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The new plastics economy

An opportunity for the Middle East

Contacts

Strategy&

Dubai

Devesh Katiyar
Partner
+971-4-436-3000
devesh.katiyar
@strategyand.pwc.com

Jayanth Kumar Mantri
Principal
+971-4-436-3000
jayanth.mantri
@strategyand.pwc.com

KAPSARC

Riyadh

Dr. Grzegorz Peszko
Executive Director
+966-11-290-3053
grzegorz.peszko
@kapsarc.org

Dr. Evar Umeozor
Senior Fellow
+966-11-290-3177
evar.umeozor
@kapsarc.org

About the authors

Strategy&

Devesh Katiyar is a partner with Strategy& Middle East. Based in Dubai, he is a member of the energy, resources, and sustainability practice in the Middle East. He has over 15 years of experience in consulting and energy, working in multiple geographies. He specializes in localization, chemicals, value chain optimization, and sustainability. He has led multiple projects in these areas, supporting governments, national oil companies, national champions, and public-sector entities in the Middle East and beyond. He is a member of the plastics committee of the Gulf Petrochemicals and Chemicals Association (GPCA). He has coauthored several Strategy& publications on sustainability and resilience in the Gulf Cooperation Council (GCC), covering topics such as using recycled plastics as a sustainable building material; environmental, social, and governance (ESG)-driven local content; and optimizing national oil company value chains.

Jayanth Kumar Mantri is a principal with Strategy& Middle East. Based in Dubai, he is a member of the energy, resources, and sustainability practice in the Middle East. He advises senior leaders across the Middle East on strategies that unlock national competitiveness through targeted investment attraction, industrial development, and economic transformation. He has worked at the intersection of strategy and operations—supporting governments, state-owned enterprises, and global corporates in Africa, India, the Middle East, and the United States. He has coauthored several Strategy& publications in the GCC, covering topics such as reconfiguring global value chains and the future plastics economy.

King Abdullah Petroleum Studies and Research Center (KAPSARC)

Dr. Grzegorz Peszko is the executive director for Energy Macro and Microeconomics at KAPSARC. He focuses on aligning economic development with energy transitions and environmental sustainability. He was previously lead economist at the World Bank, lead economist at the European Bank for Reconstruction and Development (EBRD), program manager at the Organisation for Economic Co-operation and Development (OECD), assistant professor at Krakow University of Economics, and head of unit at the Polish Ministry of Environment. He co-led the World Bank program on Pathways out of Plastic Pollution and its model the Plastic Policy Simulator, and was a member of the experts panel for the PlastInvest tool. He holds an M.Sc. in political science from Jagiellonian University in Krakow, an M.Sc. in economics from University College London, and a Ph.D. in economics from Krakow University of Economics.

Dr. Evar Umeozor is a senior fellow in KAPSARC's Oil and Gas Program, leading research on integrated oil value chains with a focus on downstream sector competitiveness. With expertise in process and energy systems engineering, he combines multidisciplinary research and industry experience to analyze the impact of technology and policy on downstream project sustainability. He applies systems thinking to optimal policy design, considering multiple stakeholder needs. Dr. Umeozor holds a master's degree in advanced chemical engineering from Imperial College London and a Ph.D. in chemical engineering from the University of Calgary.

Dr. Jennifer Considine and Dr. Fakhri Hasanov of KAPSARC, and Dr. Yahya Anouti, Utkarsh Bajpai, and Ananth Suri of Strategy& Middle East also contributed to this report.

About KAPSARC

KAPSARC is an advisory think tank within global energy economics and sustainability, providing advisory services to entities and authorities in the Saudi energy sector to advance Saudi Arabia's energy sector and inform global policies through evidence-based advice and applied research.

EXECUTIVE SUMMARY

Plastics are essential to modern life, with plastics usage growing faster than usage of alternative materials. As of 2024, the plastics industry contributed about 0.6-0.7 percent to global GDP and around 6 percent of GDP in leading Middle East countries. Today, the plastics market is shifting as sustainability regulations tighten, and circular economy initiatives expand. Although global mechanical recycling rates currently remain below 10 percent, demand for recycled plastics is growing and may exceed supply by 25 million to 35 million tons by 2030.

This joint report by Strategy& and the King Abdullah Petroleum Studies and Research Center (KAPSARC) explores how this new plastics economy presents an opportunity for Middle East countries, in particular those of the Gulf Cooperation Council (GCC),[1] to become a global hub for circular plastics. By linking plastic waste supply from Asia with recycled plastic demand in the West, the GCC countries can leverage their strengths—capital, infrastructure, and petrochemical expertise—for chemical recycling. Some GCC firms are already pioneering commercial-scale chemical recycling projects.

Developing a circular plastics economy aligns with national diversification goals, creating new value chains beyond hydrocarbons. Chemical recycling is knowledge-intensive and thus offers potentially higher economic multipliers and innovation-driven growth than traditional petrochemicals production.

To realize this potential, GCC countries would need to put in place several foundational elements. These include securing stable demand for recycled polymers; establishing plastic waste trade corridors with India, Southeast Asia, and other exporting regions; and building integrated waste management infrastructure. More broadly, the GCC region would need to foster innovation and attract private investment in large-scale recycling plants.

Key policy actions for advancing such goals include incentivizing efficient end-of-life management of plastic wastes, setting product design and labeling standards for recyclability, and establishing standards—especially for food-grade recycled plastics.

With these reforms, the GCC region can offer regulatory certainty, stimulate local markets, and attract global technology providers, positioning itself as a leader in the circular plastics economy.

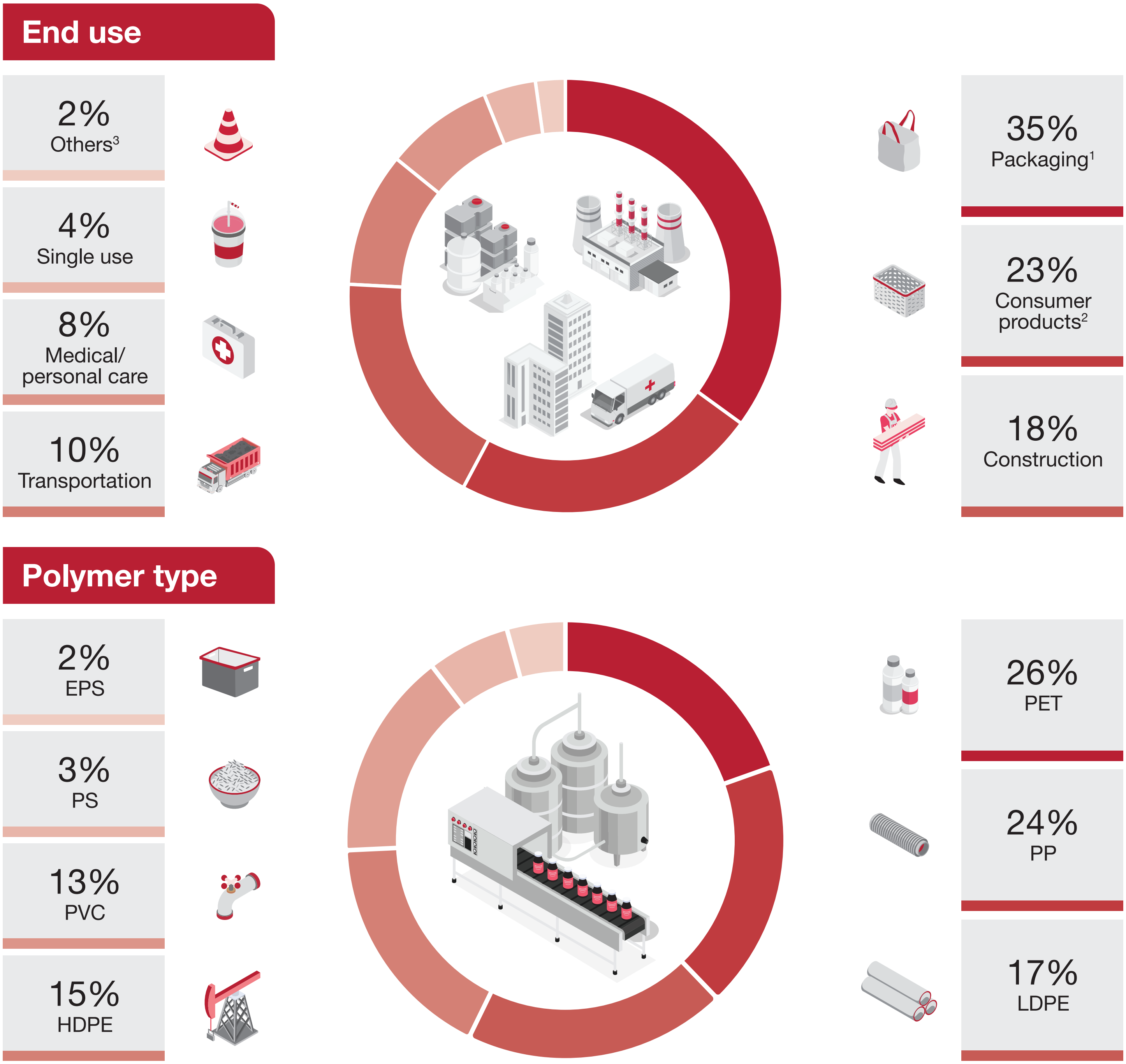
RAPID GROWTH IN PLASTICS UNDERPINS THE MODERN ECONOMY

Plastics are deeply embedded in our modern economy, underpinning value chains across a wide array of sectors. Today, packaging alone accounts for approximately 35 percent of global commodity plastics demand, followed by consumer products with 23 percent, construction with 18 percent, transportation with 10 percent, and medical/personal care with 8 percent (*see Exhibit 1*). This wide usage reflects plastics' unparalleled adaptability, cost efficiency, and functional superiority over many alternative materials.

EXHIBIT 1

Global commodity plastics demand by end use and polymer type

(%, 2024)



[1] Predominantly single-use.

[2] Consumer products such as polyester, nylon, rayon, acrylic, spandex, and aramids.

[3] Mixtures of resins including polymethyl methacrylate (PMMA), polybutylene terephthalate (PBT), polyoxymethylene (POM), fluoropolymers, polyetheretherketone (PEEK).

