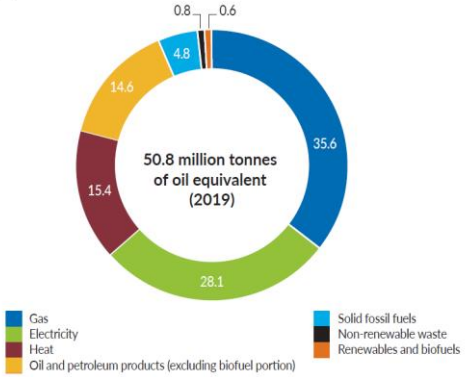
An energy intensive sector, the EU Chemicals Industry puts efficiency at the core of operations …yet, heavily dependent on gas and oil

Specific energy consumption* chemicals vs total industry



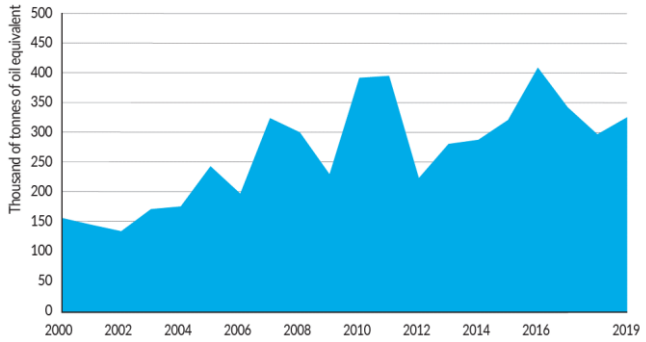
Source: Eurostat
*Specific energy consumption index is calculated as (energy consumption index/production index), (1990=100)

Total energy consumption in the EU27 chemical industry by source (%)



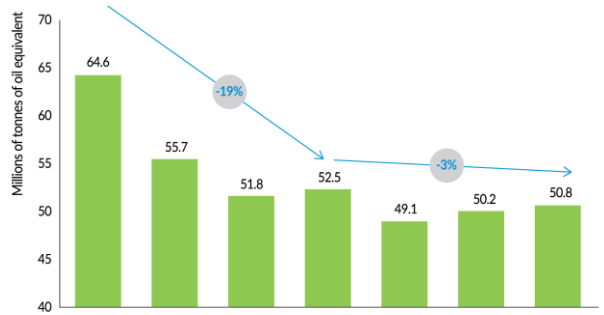
Source: Eurostat

Renewable energies consumption by the EU27 chemical industry



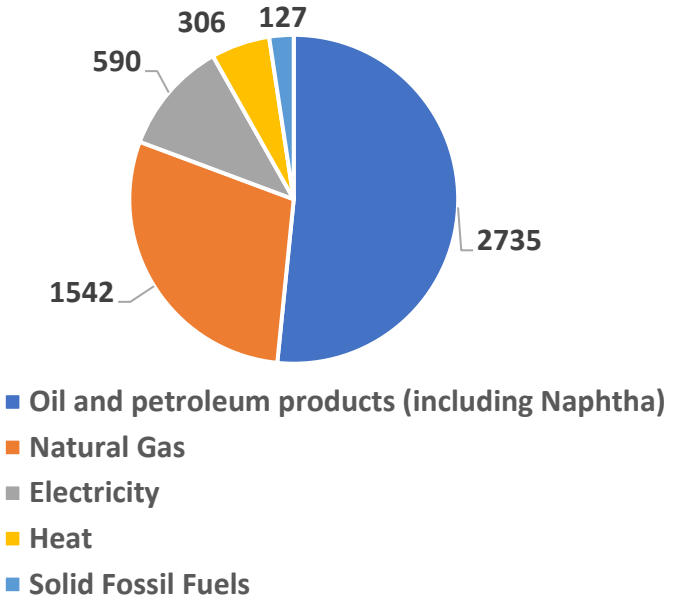
Source: Eurostat

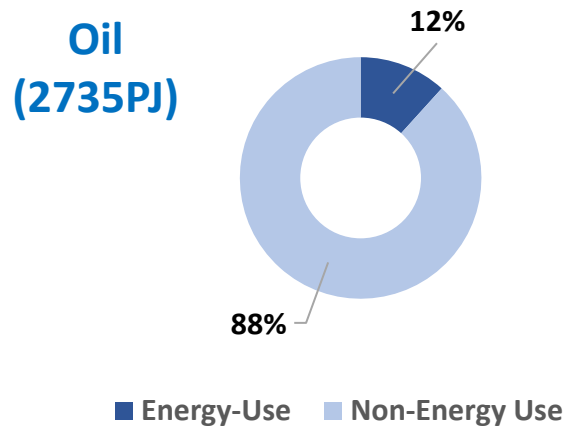
Energy consumption in the EU27 chemical industry

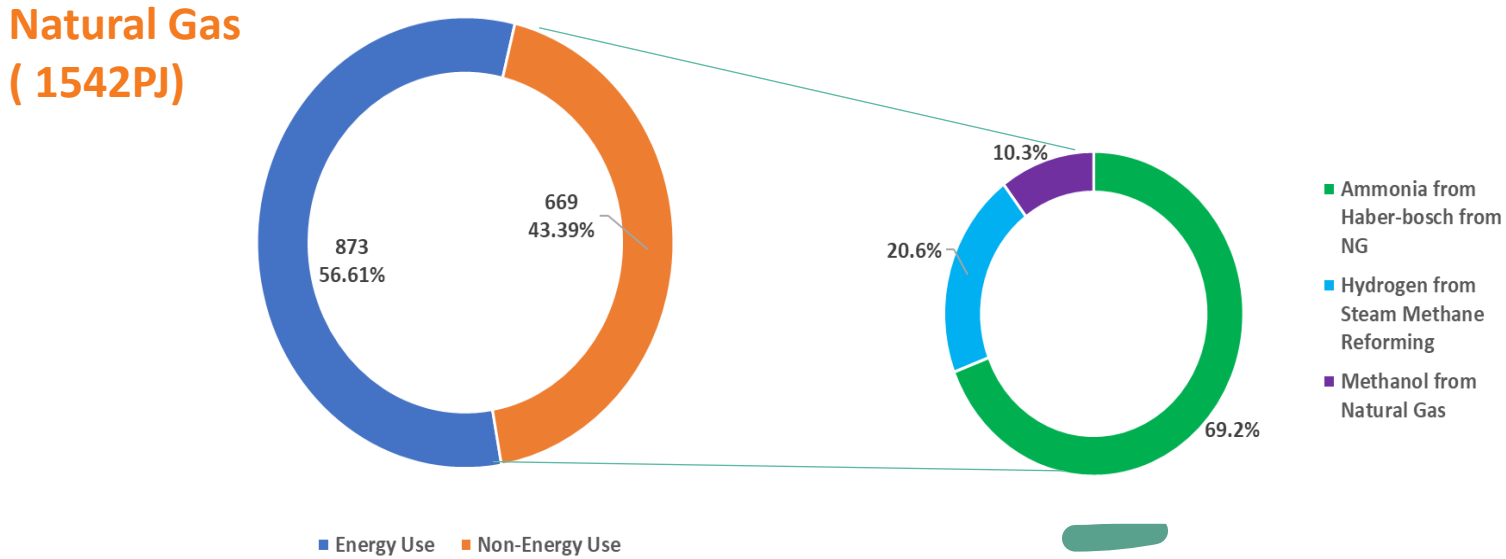


Source: Eurostat

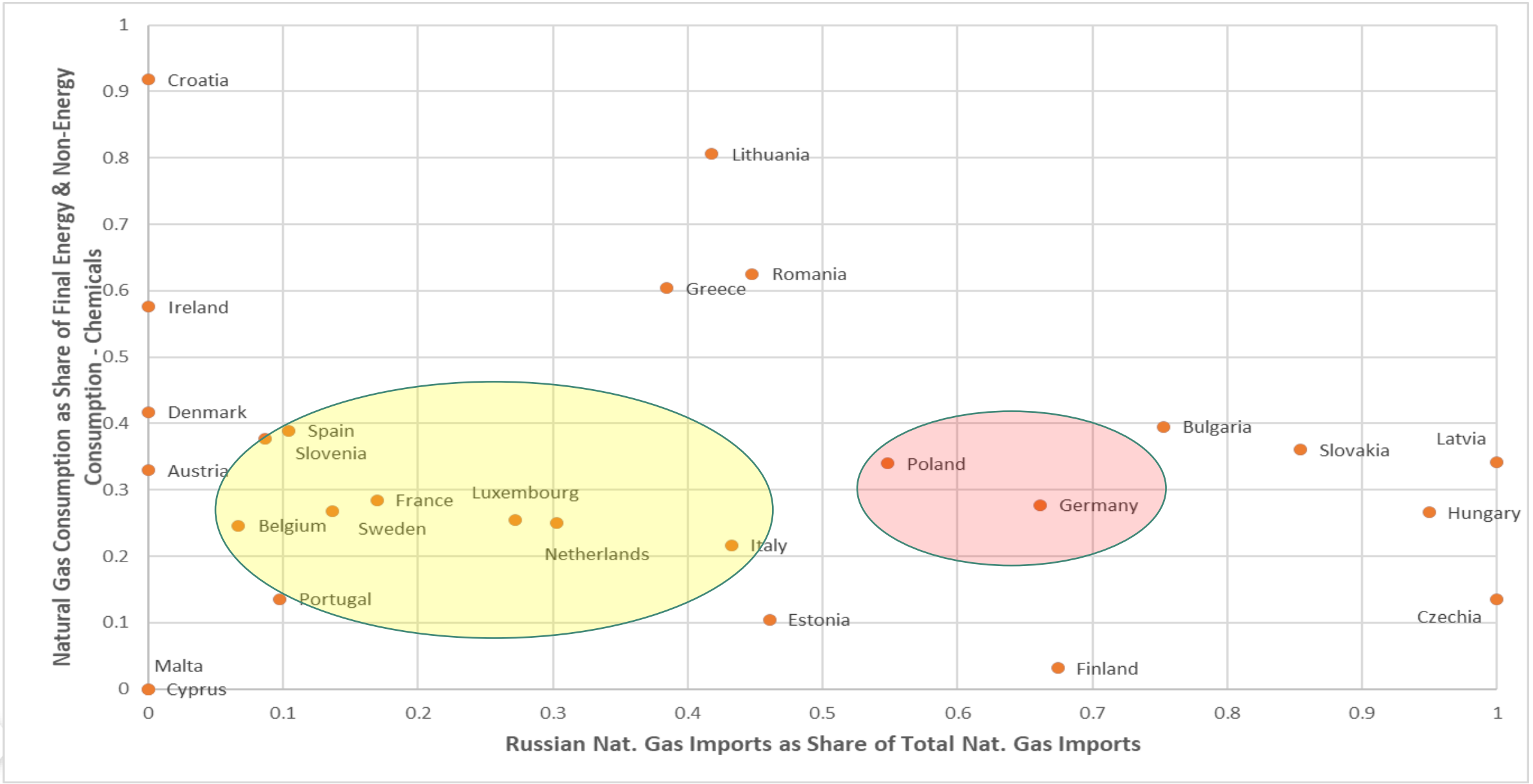
Oil and Gas end up mostly in Chemicals Molecules





