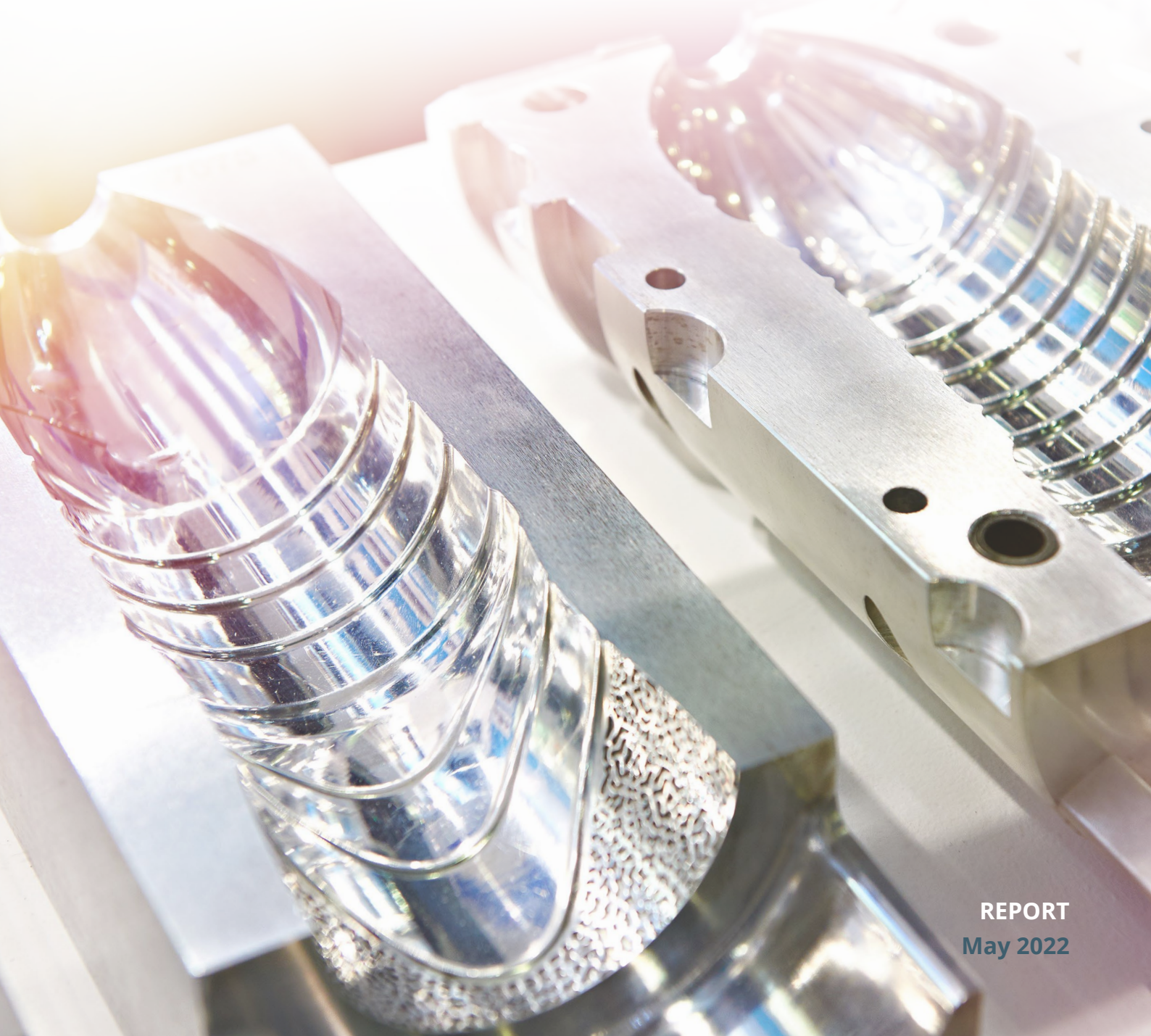


# BREAKING THE MOULD

**BUSINESS-AS-USUAL** IS A HIGH-RISK  
STRATEGY FOR THE EU PLASTIC INDUSTRY





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## Synopsis

**The EU plastic industry plays an important role in determining the fate of our climate, environment, health and economy.** To compete on a global scale and save our finite natural capital, companies and investors must commit to a transition towards sustainability. Corporates, investors, debtholders, financiers, regulators and politicians have a crucial decision to make - has the plastic industry's business-as-usual model become more risky than embarking on a transition to a more sustainability-driven strategy?

## Key takeaways

- The plastics sector benefits the economy of the EU27<sup>1</sup> providing an important source of jobs. Yet the industry's current ability to compete is compromised by other low-cost suppliers and disadvantageous pricing for plastic feedstocks. Given its declining global market share, the industry looks set for disruption. Transitioning to sustainable business practices<sup>2</sup> in line with a reduce and reuse economy, may be its best and only viable option.
- Such a transition should be led by the companies dominating plastic production. This is a group of 87 publicly traded companies accounting for 75% of plastic<sup>3</sup> production capacity across the EU supply chain<sup>4</sup>. The largest cluster (hub) operates within the Trilateral Chemical Region<sup>5</sup>, which accounts for 45% of total EU27 plastic production capacity.
- The parties financing the big 87 are all concentrated. Just 40 key banks, brokerage houses, insurance companies and investment advisers account for EUR 678 billion (USD 739 billion) invested in shares of these companies.<sup>i</sup>
- To date there have been low levels of EU investment in new production processes and facilities; progress on a sustainable transition is still slow.
- Consumers' growing awareness of the damaging effects of the plastic sector on our environment, climate and health has spurred new demand for sustainable plastics. Increasing pressure from Paris Agreement-led environmental regulations and increasing ESG demands from investors have also urged change.

***Transitioning to sustainable business practices in line with a reduce and reuse economy, may be its best and only viable option.***

<sup>1</sup> The EU27 countries are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

<sup>2</sup> E.g. zero waste plastic production, resource-efficient production and designing plastic for reuse and recycling.

<sup>3</sup> Plastic in this paper encompasses acrylonitrile butadiene styrene (ABS), expandable polystyrene, high density polyethylene (HDPE), low density polyethylene (LDPE), linear low density polyethylene (LLDPE), polyethylene terephthalate (PET), polypropylene, polystyrene and polyvinyl chloride (PVC).

<sup>4</sup> The plastic supply chain in this paper is defined as the basic chemicals that make up the plastic production supply chain.

<sup>5</sup> The Trilateral Chemical Region encompasses Flanders (BE), the Netherlands and North Rhine Westphalia (DE).



- Thanks to several new policies, sector commitments and growing consumer and investor demand, a small-scale transition has begun to take place.
- Some financial institutions are beginning to recognise the problems associated with plastic pollution such as Robeco<sup>6</sup> and Morgan Stanley<sup>7</sup>.
- In the last five years, an analysis of proposals shows that only 9 resolutions have been discussed at AGMs. This demonstrates that investors are largely disengaged from the problems associated with plastic production.
- Our analysis of 990 corporate bonds and loans issued by the world-leading plastics manufacturers found only three linked to decreasing plastic pollution. None of the sector's 40 green bonds or loans are linked to reducing plastic pollution in the EU.
- For the EU27 plastic industry to remain competitive at a global level, the 87 plastics companies tracked in this paper should develop and publish their business transition strategies with quarterly key performance indicators targeting 100% sustainable plastic production by 2025. Without the input of these industry leaders, meaningful progress is challenging.
- Investors, debtholders, financiers and regulators must engage more meaningfully with the plastic production companies currently dominating the market. These include Borealis, INEOS and TotalEnergies<sup>8</sup>. The EU plastic industry is facing competitive headwinds. In addition, regulatory challenges are rising, with the EU often leading this global movement. Consumers and investors are beginning to understand the effects of physical plastic pollution and the carbon emissions associated with this industry. Add on its plastic toxic footprint and the impact on human health, and a business-as-usual model appears a high risk option. Now is the time to transition to more sustainability-driven business strategy.

<sup>6</sup> Robeco backs calls for a new global plastic treaty. For a fuller analysis of institutions and corporates which did and did not back the call for a global plastic treaty see Planet Tracker's 'Hiding Away'.

<sup>7</sup> Morgan Stanley's Plastic Waste Resolution Senior Researcher.

<sup>8</sup> For list of the top 20 global plastic producers please see Minderoo's 'Plastic Waste Makers Index' and Planet Tracker's 'Policing the Plastic Producers'.



## Introduction: The risk of not doing something new

*“People normally say the risk of doing something new is very high. I’d argue today, actually, the risk of not doing something new is very high indeed.”* Paul Hodges, Chairman of New Normal Consulting

Thanks to its flexible, durable composition, plastic has become a ubiquitous material with numerous applications. Plastics have strategic uses in several sectors, including government, with their applications in medical equipment, food hygiene and military provisions.

The importance of the plastic and petrochemical industry to a number of EU economies has protected its operations from disruption. However, a growing awareness of the detrimental impact of plastic pollution, CO<sub>2</sub> emissions, toxins and consequent health implications is causing a revaluation of the economic benefits.

As one of the EU’s biggest contributors of carbon emissions, industrial pollution and post-consumer waste, today’s plastic industry will struggle in a more climate-friendly future. Pressures from resource scarcity, shifting consumer and investor preferences and regulations demand major changes from the industry.

This report identifies the companies which need to catalyse this shift. These industry leaders, responsible for 75% of capacity across the EU plastic production supply chain (105,311 kt), are largely clustered within the Trilateral Chemical Region, which accounts for 45% of total EU27 plastic production capacity. That is where pressure is mounting and that is where change must start.

Enter the sustainability transition plan. This single tool could give the EU27’s plastic companies a realistic means to shift their plastic production supply chains by 2025. There are a range of known solutions available to major plastic producers which they can choose to incorporate into their plans.

This report also looks at the risks and opportunities facing institutional investors in this space. This is closely linked with these companies’ strategies.

The report further outlines key recommendations for different stakeholders and examines what they could do to facilitate the transition necessary for the EU27’s plastic industry to remain competitive globally and establish the EU27 as a plastic market leader.

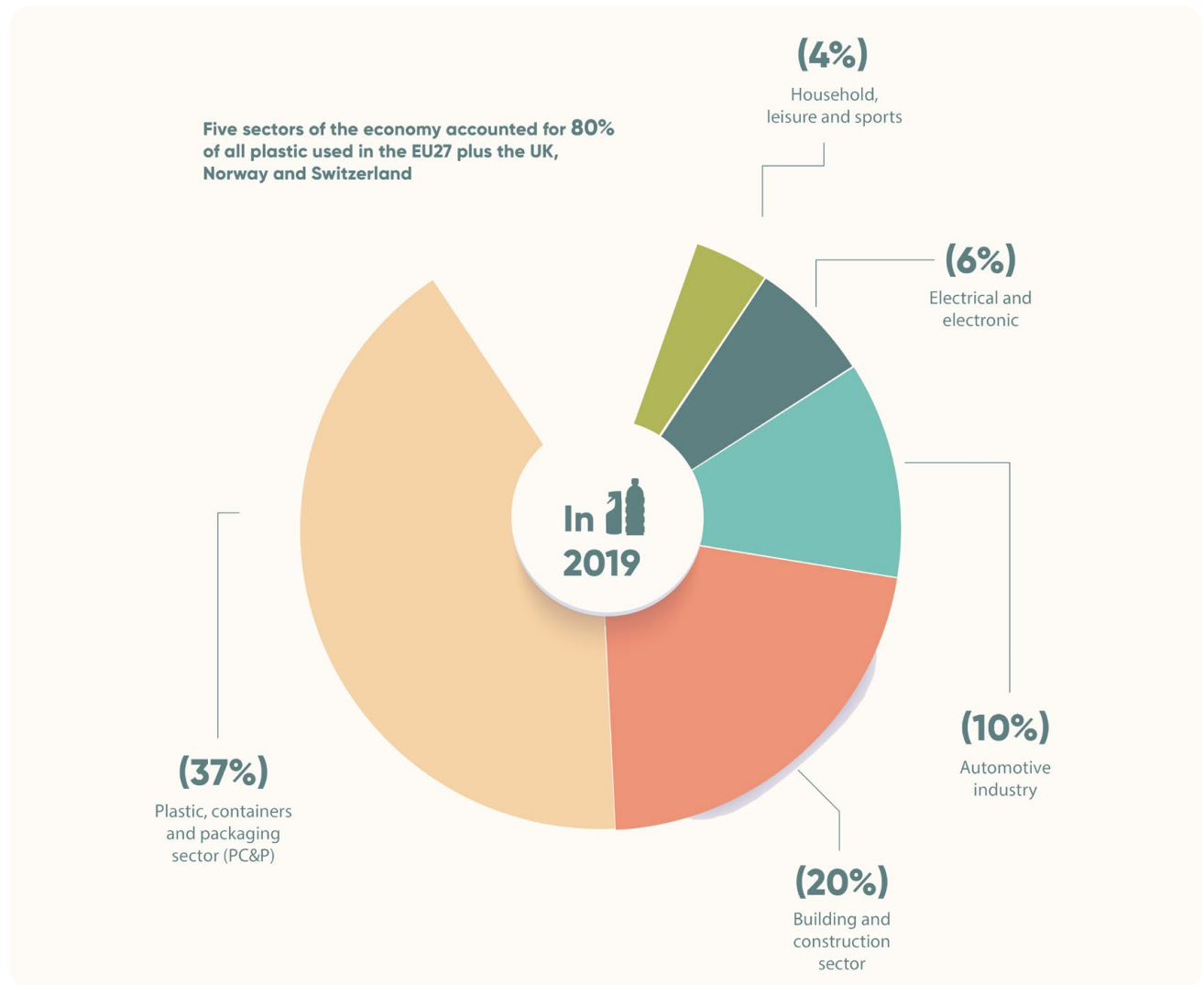


## The EU's highly concentrated plastics sector

Understanding the EU plastic sector and the basic components of its supply chain is key to identifying the risks and opportunities within the sector's overarching trends.

### Key actors

In 2019, five sectors of the economy accounted for 80% of all plastic used in the EU27 plus the UK, Norway and Switzerland:



The plastics used in all five sectors comprise basic chemicals, the building blocks for the chemical engineering processes used in plastic production. These basic chemical feedstocks are primarily produced in the Trilateral Chemical Region.

Publicly traded companies dominate production of Europe's supply chain overall and along each of its nodes. The top 30 public and private chemical companies account for 93% of total EU capacity while 22 publicly traded companies make up 73% - see Table 1.



*Table 1: Top 30 EU27 company exposure by kilotonnes capacity, 2019.  
(Green rows are publicly traded companies, blue rows are privately held companies)<sup>ii</sup>*

Company	% EU Capacity	2019 kt capacity	ISIN/FIGI
INEOS	11.1%	14,809	BBG00J07QZM2
TotalEnergies	8.3%	11,087	FR0000120271
Dow	7.6%	10,118	US2605571031
LyondellBasell	7.0%	9,320	NL0009434992
BASF	5.2%	6,961	DE000BASF111
OMV	4.9%	6,580	AT0000743059
Shell	4.9%	6,463	GB00B03MLX29
PKN Orlen	4.7%	6,245	PLPKN0000018
Eni	4.2%	5,649	IT0003132476
BP	3.9%	5,157	GB0007980591
ExxonMobil	3.8%	5,043	US30231G1022
Repsol	3.5%	4,594	ES0173516115
SABIC	3.4%	4,586	SA0007879121
Kem One	2.3%	3,102	BBG005RSMNV8
Vynova	2.2%	2,950	BBG0018DW8M3
Indorama	2.1%	2,856	TH1027010004
MOL	2.1%	2,823	HU0000153937
Westlake	1.6%	2,175	US9604131022
Shin-Etsu Chemical	1.6%	2,117	JP3371200001
Orbia	1.2%	1,558	MX01OR010004
Agrofert Holding	1.2%	1,560	BBG000BBF755
Trinseo	1.1%	1,485	LU1057788488
Mubadala	1.1%	1,465	BBG00DZFGK16
Synthos	0.8%	1,110	BBG00NRVXR69
International Petroleum Investment Co.	0.8%	1,094	BBG000DXH5M8
Chempetrol	0.6%	821	BBG001C7SZH2
OCI N.V.	0.5%	622	NL0010558797
Braskem	0.4%	545	BRBRKMACNPA4
Ercros	0.4%	545	ES0125140A14
Evonik	0.4%	520	DE000EVNK013
<b>Total</b>	<b>92.6%</b>	<b>123,440</b>	



**These companies are essential for effecting a significant transitioning to a sustainable business model in Europe.** Their outsized influence over the industry means that they have the technological resources, investment and capacity to embed sustainable practices into mainstream plastic production. See Planet Tracker's report [\*Paying for Transition\*](#)

## Supply chain

Currently, the EU27 plastic industry is almost solely reliant on fossil fuel feedstocks: crude oil or natural gas. These feedstocks are used to produce ethane, naphtha, pentane and ammonia, which in turn produce the feedstocks to create basic chemicals for use in the plastic production supply chain. Brine is used to produce sodium chloride, while caustic soda is used to produce chlorine used in the Chlor-Alkali & Vinyls supply chain in PVC production.