Note: EPS = expanded polystyrene, HDPE = high-density polyethylene, LDPE = low-density polyethylene, PVC = polyvinyl chloride, PUR = polyurethane. Commodity plastics are polymers produced in high volumes for general-purpose applications in consumer and industrial products. They are characterized by low production costs, standard mechanical and chemical properties, and widespread use in everyday items. Common types include polyethylene (PE), polypropylene (PP), PVC, polystyrene (PS), and polyethylene terephthalate (PET).

Source: OECD (2022), Global Plastics Outlook: Policy Scenarios to 2060, OECD Publishing, Paris, https://doi.org/10.1787/aa1edf33-en; Alan Wei, “The Disruptive Path to Circular Plastics,” Chemical Market Analytics by OPIS, A Dow Jones Company (2024) (https://scic.sg/images/1._The_Disruptive_Path_to_Circular_Plastics_Alan_WeiChemical_Market_Analytics_by_OPIS.pdf); Strategy& analysis

Global plastics production increased from about 2 million tons in 1950 to more than 460 million tons by 2020, growing at an average annual rate of 7.5 percent.[2] By 2060, the OECD forecasts that global production could nearly triple again, reaching 1,231 million tons.

The plastics industry accounts for 0.6–0.7 percent of global GDP, as of 2024.[3] However, its economic footprint is significantly larger in petrochemical-exporting regions like the Middle East, where plastics and associated chemical sectors can account for up to 6 percent of GDP.[4] In the case of Saudi Arabia, the range is 6–9 percent. Price or supply shocks in virgin plastics can inflict deep, lasting GDP losses in this region unless viable substitutes are available (*see "The economic impact of disruptions to plastics production"*).

The economic impact of disruptions to plastics production

Price shocks in plastic feedstocks (for example, shocks due to fossil fuel volatility or taxes) tend to have the most pronounced and persistent effects on highly trade-exposed economies, including both advanced industrial nations and export-oriented producers such as those in the GCC. Depending on policy design and how easy it is to substitute alternative materials, the GDP impacts of global constraint on polymers' supply can be relatively shallow and temporary or deep and persistent.

According to macroeconomic analysis we conducted for this study, supply constraints such as plastic production caps could have abrupt and persistent, or gradually transmitted and temporary, impacts depending on whether suitable substitutes for virgin plastics will be available to balance plastic supply with demand.

In scenarios in which viable substitutes for plastics could help rebalance the market over a few years, the global GDP contraction is more temporary and only about 40 percent of what it could be in the absence of alternative materials sufficient to meet rising demand.

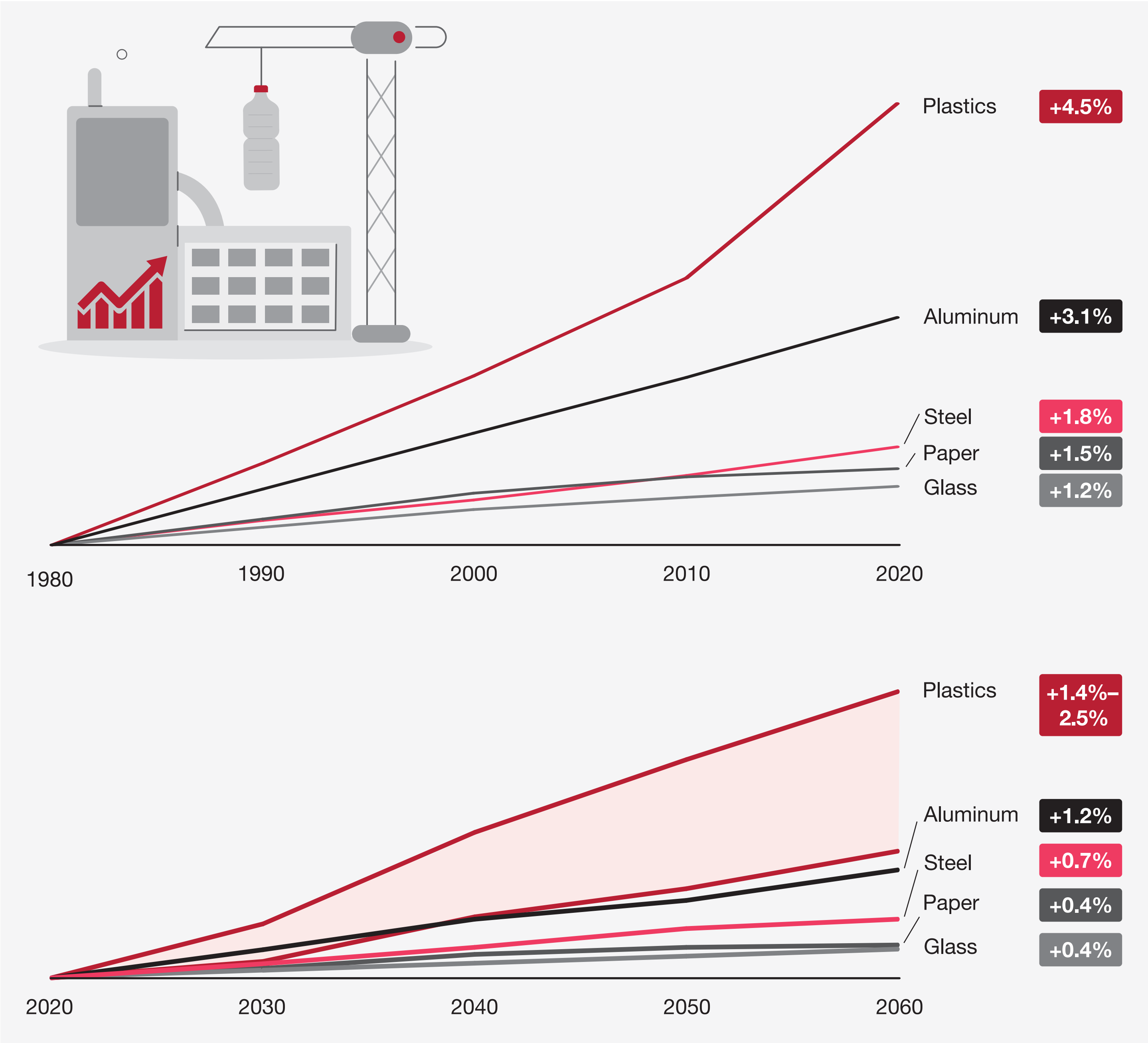
The policy implication is that blanket and comprehensive production caps can be very disruptive to the economy and society, especially if not accompanied by strong industrial policies designed to provide comprehensive access to cheap alternative materials with the same utility. Should policymakers opt for caps or bans, these measures could be carefully directed toward specific product categories that are not critical to everyday well-being and that can easily make use of alternatives to plastic.

The growth rates of plastics usage have significantly outpaced the rates of some alternative materials such as aluminum, steel, paper, and glass, not only in volume but also in versatility and economic reach (*see Exhibit 2*). This trend is expected to continue in the future, albeit at a relatively slower pace, as global markets mature, sustainability regulations tighten, recycling and circular economy efforts scale up, and consumers increasingly demand eco-friendly alternatives.

EXHIBIT 2

Plastics will remain the fastest-growing basic material

(Base year indexed at 1, compound annual growth rate %)



Source: OECD (2022), Global Plastics Outlook: Policy Scenarios to 2060, OECD Publishing, Paris, https://doi.org/10.1787/aa1edf33-en; Systemiq, Handelens Miljøfond, and Mepex, "Achieving Circularity for Durable Plastics: A Low-Emissions Circular Plastic Economy in Norway," 2023 (https://www.systemiq.earth/reports/achieving-circularity/for-durable-plastics/); CRU Consulting, *Opportunities for Aluminium in a Post-Covid Economy: Prepared for the International Aluminium Institute, 2022* (https://international-aluminium.org/wp-content/uploads/2022/03/CRU-Opportunities-for-aluminium-in-a-post-Covid-economy-Report.pdf); Systemiq, "ReShaping Plastics: Pathways to a Circular, Climate Neutral Plastics System in Europe," 2022 (https://plasticseurope.org/wp-content/uploads/2022/04/SYSTEMIQ-ReShapingPlastics-April2022.pdf); Strategy& analysis

The advantages of plastics compared with alternative materials include material efficiency, cost-effectiveness, and durability. Plastics are low weight, with correspondingly low transport costs, and high strength-to-weight ratios. This translates to increased material efficiency—that is, manufacturers can use less material for the same job. In packaging, for example, plastics require one-half to one-sixth the weight of alternatives such as paper, aluminum, and glass serving the same purpose.[5] Replacing a 30-gram polyethylene terephthalate (PET) bottle, for example, would require 140 grams of alternative materials like glass, aluminum, or tin. In addition, plastics are durable and survive extreme environments without degrading in hot and cold temperatures, thus preserving the integrity of the food or beverage.

Plastic also has its downsides. Plastic waste has become a social and economic challenge, given its growth in volumes, its long-lasting impact on the environment, and factors relating to the design of plastic products, including difficult-to-manage additives and unrecyclable components. Most of the external cost of plastic waste pollution originates not when primary polymers are produced, but when polymers are combined and shaped into products. Multi-material structural components of products with additives or other substances that enhance the functionality and marketability of the products to end-users can also make them more difficult to manage as waste, more difficult to recycle, and more harmful when they leak into the environment. Upstream government policy interventions designed to prevent plastic pollution typically target intermediate and final plastic products rather than virgin polymers.

Furthermore, given the extensive integration of plastics into virtually every industrial value chain—whether automotive, construction, food, textiles, healthcare, or others—global constraint on polymers' supply can have significant economy-wide implications (*see "The economic impact of disruptions to plastics production," page 4*). Such constraints may disproportionately negatively affect export-oriented polymer producers like those in the GCC and other countries with large petrochemical sectors. Supply-side disruptions could multiply any plastic price shocks driven by fossil fuel price volatility.

> "Plastics are low weight, with correspondingly low transport costs, and high strength-to-weight ratios. This translates to increased material efficiency—that is, manufacturers can use less material for the same job.