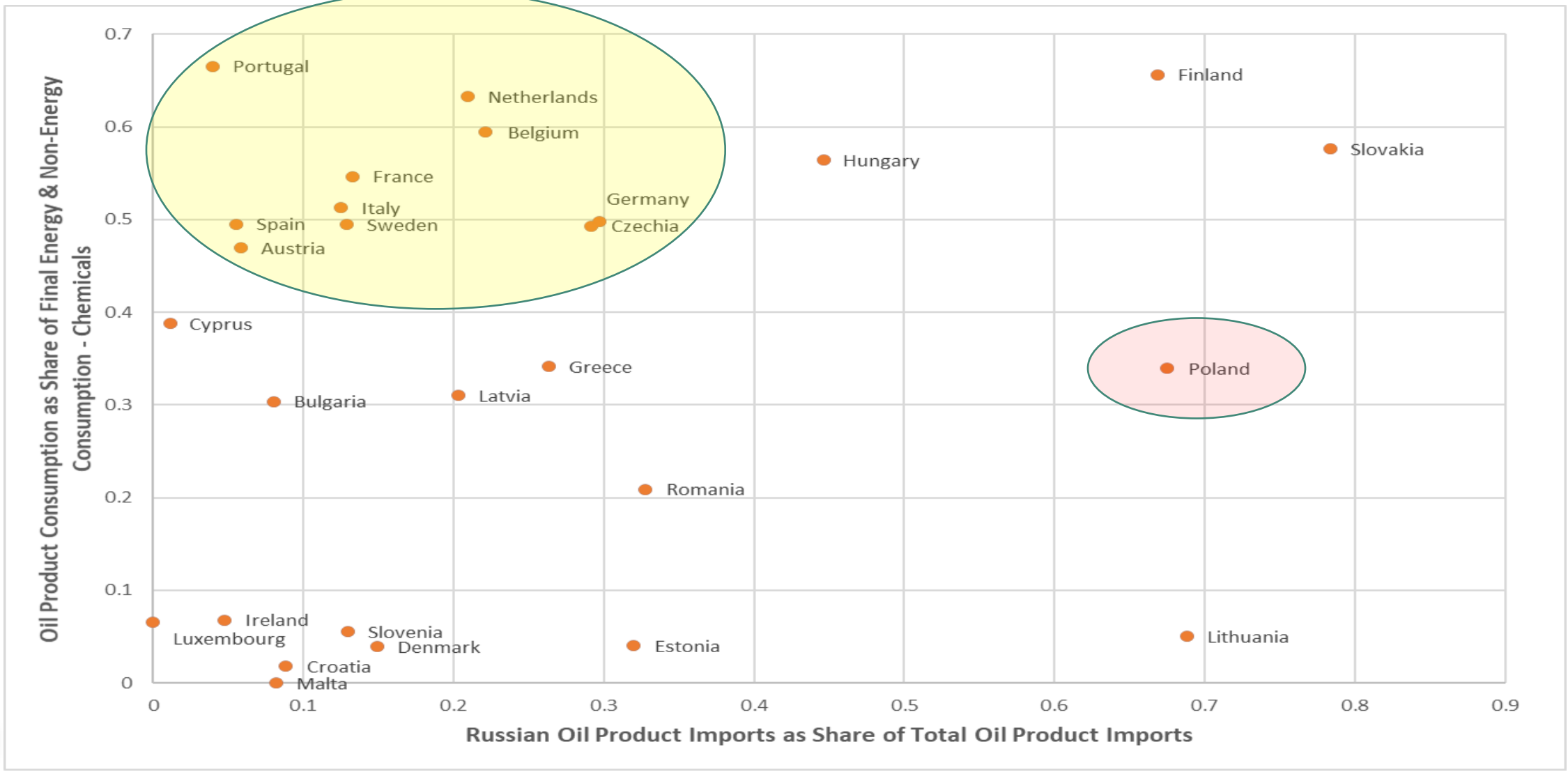


Exposure to Russian Natural Gas Supply Disruption



*Note: Eurostat figures rely on the accuracy of Member State reporting. On occasion, this may result in distortions in the data following Member State reporting practices

Potential Exposure to Russian Oil Supply Disruptions



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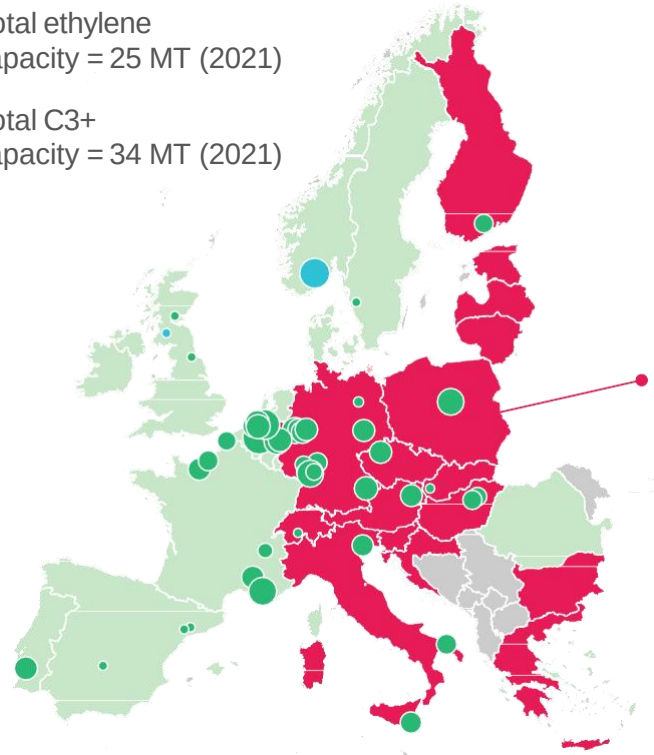
Despite Gas Supply Risk, Oil-Based Steam Crackers in Europe Secure Feedstock for Chemical Production

Steam cracker landscape in Europe

Total ethylene capacity = 25 MT (2021)

Total C3+ capacity = 34 MT (2021)

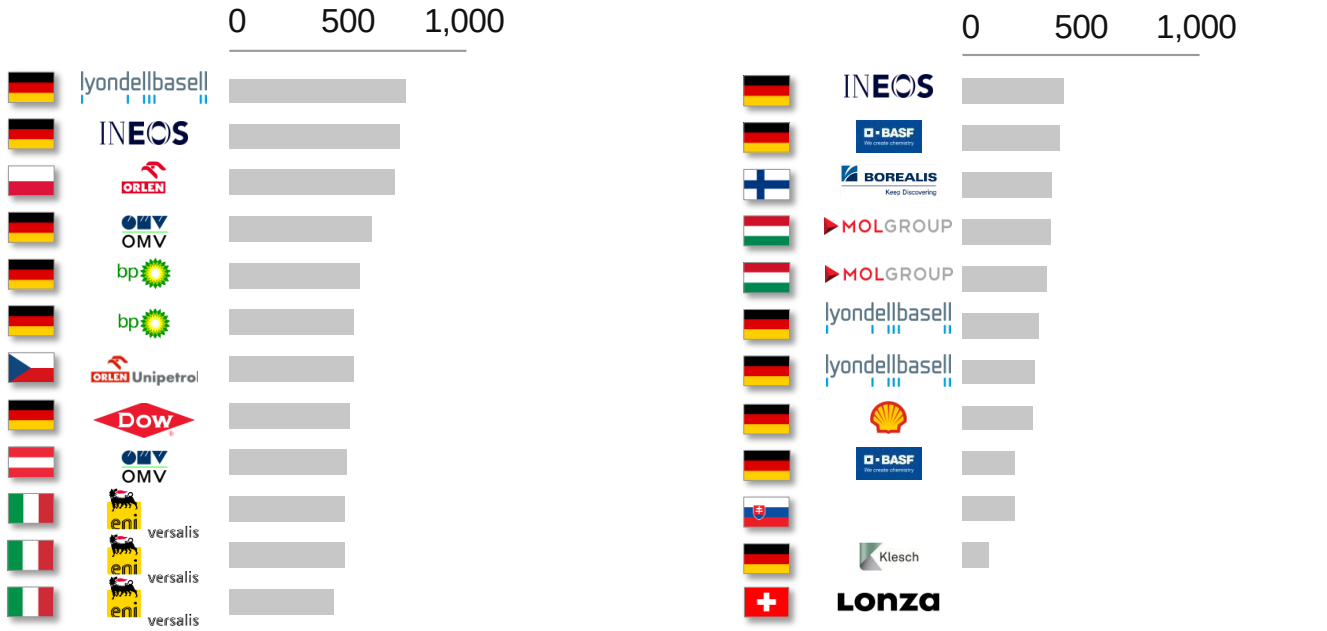


Steam crackers in countries with significant **dependence on Russian gas** (as energy source)

Bubble size = 600 kt Ethylene capacity, 2021 — Oil based — Gas based

Risk of gas supply shortages — Significant — Low

ETHYLENE CAPACITY (NAMEPLATE CAPACITY) [KT/YEAR]



