Plastic Money:

Turning Off the Subsidies Tap

Phase 1 Report

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Executive Summary

This interim report, which is a work-in-progress and not yet exhaustive, represents the first comprehensive attempt to address significant information gaps regarding the level of subsidisation received by the primary plastics polymer (PPP) production industry. The report specifically examines the stages of production from the processing of raw plastic materials—such as steam cracking of naphtha, isolation of alkenes from raw natural gas, and coal gasification—through to the production of basic resins and the compounding and extrusion of plastic pellets. This segment of the industry is geographically concentrated and dominated by a small number of very large enterprises, some of which are state-owned. Subsidies certainly are provided both upstream and downstream of that segment but are beyond the scope of this study.

The objective of this report is to fill the existing information gap as much as possible, given the proprietary nature of some data, the importance of state-owned enterprises, and other transparency challenges. The study focuses on standard ('commodity') polymers that constitute the bulk of global polymer production: polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polyethylene terephthalate (PET), and polystyrene (PS).

The study gathered information from an extensive review of a breadth of literature, and it was complemented by modelling to enable the development of quantifiable estimates on the level of subsidy support received by the PPP industry. The modelling exercise combined data from three primary sources:

- The IMF's Fossil Fuel Subsidies Data: 2023 Update database[1], which was used to estimate feedstock and process energy subsidy rates to the PPP industry.
- Polymer production capacity data by country and polymer obtained from the extensive database held by Polyglobe[2].
- Scientific papers that were used to estimate feedstock and energy consumption rates per unit of polymer produced.

The Appendix of the study also contains profiles of eight representative producing countries (Belgium, Brazil, Canada, China, India, Russia, Saudi Arabia, and the United States), focusing on the structure of the industry and what is known of the countries' national and subnational support policies, based on government and industry reports, scientific literature, and a small number of studies produced by non-governmental organisations.

Key Findings

Key findings from this study reveal that subsidies to the PPP production industry in the top 15 polymer-producing countries are on the order of USD 30 billion annually. The largest subsidies are observed in China (over USD 11 billion) and Saudi Arabia (around USD 8 billion), with the potential for untracked and unreported subsidies to raise these estimates even higher. The report emphasises the need for a more concerted effort at both national and international levels to ensure adequate tracking and transparency of subsidies within this industry.

There have been some important policy changes that could lead to lower per-unit subsidies in the future, but expansion plans could mean that total subsidies remain close to current levels.

The types of subsidies investigated in this study include:

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[1] IMF Fossil Fuel Subsidies Data: 2023 Update, https://www.imf.org/-/media/Files/Topics/energy-subsidies/EXTERNALfuelsubsidiestemplate2023new.ashx

[2] https://www.polyglobe.net/login.asp

Capital-related support

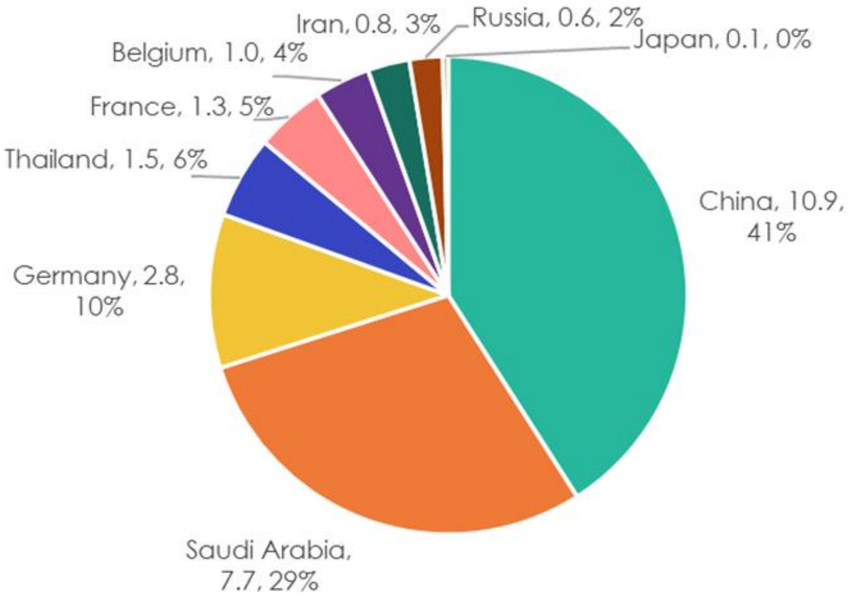
Capital-related support includes grants tied to investments in plants and concessional loans and loan guarantees from public finance institutions. Grants tied to investments in plants are the most transparent forms of capital-related support, and on occasion can be significant. Those identified by this study across a subset of countries appear to be worth upwards of several hundred million dollars a year on average.