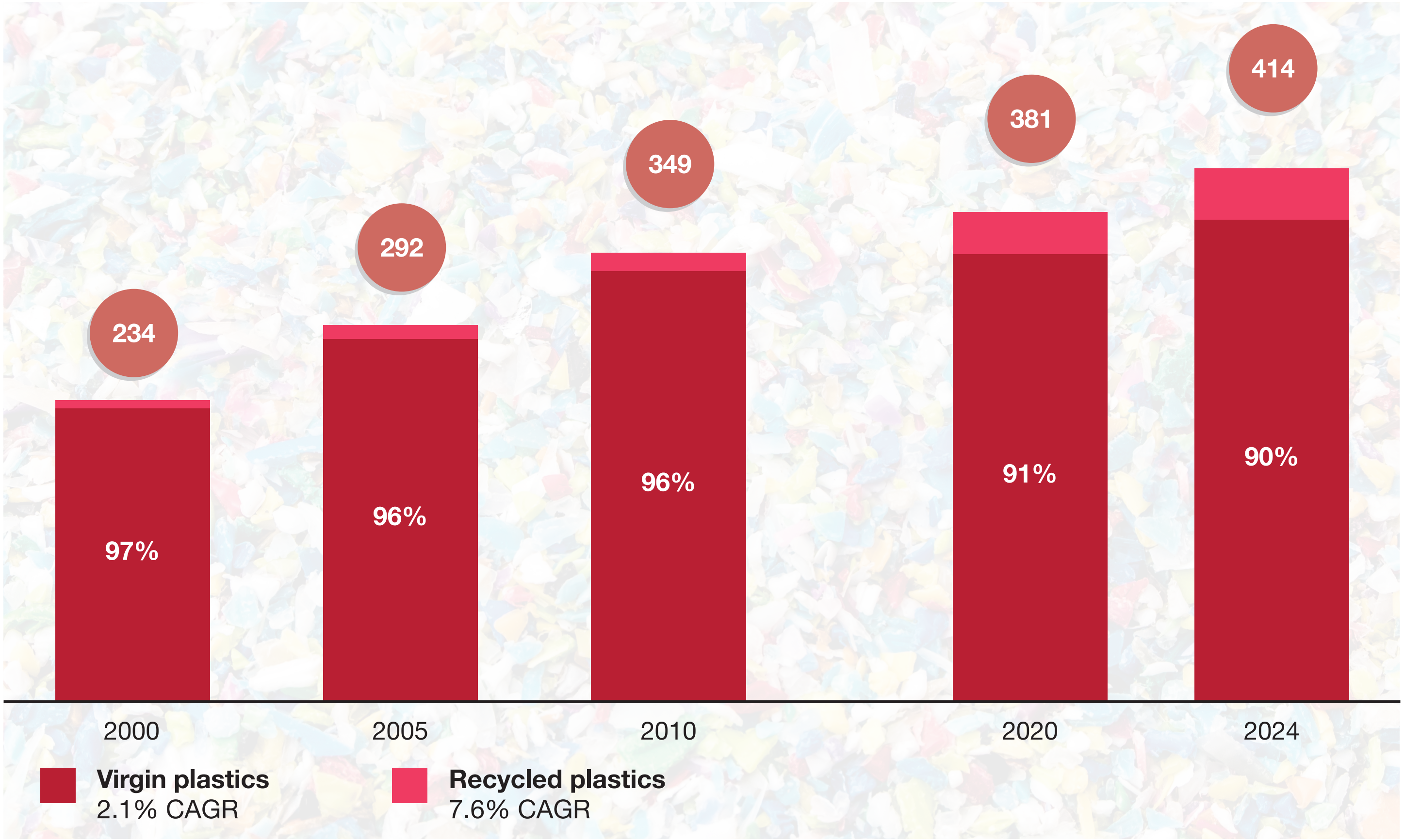
THE PLASTICS INDUSTRY IS BECOMING MORE SUSTAINABLE THROUGH DECARBONIZED PRODUCTION AND RECYCLING

Recycled plastics today account for about 10 percent of global plastics production. The growth of demand and hence production of recycled plastics, at an average annual rate of about 8 percent, has been much faster than the growth of virgin plastics, which is expanding at about 2 percent annually on average (*see Exhibit 3*).

EXHIBIT 3

Production of recycled plastics is growing rapidly

Global plastics production by category (million tons/year, 2000–2024)



Note: CAGR = compound annual growth rate.
Source: OECD (2022), Global Plastics Outlook: Policy Scenarios to 2060, OECD Publishing, Paris, https://doi.org/10.1787/aa1edf33-en; Systemiq, "ReShaping Plastics: Pathways to a Circular, Climate Neutral Plastics System in Europe," 2022 (https://plasticseurope.org/wp-content/uploads/2022/04/SYSTEMIQ-ReShapingPlastics-April2022.pdf); Strategy& analysis

The plastics economy of the future is expected to be less polluting as well as more circular, digital, and decarbonized. Many forces are propelling this shift to circularity and greater sustainability, including government regulations, end-user demands, corporate sustainability plans, and investor activism.

Several countries are introducing policies designed to cut plastic pollution, targeting different stages of the plastic value chain. Upstream measures use pricing and standards to influence manufacturers and brand owners, midstream policies affect retailers and consumers, and downstream efforts focus on funding waste management and supporting circular business models. Although few countries use all these approaches, coordinated policy packages can boost the commercial viability of circular plastics and improve waste management systems. Various types of national policy instruments are being introduced (*see Exhibit 4*).

EXHIBIT 4

National policy instruments designed to reduce plastic pollution and increase circularity

Upstream (production)

- Eco-modulated EPR fees
- Product design standards
- Requirements for recycled content
- Eco-modulated excise taxes on selected plastic packaging products
- Bans of certain problematic non-essential plastic products (e.g., single-use plastic bags or straws) or product components (chemicals of concern)
- Subsidies for alternative materials

Midstream (consumption)

- Deposit-return systems
- Behavioral nudges
- Subsidies for reuse systems
- Eco-modulated waste management tariffs

Downstream (solid waste management)

- EPR financing (PROs)
- Public financing of waste collection, sorting, recycling, material or energy recovery, and sanitary landfilling
- Landfill taxes
- Waste import bans

Note: EPR = extended producer responsibility, PROs = producer responsibility organizations.
Source: World Bank, "Where Is the Value in the Chain? Pathways out of Plastic Pollution," 2022 (https://tinyurl.com/595xxxhr)

The European Union (E.U.) aims to curb plastic pollution by steering production and use toward substitutes for plastics with high pollution impact. From 2021 through 2027, the E.U. member states will pay a plastic levy of €0.80 (US$0.94) per kilogram of non-recyclable plastic waste to help fund the E.U. budget and accelerate sustainability; under this arrangement, each country decides whether and how to pass the cost on to producers and importers.[6] E.U.-level and national measures (often mirrored in the U.K.) increase the cost of single-use items made with virgin content and toxic additives that are difficult to recycle, while boosting demand for recycled feedstock and alternatives. The E.U. regime discourages unsustainable plastic products, domestic or imported, and attracts capital to circular solutions, including SABIC's chemical recycling plant in the Netherlands.

The 2025 Packaging and Packaging Waste Regulation (PPWR) mandates, among other things, a 15 percent cut in total packaging by 2040, at least 10 percent recycling of food and beverage packaging by 2030, products designed for recycling, restrictions on chemical additives, minimum recycled content requirements by 2030 and 2040, and recyclability of all packaging placed on the E.U. market, phased in between 2030 and 2035.[7]

E.U. member states blend recycled-content quotas, extended producer responsibility (EPR) programs, and plastic taxes—the trio with the greatest impact on virgin-versus-recycled resin economics—to achieve circularity goals. EPR extends producers' responsibility to post-consumer waste. Eco-modulated fees, which are higher on single-use, hard-to-recycle, or toxic items, are paid by firms that place these products on the market, and fee revenue is used to fund producer responsibility organizations (PROs) that run collection and recycling. Fees average €0.5–€1 (US$0.58–$1.17) per kilogram in most member states; surpass €1 (US$1.17) per kilogram in Belgium, the Netherlands, and Sweden; and can reach €3 (US$3.51) per kilogram for the worst offenders.[8]

E.U. producers already pay carbon costs under the Emissions Trading System, and imports may face equivalent charges when the Carbon Border Adjustment Mechanism (CBAM) extends to polymers around 2030. Some countries, including Malaysia,[9] Saudi Arabia,[10] and the United Arab Emirates (UAE),[11] have also outlined specific waste management and plastic sustainability road maps.

Other changes are taking place on the global level. In March 2022, the United Nations Environment Assembly (UNEA) created the Intergovernmental Negotiating Committee (INC) under the United Nations Environment Programme (UNEP) and charged it to conclude its efforts by the end of 2024 as part of an effort to craft a treaty that would end plastic pollution—on land and at sea.[12] Negotiations continue, yet delegates still differ on core provisions such as compulsory EPR, minimum recycled-content thresholds, production caps, and a virgin-resin tax, all of which remain on the table for the final rounds of negotiations.