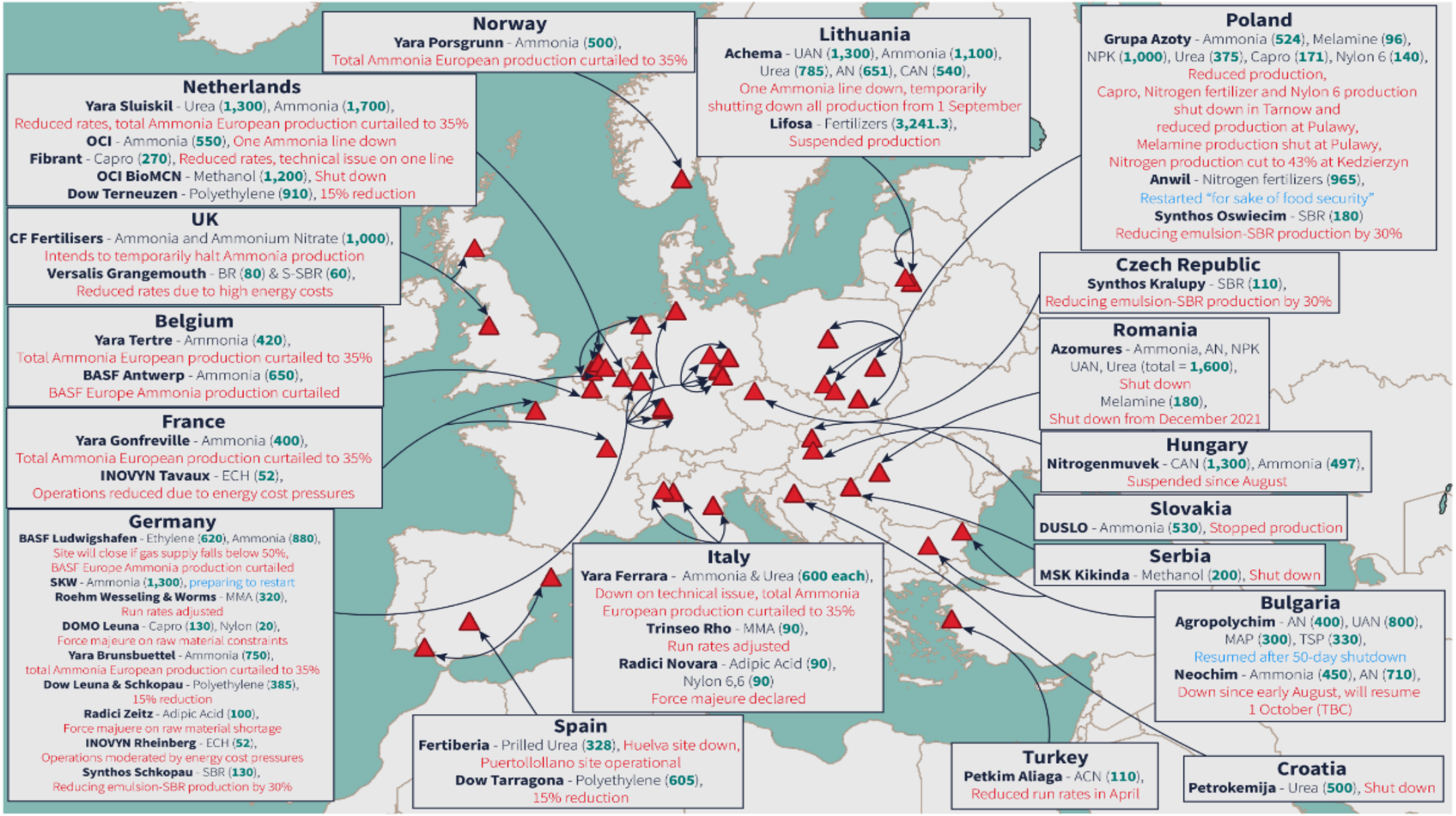
~40% of European steam cracker ethylene capacity (10 Mt) in countries w/ significant dependence on Russian gas (as energy source), **yet steam crackers use mainly oil as feedstock**

Note: Rounded figures, only steam crackers shown

Source: *BCG analysis*

Soaring gas prices hit Europe chemicals, fertilizers

Capacities in '000 tonnes/year put next to product impacted in **green**, updated on 16 September 2022



SOURCE: ICIS, Natural Earth

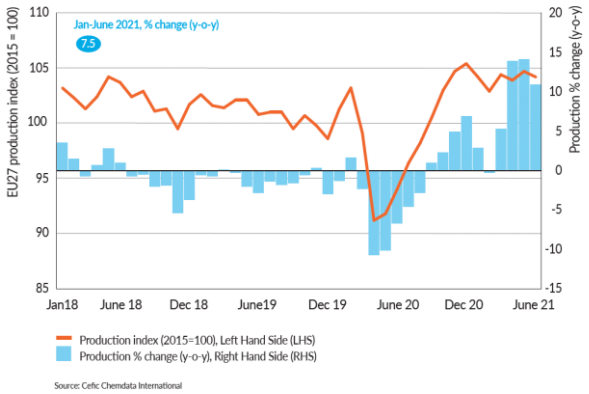
Notes and references

Facing Head Winds in Europe

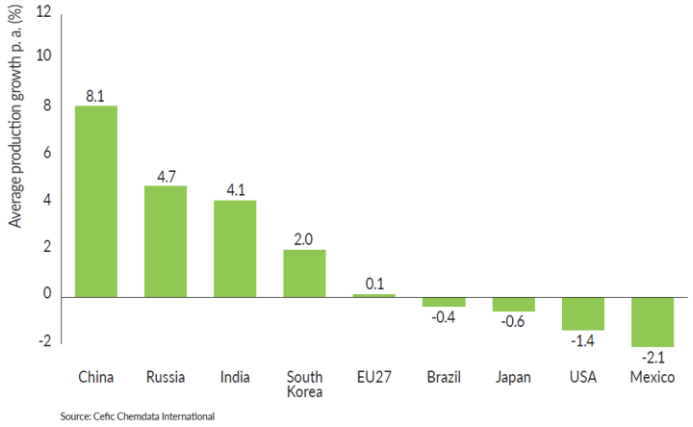
Global Chemicals :

At a competitive disadvantage vs. USA, ME and fast-growing regions

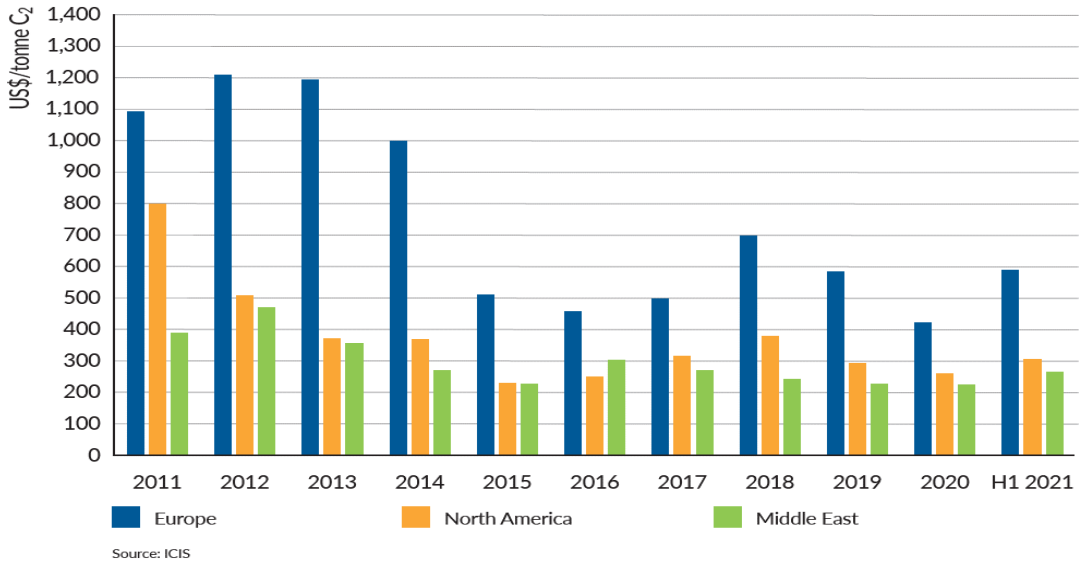
EU27 chemical industry production



Average chemicals production growth per annum (2010-2020)



Ethylene cash cost of regional steam crackers



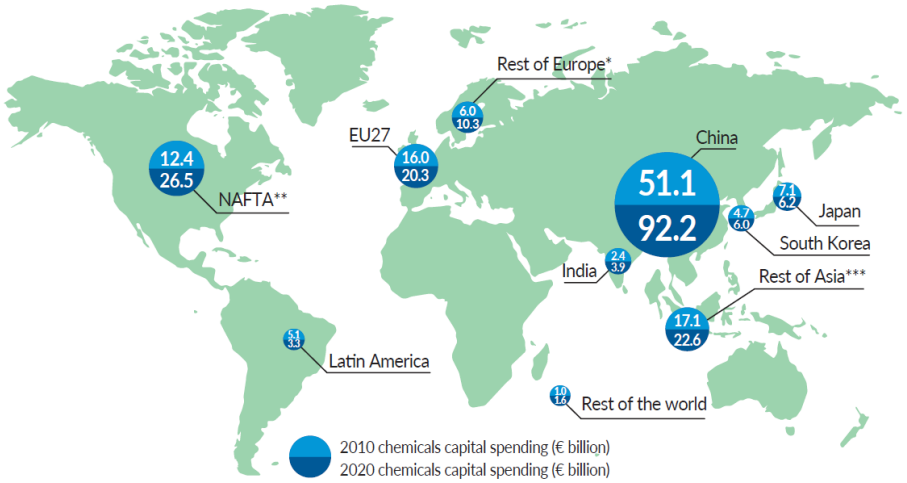
Source: ICIS

ECC measure provides an assessment of the ex-works cash margin obtained for the product over raw material costs, credit for selling co-products and key variable manufacturing costs, including power and steam, chemicals and catalysts.