The plastic supply chain has **three main nodes** - see Figure 1 and Appendix 1 for further detail:

- 1 Basic Chemicals:** Cracking and refining convert feedstocks into monomers, which are the building blocks of polymers. Refining requires heating the feedstocks and sending the contents to a distillation unit so that the lighter and heavier compounds separate, which is called fractionalisation. After distillation, either steam or catalytic cracking occurs, which breaks down hydrocarbons into intermediate chemicals.
- 2 Intermediates:** Polymerising monomers such as the olefins - ethylene, propylene or butylene - creates polymers, via one of two manufacturing processes. Addition polymerisation applies a catalyst, such as peroxide, to produce polyethylene, polystyrene and polyvinyl chloride. Condensation polymerisation joins monomers by removing molecules such as water and adding a catalyst to produce polyester and nylon.
- 3 Plastics:** Processing polymers creates plastics. This includes extruding, palletisation, adding chemicals and additives and shaping plastic into the products sold by the plastic container and packaging sector. See Planet Tracker's report [\*Paying for Transition\*](#)





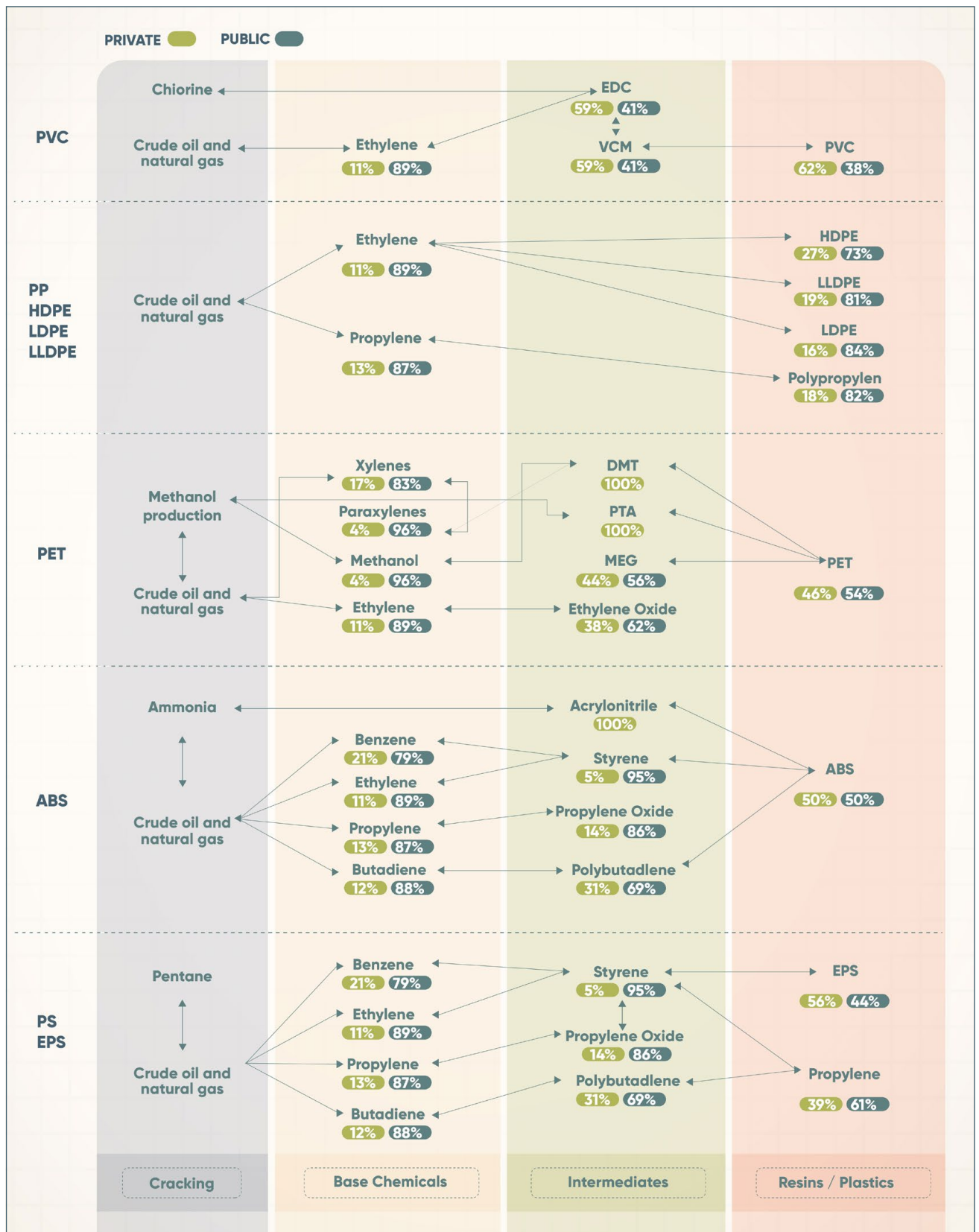


Figure 1: EU27 supply chain ownership of polyvinyl chloride (PVC), polypropylene (PP), high density polyethylene (HDPE), low density polyethylene (LDPE), linear low density polyethylene (LLDPE), polyethylene terephthalate (PET), acrylonitrile butadiene styrene (ABS), polystyrene (PS) and expanded polystyrene (EPS), 2019 kilotonnes capacity<sup>iii</sup> Assessment of 20,000 investor positions in publicly traded and privately held institutions that dominate the EU27 plastics production supply chain across each of nine plastic resins. Source: Planet Tracker.





Across these three supply chain nodes are three main **supply chain categories**:

- **Aromatics:** Aromatics include benzene, toluene and xylenes (together called BTX). They are produced via naphtha obtained from petroleum refineries. BTX can be also produced by the aromatisation of alkanes. Manufacturers use xylenes to produce plastics and synthetic fibres. Aromatics supply chains include ABS, PET, expandable polystyrene (EPS), and polystyrene (PS) – both high impact polystyrene (HIPS) and general-purpose polystyrene (GPPS).
- **Olefins/Polyolefins:** The olefins/polyolefins supply chain starts with distilling oil or natural gas during the refining process. The distillate is then cracked to produce ethylene and propylene. The next step is to polymerise ethylene and propylene to produce polyethylenes - HDPE, LDPE, and LLDPE - and polypropylene (PP).
- **Chlor-Alkali & Vinyls:** Chlorine and caustic soda sourced from brine characterise the chlor-alkali & vinyls supply chain. These feedstocks are used via a complicated set of steps to produce many products including polyvinyl chloride (PVC).





## A decade of stagnating returns

The past decade upended many of the assumptions that the EU plastics sector had previously forecast. Price volatility for feedstocks and a declining global market share have threatened the EU's competitiveness in the global industry.

### Plastic prices: 2010–2020

With increasing global competition, energy costs are one of the EU's greatest obstacles to maintaining a competitive edge in its production of plastics. Compared to the EU, US shale gas expansion has decreased both energy and feedstock costs in the US. From 2010 to 2019, ethylene cash costs for the EU were approximately twice as expensive as in the US. Yet this gap diminished from 2014 to 2019 with EU ethylene cash costs falling from 2.7 to 1.8 times more expensive than US cash costs.

During this period, from the start of 2010 to Q2 2021, the prices of most basic chemicals, intermediates and plastic resins remained stable, apart from a couple of outliers. In general, basic chemicals in the EU have seen price declines over the past decade, 2010–Q2 2021 - see Figure 2.

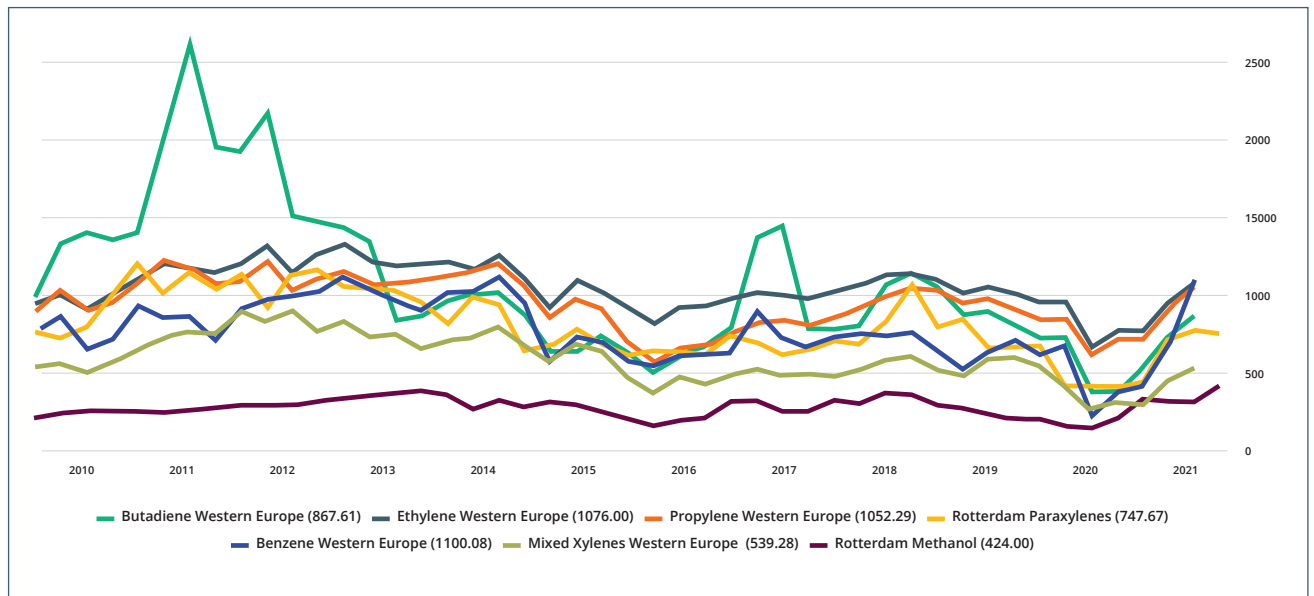


Figure 2: EU27 basic chemical prices EUR per kilotonne, quarterly 2010 to Q2 2021.<sup>iv</sup>



Similarly, the EU prices for intermediate chemicals have stayed relatively stable, 2010 to Q2 2021 - see Figure 3.

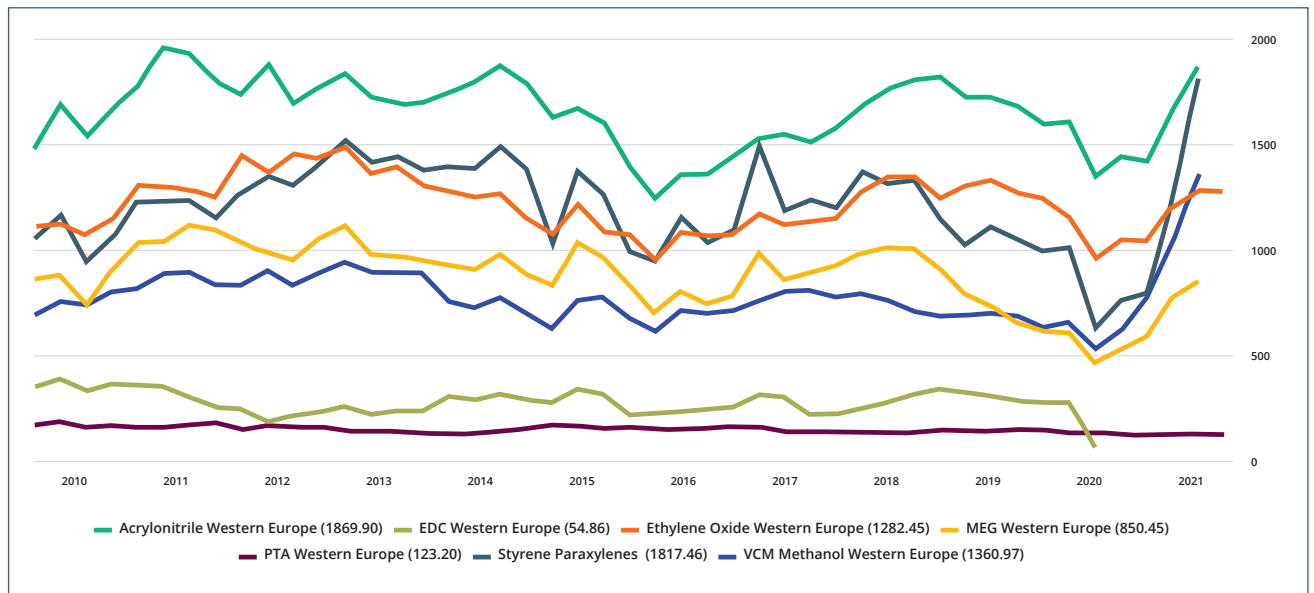


Figure 3: EU27 intermediate chemical prices EUR per kilotonne, quarterly 2010-Q2 2021.<sup>v</sup>

Meanwhile, EU plastic prices have experienced substantial volatility from 2010 to Q2 2021 - see Figure 4.

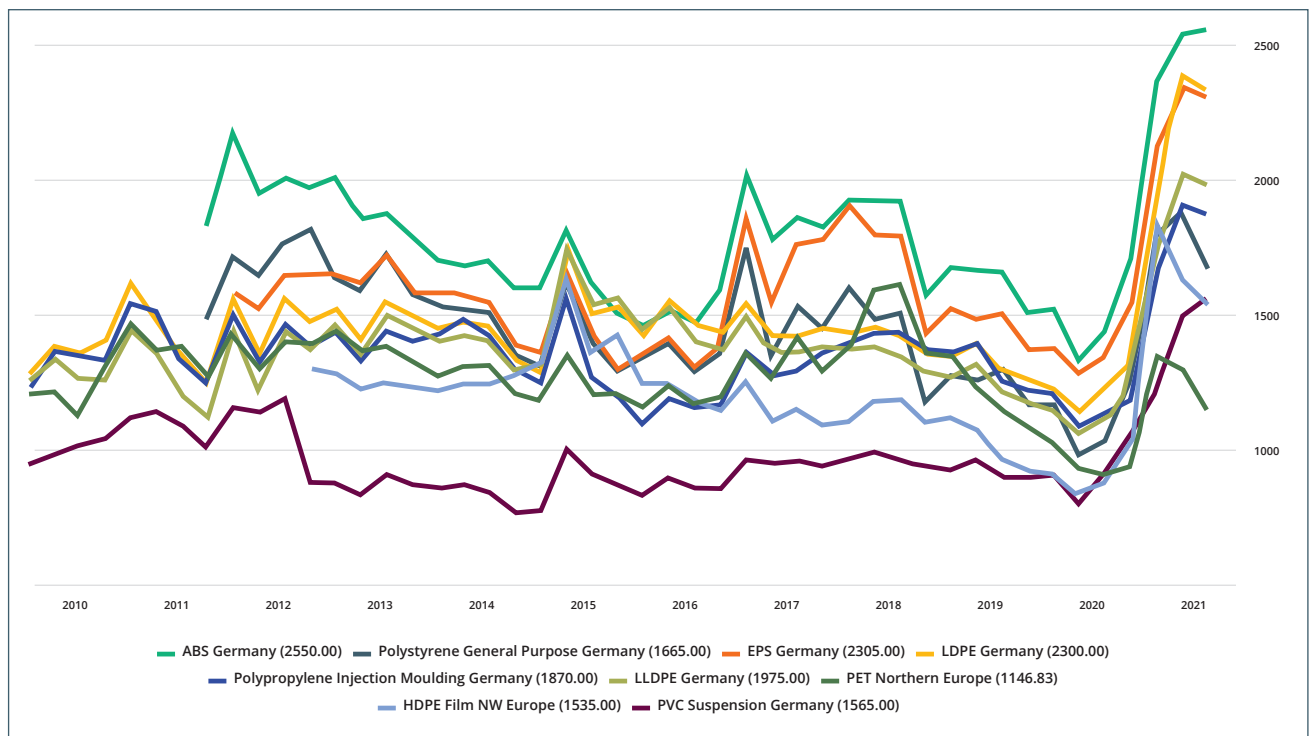


Figure 4: EU27 plastics prices EUR per kilotonne, quarterly 2010-Q2 2020.<sup>vi</sup>

EU27 plastic price spikes broadly correlate with macro-economic events, such as the 2015 oil spike, GDP growth changes and, of course, changes in consumer preferences such as heightened sanitisation concerns during the COVID-19 pandemic.