Corporate pull for plastic circularity is strong. Unilever targets reaching 25 percent recycled plastic in all packaging by 2025.[13] Target and Lego have similarly high-profile goals, with Lego aiming to eliminate fossil-based resins by 2032.[14] The Ellen MacArthur Foundation's Global Commitment—which unites governments, enterprises, investors, and charities in a shared promotion of circular economics—now counts 1,000 organizations and governments pursuing an 18 percent cut in virgin plastic and 100 percent reusable, recyclable, or compostable packaging by 2025—tightening market demand for quality recyclate.[15]

For their part, consumers are showing strong support for recycled plastics. Surveys show that a substantial portion of consumers (often 50–70 percent) are willing to pay slightly higher prices (usually 5–15 percent more) for sustainably sourced or recycled products.[16] Brands like Adidas, Coca-Cola, and Patagonia are tapping into this consumer sentiment by marketing products made from recycled plastics. For example, millions of pairs of Adidas's recycled plastic sneakers (the "Parley" series) have been sold at premium pricing, demonstrating market acceptance for higher-priced recycled products when backed by strong branding and clear messaging.[17]

These changes are spurring innovation. Patent activity increased 18-fold between 1990 and 2023, with more focus on waste prevention and recycling.[18] Plastic-to-plastic chemical recycling technologies are being commercialized. There are innovations across the waste management value chain, such as artificial intelligence (AI)-based sorting tools and the use of blockchain technology to improve end-of-life plastic waste management. Examples include Greyparrot's AI-powered camera systems, which identify over 100 categories of waste in real time to improve sorting efficiency;[19] AMP Robotics' high-speed robotic arms capable of sorting more than 80 plastic items per minute with high accuracy;[20] and Bin-e's smart recycling bins, which use AI to segregate recyclables and achieve sorting precision above 90 percent.[21]

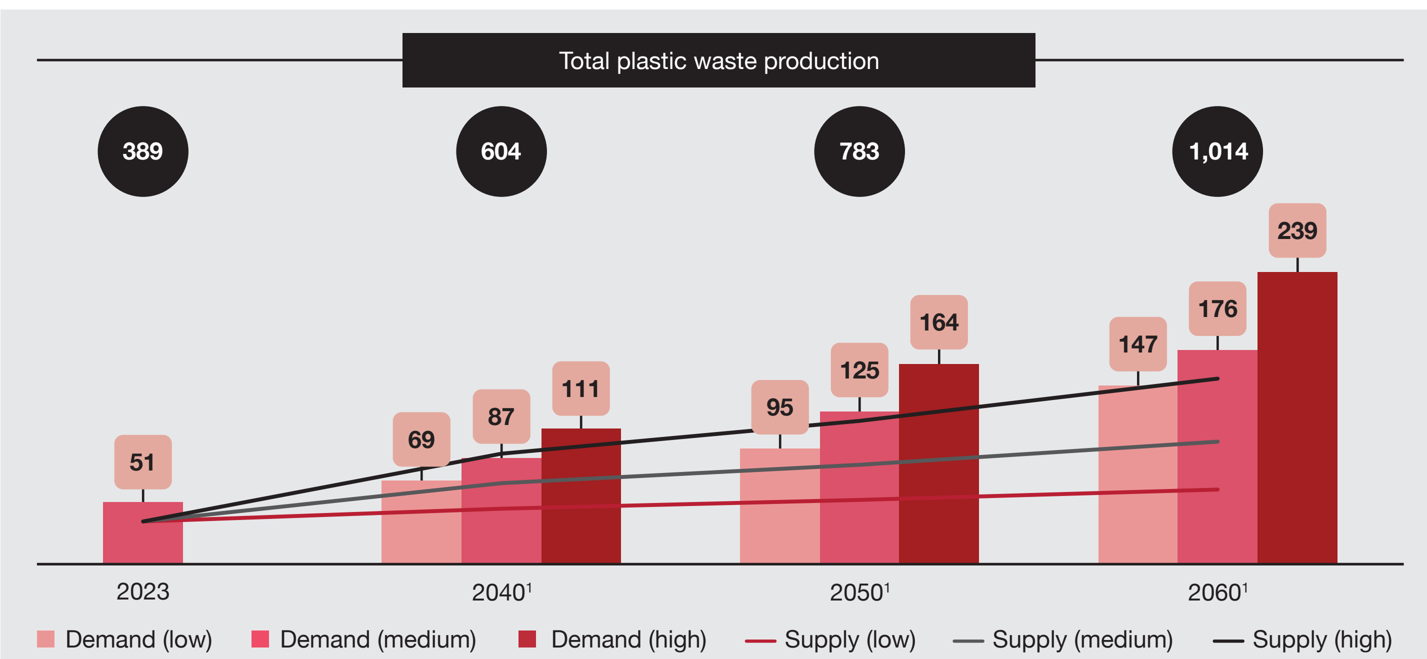
CLOSING THE DEMAND–SUPPLY GAP FOR CIRCULAR PLASTIC

In the face of this growing global demand for recycled plastics, supply, for now, is unable to keep up: Current supply meets less than 70 percent of demand (*see Exhibit 5*). The trend is expected to continue long into the future, despite significant efforts to scale up recycling capacity and reduce the gap. One of the key drivers of this demand for recycled plastics is the global majors that have formally committed to reduce virgin plastic usage and increase the share of post-consumer recycled (PCR) content across all plastic packaging.[22] Over 70 percent of the signatories of the Ellen MacArthur Foundation Global Commitment are companies belonging to the category of packaged goods companies, packaging producers, and retailers. Of those businesses, 80 percent are headquartered in North America and Europe.[23] The latest progress report reveals that most of the signatories are not on track to meet their commitments, due to supply shortages.[24]

EXHIBIT 5

Many companies are not meeting their commitment to recycled plastics

Global recycled plastic (million tons/year)



[1] Supply is estimated based on projected waste under three recycling rate scenarios: 9 percent (low), 12 percent (medium), and 15 percent (high), assuming increasing adoption of recycling capacity worldwide. Demand is estimated based on varying recycling rates among recyclable waste production and three demand scenarios: 20 percent (low), 25 percent (medium), and 30 percent (high) in 2023, which increases by 5 percentage points every five years to account for increasing adoption of recyclable plastics.

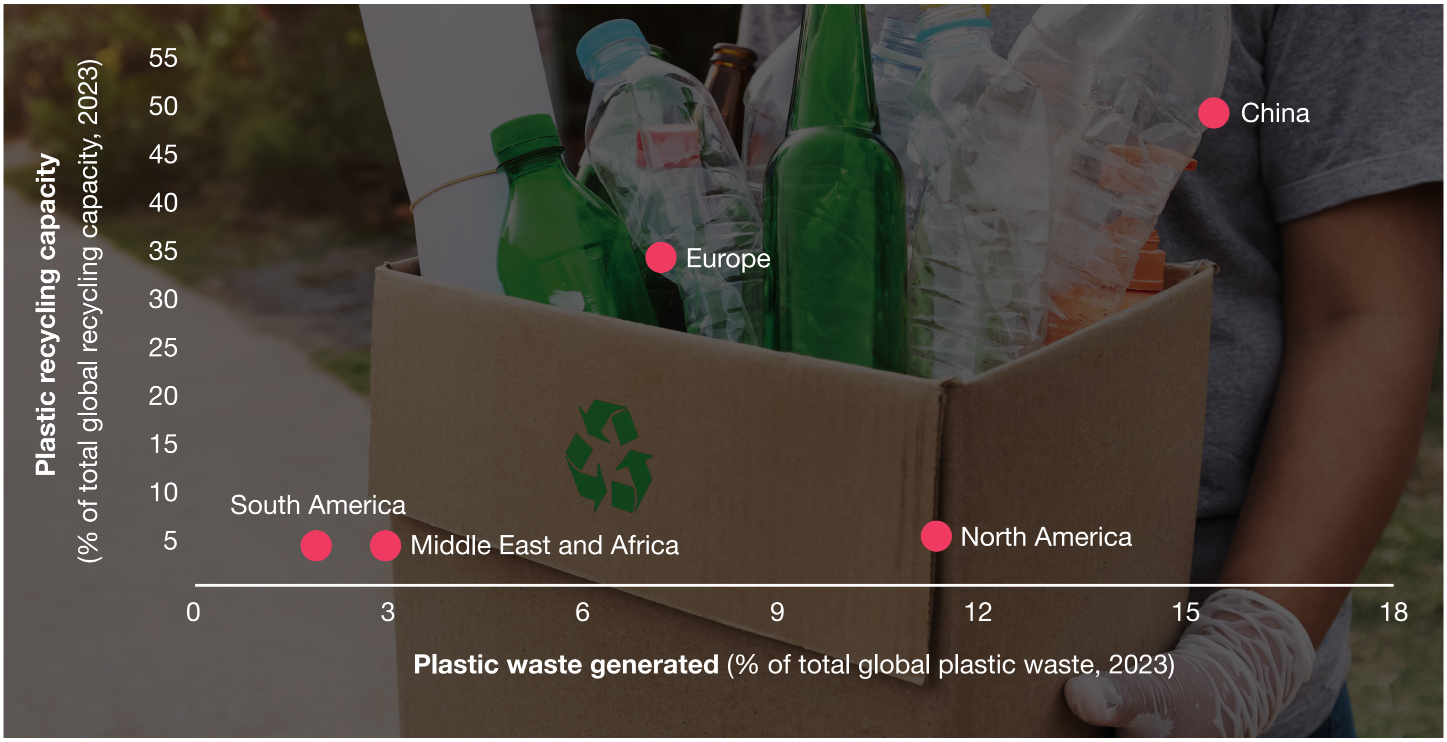
Source: Ellen MacArthur Foundation, “The Global Commitment: 2024 Progress Report” (https://gc-data.emf.org/); Strategy& forecasts for demand and supply scenarios

This gap between demand and supply presents an opportunity to regions with access to plastic waste feedstock, assuming they can overcome other constraints. Some regions are already building competitive advantages and moving fast to scale up their plastic recycling capacity. The majority of global recycling capacity is currently concentrated in the E.U. and China (*see Exhibit 6*).

EXHIBIT 6

Regions with more recycling than waste have a commercial opportunity

Plastic waste generation compared with recycling



Source: OECD (2022), Global Plastics Outlook: Policy Scenarios to 2060, OECD Publishing, Paris, https://doi.org/10.1787/aa1edf33-en; Systemiq, "ReShaping Plastics: Pathways to a Circular, Climate Neutral Plastics System in Europe," 2022 (https://plasticseurope.org/wp-content/uploads/2022/04/SYSTEMIQ-ReShapingPlastics-April2022.pdf)

For example, the E.U. has ramped up recycling capacity (from 7.7 million tons in 2014 to 11.1 million tons in 2023).[25] Innovation funding, including initiatives such as Horizon 2020 and the LIFE Programme, has funded more than €350 million (US$407 million) to support plastic circular economy projects over the past decade.[26] Several digital marketplaces can now automatically connect waste generators and recyclers in order to improve the plastics circular economy.