Investments in the EU 27 Chemicals lagging…

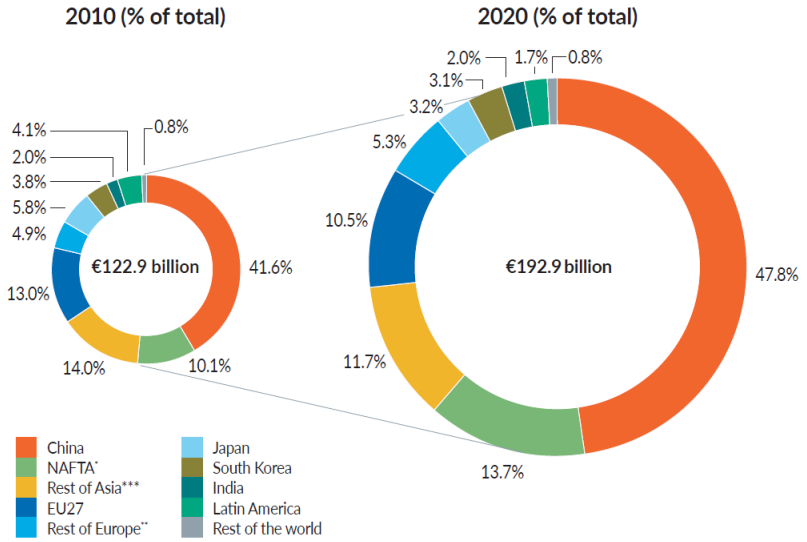
…China and US leading the race

Capital spending in the chemicals industry by region: 2020 vs 2010



Source: Cefic Chemdata International
* Rest of Europe covers UK, Switzerland, Norway, Turkey, Russia and Ukraine
** North American Free Trade Agreement
*** Asia excluding China, India, Japan and South Korea

Chemicals capital spending by country, 2020 vs 2010

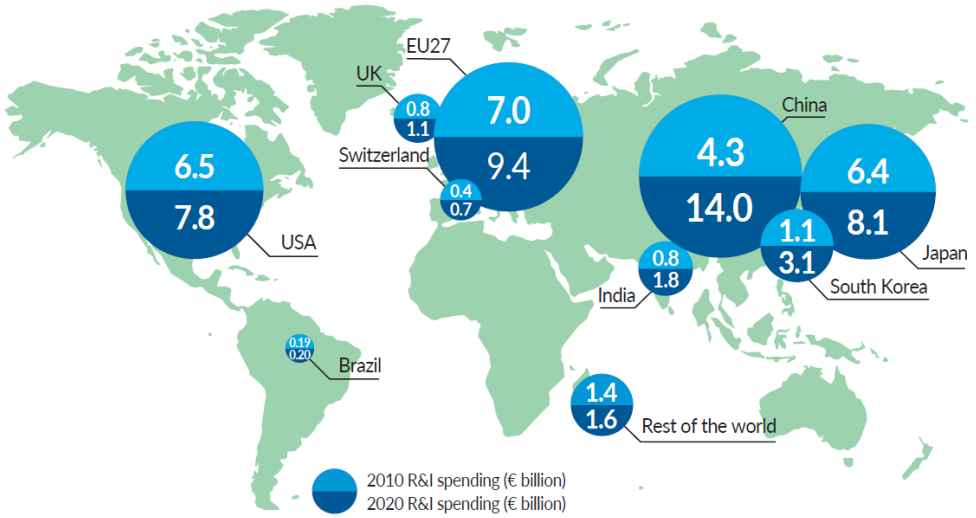


Source: Cefic Chemdata International
* North American Free Trade Agreement
** Rest of Europe covers UK, Switzerland, Norway, Turkey, Russia and Ukraine
*** Asia excluding China, India, Japan and South Korea

EU27 is the second largest R&I investor in the world

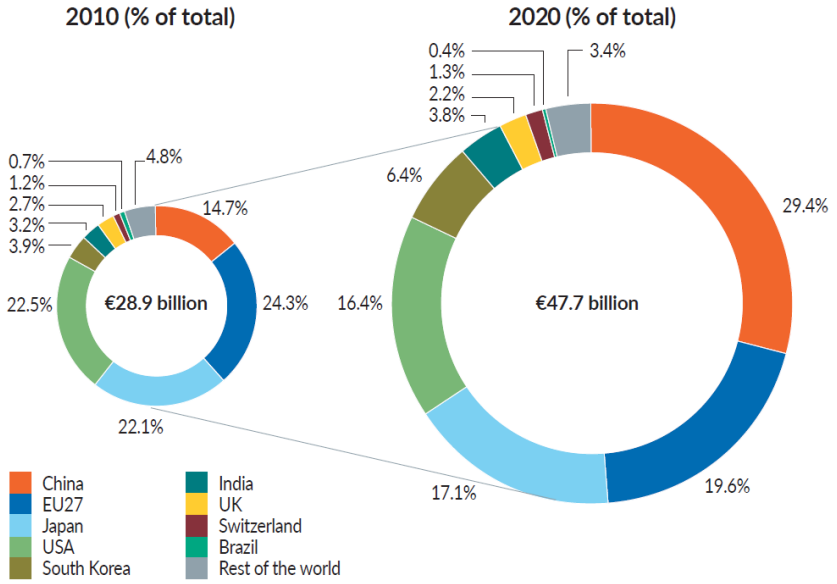
…but China outpaces all other regions

R&I spending in the chemicals industry by region: 2020 vs 2010



Source: OECD and Cefic Chemdata International

Chemicals R&I spending by country, 2020 vs 2010



Source: OECD and Cefic Chemdata International

On top of the license to operate, chemical companies are witnessing a wave of cost increase

+50%

Total production costs increasing by 50% over the last months

2.5x

Futures market **energy cost** at double to triple levels versus 2021

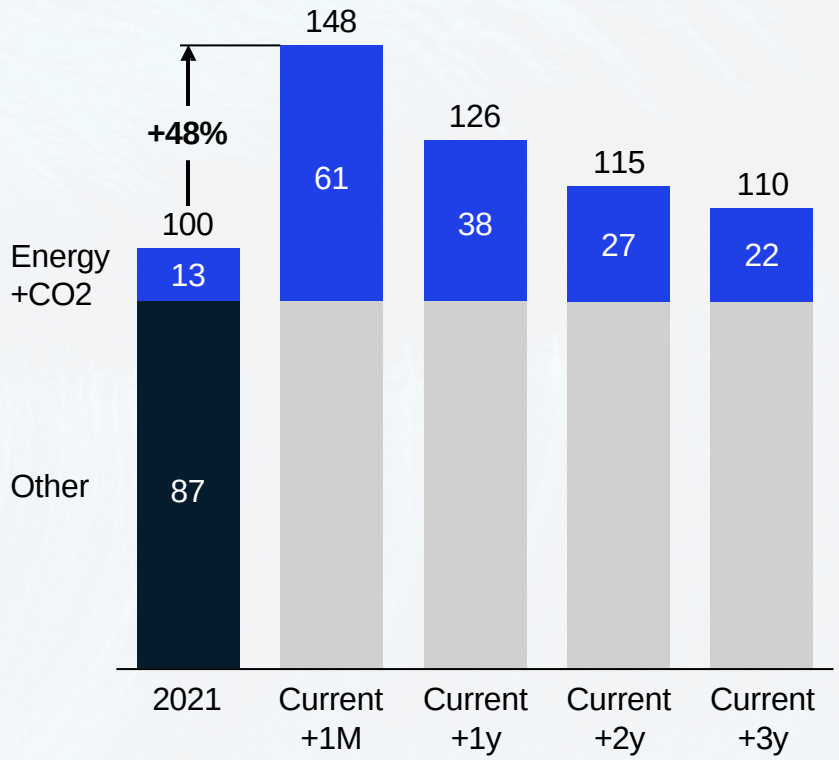
>10%

Raw material increase due to inflation, scarcity and supply issues

1. Fraction of total cost in 2021 for electricity 5% (60 EUR/MWh), gas 5% (20 EUR/MWh), CO2 2.5% (50 EUR/MWh) - electricity price assumed double of natural gas price including CO2, CO2 price evolving to 100 EUR/ton for future years

Typical production cost structure[1] (process industry player)

EEX futures, TTF March 14th 2022



Perspectives

Geopolitical tensions are increasing the probability of decoupling

US decoupling forces

- **Pressure from politics** and business community: **anti-dumping, export controls, tariffs, etc.**
- **Backlog of trade adjustment costs**
- **Confluence of concerns of trade hawks**, **human rights hawks**, and **national security hawks**

China decoupling forces

- **Drive to maintain domestic control** (e.g., data)
- **Technological decoupling** as greatest challenge (**limited near-term options for self sufficiency/diversified sourcing)**
- **Restrictions on access to dollar-based trade** would significantly threaten China's ability to engage internationally

EU concerns

- **Very integrated into global value chains with China and the US**
- Expectation is that **US** will continue to **put significant pressure on China**
- EU **focused on "open strategic autonomy,"** strengthening its capacity to pursue its interests while continuing to work with global partners around the world

Source : McKinsey

Major trends – significantly accelerated

1 Volatility of the macroeconomic context

- Dampened growth environment, much more differentiated
- Inflation soaring, volatility increased
- More frequent and longer supply chain disruptions
- Decoupling, de-globalization, re-regionalization?

2 The sustainability transformation

- Scope 1, 2, and 3 decarbonization driven by regulatory and consumer pressure, for real and not limited to Europe
- Circular economy massively accelerating
- Downstream demand with significant (product) portfolio effects

3 Core technology and digital transformation

- Digital transformations finally unfolding in chemicals
- Overdue large-scale modernization of core tech (ERP, data, analytics)

4 Talent and capabilities

- Talent scarcity and attrition
- Upskilling/reskilling

Source: McKinsey

Decarbonization is becoming a pre-requisite for industrial companies' license to operate