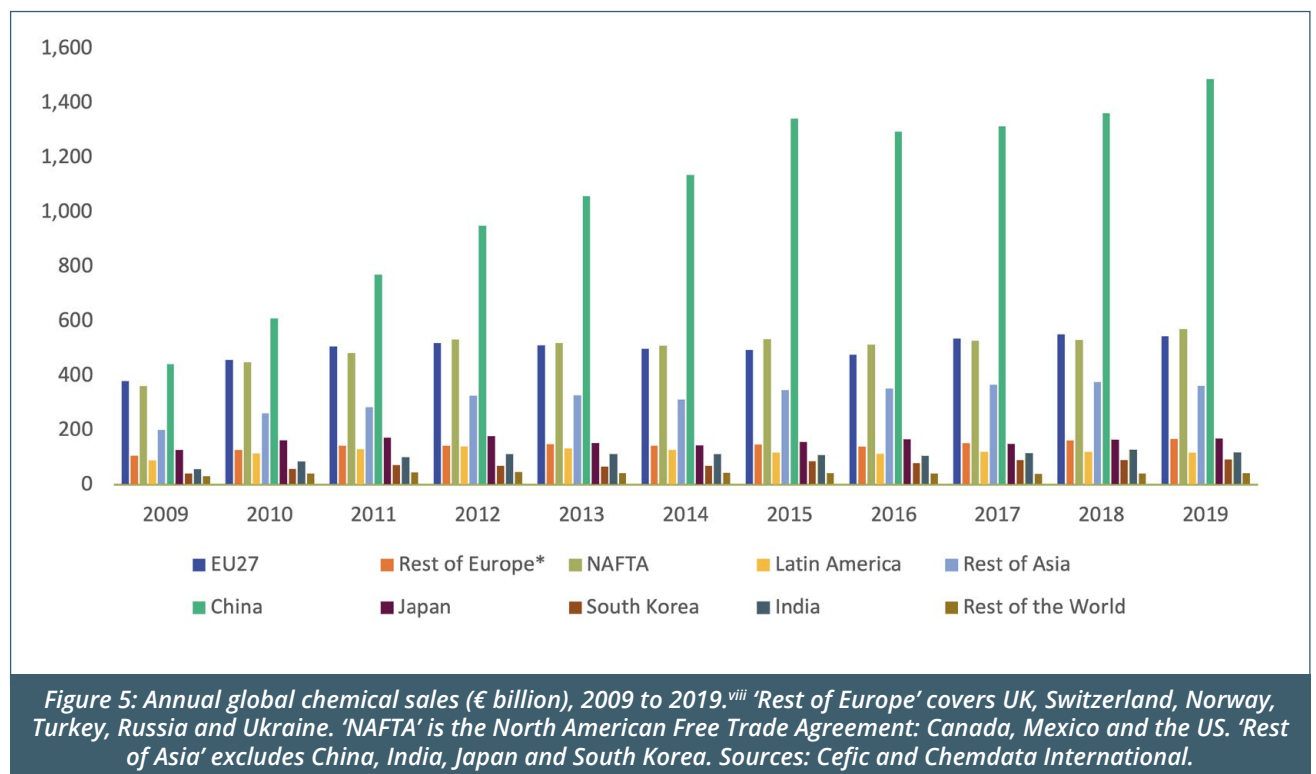


## A sector in decline

The economic turnover of the EU27's plastic sector has already flatlined, with zero growth recorded from 2010 to 2019, despite an uptick in global plastics production. In fact, over the course of this decade, the EU27 global chemical market share, and plastics as a percentage of EU27 chemical sales, both went down.<sup>vii</sup>

At the beginning of the last decade, the EU27 was the second largest chemicals producer in the world; by the end of 2019, it had dropped to third largest by sales. Meanwhile, China grew its global chemical sales from EUR 609.5 billion to EUR 1,488.0 billion and expanded its global market share from 25.8% to 40.6%. China is now the leading chemical producer globally by a notable margin.

The top six EU27 countries by plastic production capacity - Belgium, France, Germany, Italy, the Netherlands and Spain - have been hardest hit by the EU27's decline in global market share dominance - see Figure 5.



The declining share of the global market and a lack of investment in new plant and production processes are indications of a struggling EU plastic industry.

This implies existing business strategies are failing. Surely a different strategy is worthy of serious consideration?





## Mounting pressures: the case for transition

Too often, sustainable transition narratives skip to the question of **how** change can be achieved. Oftentimes, this has led to much rhetoric with minimal action, as the key actors are yet to be convinced of the **why**.

On top of the deteriorating competitive position of the EU chemical and plastic industry, environmental issues are mounting. Half of the plastics that have ever been produced have been made in the last 15 years.<sup>ix</sup> The escalation of plastic production has inevitably highlighted the negative impacts of plastic.

The issue of **carbon emissions** is not vanishing. The EU is perceived as the world leader in reducing its carbon footprint.

**Plastic pollution** has become increasingly visible to both the Global North and South. This appears to be one of the major reasons that the world's countries agreed to progress with a *global plastic treaty*. Europe produces 15.8 million tonnes<sup>x</sup> of plastic packaging waste each year, or 31 kg per person. The three main management strategies for plastic waste in the EU are incineration (43%), recycling (33%), and landfill (25%).<sup>xi</sup>

Europe exports a significant amount (2.37 million tonnes in 2020<sup>xii</sup>) of the plastic post-consumer waste, sending waste to countries lacking effective waste management infrastructure. Following China's plastic import ban in 2018, Turkey and Malaysia became the top importers of plastic waste from Europe, however the EU now prohibits sending unsorted bales of plastic waste<sup>9</sup>.

Increasingly, research is raising public awareness about the **toxic risks** associated with plastic.

These environmental issues are likely to heap additional costs on chemical producers at a time when remaining competitive is a challenge. We discuss these threats in further detail below.

Corporate management should require little convincing on why a change is necessary.

<sup>9</sup> <https://www.euractiv.com/section/energy-environment/news/recyclers-fret-as-eu-plastic-waste-export-ban-comes-into-force/>





## Climate

The 2015 Paris Agreement set a clear goal for countries to limit global warming to well below 2°C, preferably 1.5°C, reiterated recently at COP26 in Glasgow. A 2050 scenario of increased plastic lifecycle emissions and oil feedstocks would prevent nations globally from decarbonising their economies and achieving this threshold.

Climate impacts are already noticeable across Europe, such as floods, droughts, extreme temperatures, wildfires and sea level rise. The EU plastic industry's leaders must take action now to reduce emissions, or risk stranding its assets if policymakers respond abruptly to climate tipping points.

The EU27's plastic industry current supply chain emitted an estimated 178 million mtCO<sub>2</sub>e in 2018.<sup>xiii</sup> If emissions continue to increase as they have over the past decade, plastic lifecycle emissions from production to incineration could reach 2.75 gigatons CO<sub>2</sub>e annually or 56 gigatons total by 2050. This equates to 10 to 13% of the entire remaining carbon budget within the 1.5°C scenario.<sup>xiv</sup> In some scenarios, it might equal as much as 15% of the global carbon budget.<sup>xv</sup>

Furthermore, oil feedstocks for plastics and textiles could double from 9 million barrels per day to about 18 million barrels per day, unless industry, regulators and policymakers manage to successfully unite to address this problem.<sup>xvi, xvii</sup>

One critical risk for investors is financing plastic waste-to-energy incineration plants. According to a recent report by the UN Environment Programme, direct emissions from waste incineration, which includes plastics, makes emissions from waste-to-energy equivalent to coal emissions.<sup>xviii</sup> As a result, most of the EU's development funds and the EU taxonomy now exclude these facilities.

**Investor Impact:** For investors in the EU, the impacts of financing plastic incineration within the EU waste-to-energy infrastructure are significant.

- EU Recovery and Resilience Facility, February 2021, at EUR 672.5 billion (USD 732 billion) presents construction of new waste incinerators<sup>xix</sup> as an example of non-compliance.<sup>xx</sup>
- With some exceptions, the European Regional Development Fund and the Cohesion Fund, together at EUR 234 (USD 255) billion, prohibit investment in expansion of waste-to-energy facilities.<sup>xxi</sup>
- Just Transition Fund, EUR 40 billion (USD 44 billion), explicitly prohibits waste incineration from financial support.<sup>xxii</sup>
- EU Taxonomy excludes activities that "lead to a significant increase in the generation, incineration or disposal of waste, with the exception of the incineration of non-recyclable hazardous waste".<sup>xxiii</sup>
- European Investment Bank's Climate Bank Roadmap excludes waste incineration.
- EU Renewable Energy Director excludes waste incineration, unless first in compliance with the EU Waste Framework Directive.<sup>xxv</sup>



## Health

Many listed toxic chemicals are released during the chemical engineering process to produce plastics. For example, benzene, a known human carcinogen, is one of the toxic chemicals most often released during plastic production.<sup>xxvi</sup> It can cause a vast range of negative health impacts, such as endocrine disruption, asthma and diabetes.

During the fossil fuel extraction part of the process, dangerous pollutants like sulphur oxides, nitrogen oxides, volatile organic compounds, chlorinated and other toxic organic chemicals are released into the environment.

Many toxic chemicals are also often released during plastic production itself. According to the European Industrial Emissions Portal, the EU27 plastic sector had up to 2,167 toxic chemical releases that exceeded legal and regulatory limits across all pollutant categories in 2017. They accounted for 53% of the total toxic chemical output across the entire chemical sector. Most of the toxic chemical releases from EU plastic production occurred via air (58.2%) or water (41.3%).<sup>xxvii</sup>

The detrimental effects of plastic on human health do not only concern individuals, they can also cost the healthcare sector and the taxpayers that fund it.



## Plastic Pollution

Plastic pollution is a clear, present and persistent danger to our shared environment.

By 2040, global plastic pollution is forecast to triple, with 80% expected to come from flexible and multilayer plastics, which are often transported as nurdles<sup>xxviii</sup> - small bean-sized pellets which are heated and formed into the plastic products we use and dispose of every day. Nurdle spills in the environment cause harm to wildlife - see Case Study.

Meanwhile, only an estimated 25% of post-consumer plastic waste recovered in the EU is downcycled and used in new products each year.<sup>xxix</sup> The rest is landfilled, incinerated or unaccounted for, which in turn pollute land, air, waterways and oceans.





Today, total plastic waste in the ocean is estimated to be 150 million metric tonnes, at a minimum, and rising.<sup>xxx</sup> At least 229,000 tonnes of this are spilling into the Mediterranean Sea every year<sup>xxxi</sup> - the equivalent of 500 shipping containers each day.

Once at sea, the effects of plastic pollution on the marine environment erodes natural capital to the tune of EUR 30,000 (USD 33,000) per tonne every year, rendering the cost of marine plastic pollution to the EU economy from pollution in the Mediterranean Sea as much as EUR 7.4 billion (USD 8 billion) annually.<sup>xxxii</sup>

The crisis is so large that the European Space Agency Sentinel-2 satellites are now being used to actively track plastic pollution on the high seas.<sup>xxxiii</sup>

Plastic waste is also fouling EU beaches. The OSPAR Commission<sup>10</sup> reported that, from April 2012 to January 2018, 89% of waste found on beaches in the EU was plastic.

Beyond the immediate effects to our world's natural ecosystems, plastic waste and pollution also equal wasted financial capital, resulting from either the inefficient use, or active destruction, of economic and natural capital resources.

### Case Study: Stenungsund Chemical Industry Cluster and plastic pollution spilling into the North Sea

In the EU27, almost all of the plastic production facilities assessed are within 3 kilometres or less from a Natura 2000 protected area. When these facilities spill plastic during production, this plastic pollution can enter protected areas, harming biodiversity.

Stretching over 18% of the EU's land area and more than 8% of its marine territory, Natura 2000 is the largest coordinated network of protected areas globally. It includes Europe's most valuable and threatened species and habitats.

The Stenungsund Chemical Industry Cluster in Stenungsund, Sweden, has plastic facilities owned by INEOS, Akzo Nobel and Borealis - see Figure 6. It is the biggest chemical cluster in Sweden, accounting for 5% of the country's fossil fuel consumption<sup>xxxiv</sup>, with a steam cracker that produces ethylene and various fuel gases.<sup>xxxv</sup> It also employs approximately 2,500 people.<sup>xxxvi</sup>

Fluxes of over 300+ chemicals originate from this cluster, with significant issues with storm water runoff, including the presence of organic pollutants and inorganic material.<sup>xxxvii</sup>

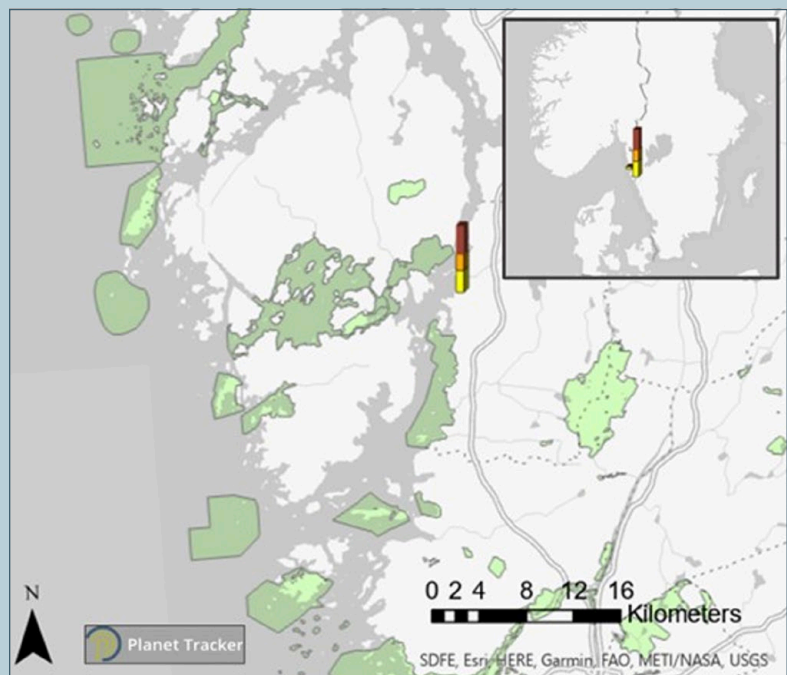


Figure 6: Stenungsund, Sweden chemical and plastic cluster.<sup>xxxviii</sup>

<sup>10</sup> OSPAR is the mechanism by which 15 Governments & the EU co-operate to protect the marine environment of the North-East Atlantic.



In 2016, this cluster was found to be spilling up to 36 million nurdles into plastic into the environment into waters next to nearby Natura 2000 protected areas and waters - Steunungsundskusten, Halsefjorden and other protected areas - and also directly into the North Sea - see Figure 7.



*Figure 7: (A) and (B) 300 µm Mesh Nets Collecting Nurdles on The Rivers outside Production Sites in the Orust-Tjörn Fjord System, Stenungsund, Sweden. February 2016. Image: Karlsson et al.*

Noteworthy is that this is a relatively small production cluster accounting for 0.8% and 1.3% of HDPE and LDPE global capacity respectively.