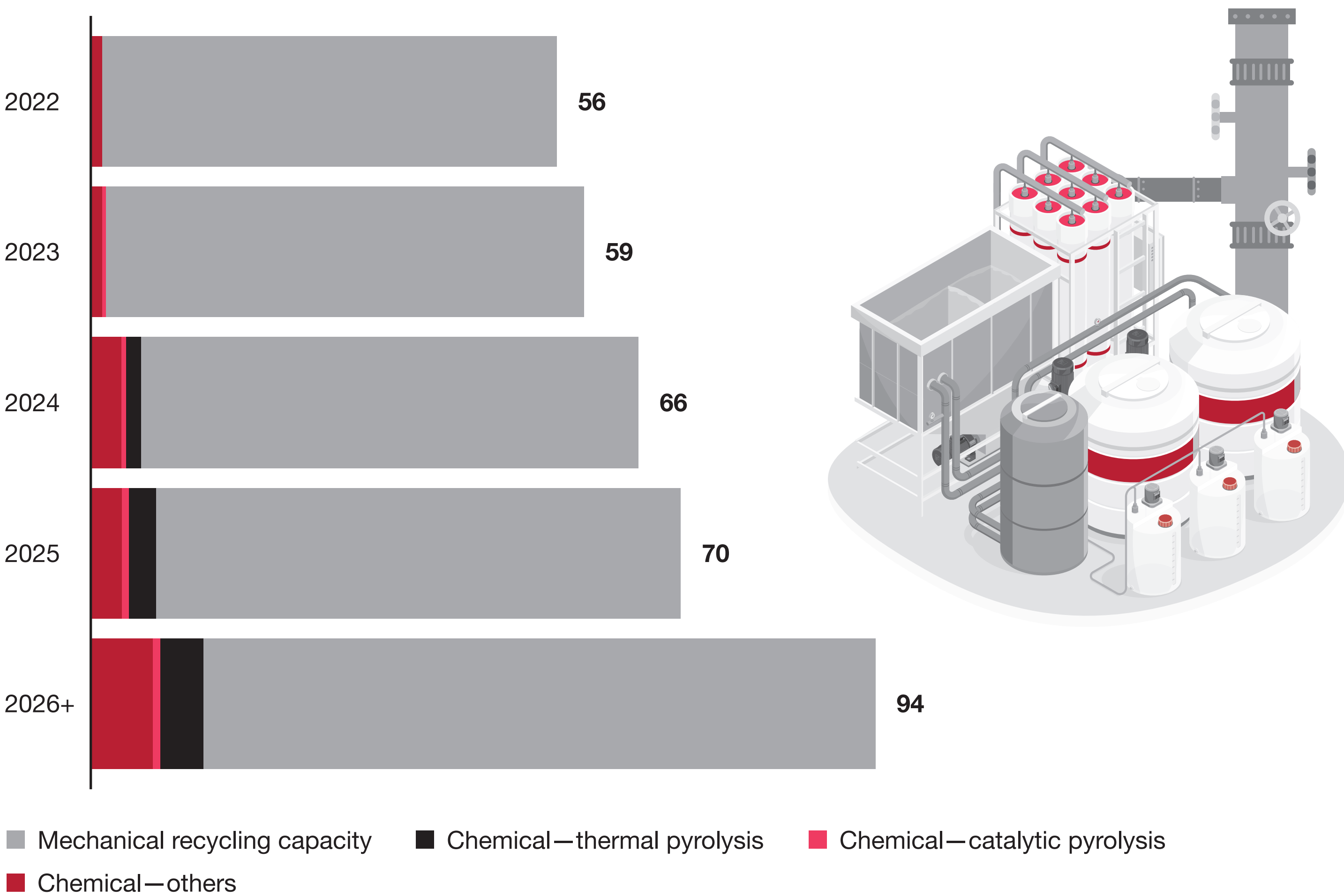
China has rapidly expanded its recycling infrastructure: Its plastic recycling rate surpassed 30 percent in 2021, approximately 1.7 times the global average.[27] This reflects the impact of sustained policy focus and investment, positioning China as a leading example of how national-level interventions can drive circularity at scale.

For now, mechanical recycling remains the dominant recycling technology. This method primarily handles single-polymer streams, such as PET, high-density polyethylene (HDPE), and polypropylene (PP), with minimal contamination; it currently accounts for about 90 percent of global plastic recycling capacity (*see Exhibit 7*). However, chemical recycling is rapidly maturing, supported by several emerging technologies.

EXHIBIT 7

Chemical recycling can accept more diverse feedstock

Chemical and mechanical recycling capacity (million tons/year)



Source: Alan Wei, "The Disruptive Path to Circular Plastics," Chemical Market Analytics by OPIS, a Dow Jones Company, 2024 (https://scic.sg/images/1._The_Disruptive_Path_to_Circular_Plastics_Alan_WeiChemical_Market_Analytics_by_OPIS.pdf); Applied Market Information Ltd, Global Recycling Information

Pyrolysis is currently the most advanced, attracting substantial investments. Although chemical recycling accounts for only around 10 percent of global recycling capacity today, its use is growing quickly.[28] Unlike mechanical recycling, chemical processes accept diverse feedstocks (including mixed or contaminated plastics) and produce hydrocarbon feedstocks or monomers that can be reprocessed into virgin-quality plastics.

Several constraints in the recycling value chain hamper the supply of recycled plastics. These constraints include the collection, sorting, and treatment of plastic waste. Consequently, recycling rates remain low, around 10 percent.[29]

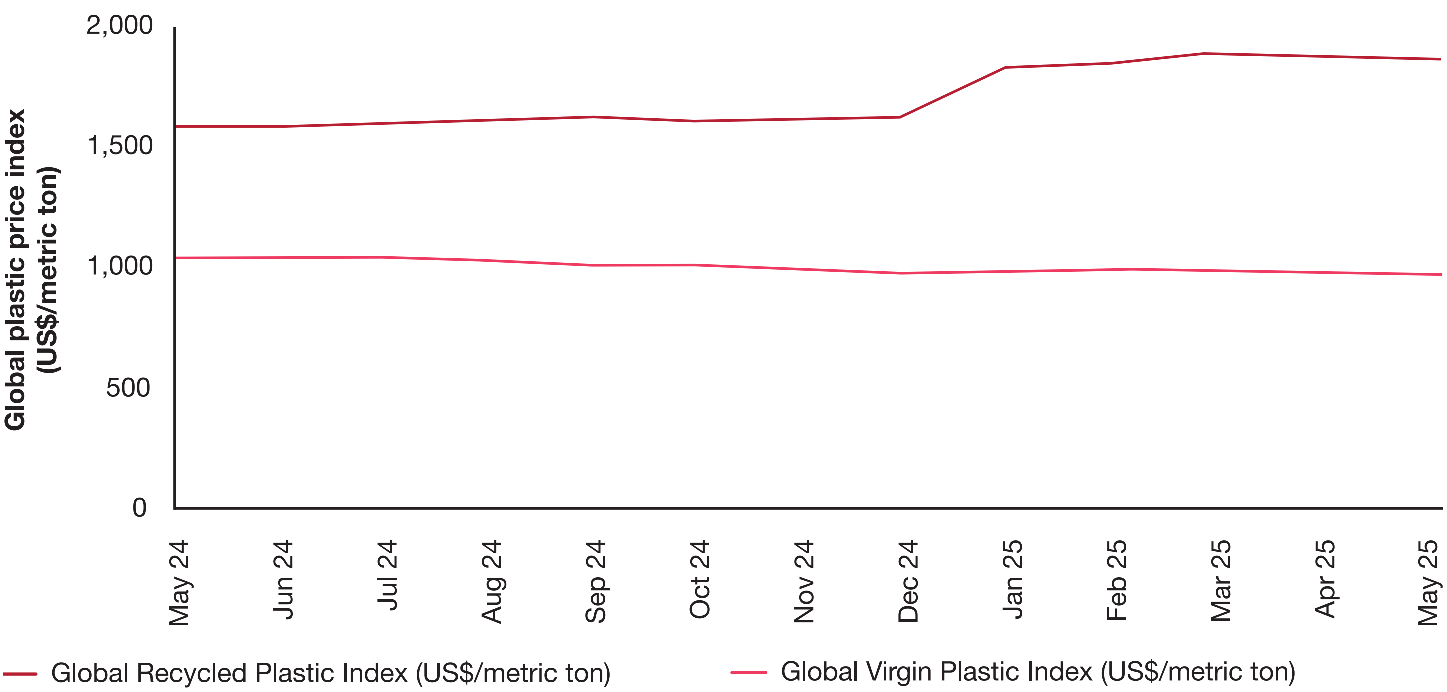
A number of the constraints are discussed below.

Economic viability

Recycled plastics enjoy a price premium on the market (*see Exhibit 8*). But recycling technologies, especially advanced chemical recycling methods such as catalytic pyrolysis, also face high operational and capital costs, reducing their economic viability compared with virgin plastic production. Plastic recycling suffers from fluctuating trade barriers and policy conditions for recycled materials, often rendering recycled plastics less predictable and competitive than virgin plastics.

EXHIBIT 8

Recycled plastics often earn a premium, though their prices are more volatile
Global recycled and virgin plastic price index (US$/metric ton)



Note: S&P Global Platts; Platts Global Recycled Packaging Index (ARPGI03) comprises prices for recycled materials such as polyethylene terephthalate (PET) flakes, high-density polyethylene (HDPE) pellets, and aluminum used beverage cans from regions including North America, Europe, and Southeast Asia. Platts Global Plastic Price Index (AAXVS00) focuses on polypropylene (PP) prices, integrating data from major production and consumption areas such as Asia, Europe, and the United States.
Source: S&P Global Platts

In the GCC, for example, chemical recycling of plastics via thermal or catalytic pyrolysis requires up-front investments of approximately US$0.8 million to US$2.5 million per thousand tons of annual capacity, depending on technology and scale.[30] A mechanical plastic recycling facility would cost around one-fourth that amount and have shorter payback periods.[31] The economics of chemical recycling are highly sensitive to feedstock costs, feedstock quality, energy prices, and plant utilization rates (commonly constrained by feedstock availability), increasing the risk profile for early-stage investors.