Acceleration in aspiration

1,500+ companies globally have set a **net-zero emissions** target –

That is a **3x increase** since the start of 2020

Significant value-at-stake

~5-10% of EBITDA

Shifting customer expectations

15-30% price premiums

Increasing investor requirements

38% of assets

Bolder environmental regulation

30-50% corporate profits at risk

Talent moving to sustainable companies

25-50% less turnover

Source: CDP Climate Change Report 2019, McKinsey analysis

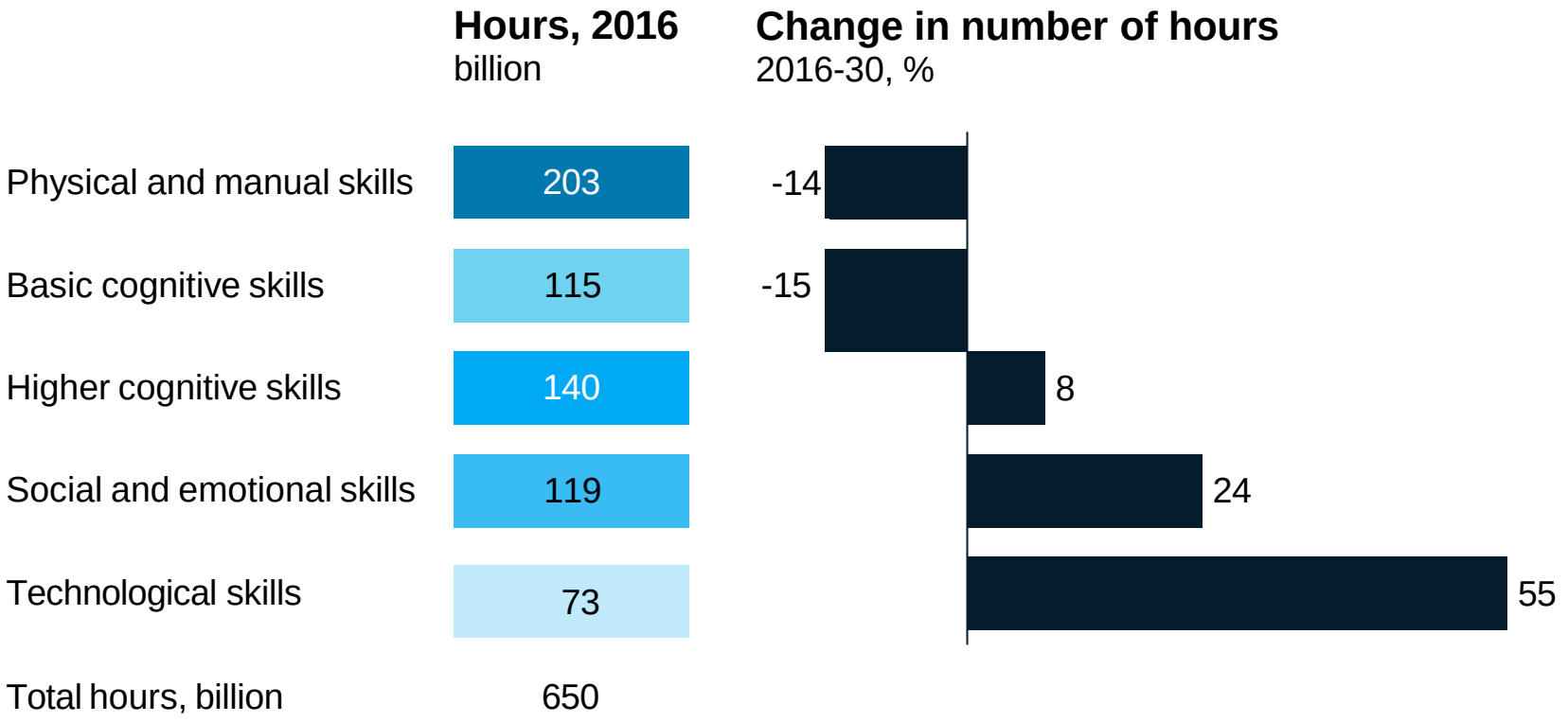
Chemical companies are at the brink of a larger scale technology modernization

From…	To…	
… tailor-made environments for lighthouses (to bypass current limitations)…	… a modern backbone that supports technology ambition at scale	***Enable digital at scale***
… complex architectures and inefficient legacy processes	… lean, modular architecture and automated, efficient processes	***Reduce technical debt***
… fast growing IT costs with a bias towards investments into inefficient legacy systems	… skewing investments into modernized, flexible systems ("change" vs. "run")	***Bend the cost curve***
… monolithic, inflexible systems	… a flexible tech stack as strategic asset, supporting technology-centric business capabilities and portfolio management	***Support business priorities***
… siloed organizations with IT as a "support function"	… digital native workforce in business and technology that seamlessly integrates technology into everyday work	***Attract and retain digital native workforce***

The “skills of the future” are technological, but also socio-emotional and higher cognitive

McKinsey Global Institute Analysis, all sectors

United States and Western Europe



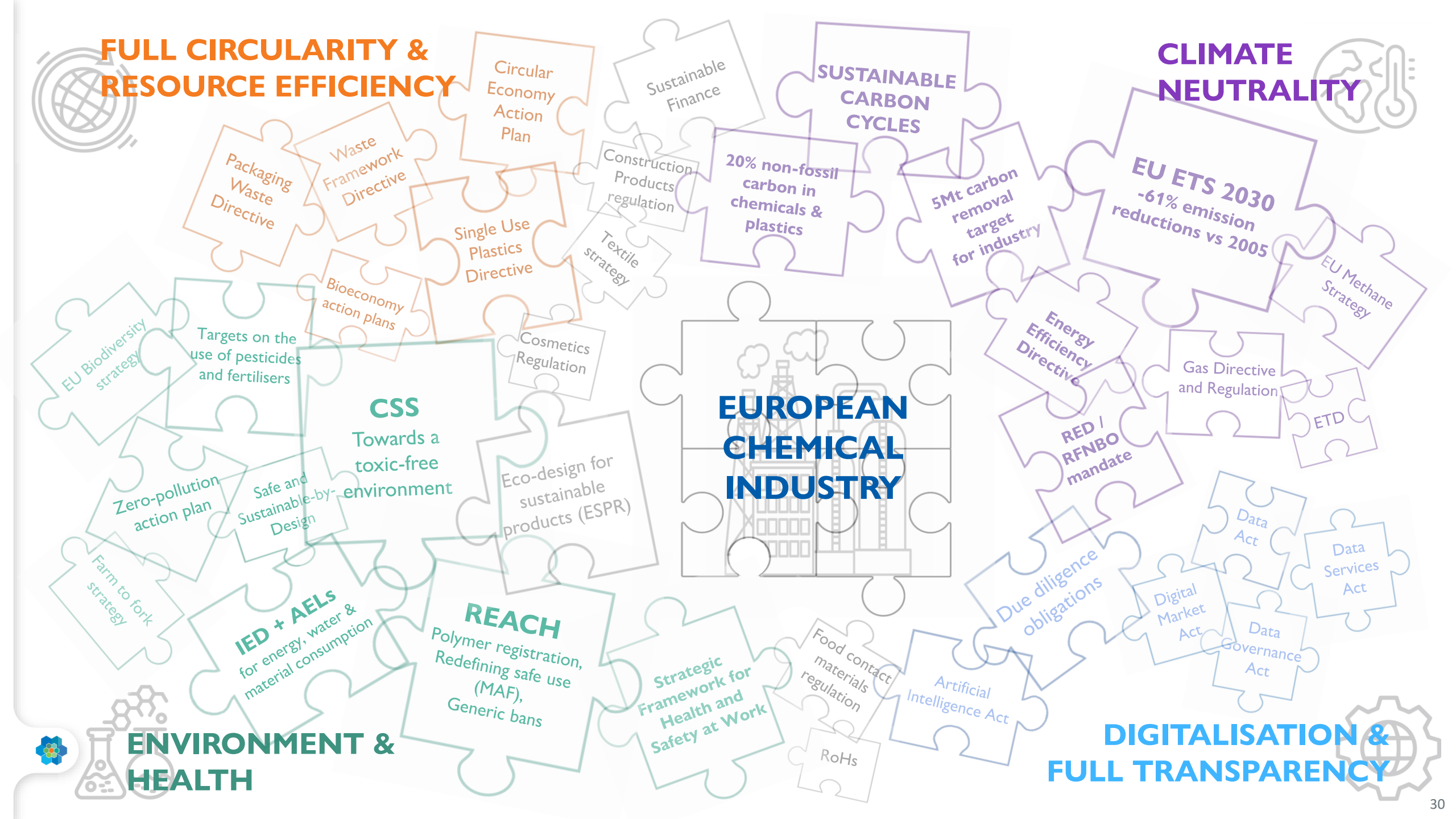
Though technological are key, higher cognitive and socio-emotional will also be in demand in the future

Research also finds that the shifts in exact skill needed is accelerating, so meta skills like adaptability are critical

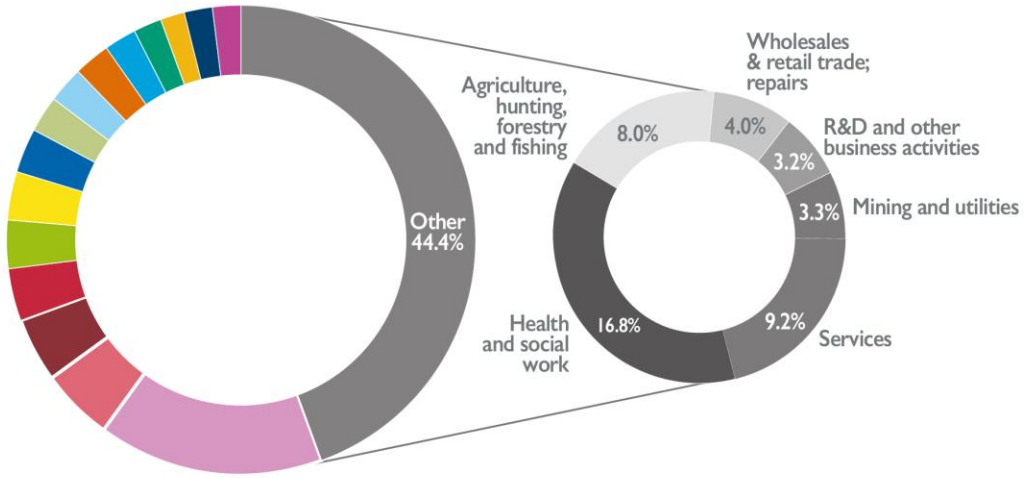
Importance

Lower — Higher

Source: McKinsey Global Institute analysis


FULL CIRCULARITY & RESOURCE EFFICIENCY
Circular Economy Action Plan
Sustainable Finance
SUSTAINABLE CARBON CYCLES
CLIMATE NEUTRALITY
Packaging Waste Directive
Waste Framework Directive
Construction Products regulation
20% non-fossil carbon in chemicals & plastics
5Mt carbon removal target for industry
EU ETS 2030 -61% emission reductions vs 2005
Single Use Plastics Directive
Textile strategy
Bioeconomy action plans
EU Methane Strategy
EU Biodiversity strategy
Targets on the use of pesticides and fertilisers
Cosmetics Regulation
Energy Efficiency Directive
Gas Directive and Regulation
CSS
Towards a toxic-free environment
EUROPEAN CHEMICAL INDUSTRY
ETD
RED / RFNBO mandate
Zero-pollution action plan
Safe and Sustainable-by-Design
Eco-design for sustainable products (ESPR)
Data Act
Farm to fork strategy
IED + AELs
for energy, water & material consumption
REACH
Polymer registration, Redefining safe use (MAF), Generic bans
Strategic Framework for Health and Safety at Work
Food contact materials regulation
Due diligence obligations
Digital Market Act
Data Services Act
Data Governance Act
Artificial Intelligence Act
RoHs
ENVIRONMENT & HEALTH
DIGITALISATION & FULL TRANSPARENCY