Additionally, in 2017 the European Environment Agency reported that the same facilities in Stenungsund also released dangerous chemicals exceeding EU27 regulatory levels, including arsenic and its compounds, benzene, mercury and compounds, and more.<sup>xi</sup>

But there is an opportunity for an improvement. At least this cluster provides district heat to the Municipality of Stenungsund, which could possibly be extended to the City of Gothenburg, Sweden.<sup>xii</sup> Also, it is part of Sweden's Sustainable Chemistry 2030 master plan<sup>xiii</sup>, with a planned build-out of Borealis' chemical recycling programme with Stena Recycling and Fortum Recycling and Waste.<sup>xiii</sup>



## Will the public drive change?

There is growing consumer opposition to environmentally damaging products, the impact of which is now being felt in the global arena. Plastic demand forecasts have often been a function of global GDP, but JP Morgan Cazenove is now suggesting that global plastic demand may decrease from 1.5x GDP to 0.5x GDP by 2050.

At the same time, demand for sustainable plastics is growing. The EU Commission's legislative agenda is pushing for a transition towards sustainable plastic production in line with the goals of the 2015 Paris Agreement. It has issued new mandates enforcing certain product bans and design requirements. Numerous policies also support plastic sector innovation.

On 5 June 2019, the European Commission issued a Directive<sup>11</sup> on single-use plastics (SUPs)<sup>xliv</sup> which came into force in July 2021 and prohibits certain plastic items with viable alternatives from entering the market of EU member states: cotton bud sticks, cutlery, plates, straws, stirrers, sticks for balloons, cups and food and beverage containers made of expanded polystyrene.

It also bans all products made of oxo-degradable plastic, often marketed for its biodegradability. The lack of evidence of its ability to break down in the environment has resulted in claims that this misleads customers.

The EU's Directive outlines additional measures requiring Member States to reduce their consumption of single-use plastics, targets for the collection and recycled content of plastic bottles, informative labelling for certain single-use plastic products and extended producer responsibility requiring producers to pay for waste management clean-up, data gathering and certain awareness raising measures on single-use plastic items.

A new UN resolution, "End Plastic Pollution: towards a legally binding instrument"<sup>xlv</sup> signed at the UN Environment Assembly (UNEA-5.2) on May 2, 2022, initiated the process to develop a global legally binding plastic treaty to curb plastic pollution. The plastic treaty aims at expanding circular economy solutions and eliminating single use plastic. It is expected to go into effect by 2024 - see Figure 8 on page 20. The work to establish an international working group on a global plastic treaty is now underway.

Some corporations and trade associations have also issued related commitments. These motivate companies to convert climate, economic and environmental crises into long-term growth strategies that address these crises.

**Unfortunately, none of these EU companies which address the sector's environmental risks are the leading companies in the EU plastics production supply chain highlighted in this report.** This is why the sector still needs further pressure to make a sustainable transition.



<sup>11</sup> <https://eur-lex.europa.eu/eli/dir/2019/904/oj>

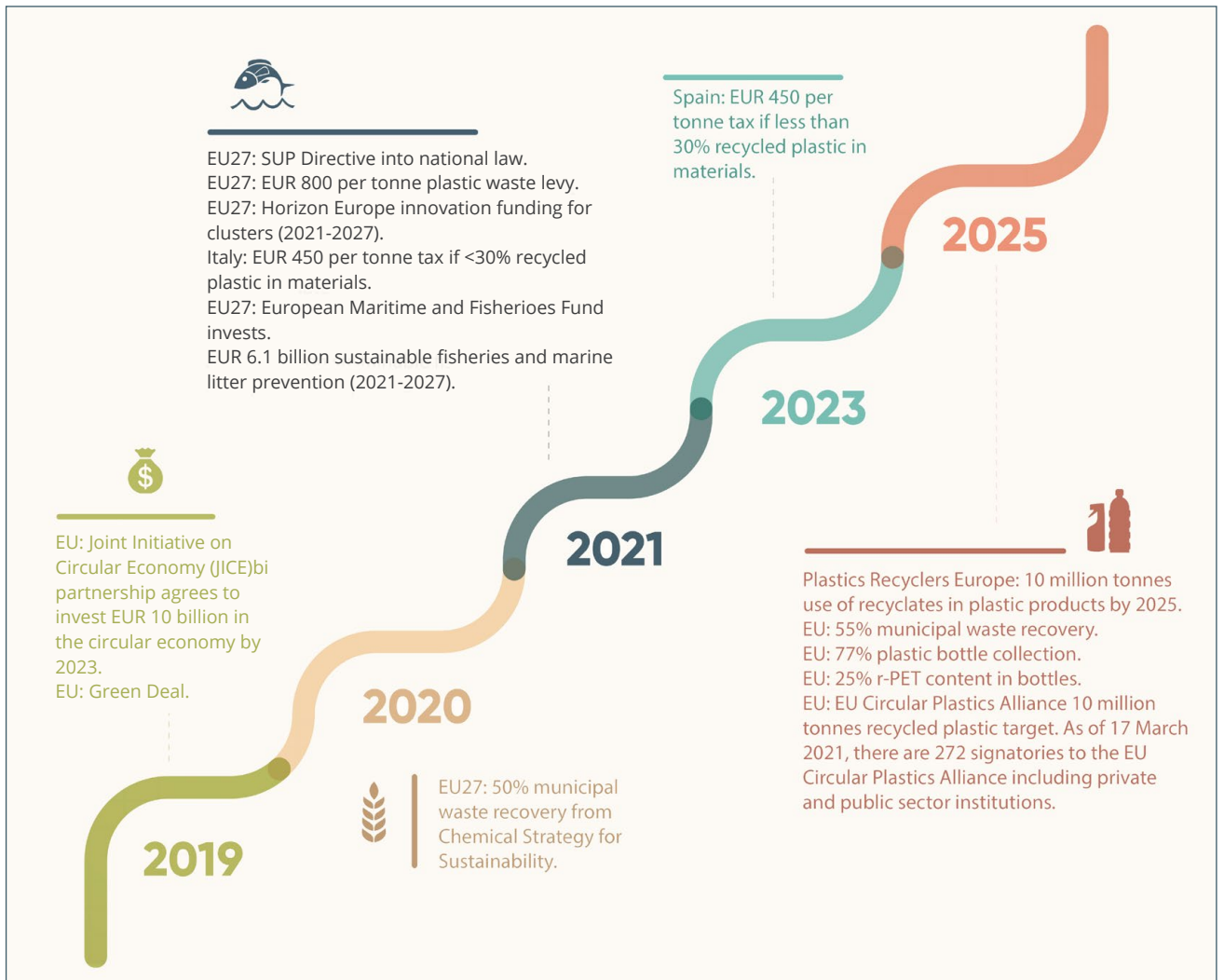


Figure 8: EU27 plastic policy cliff, 2019–2025. Source: Planet Tracker.





## Case Study: The Trilateral Chemical Region Powerhouse

The Trilateral Chemical Region is the plastics powerhouse of the EU27 and one of the largest plastics production clusters globally. It also has the highest global chemicals sales per capita at EUR 3,600 (USD 3,920), compared with EUR 2,400 (USD 2,613) in the United States (US), EUR 1,500 (USD 1,633) in Japan and EUR 1,300 (USD 1,416) in China - see Figure 9.<sup>xlvi</sup>

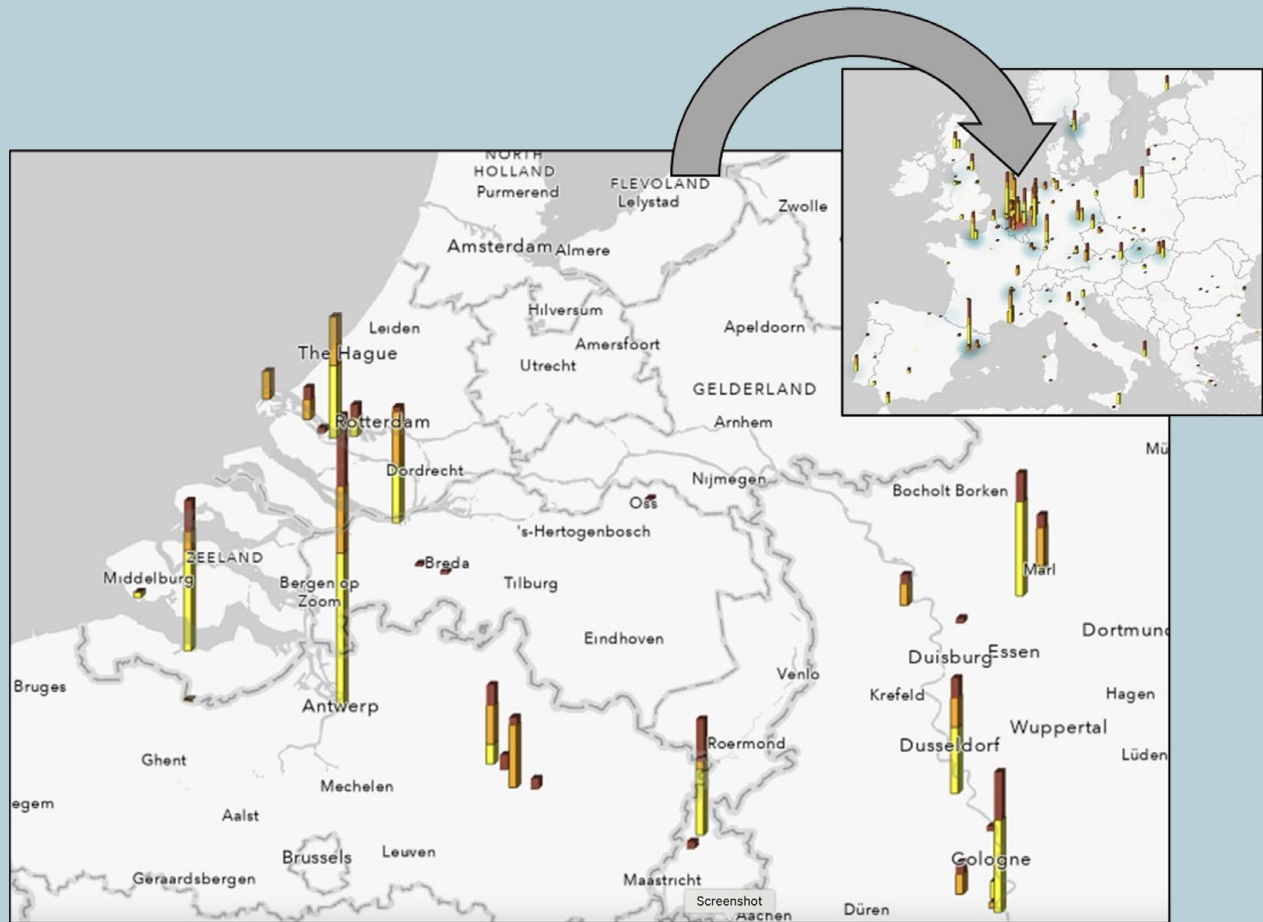
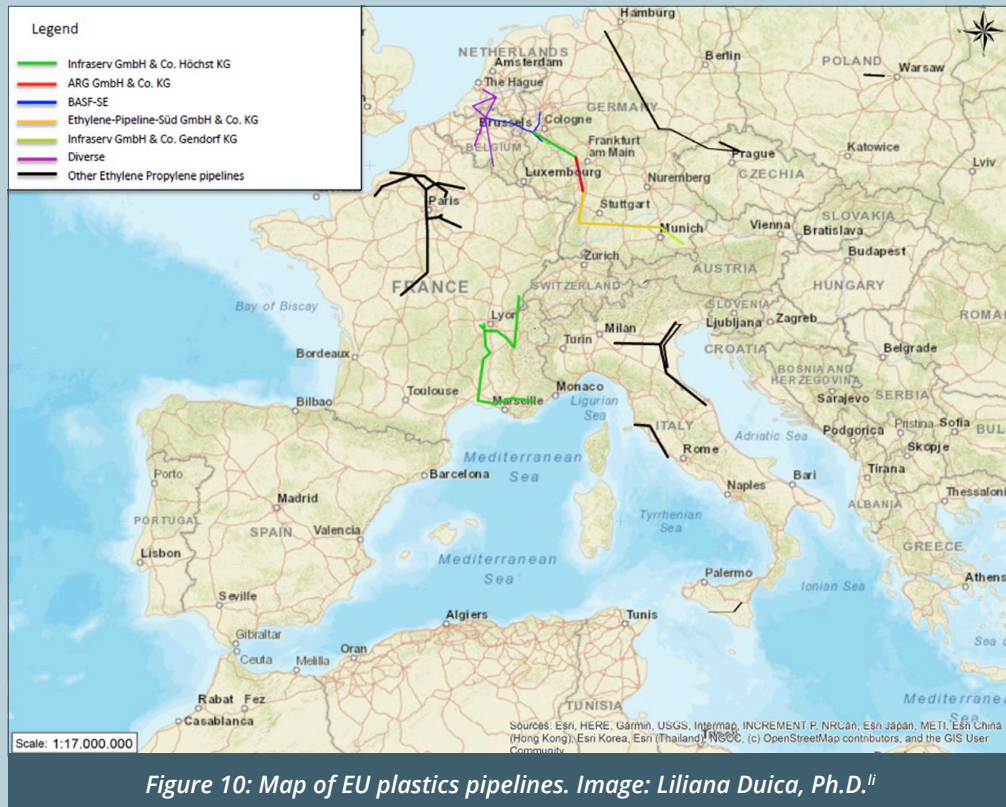


Figure 9: Trilateral Chemical Region plastics production capacity, kilotonne, 2019, with facility location by capacity (basic chemicals = yellow, intermediate = orange, plastic resins = red).<sup>xlvii</sup>

The region is defined by its “Verbund (compound) structure” as a set of tightly integrated chemical companies connected via shared infrastructure. Multiple plastic chemical pipelines connect to the Trilateral Chemical Region. These are led by pipeline companies Höchst (Infraserv GmbH & Co.), ARG GmbH & Co., BASF, Gendorf (Infraserv GmbH & Co.), Ethylene-Pipeline Süd GmbH and many others - see Figure 10.<sup>xlviii</sup> The combined economic turnover of the region is EUR 180 billion (USD 196), and the chemical industry and plastics sectors employ more than 350,000 people.

Currently, the region is working to expand its pipeline network, according to a signed joint declaration of intent.<sup>xlix</sup> The pipeline project led by eight chemical companies and the ports of Antwerp and Rotterdam is designed to improve the global competitive nature of chemicals and plastic production in the Trilateral Chemical Region<sup>l</sup> - see Figure 10.



Unfortunately, it lacks a collaborative strategy to migrate to zero-waste plastic production. With the exception of Essencia, which has signed the EU Circular Plastics Alliance, none of the institutions party to the Trilateral GmbH Chemical Region's steering committee<sup>12</sup> are signatories to any of the leading EU initiatives to migrate industry towards zero-plastic waste.

Examples of these include the New Plastics Economy with 450+ signatories, the European Plastics Pact with 147 signatories,<sup>iii</sup> and the EU Circular Plastics Alliance with 282 signatories.<sup>iiiii</sup>

Countries in the Trilateral Chemical Region are now facing significant sovereign risk as a result of their economic dependence on chemicals and plastic production and failure to transition towards sustainable processes and design.

For example, in 2019, chemicals and products from allied industries accounted for 26% of Belgium's total exports. Valued at EUR 73 (US 79) billion, these were Belgium's largest and most important exports. Therefore, chemicals and plastics production are key to the economic stability and sovereign health of Belgium.

The chemicals industry in Belgium produced 16% total manufacturing value-added in 2019 and 5% of EU27 value-add. Its chemical sector employs 94,000 people directly and 220,000 people indirectly at more than 720 companies.

Given the sovereign risk facing Belgium, the government of Belgium should actively promote Belgium as a sustainable plastics hub by transitioning its industry immediately to zero-waste plastic production.

<sup>12</sup> Ministry of Economic Affairs, Netherlands; Ministry of Economic Affairs, Innovation, Digitalization and Energy, Nordrhein-Westfalen, Germany; Department of Economy, Science & Innovation, Flanders, Belgium; Royal Association of the Dutch Chemical Industry (Koninklijke Vereniging van de Nederlandse Chemische Industrie, VNCI); Association of the Chemical Industry, Nordrhein-Westfalen, Germany (Verband der Chemischen Industrie, VCI); and Essencia (Belgische Federatie van de Chemische Industrie en Life Sciences).