Technological limitations

Chemical recycling processes such as depolymerization, gasification, and pyrolysis are still not fully mature (e.g., pyrolysis technology is at the technology readiness level [TRL] 7–8 stage), and their scalability is not yet proven at an industrial level globally.[32] The processing capacity of facilities today is around 30,000–50,000 tons per year, but that is expected to grow to up to 100,000 tons per year in 2030, as the technology and market mature.[33]

Current technologies have limitations with respect to the purity and quality of the output, especially those technologies involved in processing mixed plastics or contaminated waste streams. Technologies such as catalytic pyrolysis require high-quality input materials, making them sensitive to contamination, which significantly impacts product quality and yield.

“The economics of chemical recycling are highly sensitive to feedstock costs, feedstock quality, energy prices, and plant utilization rates (commonly constrained by feedstock availability), increasing the risk profile for early-stage investors.

Limited availability of quality feedstock at scale

Inadequate plastic waste recovery infrastructure, supply chain complexity, and increased scrutiny on global trade of waste plastics all limit the amount of quality feedstock available to recyclers attempting to build and scale up plastic recycling hubs.

Limited plastic waste recovery infrastructure

Globally, plastic waste recycling infrastructure (e.g., collection, sorting, recovery facilities), especially in emerging economies, is inadequate to handle the rapidly growing volumes of plastic waste. This lack of infrastructure exacerbates littering and mismanagement, leading to significant environmental costs. Inconsistent feedstock volumes and contamination complicate collection and sorting, highlighting the need for improved infrastructure, such as better bin systems, advanced sorting technologies, and increased public–private investment.

Today, GCC countries generate approximately 10 million tons of plastic waste annually, yet only about 10 percent is recycled, reused, or recovered.[34] This ratio is in line with the global average but significantly lags behind that of the OECD countries and China. This low recovery rate reflects deep structural gaps in waste management systems, particularly the lack of sufficient recycling infrastructure such as material recovery facilities (MRFs), which are critical for sorting and processing diverse waste streams.

Supply chain complexity

Complex global supply chains hinder closed-loop recycling models, as manufacturers may have limited control or visibility over end-of-life plastics, particularly packaging materials. The fragmented nature of supply chains and limited cooperation across stakeholders (manufacturers, waste collectors, recyclers) reduce efficiency and increase costs. One way to minimize complexity is to place an emphasis on design-for-recyclability and mono-material packaging. Ensuring transparent sustainability claims and establishing standardized metrics can also strengthen stakeholder trust and drive system-wide improvements.

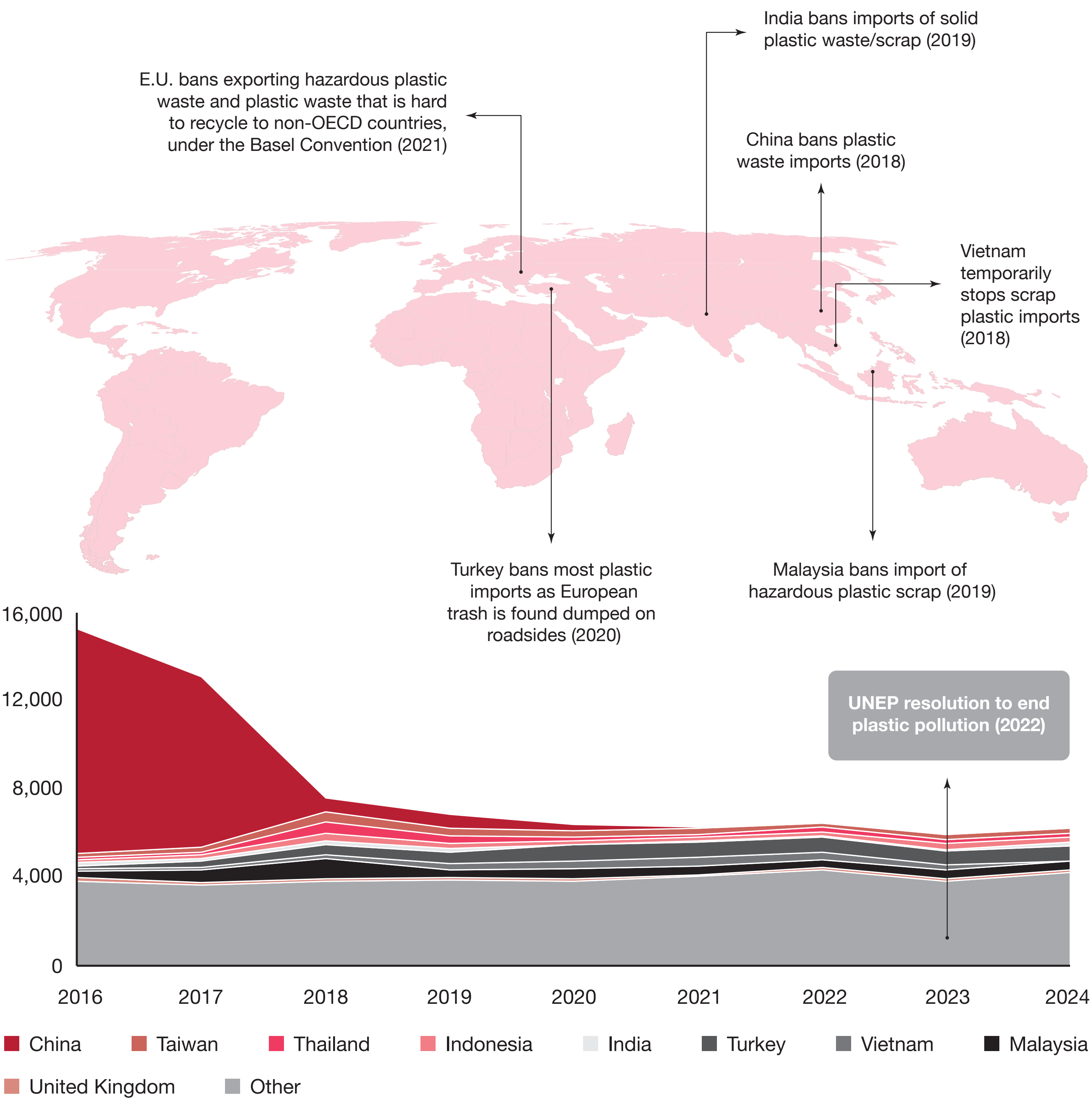
Global trade restrictions

Bans on plastic waste imports in countries such as China and India, along with tighter Basel Convention rules and UNEA Resolution 5/14, have drastically reduced global cross-border plastic waste flows, from 15.3 million tons in 2016 to 6.3 million tons in 2024, limiting easy access to external waste streams (*see Exhibit 9*).[35] Per the Basel Convention requirements, any party exporting mixed or contaminated plastic waste must fully inform the importing party and seek consent to trade.

EXHIBIT 9

International action is reducing cross-border plastic waste flows

Plastic waste imports (thousand tons/year)



Source: ITC Trademap (trademap.org)

Today, the GCC region imports around 50,000 tons of plastic waste per year (2024).[36] Saudi Arabia accounts for more than half of this. Feedstock supply security for new plastic recycling capacity in the region will rely on additional plastic waste imports and increased domestic plastic waste collection and sorting rates.

Evolving policy and regulatory framework

Current regulations often do not incentivize recycling sufficiently, or they fail to create penalties or costs high enough to discourage plastic waste generation or dumping. Limited global regulation impedes the development of robust recycling industries. Without stronger legislative frameworks, plastic recycling technologies face uncertainties in investments and scale-up strategies, negatively affecting the business case for advanced recycling technologies.

In the GCC region, circular plastics policy frameworks are still maturing. Although countries like the UAE plan to introduce EPR programs, other GCC states still lack mandatory EPR policies, recycled content targets, or product design standards.[37] Moreover, virgin plastic production in the GCC countries benefits from low feedstock and energy prices, making virgin polymers very cost-competitive with less incentive to invest in circularity. In contrast, places such as the E.U. and China are implementing policies to incentivize efficient plastic end-of-life management, such as deposit-return systems and plastic taxes, to promote the use of recycled content.

GCC COUNTRIES HAVE AN OPPORTUNITY TO POSITION THEMSELVES AS A GLOBAL HUB FOR CIRCULAR PLASTICS

The GCC region is strategically positioned to connect waste supply from the East (Asia accounts for over 30 percent of the global plastic waste generated) to demand for recycled plastics in the West (e.g., Europe), which has put in strict regulations on PCR content, and is home to top global plastic packaged goods companies, packaging producers, and retailers that have committed to increase PCR content in their products.

As Strategy& has suggested elsewhere, the GCC region is well positioned to address the full spectrum of recycling and waste management challenges.[38] Chemical recycling would be a key pillar of this strategy leveraging the region's unique competitive advantages in capital availability, advanced infrastructure, and petrochemical industry skills that can be transferable to chemical recycling[39] (*see "How chemical recycling in GCC countries can be competitive," page 22*). The key challenge will be to accelerate the creation of enabling domestic policy and market conditions for scaling up commercially viable recycling business models in the GCC region.

Deep capital pools can unlock infrastructure and scale

The GCC region has deep capital availability through sovereign wealth funds such as Saudi Arabia's Public Investment Fund and Abu Dhabi's ADQ and Mubadala, as well as through industrial champions such as SABIC, Aramco, and Borouge. Mobilizing these financial resources can enable the rapid buildout of MRFs, AI-enabled sorting systems, and chemical recycling plants. Such efforts would overcome the capital intensity barrier that restricts progress in other markets.