Customer sectors of the EU27+UK chemical industry (2017)



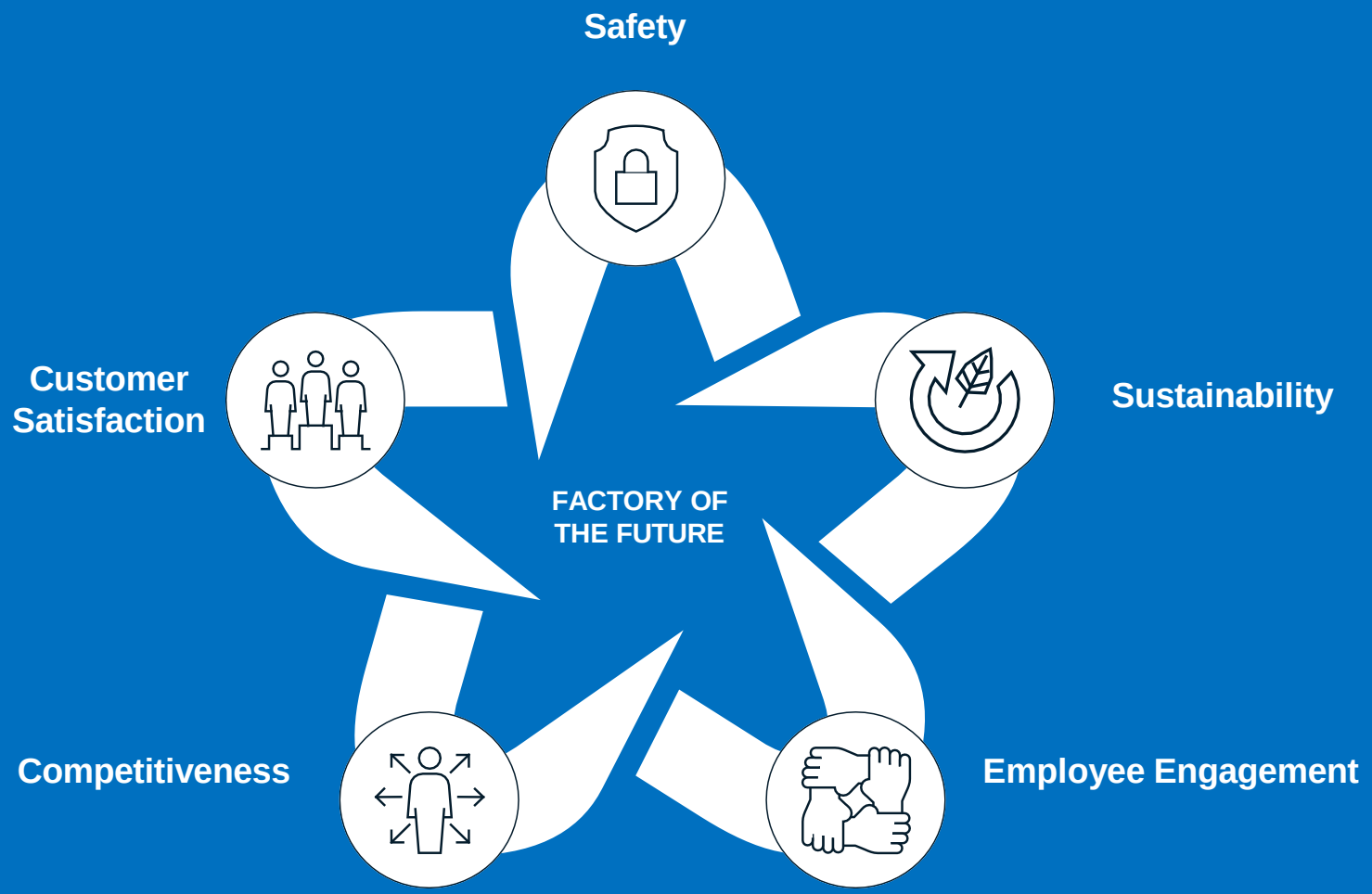
- Rubber and plastics products 15.5%
- Construction 5.1%
- Pulp, paper, paper products, printing and publishing 4.3%
- Coke, refined petroleum products and nuclear fuel 3.6%
- Textiles, textile products, leather and footwear 3.5%
- Food products, beverages and tobacco 3.3%
- Motor vehicles, trailers and semi-trailers 3.0%
- Basic metals 2.6%
- Computer, electronic and optical equipment 2.4%
- Fabricated metal products 2.4%
- Electrical machinery and apparatus, nec 2.2%
- Other non-metallic mineral products 2.0%
- Machinery and equipment, nec 1.8%
- Manufacturing nec; recycling 1.7%
- Other manufacturing 2.2%

Sources: ICCA report 2019, Catalyzing Growth and Addressing Our World's Sustainability Challenges (Oxford Economics)

Unless specified, chemical industry excludes pharmaceuticals

Thriving European value chains depend on chemicals

and win through a holistic transformation



Thank You !

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About Cefic

Cefic, the European Chemical Industry Council, founded in 1972, is the voice of large, medium and small chemical companies across Europe, which provide 1.1 million jobs and account for 15% 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.

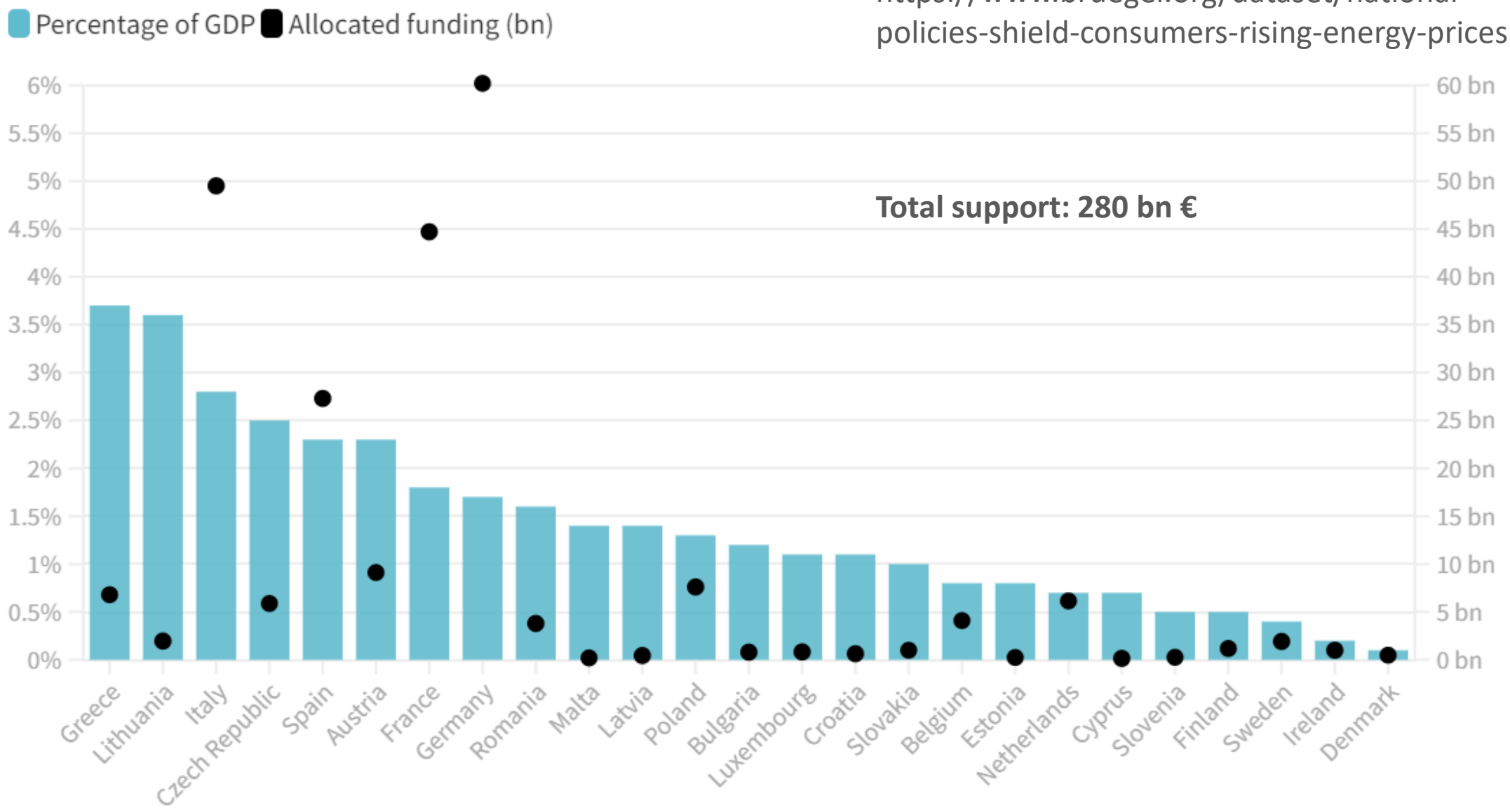
Cefic is an active member of the International Council of Chemical Associations (ICCA), which represents chemical manufacturers and producers all over the world and seeks to strengthen existing cooperation with global organisations such as UNEP and the OECD to improve chemicals management worldwide

1 of 2

Governments allocated funding (Sep 2021 - Jul 2022) to shield households and businesses from the energy crisis