Feedstocks subsidy supports

Government support to chemical feedstocks is typically provided via one of three mechanisms: (1) government intervention in the setting of prices for those feedstocks; (2) government policies, such as tax credits or rebates, that reduce the effective price paid by purchasers of those feedstocks; and (3) policies that reduce or exempt the feedstock chemicals from taxes normally applied to similar products.

The feedstock subsidy support to the polymer production industry in the 15 top polymer producing countries by volume, is estimated to have amounted to approximately USD 26.4 billion in 2022. China is the largest polymer producer by capacity and is also providing the largest level of subsidisation with almost USD 11 billion (41% of the total). Saudi Arabia was second, providing nearly USD 8 billion (29% of the total), with Germany coming third with feedstock subsidies valued at almost USD 3 billion (10% of the total). Some of the major polymer producing countries including the USA, South Korea and India appear to have not provided any substantial feedstock support to the polymer industry.

Figure E1-1: Share of feedstock subsidies among major polymer producing countries (2022 USD billion)



The study also revealed that most countries appear to have started providing feedstock support to the industry from 2021 onwards (likely due to the aftermath of the Covid-19 pandemic), with only Saudi Arabia, and to a lesser extent Thailand, consistently providing support throughout the years.

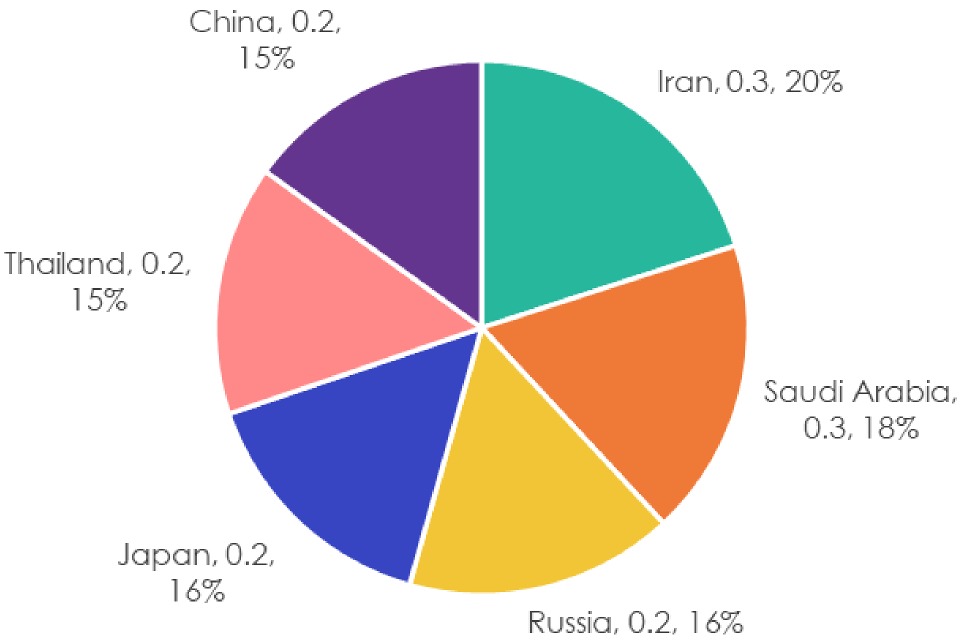
Process energy support

As with feedstocks, government support for energy used in the processes for producing monomers and polymers is typically provided via one of three mechanisms: (1) government intervention in the setting of prices charged for fuels or electricity; (2) government policies, such as tax credits or rebates, that reduce the effective price paid by purchasers of fuels or electricity; and (3) policies that reduce or exempt the fuels or electricity from taxes normally paid by other consumers of the same fuels or electricity.

Government support for energy used in PPP processes in the top 15 polymer producing countries was estimated to be approximately USD 1.5 billion in 2022. Energy subsidies provided to support the production of precursors (e.g., monomers and intermediates) was not estimated at this stage, therefore the true level of subsidisation of energy use across the supply chain of polymer production is expected to be substantially higher.