## Viable solutions await adoption

Chemical and petrochemical businesses can choose to return to their roots as sources of innovation and start rolling out plans to produce products based on sustainable design, reuse, recycling and alternative feedstocks.<sup>13</sup>

Long-term sustainable plastics production must decouple from fossil feedstocks and shift permanently towards low-impact feedstocks and energy sources, such as “green hydrogen”. The industry may also consider investing in carbon capture solutions that can sequester carbon during the plastic production phase as an interim measure and, in some cases, potentially convert carbon pollution into a reusable material.<sup>14</sup>

Most of the technologies necessary for this transition already exist, ranging from system-ready processes to prototypes. Investors and the business sector EU-wide should embrace innovation and act and coordinate collectively around a 2025 vision for zero plastic waste in Europe - see Figure 11.

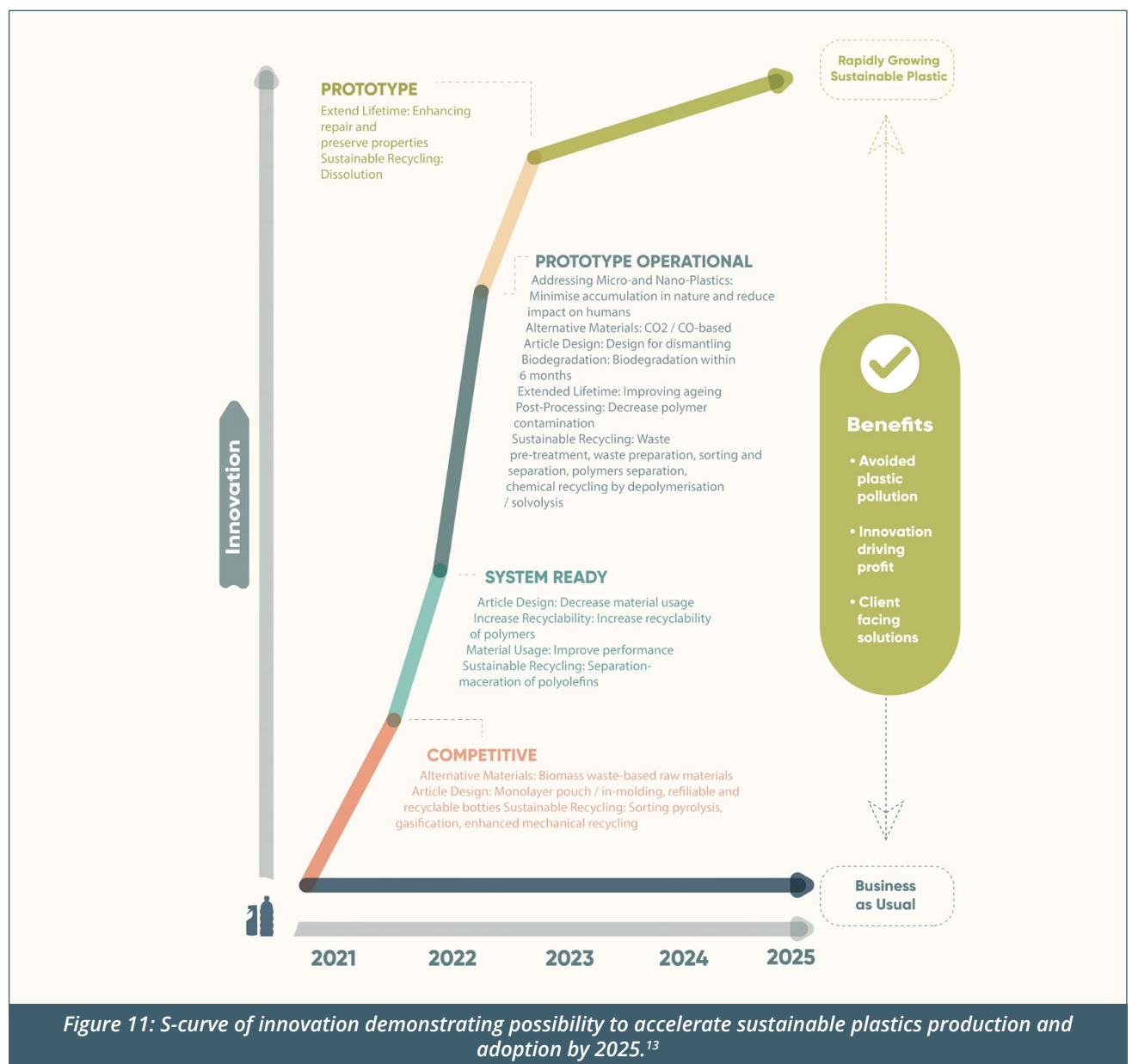


Figure 11: S-curve of innovation demonstrating possibility to accelerate sustainable plastics production and adoption by 2025.<sup>13</sup>

<sup>13</sup> Planet Tracker analysis based on work done by SusChem (European Technology Platform for Sustainable Chemistry), CEFIC (European Chemical Industry Council), DECHEMA (German Society for Chemical Engineering and Biotechnology), ESAB (European Society of Applied Biocatalysis), EuropaBio (European Association for Bioindustries), GDCh (the German Chemical Society), PlasticsEurope, EuPC, ECP4, RSC (Royal Society of Chemistry (UK)) and EU Circular Plastics Alliance.



## If investors and companies work together, the sector could target a range of policies in the near term:



<sup>14</sup> Pyrolysis, gasification, depolymerization /solvolysis and dissolution of multi-polymer recycling.





## Money talks – why investors can finance the transition

While often viewed in terms of environmental or social impact, the plastic industry's emissions and waste are enormous drains on the economy as well.

For example, it has been estimated that the planet loses 1 to 5% of marine ecosystems due to plastic waste - equating to the loss of EUR 459 (USD 500) billion to EUR 2,296 (USD 2,500) billion) annually.<sup>lvi</sup>

In many ways, this loss, as well as other losses resulting from plastic waste, can be seen as a tax on bad practice. For now, business owners and financiers seem to be happy to pay it.

Yet this “tax” will rise. Investments based on a business-as-usual scenario face the slow melt towards becoming stranded assets. Fortunately, there is still time to harness capital forces to reverse this trend.

Investors in the publicly traded companies dominating plastic production are heavily exposed across all the nine key plastic supply chains analysed in the EU27 - see Figure 1 and Table 7. In some circumstances, this allows for economies of scale, thus improving efficiency of resource usage. However, it also makes the industry overdependent on single-use plastic (SUP) production, which heightens the business risk as SUP regulation is tightened.

While the wider economic drivers are there, many individual companies are not sufficiently incentivised to transition on their own and financing instruments are not presently requiring this. It is therefore both in the interest of companies and their investors to collaboratively finance the transition.

## Investor exposure

Banks, brokerage houses, insurance companies and investment advisers have a EUR 689 billion (USD 750 billion) equity position in the EU27 + UK plastics production sector, across basic chemicals, intermediates and plastic resins - see Table 2.

*Table 2: EU27 + UK equity investors summary by category of investors.<sup>lvii</sup>*

	Number of Investments	%	Total (USD billions)	%
Bank	1,589	8.8%	70	9.3%
Brokerage	193	1.1%	11	1.5%
Insurance Companies	1,808	10.0%	41	5.5%
Investment Advisors	14,453	80.1%	628	83.7%
Total*	18,043	100.0%	750	100.0%

*\*Excluded investor categories include EUR 1,963 (USD 2,137 billion) and 3, 324 positions in 401K, Corporations, Endowment, Family Office/Trust, Foundation, Government, Hedge Fund Manager, Holding Company, Other, Pension Fund, Sovereign Wealth Fund, Stock Ownership Plan, Trust, Unclassified and Venture Capital, and Kingdom of Saudi Arabia's EUR 1,635 (USD 1,780 billion) position in Aramco and Russian Federation's EUR 26 (USD 28 billion) position in Rosneft.*

The top 40 institutional equity investors are highly concentrated in the EU resins sector, with 67% of total exposure, led by BlackRock, Vanguard, Capital Group, State Street and Citigroup - see Table 3.



Table 3: Top 40 EU27 + UK equity investors in publicly traded companies in the plastic production supply chain.

Source: Bloomberg.<sup>lviii</sup>

Rank	Company	Investments (USD billions)	%	Total Positions	Cumulative Total
1	BlackRock	125.92	16.8%	41	16.8%
2	Vanguard Group	72.75	9.7%	41	26.5%
3	Capital Group Co.	32.32	4.3%	15	30.8%
4	State Street	28.76	3.8%	41	34.6%
5	Citigroup	16.59	2.2%	12	36.8%
6	Credit Agricole	14.35	1.9%	37	38.7%
7	FMR LLC and FIL Ltd. (Fidelity)	17.17	2.3%	36	41.0%
8	JPMorgan Chase & Co.	12.62	1.7%	32	42.7%
9	UBS	11.60	1.5%	39	44.3%
10	Franklin Resources	10.95	1.5%	33	45.7%
11	Invesco	8.61	1.1%	37	46.9%
12	Northern Trust	8.22	1.1%	32	48.0%
13	Standard Life Aberdeen	7.85	1.0%	31	49.0%
14	Deutsche Bank	7.49	1.0%	36	50.0%
15	Legal & General Group	7.47	1.0%	38	51.0%
16	Bank of New York Mellon	7.39	1.0%	31	52.0%
17	Geode Capital Management	6.92	0.9%	33	52.9%
18	Dimensional Fund Advisors	6.70	0.9%	39	53.8%
19	Charles Schwab Corp.	6.56	0.9%	37	54.7%
20	Mitsubishi UFJ Financial Group	6.45	0.9%	32	55.5%
21	Sumitomo Mitsui Trust Holdings	6.33	0.8%	29	56.4%
22	Sun Life Financial	6.19	0.8%	18	57.2%
23	Wellington Management Group	5.13	0.7%	16	57.9%
24	Aviva	5.03	0.7%	34	58.6%
25	T. Rowe Price Group	4.89	0.7%	28	59.2%
26	Nomura Holdings	4.70	0.6%	31	59.8%
27	HSBC	4.61	0.6%	36	60.4%
28	Credit Suisse	4.33	0.6%	38	61.0%
29	TIAA	4.24	0.6%	35	61.6%
30	Nippon Life Insurance	3.94	0.5%	28	62.1%
31	Bank of America	3.71	0.5%	9	62.6%
32	State Farm Mutual	3.67	0.5%	23	63.1%
33	Schroders	3.61	0.5%	29	63.6%



Rank	Company	Investments (USD billions)	%	Total Positions	Cumulative Total
34	Royal London Asset Management	3.59	0.5%	10	64.1%
35	BNP Paribas	3.23	0.4%	32	64.5%
36	M&G	3.19	0.4%	23	64.9%
37	Wells Fargo & Co.	2.98	0.4%	34	65.3%
38	Ameriprise Financial	2.98	0.4%	29	65.7%
39	Allianz SE	2.89	0.4%	40	66.1%
40	Goldman Sachs	2.84	0.4%	34	66.5%
	<b>Total</b>	<b>498.8</b>			<b>66.5%</b>
	<b>Grand Total: Banks, Brokerage, Insurance Companies and Investment Advisors with 18,043 investment positions</b>	<b>750.4</b>			<b>100.0%</b>

*Note: Summary excludes First Pacific Advisors at EUR 12.3 (USD 13.4 billion), with its single investment in ExxonMobil, Hargreaves Lansdown Asset Management at EUR 4.0 (USD 4.3 billion), with its two investments in BP and Shell, and Grindale Investments at EUR 3.1 (USD 3.4 billion), with its single investment in Lukoil.*

The largest institutional investors exposed to five fixed income securities categories – bonds, loans, preferreds, municipals and mortgages - across the top companies in the EU27 are led by Vanguard, BlackRock, Prudential Financial, J.P. Morgan Chase and Capital Group, according to findings from Planet Tracker<sup>15</sup> - see Table 4. The top ten investors have an estimated ownership of EUR 56.8 (USD 61.8) billion - or 64% - of the EUR 114 (USD 124.1) billion tracked.

*Table 4: Top 10 EU27+ UK fixed income investors assessed (given data availability). Source: Bloomberg.<sup>lviii</sup>*

Rank	Investor	Total (USD millions)	% of Total
1	Vanguard Group	11,671	19%
2	BlackRock	9,669	16%
3	Prudential Financial	3,423	6%
4	J.P. Morgan Chase	3,059	5%
5	Capital Group	2,867	5%
6	Credit Agricole	2,462	4%
7	Allianz	1,803	3%
8	Invesco	1,706	3%
9	FMR	1,484	2%
10	Northern Trust	1,293	2%
	<b>Grand Total</b>	<b>61,800</b>	<b>64%</b>

<sup>15</sup> To reach these rankings, Planet Tracker assessed ownership for 990 fixed income securities of which data was partially available for 565 securities, equal to 29% of total amount outstanding.



The top 30 companies have self-reported very few fixed income securities as green. They total 40 fixed income securities. Of these, 23 loans and one green bond from TotalEnergies and seven loans from Mubadala equal 60% of all green issuance in the sector. Overall, only the Indorama green financing vehicle is used to reduce plastic pollution's impact and the capital deployed by this loan is used on projects outside of the EU27. It is important to note that green and sustainability-linked loans usually carry fewer restrictions than green bonds that must be used to finance green projects.

Furthermore, an examination of proxy voting records over the last five years shows that only 9 resolutions have been debated at companies' AGM, implying that many financial institutions are failing to engage on this matter - see Table 5 for further details.

*Table 5: Investor voting record on environmental proposals containing the word plastic.*

Proposal Text Summary	Company	Year
SP 4: Propose an Action Plan to Achieve Zero Plastic Waste by 2030	Metro Inc.	2022
Preparation of a Report on Plastic Pollution	ST Dupont	2019
Report on Plastic Straws	McDonald's Corporation	2018
Report on Impacts of Single-Use Plastic Bags	Walmart Inc	2020
Report on Plastic Pollution	Phillips 66	2019
Report on Efforts to Reduce Plastic Pellet Pollution	DuPont de Nemours, Inc.	2019
Report on Comprehensive Policy on Plastic Pollution and Sustainable Packaging	Restaurant Brands International Inc	2020
Report on Plastic Pollution	DuPont de Nemours, Inc.	2021
Report on the Impacts of Plastic Packaging	Amazon.com Inc.	2021

Sources: Proxy Insight, Planet Tracker analysis





## Mitigating risk and harnessing opportunity as an investor

Plastic and climate risk are both contributing to increased portfolio risk for institutional investors via pressure on profit margins and the possibility of stranded assets through rising regulatory pressure.

Supply chain mapping, as discussed above, can empower investors to better measure, monitor and manage their risks and opportunities. Financial, operational and geographic risks should be analysed.

Subsequently, investors can shift their portfolios in the direction of companies focused on retooling towards sustainable plastics solutions. Untapped opportunities for sustainable returns can be uncovered because the supply chain is where ground-level innovation occurs as the sector migrates from making public statements to actually deploying capital and adopting sustainable plastics solutions.

## The sustainable transition: who's foot is on the pedal and who's asleep at the wheel?

Corporate commitments are rising, as evidenced below. Also, there is a strong demand signal from the Plastics Recyclers Europe trade association which is pledging to use 10 million tonnes of recyclates in plastic products by 2025 - see Table 6 for a list of corporate commitments.<sup>lix</sup>

However, the largest companies in the plastic supply chain lack a set of co-ordinated policies to fully and immediately transition to sustainable plastics.