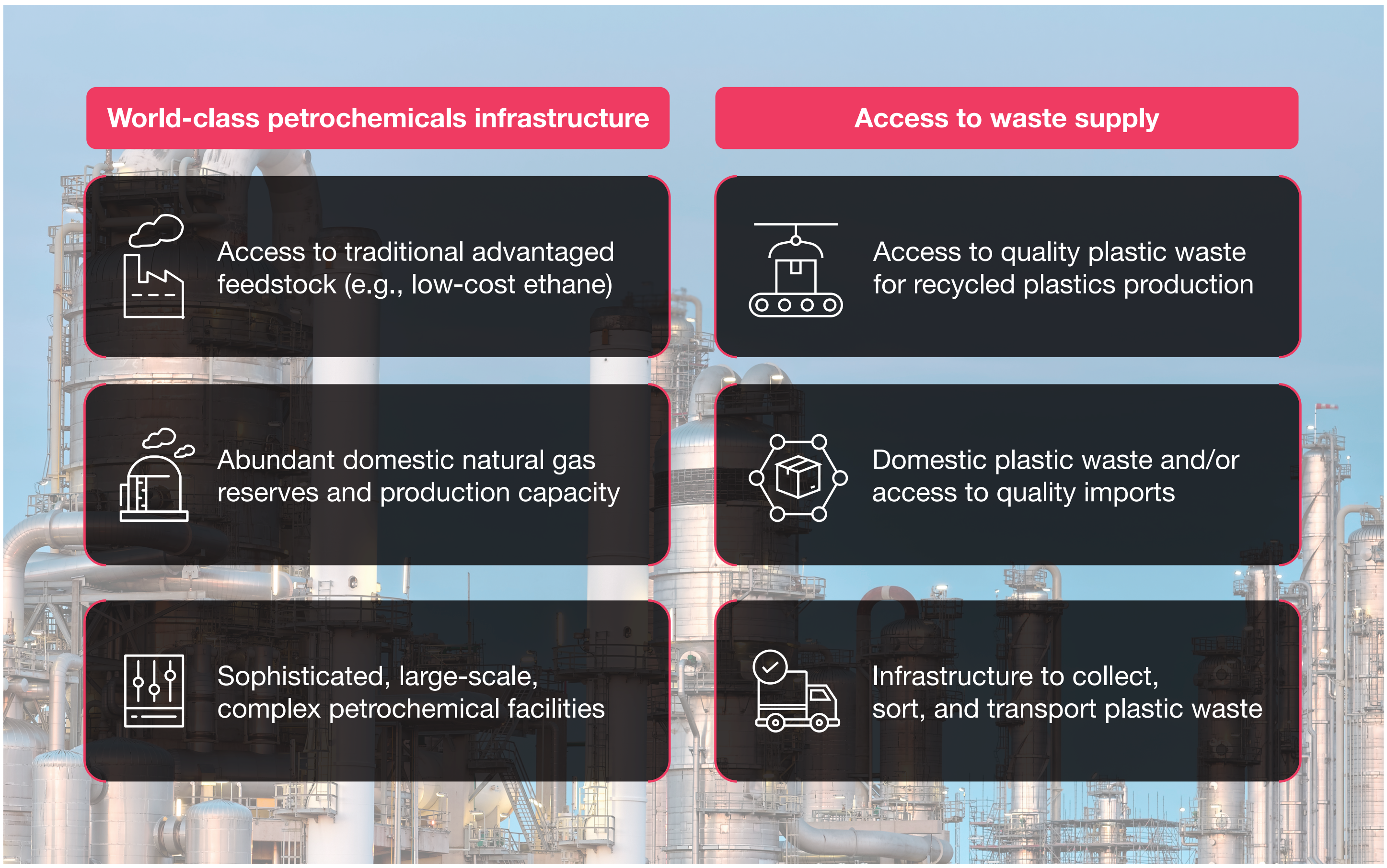
> "The GCC region is well positioned to address the full spectrum of recycling and waste management challenges.

Integrated feedstock strategy can improve technology economics and supply chain efficiency

Embedding chemical recycling within petrochemical clusters allows for integration of recycled liquid outputs with virgin feedstocks, which provides GCC countries with a dual feedstock advantage (*see Exhibit 10*). This dual-feedstock approach reduces logistics costs, supports continuous utilization of chemical recycling units, and mitigates risks from fluctuating or inconsistent waste streams.

EXHIBIT 10

GCC countries possess a dual advantage



Source: Strategy&

World-class logistics infrastructure and strategic location help companies access quality feedstock and export recycled products

The GCC's proximity to Asia and Africa—regions with significant plastic waste generation—and its advanced port infrastructure create an opportunity to establish a plastic waste import corridor. This could offset domestic collection limitations and secure higher-quality, industrial-grade waste streams from countries such as India and Indonesia. That access could alleviate one of the most critical challenges: inconsistent and contaminated feedstock. Considering that the cost of waste plastic feedstock accounts for about 55 percent of the supply cost of chemically recycled material, feedstock supply consistency and efficiency are critical to the economic competitiveness of a circular supply chain. Hence, systems and infrastructure optimizing the current practice for end-of-life management of plastics including collection, diversion, sorting, shredding, cleaning, storage, and shipment are essential to achieving global plastics' circularity.

Competitive energy costs enhance economic viability

Conventional thermal pyrolysis is energy intensive, requiring 0.7–1 megawatt-hours per ton of plastic waste as feedstock.[40] GCC countries such as Saudi Arabia currently offer highly competitive energy prices because of their low-cost natural gas and industrial electricity compared with other relevant global markets. This significantly reduces chemical recycling operating costs and enhances economic viability even in the face of fluctuating recycled plastic prices; for instance, in today's scenario, our estimates indicate that a chemical recycling facility in the GCC region can operate pyrolysis at one-quarter to one-fifth of the energy cost per ton relative to Europe.

In the future, with the development of technologies related to the electrification of pyrolysis plants along with the upstream recycling value chain,[41] GCC countries can continue to hold a competitive advantage by leveraging the increasing proportion of inherently low-cost renewable energy.[42]

How chemical recycling in GCC countries can be competitive

We have conducted a proprietary modeling exercise of a pyrolysis-based chemical recycling facility in the GCC region to analyze supply cost for R-naphtha output in comparison with the market price of virgin naphtha in different markets. Overall results are promising; however, the economics remain sensitive to feedstock availability, plant utilization rates, and energy costs.

In the base case scenario, chemical recycling offers competitive product supply cost (break-even price) if the real price of process-ready waste plastic feedstock can be guaranteed to be between US$240 and US$280 per metric ton.[43] This price is in line with the recent average feedstock prices (May–June 2025) for waste plastic bales, which range between US$274 per metric ton in Northwest Europe and US$348 per metric ton in the U.S. Gulf Coast region, underscoring the near-term viability of such investments.[44] Even at higher feedstock prices of US$450–US$500 per metric ton, breakeven can still be achieved on a cash cost basis.

In a second scenario for which there is a 10 percent price premium on recycled plastics relative to virgin plastics, that premium can be translated to the recycled naphtha equivalent feedstock to produce the plastics. This would increase the offtake prices of virgin naphtha accordingly and make recycled naphtha competitive with virgin naphtha at higher waste plastic feedstock prices (about US$280–US$340 per metric ton).

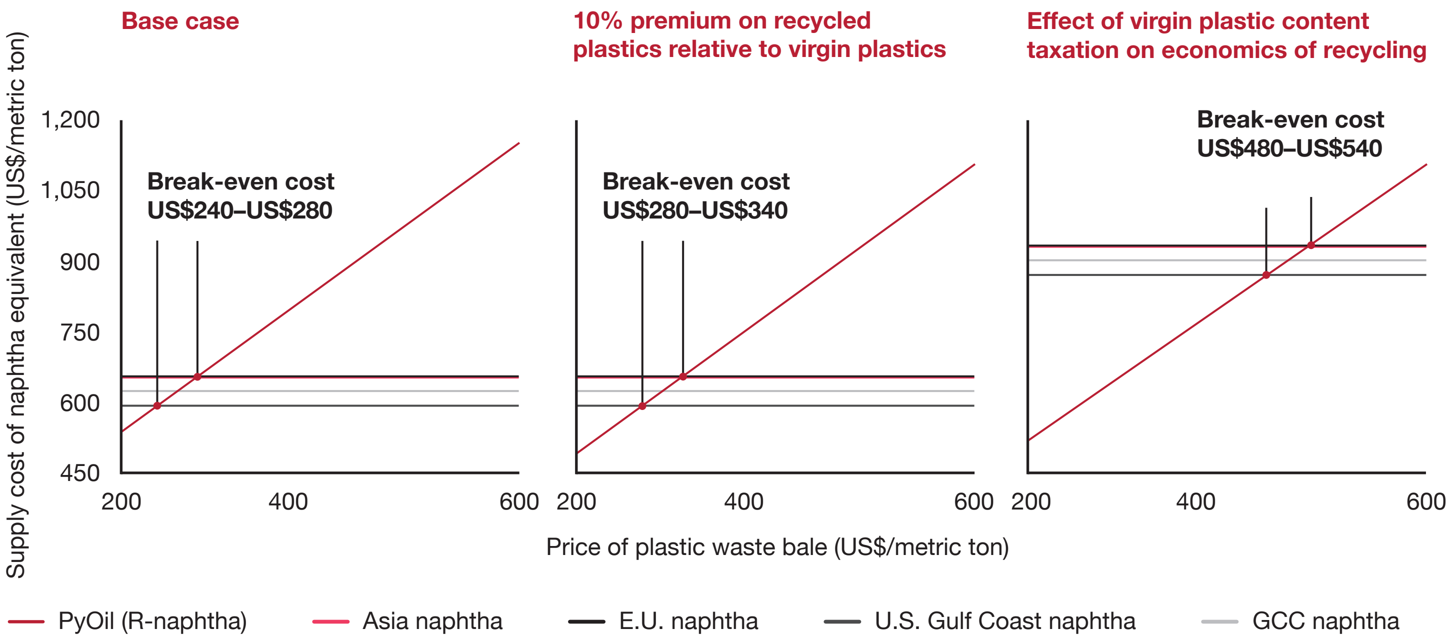
In a third scenario, a price premium for recycled plastics materializes because of taxes or fees on non-recycled content of plastic products in offtake markets. Such upstream taxes and fees would translate to improved relative competitiveness of R-naphtha compared with virgin naphtha feedstock. For example, the reported tax rates in Spain of about US$465 per metric ton of virgin content would represent a virgin naphtha equivalent tax rate of around US$320 per metric ton. The potential impact of such offtake price premiums on the R-naphtha break-even feedstock price would make R-naphtha cost-competitive up to US$540 per metric ton of waste plastic feedstock (*see Exhibit 11*).