Last update: 10.08.2022

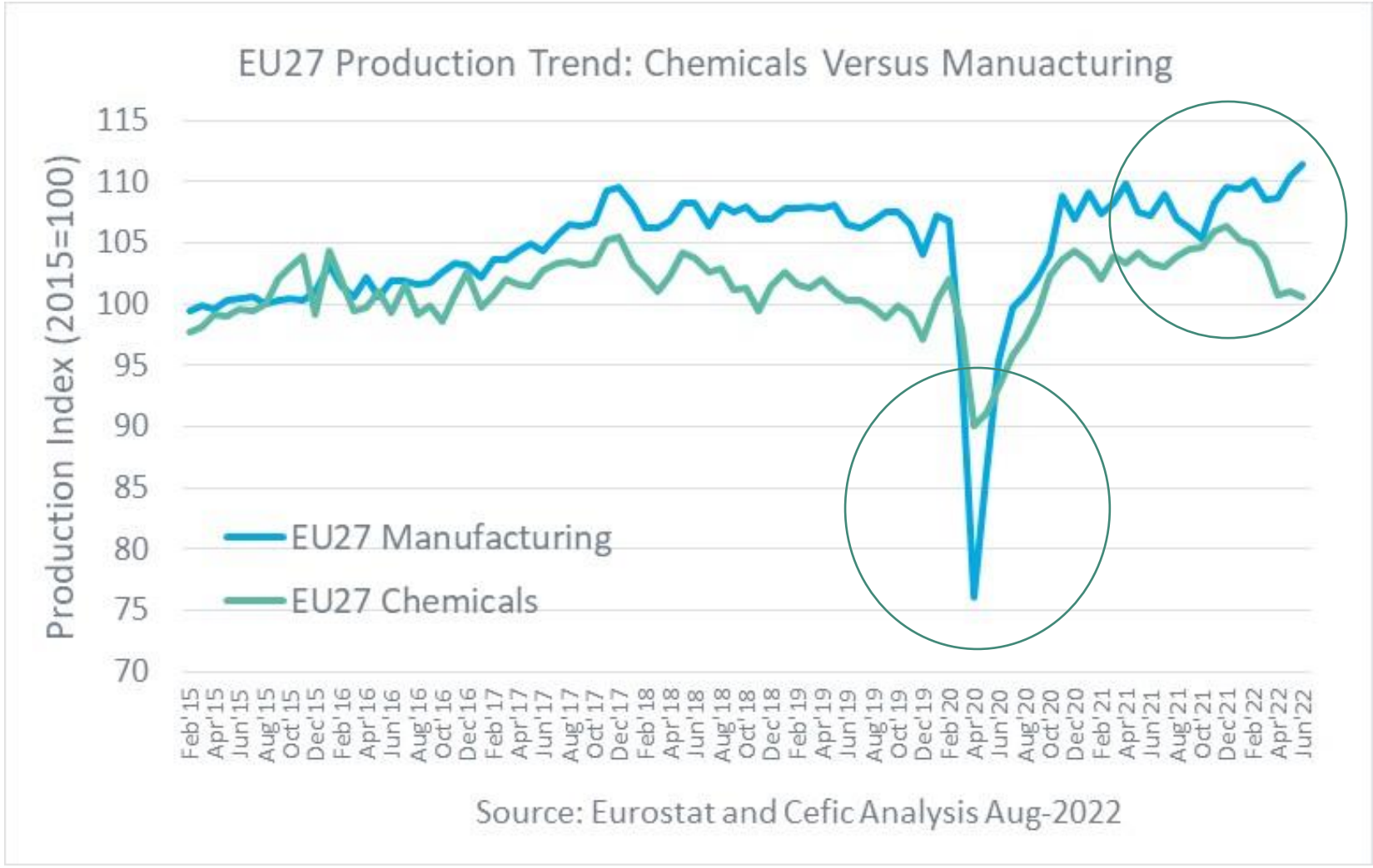
https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices



Total support: 280 bn €

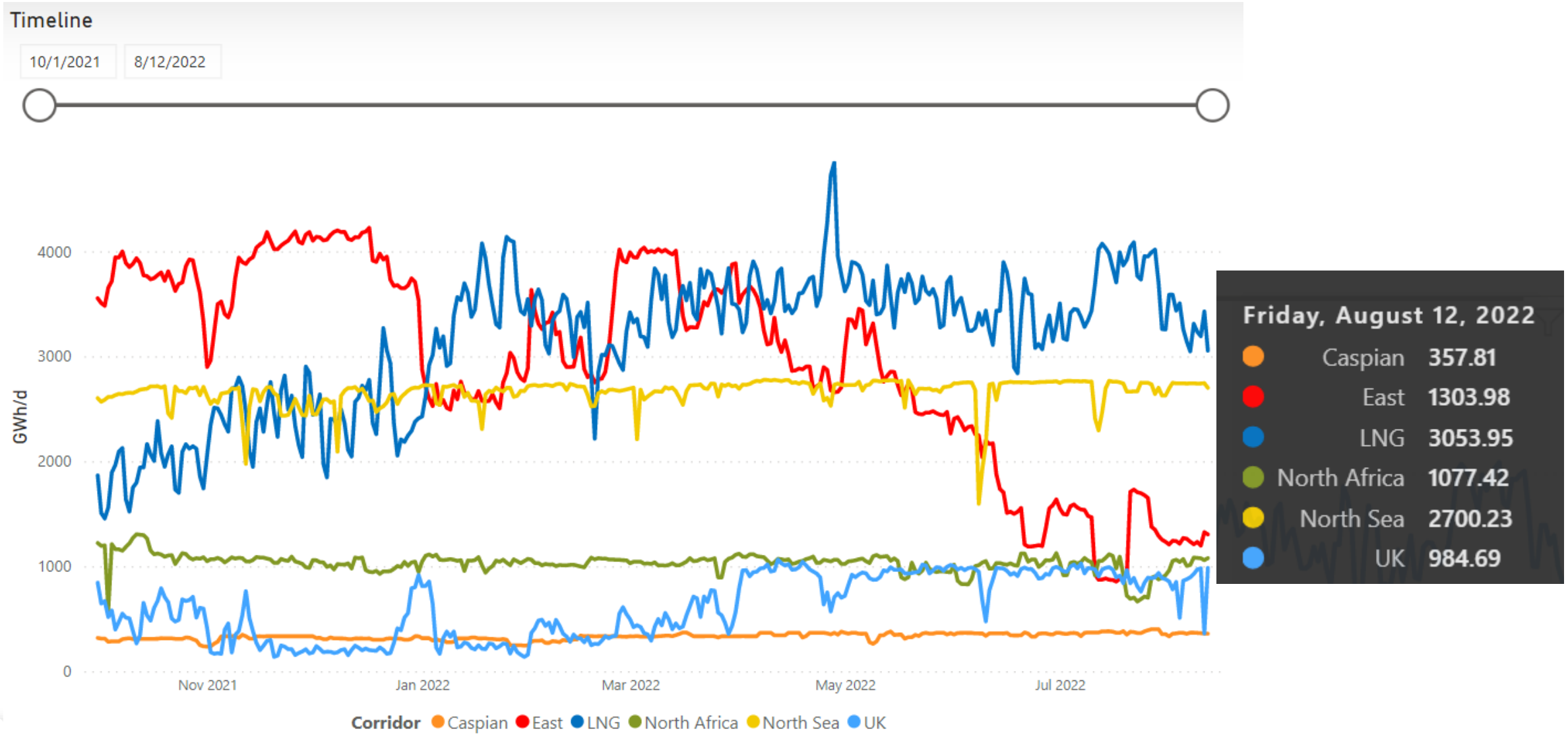
Manufacturing and chemicals moved to opposite direction

- ***In June 2022, EU27 manufacturing production increased by 3,9% compared to June 2021****. The analysis of the first half of 2022 shows that output was 1.4% above 2021's level (Jan-June),*
- ***On the chemicals side, figures are less positive, output in June was 2,7% below 2021's level****, and 1H2022 was 0,7% below the first half of 2021.*
- ***Chemicals and manufacturing move to opposite direction during the first half of 2022.*** *Chemicals is most impacted by the energy crisis than the overall manufacturing sector.*

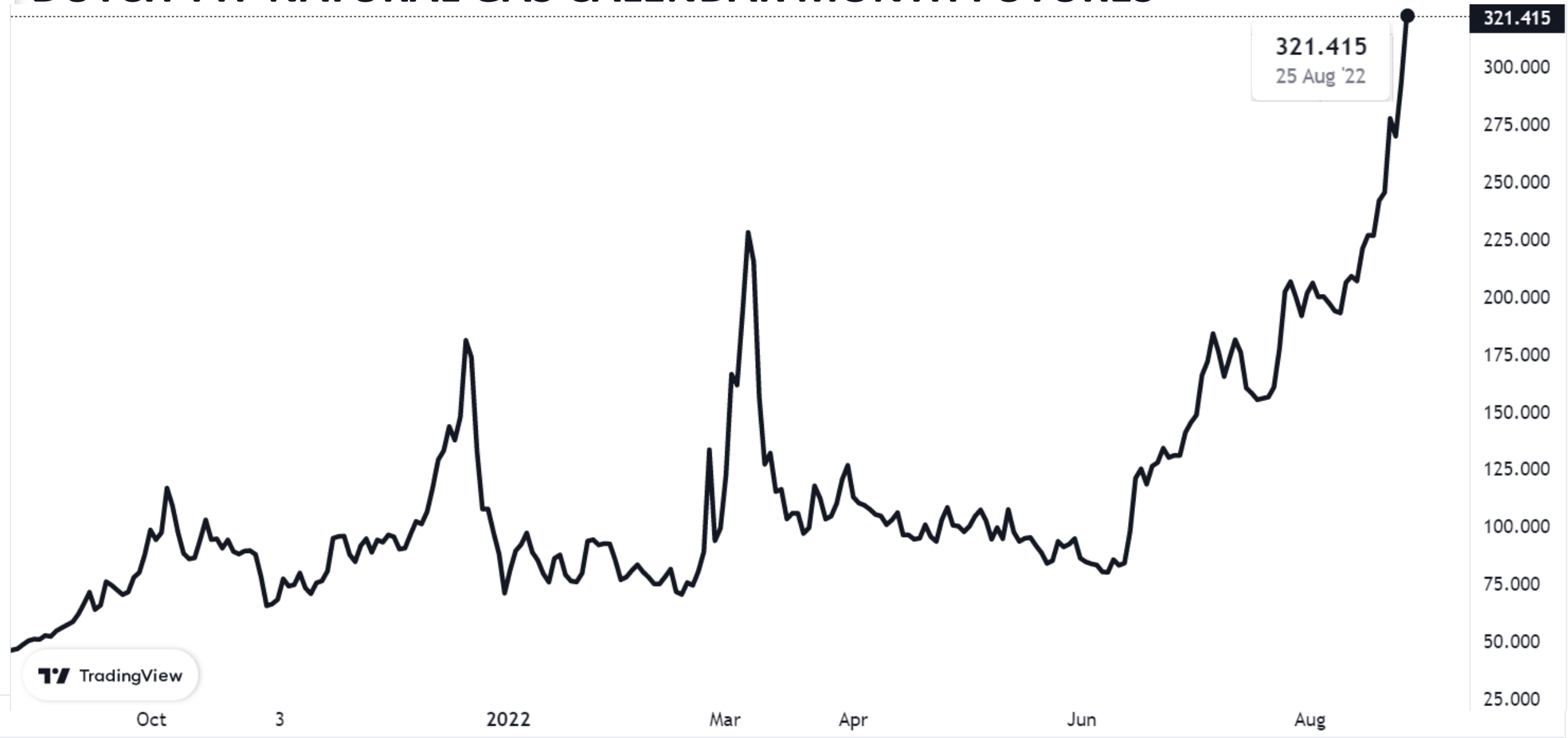


Source: Eurostat and Cefic Analysis-**August 2022**

Gas supply to corridors and flow to Europe (source: ENTSOG Dashboard)