Table 6: Examples of EU27 corporate plastic and waste reduction commitments, 2017–2025.<sup>ix</sup>

Company	Plastic <sup>16</sup>	Pledge
Alfred Kärcher	PP, ABS, PA	100s mt/year of r-PA from recycled material from airbag production.
Aliplast	LDPE, PET	70% the plastic recycled, compared to 2017 with target 2025: 100 kt/year.
Barilla G. and R. Fratelli SpA	LDPE, PP	Multi-materials will be changed to mono-materials by end 2020.
Bel Group	PET	Increasing the use of Recycled PET in Bel product packaging.
Cola-Cola*	PET	Average 45% r-PET by 2025, equating to more than 160,000 mt.
Confederation of Danish Industry	Other	202,412 mt recycled plastic used in 2025 on behalf of CDI members.
Coop Italia	LDPE, PP, PET	From January 2025, Coop will use 6,400 mt/year recycled plastic.
Danish Brewers' Association	PET	50% r-PET in bottles by 2025.
ECEPLAST	LDPE	Pledges 2,500 mt by 2025 recycled plastic use.
EDANA	PET	Increase r-PET in nonwovens from 34% in 2017 to 40% in 2025, equalling 300,000 mt of r-PET by 2025, providing that the post-consumer waste volumes necessary to back such a growth are available.
European Federation of Bottled Waters	PET	At least 25% of r-PET in bottles by 2025. Pledged specific PET tonnage towards the goal of 10 million mt.
European Plastics Converters	ABS, EPS, HDPE, LDPE, PET, PP, PS, PA	Consolidate per polymer type and register at EU and national level all recycled polymers used by plastic converters in different markets to reach the goal of 10 million mt of use of recycled plastic between 2025 and 2030.
Hera	LDPE, HDPE, PP, PS, PET, PVC	Increase approximately +30% the plastic collected and to be recycled, compared to 2017 with 2025 target of 120 kt/year.
HP	LDPE, HDPE, PP, PS, PET, ABS, PA	Intends to grow the amount of recycled plastic content (RCP) used by more than 50% by 2020; and intends to use a total of 22,500 mt of recycled plastic in the 28 EU countries in their products from 2017-2020 inclusive.
Iberostar Group	HDPE	2018-2025, use on average 6 mt of recycled plastic per year.
IKEA	PP, PET	IKEA recognises that to create a positive impact for people and planet, we must use their global reach and scale to accelerate the transition to a circular economy.
Indorama	PET	Minimum 20% r-PET.
Kaufland Stiftung	PET	Increase r-PET content of bottles from 25% currently.
Lidl Stiftung	PET	Increase r-PET in "Saskia" and "Freeway" brands from 60%.
LIPOR - Porto, Portugal		LIPOR signed a commitment to the Single Use Plastics and Plastics Strategy.
MACPAC	PP, PS, PET	Increase r-PET use to 2,600 mt, r-PP to 250 mt and r-PS to 200 mt in totalling 3,050 mt in 2025 from 2017 baseline of 1,452 mt.
Mayansi Circular Plastics	PET	To manufacture and market irrigation equipment and pipes made from r-PET.
Miele & Cie.	PP, ABS	Use 5,000 mt to 7,500 mt of recycled plastic by 2025.
Neste	LDPE, HDPE, PP, PS	Work towards chemical recycling of more than one million tons of plastic waste annually from 2030 onwards



Company	Plastic <sup>16</sup>	Pledge
Nestlé	LDPE, PET	Commitment is that by 2025 100% of their packaging is recyclable or reusable.
PepsiCo*	PET	Use 45% r-PET in its plastic bottles across the EU by 2025 and 50% by 2030.
Petcore Europe	PET	Increase PET collection rates to 90% by 2025, resulting in an annual use of r-PET of approx. 2.07 million mt by 2025 compared to approx. 1.23 million mt in 2017.
Plastics Recyclers Europe	LDPE, HDPE, PP, EPS, PS, PET, PVC, PU, ABS, PA	10 million mt use of recyclates in plastic products by 2025.
Plastix	HDPE, PP, PA	Increase recycling of fishnets, trawls and ropes from the maritime industry.
Polyolefin Circular Economy Platform	LDPE, HDPE, PP	A 1 million mt increase of recycled polyolefins in EU products by 2025.
Procter & Gamble	HDPE, PET	Increase r-PE and r-PET packaging in EU by additional 25,000 mt by 2025 and 100% recyclable or reusable packaging by 2030 and reduce global use of virgin petroleum plastic in packaging by 50% by 2030.
Swedish Food Retailers' Federation	LDPE, HDPE, PP, PS, PET, PVC	All plastic packaging to be recyclable by 2022, and all plastic packages to be produced from renewable or recycled raw materials by 2030.
Unilever	HDPE, PP, PET	Increase the use of recycled plastic content in our packaging to at least 25%. Halving the waste associated with the disposal of our products. 100% of plastic packaging fully reusable, recyclable or compostable.
Eni (Versalis)	LDPE, HDPE, EPS, PS, Other	Support building blocks of its circular economy strategy, articulated in three main pillars: eco-design, recycling technologies and alternative feedstock.
Vöslauer Mineralwasser	PET	Use 45% r-PET in its plastic bottles across the EU by 2025 and 50% by 2030.
PepsiCo*	PET	40% more PET recyclate by 2025.

\*Please see Planet Tracker's 'Recycling Targets - Soda -pressing' for further details on the recycling targets of Coca-Cola and PepsiCo

Source: Circular Plastics Alliance. Note: The use of the phrase recycling in this table reflects word-for-word the use of the phrase in the summary documents by the Circular Plastics Alliance, yet most "recycled products" are downcycled as the underlying physical chemistry of plastic products can make recycling impossible.

<sup>15</sup> **Acronyms:**

- **ABS:** Acrylonitrile butadiene styrene
- **EPS:** Expandable polystyrene
- **HDPE:** High density polyethylene
- **LDPE:** Low density polyethylene (may include LLDPE - linear low-density polyethylene)
- **PA:** Polyamide (nylon)
- **PET:** Polyethylene terephthalate
- **PP:** Polypropylene
- **PS:** Polystyrene
- **PU:** Polyurethane
- **PVC:** Polyvinyl chloride.



However, many of the top 40 investors are not pushing these companies to act despite holding the capacity to wield significant influence. BlackRock is an exception. The largest investor in the sector, with EUR 116 (USD 126) billion of exposure in the publicly traded companies in the sector, BlackRock has called on all companies in its investment universe to disclose how they will “eliminate discharge of plastics or waste” to the planet’s waterways and oceans.<sup>lxix</sup>

Hope lies in actors like Indorama<sup>17</sup> and BlackRock who are committing to drive forward a transition strategy.

Furthermore, there are over 240 EU plastics companies which have supported addressing the sector’s environmental risks by innovating as quickly as possible across industry to execute sustainable plastics solutions. According to their own published materials, these companies are saying that innovation in the plastics sector can be imminent if companies choose to act. Some technology solutions are immediately commercially viable with return on investment (ROI) less than five years.

Again, unfortunately, none of these EU companies addressing the sector’s environmental risks are the same companies in the EU plastics production supply chain highlighted in Table 7. The plastics industry is currently highly fragmented and lacking a clear vision. The next step towards achieving a completely sustainable plastics economy will be to unite existing efforts and solutions and bring more companies and investors on board.

Any transition must involve making the plastic products we use and depend on every day based on low-impact feedstocks, manufactured with sustainability-by-design and sustainable recycling, reuse, reduce and refill concepts at the forefront.

Such a transition would also present an economic opportunity, the scale of which is particularly large in the EU27, with over 1,094 publicly traded companies with a combined market capitalisation of more than EUR 2 trillion (USD 2.2 trillion) which are the buyers of plastics in the EU27 alone.<sup>lxxii</sup>

<sup>17</sup> See also Minderoo’s the [Plastic Waste Makers Index](#) for circularity scores





## Recommendations

### Companies should:

#### High-level:

- Decide if the present business-as-usual strategy is financially sustainable or whether a realignment to a more circular business model based on reduce, reuse and recycle, has become a lower risk option and longer term more profitable?

#### Detailed:

- Embed transparent impact reporting processes into business systems. These employ a comprehensive, comparable life cycle assessment (LCA) approach with reliable and externally transparent benchmarking to demonstrate quantifiable decrease in negative environmental, social and governance impacts across the short-term (2021 to 2025), mid-term (2026 to 2030), and long-term (2030 to 2050).
- Disclose transition plans with quarterly key performance indicators targeted at achieving 100% sustainable plastics production by 2025, in line with industry suggestions published by SusChem.
- Disclose plans to immediately pivot plastic feedstocks towards low-carbon feedstocks to align their companies' GHG emission pathways with 1.5°C and the Paris Agreement.
- Eliminate the production of unnecessary plastics, remove problematic additives, improve material choice to boost recyclability and reusability, and employ consistent labelling to avoid greenwashing.
- Decrease the climate, environmental and health risks associated with the plastics production supply chain, including nurdle spills, towards achieving zero-waste.
- Design all products for improved recyclability in ways that increases the economic value of recycled plastic (upcycling). In these systems, one must redesign supply chains and products for optimal value retention – from improved sorting to renewed raw materials while incorporating alternative feedstocks that reduce waste and emissions.
- Support products with a longer lifespan and greater capacity for reuse and refill. Develop and employ a standardised green list of key materials whose impact across the supply chain – from production, use and waste management – quantifiably decreases material and resource inefficiencies from the plastic life cycle. The use of these materials will support achieving various EU27 policy commitments – from climate, to environment, to health. As a result, these materials would receive preferred tax status, carbon-board adjustments, and other financial benefits for mainstreaming their use.
- Contribute to mainstreaming refill/reuse processes and products across the EU27.
- Fully support a consistent single policy across all EU27 markets for mandatory deposit return schemes (DRS) and extended producer responsibility (EPR). This would enable a balanced competitive market.



## Equity investors, debtholders and financiers should:

### High-level:

- Probe executives on how they assess the impact of current headwinds (e.g falling cost competitiveness, increasing regulation etc.) and their plan to maintain or increase returns against this backdrop.

### Detailed:

- Incorporate supply chain modelling and cluster and concentration risks into forecasting for companies in the EU27 plastics production supply chain. These forecasts should focus on supply chain disruption and company revenue projections associated with zero-waste plastic products.
- Demand that companies in the EU27 plastics production supply chain publish business-wide sustainable plastics transition plans to be met by 2025.
- Insist that companies they invest in, including all publicly traded companies and privately held institutions, decrease the climate, environmental and health risks associated with the plastics production supply chain by disclosing publicly audited quarterly key performance indicators.
- Install investment-holding company-wide investment policy statements that explicitly include zero-waste plastic targets and goals for all investments in the plastics production supply chain.
- Include plastic production supply chain risks with modeling sovereign risks for countries with high plastic production concentrations in the EU, with particular focus on the three countries in the Trilateral Chemical Region: Belgium, Germany and the Netherlands.

## Policymakers and regulators should:

### High-level:

- Push the plastic industry to change its present business model from being a major emitter of carbon dioxide, a significant source of toxins, the origination of plastic pollution and a negative influence on human health.

### Detailed:

- Align every regulation of the plastics production supply chain with the goal for zero plastic waste by 2025, focusing on the Trilateral Chemical Region.
- Request that the Trilateral Chemical Region fully adopt 100% sustainable plastics and zero plastic waste as their sustainability goal, with quarterly key performance indicators from Q3 2021 to Q4 2025 that help demonstrate and monitor the achievement of this goal by 2025.



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# Appendix 1: Key EU chemicals

## Basic chemicals

Basic chemicals form the building blocks of the plastics production supply chain. These are the formative chemicals whose production enables the production of hundreds of thousands of plastic products downstream.

**Benzene** ( $C_6H_6$ , EC #200-753-7 and PubChem CID# 241)<sup>lxv</sup> is a basic chemical feedstock used in the production of **polystyrene**, **EPS** and **ABS**.

- **Environmental, Health and Safety Risks:** Benzene is a clear and colourless liquid. Benzene is a highly flammable and volatile liquid. It is rated as flammable, an irritant and a health hazard and is a known carcinogen linked to many cancers. Exposure to benzene causes neurological symptoms and affects the bone marrow causing aplastic anaemia, excessive bleeding and damage to the immune system.<sup>lxvi</sup>
- **Capacity and Production Methodology:** Most of the EU27 benzene production is produced via pygas extraction (49%), reformat extraction (25%), and HDA (12%). EU27 2019 total capacity was 10,241 kilotonnes, which equalled 14.8% global capacity.<sup>lxvii</sup>
- **Clusters:** Benzene is predominately produced in the **Trilateral Chemical Region** cluster (about 60% EU capacity).
- **Key Companies:** Benzene production in the EU28 is led by **Shell, Dow, TotalEnergies, ExxonMobil**, and others.<sup>lxviii</sup>

**Butadiene** ( $C_4H_6$ , EC #25339-57-5, and PubChem CID# 7845) is a basic chemical feedstock used in the production of **polystyrene** and **ABS**. Butadiene is a synthetic, colourless gas that is insoluble in water and soluble in benzene.

- **Environmental, Health and Safety Risks:** Butadiene is rated as flammable, a health hazard and carcinogen. When exposed to air, it produces explosive peroxides. Acute exposure to butadiene can cause irritation of the eyes, nasal passages and throat.<sup>lxix</sup>
- **Capacity and Production Methodology:** All EU27 butadiene production uses the extractive distillation process. EU27 2019 butadiene capacity was 3,104 kilotonnes, which equalled 19.6% total global capacity.<sup>lxx</sup>
- **Clusters:** Production is predominately in the **Trilateral Chemical Region** with about 33% EU capacity.
- **Key Companies:** Besides privately-held INEOS, the sector's production is dominated by publicly traded companies - **LyondellBasell, Evonik, Eni, Dow, Repsol, BASF, SABIC, TotalEnergies, Mol, Shell** and **ExxonMobil**.<sup>lxxi</sup>



**Ethylene** ( $C_2H_4$ , EC #200-815-3 and PubChem CID# 6325) is a basic chemical feedstock used in the production of **ABS, EPS, HDPE, LDPE, LLDPE, PET, polystyrene** and **PVC**. Ethylene is a colourless gas lighter than air with a sweet odour and taste.

- **Environmental, Health and Safety Risks:** Ethylene is easily ignited and may rupture violently, rocket, and create explosions. It is rated as flammable and an irritant.
- **Capacity and Production Methodology:** Ethylene in the EU27 primarily uses natural gas as a feedstock with production segmented into two key categories: steam cracker - mixed feed (67%) and steam cracker - naphtha (32%) processes.<sup>lxxii</sup> EU27 2019 ethylene capacity was 21,895 kilotonnes, which equalled 12.2% of global capacity.<sup>lxxiii</sup>
- **Clusters:** Ethylene production is clustered in the **Trilateral Chemical Region**, the **Tarragona and Barcelona cluster**, and throughout the EU in some smaller clusters.
- **Key Companies:** Ethylene production is dominated by **INEOS, Dow, TotalEnergies, SABIC, LyondellBasell, Eni, OMV, BASF, Shell, Repsol, PKN Orlen, BP, MOL** and **ExxonMobil**.<sup>lxxiv</sup>

**Methanol** ( $CH_4O$ , EC #200-659-6 and PubChem CID# 887) is a basic chemical used in the production of **PET**. Methanol is a colourless volatile liquid with a pungent odour that is water soluble.

- **Environmental, Health and Safety Risks:** Accumulation of methanol vapours in confined spaces, such as buildings or sewers, can explode when ignited. It is rated flammable, a health hazard and an acute toxic.<sup>lxxv</sup>
- **Capacity and Production Methodology:** EU27 2019 methanol capacity was 2,577 kilotonnes, equal to 1.7% global capacity. It is primarily produced via liquid-based process (54%), natural-gas based (30%) and bio route (16%).<sup>lxxvi</sup>
- **Clusters:** EU27 methanol production is in the **Trilateral Chemical Region** (29% EU capacity), the **Ludwigshafen, Germany BASF cluster** (18% EU capacity) and the **Leuna, Germany cluster** (26% EU capacity).
- **Key Companies:** Methanol production is dominated by publicly traded companies **TotalEnergies, OCI, BASF, Shell** and **BP**.<sup>lxxvii</sup>

**Mixed Xylenes** ( $C_{24}H_{30}$ , EC #924-522-1 and PubChem #6850715) are basic chemicals used in the production of **PET**. It is insoluble in water and is considered inherently biodegradable.<sup>lxxviii</sup>

- **Environmental, Health and Safety Risks:** It is rated as flammable and an irritant.
- **Capacity and Production Methodology:** EU27 2019 mixed xylene capacity was 3,861 kilotonnes, equal to 4.4% global capacity. Mixed xylenes are produced via reformat extraction (78%) primarily.
- **Clusters:** Production is predominately in **Trilateral Chemical region** with about 50% EU capacity.
- **Key Companies:** Mixed xylene production is led by publicly traded companies **ExxonMobil, TotalEnergies, PKN Orlen, BP, Shell** and **Eni**.<sup>lxxix</sup>



**Paraxylenes** ( $C_8H_{10}$ , EC #203-396-5 and PubChem #7809) is a basic chemical used in the production of PET. Paraxylene is a flammable liquid and vapour.