Catalytic pyrolysis baseline break-even cost can be up to 100 percent higher than thermal pyrolysis, due to higher operating costs. Those costs are driven mainly by the costs of chemicals (catalysts) and treatments needed in the catalytic pyrolysis process. Thermal pyrolysis enables the potential for energy integration by utilizing sizable fuel gas yields (about 10 to 15 percent) to optimize process efficiency. Without this energy integration and in a higher energy cost regime, the contribution of utility cost to the supply cost increases to about 7 percent (from less than 1 percent).

When we compare supply cost sensitivities with energy cost, feedstock cost, and feedstock availability (*see Exhibit 12*), we see that feedstock availability (represented as plant utilization) and feedstock cost have the greatest effect on the economic competitiveness of chemical recycling investments.

EXHIBIT 11

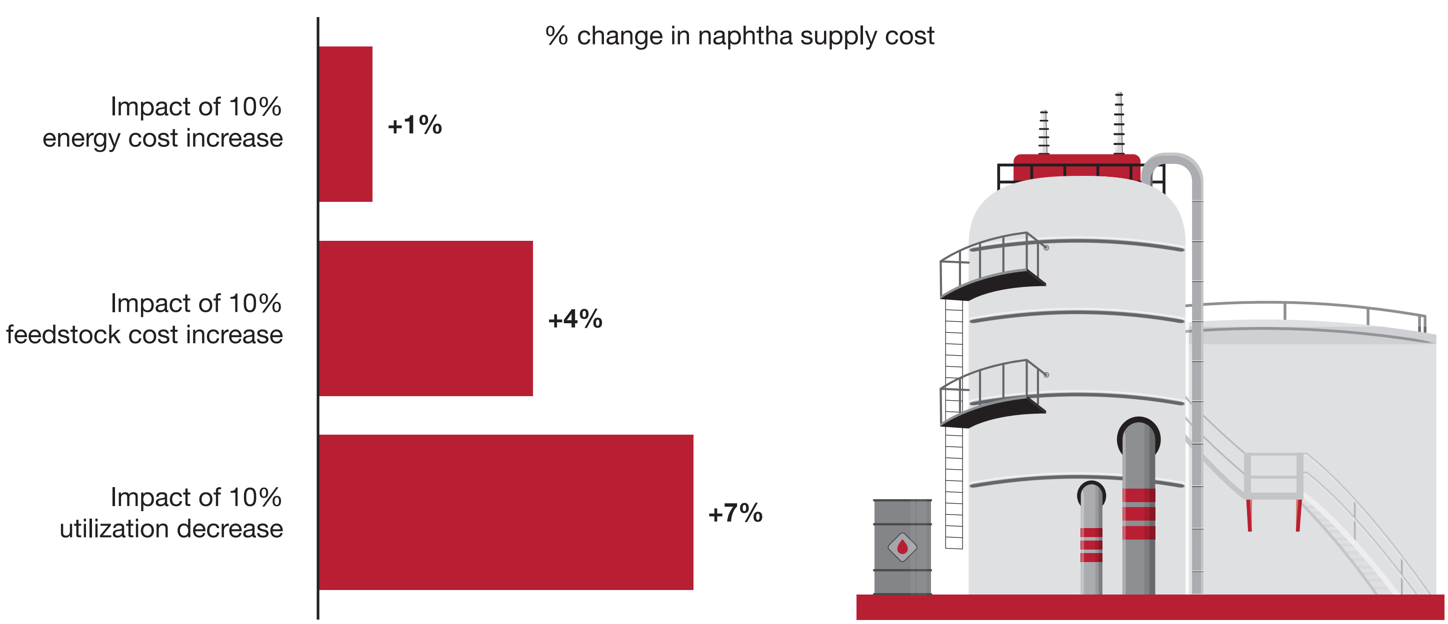
Favorable policies mean chemical plastic recycling breaks even at higher waste prices



Note: GCC = Gulf Cooperation Council.
Source: KAPSARC analysis

EXHIBIT 12

Utilization (availability), feedstock, and energy costs are key drivers of naphtha supply cost



Source: KAPSARC and Strategy& analysis

GCC COUNTRIES SHOULD SECURE ACCESS TO FEEDSTOCK, PROVIDE POLICY SUPPORT, AND CATALYZE INNOVATION

Developing the GCC region as a circular plastics hub would require actions to be undertaken by policymakers and the private sector alike, across three dimensions:

1. Secure access to quality feedstock at scale through domestic infrastructure development and establish a plastic waste trade corridor

2. Accelerate policy and regulatory enhancements to manage supply and offtake risks and strengthen economic viability

3. Catalyze innovation and consumer awareness

1. Secure access to quality feedstock at scale through domestic infrastructure development and establish a plastic waste trade corridor

Policy frameworks and business models will be required to improve end-of-life management of plastic waste and facilitate efficient sourcing of raw material. The GCC countries currently generate about 10 million metric tons of plastic waste annually.[45] This potentially offers a reliable input stream as foreign opportunities for needed feedstock supplies are explored.

Build domestic and regional integrated waste management infrastructure
Successful collection and aggregation of quality plastic waste feedstocks via local and regional networks will be needed to provide the scale necessary to run chemical recycling facilities.

Technology adoption has a role to play here in expanding collection systems, including reverse logistics. Among other infrastructure, this would include MRFs, AI-enabled sorting, and blockchain-based traceability platforms designed to improve feedstock availability and quality. Blockchain-enabled tracking systems are increasingly being used globally to strengthen transparency and traceability across waste flows. Spatial planning for waste collection and investments in recycling can be digitized in national waste mapping platforms.

Scaling up chemical recycling plants co-located with petrochemical hubs would enable dual-feedstock integration, reduce costs, and close material loops. For example, ExxonMobil and LyondellBasell are investing in the US$100 million Houston Circularity Center, which integrates an advanced recycling facility with municipal plastic waste collection systems.[46]

To finance this infrastructure and split the early-stage investment risk between the private and public sectors, the GCC region could mobilize sovereign wealth funds and blended capital. In this way, it would leverage private investments, provided that enabling policy conditions were established to ensure market-based commercial revenue flows to these projects in the operation phase. GCC countries will require an estimated US$12 billion to US$25 billion in plastic waste infrastructure by 2045, or approximately US$1.2 billion per year, according to industry assessments.[47]

Establish a plastic waste trade corridor and alliances

To become a fully functioning hub for the new plastics economy, in addition to developing the domestic infrastructure, the GCC region would need to establish formal plastic waste trade agreements and closed-loop supply chains with India, Southeast Asia, Africa, and Europe. This would both secure long-term inbound feedstock supply and enable outbound exports of certified circular polymers and recycled resins.

In addition, establishing the corridor would require upgraded port logistics, free zones, and customs frameworks designed to facilitate compliance, as well as traceable cross-border waste flows in line with international regulations and mass balance systems.[48]

A thriving hub is an entire ecosystem. This would require coordination among governments and joint ventures/alliances between recyclers, fast-moving consumer goods companies, and technology providers in order to codevelop infrastructure and enable circular value chains. One model for this is Dow's global network of partnerships with recyclers and converters across mechanical and chemical ecosystems.[49]

2. Accelerate policy and regulatory enhancements to manage supply and offtake risks and strengthen economic viability

Relying excessively on foreign supply of waste feedstock and foreign demand for recycled content would increase political and commercial risks to the business model of the regional recycling hub in the GCC. Policymakers and firms in the region would not have influence. What's more, they would lack such advance information as whether, when, and how foreign trade partners would implement certain domestic policies, such as tariffs, subsidies for domestic recyclers, or trade barriers that would significantly change the commercial viability of the GCC recycling hub. Therefore, accelerating domestic regulatory and market maturity to ensure the cost-competitive domestic supply of the plastic waste stream and effective domestic demand for recycled plastic are essential hedges for the business risks to creating a recycling hub in GCC.

Among the policy and regulatory enhancements, GCC countries could focus on fast-tracking EPR systems with eco-modulated fees, product design standards (for example, including mono-material packaging and modular product formats), clear labeling requirements, reforming energy and virgin feedstock prices, introducing recycled content mandates, and adopting harmonized standards for recycled materials—especially for food-grade applications. The E.U.'s PPWR and similar regulatory packages in Japan, Korea, and China emphasize these practices as levers for plastic packaging circularity.

GCC members could also establish standards for chemical recycling feedstocks and hazardous contaminant management. This would address current regulatory gaps flagged by international partners such as the European Chemicals Agency, to enable safe, high-quality applications of chemically recycled plastics.

In addition, GCC countries could establish a regional coordination task force to harmonize recycling definitions, waste codes, and tariffs; quality and accounting standards; and food-grade certification pathways across the region. This would facilitate cross-border investment and trade, mirroring Europe's PPWR, which mandates full recyclability of packaging by 2030.

While considering national circumstances, national policies can be aligned with global frameworks such as the Basel Convention,[50] the American Chemistry Council's mass balance principles,[51] and UNEP's Global Plastics Treaty.[52] The aim would be to facilitate global trade and accountability in plastic recycling.

3. Catalyze innovation and consumer awareness

Innovation is paramount if the GCC members are to realize this vision of creating a global hub for the new plastics economy. Government co-funding could help accelerate R&D in partnership with the private sector in key focus areas of chemical recycling, including advanced chemical recycling process technologies and electrification of the circular value chain.

National awareness campaigns, targeted behavioral nudges, and retooling of public education systems to add recycling to curricula can shift long-term consumer behavior, stimulate demand for sustainable plastic products, and reduce the costs of source segregation. Europe has again paved the way on some of these actions, for example with its mandated product labeling and education initiatives in 2028.

Targeted consumer and corporate incentives can be introduced that encourage the uptake of recycled content and sustainable products, closing the loop between supply and demand for recycled plastics.

SEIZE THE PLASTICS OPPORTUNITY NOW

GCC countries are all searching for opportunities to diversify their economies away from hydrocarbons. The new plastics economy presents a particularly potent opportunity, given both its adjacency to petrochemicals, which is a core strength in the regional economy, and the access to funding and renewable energies that the GCC region can offer. Some global precedents exist for the policy shifts that would be needed. Above all, GCC countries are ideally placed geographically to serve as a hub, a connection point between East and West, able to fill the large gap between the demand for circular plastics and their supply. To capitalize on this opportunity, GCC countries should secure access to feedstock, provide policy support, and catalyze innovation.

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