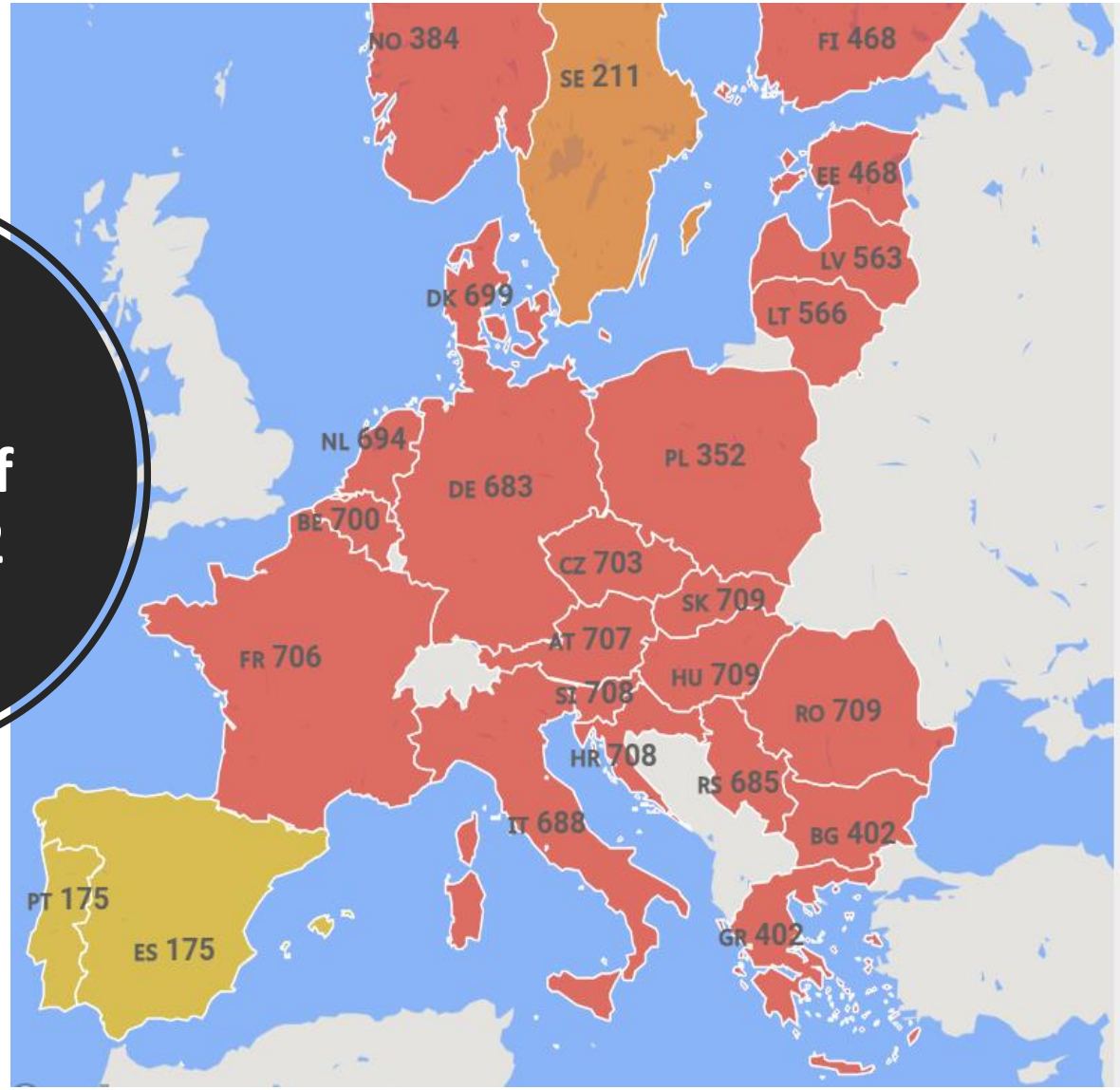


DUTCH TTF NATURAL GAS CALENDAR MONTH FUTURES



Source: https://www.tradingview.com/symbols/NYMEX-TTF1%21/

Electricity prices as of 26/8/2022



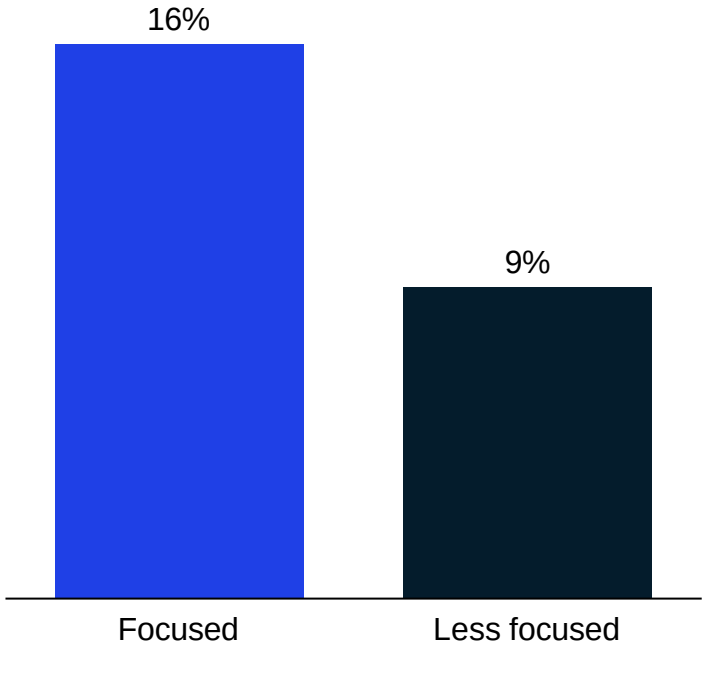
AT Austria	707.23
BE Belgium	700.41
BG Bulgaria	402.03
CZ Czechia	703.26
DE Germany	682.89
DK Denmark	699.44
EE Estonia	468.19
ES Spain	175.33
FI Finland	468.19

source: https://euenergy.live/

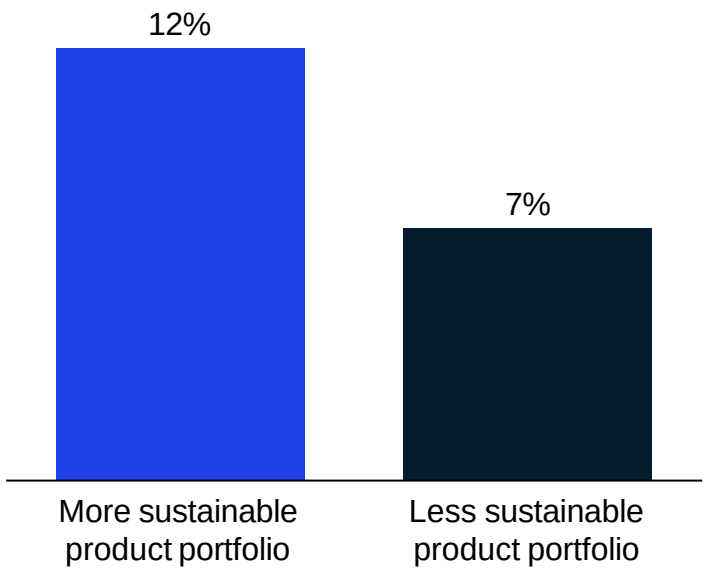
Portfolio effect – more focused and/or "greener" companies more likely to show higher TRS performance

Total return to shareholders – we see a higher TRS performance in companies....

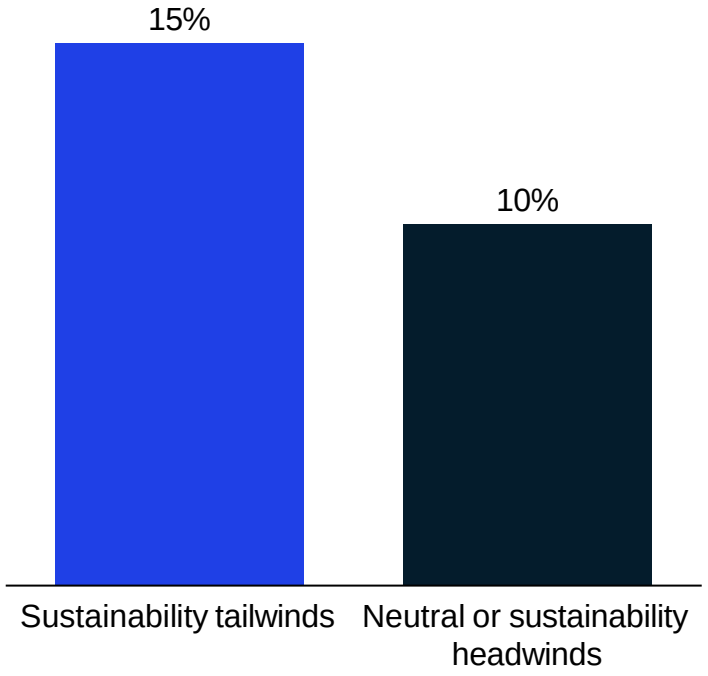
A ... with more focused portfolios[1]



B ... with more bio-based, recyclable or low-carbon product portfolios[2]



C .. exposed to sustainability tailwinds[3]



1. Focused players make more than 80% of their revenues in maximum 2 chemical segments, CAGR 17-21
2. More/less than 25% of sales in biologic, recyclable or low-carbon products, CAGR 16-20
3. Companies with sustainability tailwinds are e.g., in Evs, energy storage, water reduction, energy efficiency, natural ingredients, circular packaging, while companies with sustainability headwinds are oil&gas, ICE automotive, guns, ammunition, tobacco. See back-up for details, CAGR 16-20

Drawing a long-term investment timeline

* Illustrative