- **Environmental, Health and Safety Risks:** Paraxylene is harmful if inhaled and causes skin irritation. Paraxylenes may be fatal if swallowed. It is harmful to aquatic life with long lasting effects and may cause respiratory irritation.<sup>lxxx</sup>
- **Capacity and Production Methodology:** EU27 2019 paraxylene capacity was 2,262 kilotonnes, equal to 3.8% global capacity. In the EU, it is primarily produced via isomerization and fractionation (74%).
- **Clusters:** Production is led by the **Trilateral Chemical Region** with about 71% EU capacity.
- **Key Companies:** Leading companies are **BP, ExxonMobil, PKN Orlen, Shell** and **TotalEnergies**.

**Propylene** ( $C_3H_6$  and PubChem #8252) is a basic chemical used in the production of ABS, EPS, polystyrene and polypropylene. It is a colourless gas with a faint odour.

- **Environmental, Health and Safety Risks:** Contact with the liquid can cause frostbite. It is easily ignited. It can asphyxiate by the displacement of air. Under prolonged exposure to fire or intense heat, containers of propylene may rupture violently, rocket and cause explosions.<sup>lxxxi</sup>
- **Capacity and Production Methodology:** EU27 2019 capacity was 15,589 kilotonnes, equal to 12.7% of global capacity. EU27 production uses steam cracker – mixed feed (46%), steam cracker – naphtha (24%), and FCC off gas recovery (19%).
- **Clusters:** Production is led by the **Trilateral Chemical Region** with about 40% EU capacity.
- **Key Companies:** Leading companies are **OMV, Shell, Dow, INEOS, BASF** and other publicly traded companies.

## Intermediates

The plastic supply chain chemical intermediates are chemicals that are formed after an initial reaction of a basic chemical and a reactant or catalyst. The intermediate then requires more subsequent steps to be turned into plastic resins. The intermediate sector receives little to no public discussion regarding it as a key input to creating plastic resins.

**Acrylonitrile** ( $C_3H_3N$ , EC #203-466-5, and PubChem #7855) is an intermediate chemical used in the production of **ABS**. It is a colourless, volatile liquid with an onion-like odour.

- **Environmental, Health and Safety Risks:** Exposure to acrylonitrile irritates the mucous membranes and causes a headache, nausea, dizziness, impaired judgment, difficulty breathing, limb weakness, cyanosis, convulsions and collapse. Acrylonitrile is reasonably anticipated to be a human carcinogen and may be associated with an increased risk of developing lung and prostate cancer.<sup>lxxxii</sup> It is rated flammable, corrosive, acute toxic, irritant, health hazard and environmental hazard.
- **Capacity and Production Methodology:** All EU27 acrylonitrile production is via propylene ammoxidation. EU27 2019 capacity was 585 kilotonnes, equal to 8.8% of global capacity.
- **Clusters:** 100% of EU production is produced in the **Trilateral Chemical Region**.
- **Key Companies:** It is produced by **INEOS** and **AnQore** (100% owned by CVC Capital Partners).



**Dimethyl terephthalate (DMT)** ( $C_{10}H_{10}O_4$ , EC #204-411-8, and PubChem #8441) is an intermediate chemical used in the production of PET. It is a white solid or heated colourless liquid, and it has no odour.

- **Environmental, Health and Safety Risks:** It is classified as an irritant.
- **Capacity and Production Methodology:** DMT production in the EU27 uses only PX oxidation. EU27 capacity was 244 kilotonnes in 2019, equal to 19.3% global capacity.
- **Key Companies:** 100% of EU27 supply of DMT is produced by **Oxxynova** in Steyerberg, Germany.

**Ethylene dichloride (EDC)** ( $C_2H_4Cl_2$ , EC #203-458-1 and PubChem #11) is an intermediate chemical used in the production of PVC and other products. It is a clear liquid.

- **Environmental, Health and Safety Risks:** Exposure According to the EU, EDC is a highly flammable liquid vapour which causes serious eye irritation and skin irritation; it may cause cancer, may cause respiratory irritation and may be fatal if swallowed.<sup>lxxxiii</sup> EDC is also added to leaded gasoline to remove lead.<sup>lxxxiv</sup>
- **Capacity and Production Methodology:** 2019 EU total capacity was 9,669 kilotonnes, equal to 20.0% global capacity. EDC production in the EU27 uses only direct and oxychlorination processes.
- **Clusters:** Production is predominately in the **Trilateral Chemical Region** with about 50% of EU capacity.
- **Key Companies:** EDC production is dominated by **INEOS, Vynova, Kem One, Agrofert Holding, Shin-Etsu Chemical, Dow, Westlake, Orbia, PKN Orlen** and **Evonik**.

**Ethylene oxide** ( $C_2H_4O$ , EC #200-849-9, and PubChem #6354) is an intermediate chemical used in the production of **PET**. It is a clear colourless gas. Ethylene oxide may polymerize exothermically if heated or contaminated. If the polymerization takes place inside a container, the container may rupture violently.

- **Environmental, Health and Safety Risks:** According to the EU, ethylene oxide is toxic if swallowed, causes severe skin burns and eye damage, is toxic if inhaled, may cause genetic defects, may cause cancer, may damage fertility and is suspected of damaging unborn children and damaging their fertility, causes damage to organs through prolonged or repeated exposure, is an extremely flammable gas.<sup>lxxxv</sup> Ethylene oxide is used to make other chemicals besides PET, such as fumigants and industrial sterilants.<sup>lxxxvi</sup>
- **Capacity and Production Methodology:** Ethylene Oxide 2019 EU27 capacity was 3,115 kilotonnes, equal to 8.9% of global capacity. Ethylene oxide production in the EU27 uses direct oxidation.
- **Clusters:** Production is predominately in **Trilateral Chemical Region** with about 60% of EU capacity.
- **Key Companies:** Leading producers included **INEOS, BASF, Shell, Clariant, Sasol** and **Dow**.



**Monoethylene glycol (MEG)** ( $C_2H_6O_2$ , EC #203-473-3 and PubChem #174) is an intermediate chemical used in the production of **PET**. It is a clear, colourless syrupy liquid.

- **Environmental, Health and Safety Risks:** Its primary hazard is the threat to the environment and immediate steps must be taken to limit its spread in the environment in case of exposure. Since it is a liquid, it can easily penetrate the soil and contaminate groundwater and nearby streams.<sup>lxxxvii</sup> According to the EU, monoethylene glycol can cause damage to organs via exposure.<sup>lxxxviii</sup>
- **Capacity and Production Methodology:** EU27 total capacity in 2019 was 1,382, equal to 3.8% of global capacity. MEG production in the EU27 uses primarily EO hydration (97%).
- **Clusters:** Production is predominately in **Trilateral Chemical Region** with about 75% of EU capacity.
- **Key Companies:** Leading producers are **INEOS, BASF, Shell** and others.

**Polybutadiene** ( $(C_4H_6)_n$  and PubChem #85305481) is an intermediate chemical used in the production of **ABS** and **polystyrene**.

- **Environmental, Health and Safety Risks:** It has no classified health risks.
- **Capacity and Production Methodology:** 2019 EU total capacity was 450 kilotonnes, equal to 9.5% of global capacity.
- **Clusters:** Production is spread throughout the EU27.
- **Key Companies:** Key EU companies are **Synthos, Eni, Aramco, Trinseo** and **Michelin**.

**Propylene Oxide** ( $C_3H_6O$ , EC #200-879-2 and PubChem #6378) is an intermediate chemical used in the production of **ABS, EPS** and **polystyrene**. It is also used in the production of polyesters, pesticides and a fumigant for the sterilization of packaged foods and plastic medical instruments. It is a synthetic, highly-flammable, volatile, colourless liquid that is soluble in water.

- **Environmental, Health and Safety Risks:** It is considered flammable, an acute toxic, an irritant and a health hazard. Acute inhalation exposure of this compound can result in respiratory tract irritation, coughing, difficulty in breathing (dyspnoea) and build-up of fluid in the lungs (pulmonary edema) that can possibly lead to pneumonia. Inhaling high concentrations of the vapours for short time periods of risk up to coma. It is reasonably anticipated to be a human carcinogen.<sup>lxxxix</sup>
- **Capacity and Production Methodology:** In 2019, EU27 total capacity was 2,819 kilotonnes, equal to 26.0% global capacity. Propylene oxide production are dominated by four processes: chlorohydrin (40%), POSM (32%), TBA co-product (17%), and direct oxidation (11%).
- **Clusters:** Production is predominately in the **Trilateral Chemical Region** and the **Hamburg cluster** at about 50% and 25% of EU capacity, respectively.
- **Key Companies:** Leading producers are **Dow, LyondellBasell, BASF** and **Shell**.





**Purified terephthalic acid (PTA)** ( $C_8H_6O_4$ , EC #202-830-0 and PubChem #7489) is an intermediate chemical used in the production of **PET**.

- **Environmental, Health and Safety Risks:** It is considered an irritant.
- **Capacity and Production Methodology:** EU27 total capacity is 3,747, equal to 4.7% of global capacity. PTA is produced in the EU27 via PX oxidation.
- **Clusters:** EU production is dominated by the **Trilateral Chemical Region**, and clusters in **Sines, Portugal** and **Wloclawek, Poland**.
- **Key Companies:** **Indorama, BP** and **PKN Orlen** dominate production.

**Styrene** ( $C_8H_8$ , EC #202-851-5 and PubChem #7501) is an intermediate chemical used in the production of **ABS, EPS** and **polystyrene**. It is a colourless liquid that evaporates easily. Styrene is labelled flammable, an irritant and a health hazard.

- **Environmental, Health and Safety Risks:** According to the EU, exposure to styrene damages organs, causes serious eye irritation, may be fatal if swallowed, is suspected of damaging the unborn child and causes skin irritation.<sup>xc</sup>
- **Capacity and Production Methodology:** 2019 EU27 capacity was 5,555 kilotonnes, equal to 16.0% global supply. Styrene is produced in the EU27 via benzene alkylation (61%) and POSM (39%).
- **Clusters:** Production is predominately in the **Trilateral Chemical Region** at about 50% EU capacity.
- **Key Companies:** Leading companies are **Trinseo, BASF, Shell, Total, Eni, Repsol** and others.

**Vinyl chloride monomer (VCM)** ( $C_2H_3Cl$ , EC #200-831-0 and PubChem #6338) is an intermediate chemical used in the production of **PVC**. It is a colourless, highly flammable gas with a slight odour that may emit toxic fumes when heated to decomposition.

- **Environmental, Health and Safety Risks:** VCM is flammable and a health hazard. Exposure to vinyl chloride monomer affects the central and peripheral nervous system and causes liver damage. Prolonged exposure can cause Raynaud's phenomenon, joint and muscle pain and scleroderma-like skin changes. Vinyl chloride is a known human carcinogen associated liver, brain, lung, lymphatic, and hematopoietic system cancers.<sup>xci</sup>
- **Capacity and Production Methodology:** 2019 EU27 capacity was, 6,550 kilotonnes equal to 12.3% of global capacity. VCM is produced in the EU27 via EDC cracking (91%).
- **Clusters:** Production is predominately in the **Trilateral Chemical Region** at about 43% of EU capacity.
- **Key Companies:** Leading producers are **INEOS, Vynova, Kem One, Westlake, Shin-Etsu, PKN Orlen** and others.



## Plastic resins

After the intermediate stage of production, plastic resins can finally be formed. Plastic resins after production are then sold to companies commonly in the Plastic, Containers & Packaging sector (PC&P). In the PC&P sector, 83 companies are responsible for 93% of the sector's revenue by publicly traded companies (see Unwrapping Investor Risk). These PC&P companies in turn sell plastic products to many fast-moving consumer goods companies.<sup>18</sup>

**Acrylonitrile butadiene styrene (ABS)** ( $C_2H_3Cl$ , EC #200-831-0 and PubChem #6338) is used for hard plastic coatings, fixtures and materials.

- **Environmental, Health and Safety Risks:** None reported.
- **Capacity and Production Methodology:** EU27 capacity in 2019 was 865 kilotonnes, equal to 7.6% global capacity. ABS production is emulsion (72%) and mass (28%).
- **Clusters:** Production is dominated by the **Trilateral Chemical Region** with about 67% EU27 capacity.
- **Key Companies:** Leading companies are **INEOS, Trinseo, Sinochem** and **Eni**.

**Expandable polystyrene (EPS)** ( $C_9H_8$ , EC #935-499-2 and PubChem #24755) is a plastic used for single use cutlery, coat hangers and toys.

- **Environmental, Health and Safety Risks:** According to the EU, EPS is harmful to aquatic life with long lasting effects.<sup>xcii</sup>
- **Capacity and Production Methodology:** EU27 total capacity in 2019 was 1,945 kilotonnes, equal to 16.4% of global capacity.
- **Clusters:** EPS production is throughout the EU with a significant cluster at the **BASF Ludwigshafen, Germany cluster** (24%).
- **Key Companies:** Leading producers are **BASF, BEWi, Eni** and **TotalEnergies**.

**High Density Polyethylene (HDPE)** ( $(CH_2-CH_2)_n$  EC #919-651-5) is a plastic used for bottles, snack food trays, toys, pipes and furniture.

- **Environmental, Health and Safety Risks:** None reported.
- **Capacity and Production Methodology:** There are many different production technologies in the sector. 2019 EU27 capacity was 5,741, equal to 11.9% of global capacity.
- **Clusters:** Production is led by the **Trilateral Chemical Region** with about 43% of EU capacity.
- **Key Companies:** The largest companies by capacity in the sector are **LyondellBasell, INEOS, TotalEnergies, SABIC, MOL, Repsol** and **OMV**.

<sup>18</sup> Planet Tracker has identified a Universe of 83 publicly traded global companies in PC&P sector, which individually have an annual plastic revenue which exceeds EUR X (USD 100 million) and 10% of each company's total revenue, according to Bloomberg. These 83 companies have a combined market capitalisation of EUR X (USD 126 billion) and account for 93% of the sector's revenue. Source is Planet Tracker (2021), Unwrapping Investor Risk.



**Low Density Polyethylene (LDPE)**  $((\text{CH}_2-\text{CH}_2)_n$  EC #929-000-7) is a plastic used for films, bubble wrap, flexible bottles and bottle tops.

- **Environmental, Health and Safety Risks:** None reported.
- **Capacity and Production Methodology:** 2019 EU27 capacity was 5,603 kilotonnes, equal to 20.9% global capacity. Capacity in the EU27 uses two processes: tubular 69% and autoclave 31%.
- **Clusters:** Production is led by the **Trilateral Chemical Region** with about 41% of EU capacity.
- **Key Companies:** Top producers are **SABIC, ExxonMobil, LyondellBasell, Dow, OMV** and **Repsol**.

**Linear Low-Density Polyethylene (LLDPE)**  $((\text{CH}_2-\text{CH}_2)_n$  EC #929-000-7) is a plastic used for films, bubble wrap, flexible bottles and bottle tops.

- **Environmental, Health and Safety Risks:** None reported.
- **Capacity and Production Methodology:** EU27 2019 capacity was 3,471 kilotonnes, equal to 8.6% global capacity. Many different technologies are used to produce LLDPE.
- **Clusters:** The **Trilateral Chemical Region** is the leading producer in the EU with about 33% EU capacity.
- **Key Companies:** The dominate companies who produce **LLDPE** are **Dow, OMV, INEOS, ExxonMobil, Eni** and **SABIC**.

**Polyethylene terephthalate (PET)**  $((\text{C}_{10}\text{H}_8\text{O}_4)_n$  and EC #101-121-858) is a plastic used for bottles, trays, clothing fibre, carpets, and strapping.

- **Environmental, Health and Safety Risks:** According to the EU, PET has no known hazards under usual uses.<sup>xciii</sup> Some scientists have suggested that risks under common use might yield endocrine disruptors<sup>xciv</sup> or, if stored briefly at temperatures higher than 60°C.<sup>xcv</sup>
- **Capacity and Production Methodology:** EU27 production is via integrated CP/SSP (48%), solid state polymerisation (39%) and PTA polycondensation (13%). EU27 2019 capacity was 3,246 kilotonnes, equal to 10.2% global capacity.
- **Clusters:** Production in the EU is led by the **Trilateral Chemical Region** and the **Lithuanian cluster** at 26% and 19% EU capacity, respectively.
- **Key Companies:** Leading companies are **Indorama, JBF, NEO Group** and **Lotte Chemical**, amongst others.



**Polypropylene (PP)** ( $[\text{CH}_2\text{-CH}(\text{CH}_3)]_n$  and EC #100-117-813) is a plastic used for food bottles, crates, straws and carpet fibres.

- **Environmental, Health and Safety Risks:** None reported.
- **Capacity and Production Methodology:** Many different technologies are used to produce polypropylene in the EU. The EU27 capacity in 2019 was 10,245 kilotonnes, equal to 12.5% global capacity.
- **Clusters:** Production is spread throughout the EU.
- **Key Companies:** Leading producers are **LyondellBasell, OMV, TotalEnergies, SABIC, INEOS, Mol** and **Braskem**.

**Polystyrene (PS)** ( $[\text{CH}_2\text{-CH}(\text{C}_6\text{H}_5)]_n$  and EC #100-105-519) is used for single use cutlery, coat hangers and toys.

- **Environmental, Health and Safety Risks:** While it has no known hazards, some studies have suggested that wild-type styrene found in nature may increase thyroid hormone levels in mice.<sup>xvii</sup>
- **Capacity and Production Methodology:** EU27 2019 capacity was 2,212 kilotonnes, equal to 15.3% global capacity.
- **Clusters:** EU production is led by the **Trilateral Chemical Region** with 37% of EU capacity.
- **Key Companies:** Leading companies are **INEOS, TotalEnergies, Trinseo** and **Eni**.

**Polyvinyl Chloride (PVC)** ( $(\text{CH}_2\text{-CHCl})_n$  and EC #924-145-2) is used for pipes, cable, synthetic leather, door frames and credit cards.

- **Environmental, Health and Safety Risks:** None reported.
- **Capacity and Production Methodology:** The sector's production is either via suspension (86%) and emulsion (14%). EU27 2019 capacity was 6,295 kilotonnes, equal to 11.8% global capacity.
- **Clusters:** EU production is led by the **Trilateral Chemical Region** with 37% of EU capacity.
- **Key Companies:** Leading companies are **INEOS, Kem One, Vynova, Westlake, Shin-Etsu** and **PKN Orlen**.



**Table 7: EU28 all basic, intermediate and plastic resin chemicals ranking by company by chemical, 2019.**  
(Green rows are publicly traded companies, blue rows are privately held companies.)

Note: Further analysis on the accounting of joint ventures is in the endnotes.

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: ABS</b>		
INEOS	430	49.7%
Sinochem	180	20.8%
Trinseo	200	23.1%
Eni	55	6.4%
<b>Total</b>	<b>865</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: Acrylonitrile</b>		
INEOS	439	60.6%
CVC Capital Partners	285	39.4%
<b>Total</b>	<b>724</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: Benzene</b>		
Shell	1,978	18.3%
TotalEnergies	1,225	11.3%
Dow	1,217	11.3%
ExxonMobil	836	7.7%
BASF	655	6.1%
IPIC	653	6.0%
BP	629	5.8%
INEOS	560	5.2%
Eni	410	3.8%
SABIC	350	3.2%
PKN Orlen	312	2.9%
Arsol Aromatics	250	2.3%
Chempetrol	250	2.3%
OMV	249	2.3%
ConocoPhillips	215	2.0%
Agrofert Holding	180	1.6%
Repsol	180	1.7%
MOL	170	1.6%
Klesch Group	120	1.1%
Slovnaft	100	0.9%
HIP-Petrohemija	70	0.6%
Holburn	65	0.6%
RAIN Industries	64	0.6%
Mubadala	37	0.3%
Rosneft	35	0.3%
Voestalpine	31	0.3%
<b>Total</b>	<b>10,856</b>	<b>100.4%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: Butadiene</b>		
INEOS	340	10.6%
LyondellBasell	320	10.0%
Evonik	300	9.3%
Eni	285	8.9%
Dow	275	8.6%
Repsol	265	8.3%
BASF	260	8.1%
SABIC	230	7.2%
PKN Orlen	210	6.5%
TotalEnergies	210	6.5%
OMV	170	5.3%
MOL	130	4.1%
Shell	120	3.7%
ExxonMobil	80	2.5%
HIP-Petrohemija	45	1.4%
Mubadala	12	0.4%
<b>Total</b>	<b>3,252</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: DMT</b>		
Oxxynova	240	100%
<b>Total</b>	<b>240</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: EDC</b>		
INEOS	3,425	31.5%
Vynova	1,410	12.9%
Kem One	1,280	11.8%
Shin-Etsu Chemical	847	7.8%
Dow	845	7.8%
Westlake	810	7.4%
Orbia	680	6.2%
Agrofert Holding	620	5.7%
PKN Orlen	480	4.4%
Evonik	220	2.0%
Ercros	150	1.4%
Fortischem	82	0.8%
Hellenic Petroleum	40	0.4%
<b>Total</b>	<b>10,889</b>	<b>100%</b>



Rank	2019 Capacity (kt)	Sum of % of EU capacity
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#### Chemical: EO

INEOS	439	60.6%
BASF	845	27.1%
Shell	350	11.2%
Clariant	225	7.2%
Sasol	215	6.9%
Dow	160	5.1%
Cristian Lay	135	4.3%
PKN Orlen	105	3.4%
Akzo Nobel	100	3.2%
<b>Total</b>	<b>3,115</b>	<b>100%</b>

#### Chemical: EPS

Synthos	515	25.9%
BASF	460	23.1%
Sunpor	270	13.6%
BEWi	182	9.2%
Ravago Group	145	7.5%
Eni	127	6.4%
Unipol	85	4.3%
Jackon GmbH	80	4.0%
TotalEnergies	80	4.0%
Gabriel Technologie	40	2.0%
SIKA Group	4	0.2%
<b>Total</b>	<b>1,988</b>	<b>100%</b>

#### Chemical: Ethylene

INEOS	2,950	11.7%
Dow	2,945	11.7%
TotalEnergies	2,330	9.2%
SABIC	2,115	8.4%
LyondellBasell	1,905	7.6%
Eni	1,800	7.1%
OMV	1,780	7.1%
BASF	1,710	6.8%
Shell	1,625	6.4%
Repsol	1,447	5.7%
PKN Orlen	1,225	4.9%
BP	1,080	4.3%
MOL	880	3.5%
ExxonMobil	840	3.3%
Mubadala	250	1.0%

Rank	2019 Capacity (kt)	Sum of % of EU capacity
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HIP-Petrohemija	200	0.8%
Klesch Group	108	0.4%
Lonza Group	25	0.1%
<b>Total</b>	<b>25,215</b>	<b>100%</b>

#### Chemical: HDPE

LyondellBasell	1,370	23.5%
INEOS	1,100	18.9%
TotalEnergies	850	14.6%
SABIC	615	10.5%
MOL	420	7.2%
Repsol	280	4.8%
OMV	270	4.6%
Chempetrol	246	4.2%
Eni	200	3.4%
PKN Orlen	160	2.7%
Romp petrol	100	1.7%
Mubadala	90	1.5%
Chevron	45	0.8%
Phillips 66	45	0.8%
Celanese	40	0.7%
<b>Total</b>	<b>5,831</b>	<b>100%</b>

#### Chemical: LDPE

SABIC	873	14.1%
ExxonMobil	845	13.7%
LyondellBasell	810	13.1%
Dow	800	12.9%
OMV	581	9.4%
INEOS	500	8.1%
Repsol	495	8.0%
Eni	260	4.2%
Polychim	240	3.9%
Mubadala	194	3.1%
TotalEnergies	160	2.6%
Oxea	120	1.9%
Arkema	80	1.3%
MOL	65	1.1%
PKN Orlen	60	1.0%
Romp petrol	60	1.0%
HIP-Petrohemija	45	0.7%
<b>Total</b>	<b>6,188</b>	<b>100%</b>



Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: LLDPE</b>		
Dow	1,385	36.5%
Eni	370	9.8%
ExxonMobil	420	11.1%
INEOS	520	13.7%
Mubadala	182	4.8%
OMV	544	14.4%
Repsol	50	1.3%
SABIC	320	8.4%
<b>Total</b>	<b>3,791</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: Methanol</b>		
Equinor	830	23.0%
TotalEnergies	660	18.3%
OCI	622	17.2%
BASF	450	12.5%
Shell	440	12.2%
BP	300	8.3%
Metanolsko Sirc.	200	5.5%
Jackon GmbH	105	2.9%
INEOS	4	0.1%
<b>Total</b>	<b>3,611</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: Mixed Xylenes</b>		
ExxonMobil	1,471	32.0%
TotalEnergies	1,153	25.1%
PKN Orlen	483	10.5%
BP	448	9.7%
IPIC	251	5.5%
INEOS	184	4.0%
Shell	175	3.8%
Eni	110	2.4%
HIP-Petrohemija	100	2.2%
Oilinvest	85	1.8%
Klesch Group	84	1.8%
Rosneft	50	1.1%
OMV	1	0.0%
<b>Total</b>	<b>4,595</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: MEG</b>		
INEOS	510	36.9%
BASF	372	26.9%
Shell	155	11.2%
Clariant	110	8.0%
PKN Orlen	110	8.0%
Cristian Lay	100	7.2%
Sasol	15	1.1%
Akzo Nobel	10	0.7%
<b>Total</b>	<b>1,382</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: Paraxylenes</b>		
BP	775	34.3%
ExxonMobil	700	30.9%
PKN Orlen	400	17.7%
Shell	147	6.5%
TotalEnergies	130	5.7%
IPIC	90	4.0%
Rosneft	20	0.9%
<b>Total</b>	<b>2,262</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
<b>Chemical: PET</b>		
Indorama	1,131	31.2%
NEO Group	470	13.0%
JBF RAK	430	11.9%
Lotte Chemical	350	9.7%
Equipolymers	335	9.2%
Grupo Samca	260	7.2%
Gruppo M&G	190	5.2%
Plastipak	50	4.1%
Cristian Lay	115	3.2%
Polisan Kimya	80	2.2%
Honeycomb Fund	70	1.9%
Sigma Technical	30	0.8%
Sioen Fibers	15	0.4%
<b>Total</b>	<b>3,626</b>	<b>100%</b>



Rank	2019 Capacity (kt)	Sum of % of EU capacity
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#### Chemical: PO

Dow	905	32.1%
LyondellBasell	765	27.1%
Shell	316	11.2%
BASF	275	9.8%
INEOS	210	7.4%
Artenius	180	6.4%
Oltchim	113	4.0%
PCC Rokita	48	1.7%
Chimcomplex	7	0.2%
<b>Total</b>	<b>2,819</b>	<b>100%</b>

#### Chemical: Polybutadiene

Synthos	165	31.1%
Eni	160	30.2%
Aramco	150	28.3%
Trinseo	30	5.7%
Michelin	25	4.7%
<b>Total</b>	<b>530</b>	<b>100%</b>

#### Chemical: Polypropylene

LyondellBasell	2,640	24.5%
OMV	1,415	13.1%
TotalEnergies	1,270	11.8%
INEOS	905	8.4%
SABIC	860	8.0%
MOL	580	5.4%
Braskem	545	5.1%
Repsol	490	4.5%
Mubadala	470	4.4%
Chempetrol	325	3.0%
ExxonMobil	250	2.3%
PKN Orlen	250	2.3%
Polychim	200	1.9%
Bazan Group	180	1.7%
Hellenic Petroleum	180	1.7%
Romp petrol	100	0.9%
Lukoil	80	0.7%
HIPOL	35	0.3%
<b>Total</b>	<b>10,775</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
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#### Chemical: Polystyrene

INEOS	725	32.8%
TotalEnergies	497	22.5%
Trinseo	475	21.5%
Eni	360	16.3%
Synthos	130	5.9%
3M	25	1.1%
<b>Total</b>	<b>2,212</b>	<b>100%</b>

#### Chemical: Propylene

TotalEnergies	1,942	11.8%
OMV	1,570	9.5%
Shell	1,286	7.8%
Dow	1,246	7.6%
INEOS	1,159	7.0%
BASF	1,102	6.7%
Eni	1,072	6.5%
LyondellBasell	1,040	6.3%
Repsol	927	5.6%
PKN Orlen	837	5.1%
SABIC	744	4.5%
MOL	578	3.5%
BP	551	3.3%
ExxonMobil	466	2.8%
Sonatrach	275	1.7%
Lukoil	240	1.5%
Rosneft	234	1.4%
Mubadala	230	1.4%
ConocoPhillips	188	1.1%
Hellenic Petroleum	180	1.1%
HIP-Petrohemija	102	0.6%
Corral Petroleum	100	0.6%
IPIC	100	0.6%
Saras	90	0.5%
Romp petrol	85	0.5%
Klesch Group	65	0.4%
Gunvor	50	0.3%
Bayernoil	35	0.2%
<b>Total</b>	<b>16,494</b>	<b>100%</b>





Rank	2019 Capacity (kt)	Sum of % of EU capacity
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#### Chemical: PTA

BP	1,374	36.7%
Indorama	1,725	46.0%
PKN Orlen	648	17.3%
<b>Total</b>	<b>3,747</b>	<b>100%</b>

#### Chemical: PVC

INEOS	2,005	29.7%
Kem One	882	13.0%
Vynova	830	12.3%
Westlake	780	11.5%
Shin-Etsu Chem	650	9.6%
PKN Orlen	475	7.0%
Orbia	458	6.8%
Agrofert Hold.	400	5.9%
Ercros	195	2.9%
Fortischem	85	1.3%
<b>Total</b>	<b>6,760</b>	<b>100%</b>

#### Chemical: Styrene

BASF	832	15.0%
Trinseo	780	14.0%
Shell	723	13.0%
LyondellBasell	680	12.2%
TotalEnergies	680	12.2%
Eni	600	10.8%
INEOS	500	9.0%
Repsol	460	8.3%
Synthos	300	5.4%
<b>Total</b>	<b>5,555</b>	<b>100%</b>

Rank	2019 Capacity (kt)	Sum of % of EU capacity
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#### Chemical: VCM

INEOS	2,053	29.0%
Vynova	970	13.7%
Kem One	940	13.3%
Westlake	630	8.9%
Shin-Etsu Chem	620	8.8%
PKN Orlen	490	6.9%
Orbia	420	5.9%
Agrofert Hold.	360	5.1%
Dow	340	4.8%
Ercros	200	2.8%
Fortischem	50	0.7%
<b>Total</b>	<b>7,073</b>	<b>100%</b>



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## ABOUT PLANET TRACKER

Planet Tracker is an award-winning non-profit financial think tank aligning capital markets with planetary boundaries. Created with the vision of a financial system that is fully aligned with a net-zero, resilient, nature-positive, just economy well before 2050, Planet Tracker generates breakthrough analytics that reveal both the role of capital markets in the degradation of our ecosystem and show the opportunities of transitioning to a zero-carbon economy.

## PLASTIC TRACKER

The goal of Plastics Tracker is to stem the flow of environmentally damaging plastics and related-products that are creating global waste and health issues by transparently mapping capital flows and influence in the sector, starting from the production of resins through to product-use. By illuminating risks related to natural capital degradation and depletion, investors, lenders and other corporate stakeholders across the economy will be enabled to create more sustainable plastics products.

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**Authors:** Gabriel Thoumi CFA FRM, CEO, Responsible Alpha; John Willis, Director of Research, Planet Tracker

**Researchers:** Chris Baldock, Rian Cook, Giorgio Cozzolino CFA, Liliana Duica Ph.D., Joe Hagerty, Taylor Hodge, Arianna Manili, Catherine Tubb Ph.D.

**Editors:** Bridget McArthur, Dominic Lyle, Erica Eller

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