The country that provided the highest energy subsidies was Iran, with subsidy support estimated at circa USD 0.3 billion. Iran was closely followed by Saudi Arabia, which also provided nearly USD 0.3 billion in 2022. Russia, Japan, Thailand and China followed closely, each providing around USD 0.2 billion of subsidies. No other major polymer producing countries were identified as providing any substantial levels of energy subsidies to the polymer production industry.

Figure E1-2: Share of energy subsidies among major polymer producing countries in 2022 (USD billion)



The study shows that energy subsidies may have historically been provided by most countries that were identified as major subsidy providers in 2022, with the exception of Thailand and China which seem to have only started to provide energy subsidy support to industry from 2018 and 2020 onwards, respectively. Iran appears to have increased the level of energy support provided to its industry substantially since 2018.

Other support

Other forms of support provided to the upstream segment of the plastics industry could include subsidies for inputs other than chemicals or energy, such as to water consumed in the production process or land on which facilities are built, but also to value-adding factors, such as labour, or new knowledge (via government-funded research and development, for example). In conducting this stage of the project, we have not been able yet to investigate systematically whether producers of monomers or primary plastic polymers have benefitted from such subsidies. Price support is also provided to some producers through import protection, normally in the form of import tariffs on competing products. While the effects of these tariffs are usually to increase domestic prices, they also encourage investments in the industry in the country applying the tariffs, especially if there is a large and growing market for polymer resins and there is an opportunity for import substitution.

During this initial stage of the research project, the limited time available did not allow for a systematic search for grants provided by governments of countries, or subnational units thereof, in which production of primary plastic polymers takes place. However, it did identify several notable examples. The Government of the Province of Alberta, Canada, under its Alberta Petrochemicals Incentive Program

(APIP), offers grants of up to 12% of a project's eligible capital costs.[3] These grants have ranged from several tens of millions to several hundreds of millions of U.S. dollars, and for one plant expansion under consideration could exceed USD 1 billion.

Similarly, in recent years, Hungary's government has provided investment aids to facilities involved in the plastics polymer value chain. In 2018, for example, it approved a EUR 45 million investment aid to BorsodChem Zri, in connection with a EUR 142 million new facility for the production of aniline, an organic compound used in the production of rubber and urethane foams.[4] More recently, the Hungarian government provided a EUR 37.9 million investment grant for a EUR 1,300 million facility to produce polyol (a chemical widely used in the production of polyurethane), along with a EUR 93.6 million corporate tax credit, which can be claimed once the investment is operational.[5] In the United States, both the federal and state governments have provided grants for facilities that manufacture polymers or their precursors, though tax concessions are more commonly used, especially by sub-national governments.[6] These typically take the form of property-tax abatements, or measures that reduce corporate income tax. Although the latter are strictly speaking related to income and not investments, they are usually offered as a specific incentive to invest.

It was not possible to identify all instances of public funds used to help finance new or expansions of PPP plants. However, an analysis of the 'Public Finance for Energy Database'[7] shows that the principal value of the loans and loan guarantees provided by the included G20 governments and multilateral development banks in connection with facilities intended for the production of monomers or polymers totalled over USD 28.3 billion over the years 2013–22, or an average of USD 2.8 billion a year. To the extent that these loans or guarantees were provided on more favourable terms than the companies could have obtained through private financial institutions — which is likely — a benefit was conferred. To estimate the subsidy-equivalent value of these transactions one would have to compare the net present value of the cost of financing the borrowed amount with the value had the debt been procured from a private-sector bank. However, performing such a calculation would require more information than this study was able to obtain so far.

Finally, it is clear that subsidies conferred through tax abatements, reductions, and exemptions are significant in some countries. In the United States alone, support provided to the plastics industry by state and local governments, mainly in the form of tax benefits, have averaged over USD 800 million in some years.

Impact of subsidy removal on consumer goods prices

An illustrative analysis, which examines the impact of a theoretical increase in the price of primary polymers by 10% as a result of the removal of subsidies on the price of a select list of consumer goods, was also undertaken. The results of the assessment are presented below.

[3] Government of Alberta, 'Alberta Petrochemicals Incentive Program', accessed at https://www.alberta.ca/alberta-petrochemicals-incentive-program. Prior to this programme, the Province provided a succession of support policies, starting in 2006, to incentivise the transformation of ethane, methane or propane feedstocks into higher-value petrochemical products.

[4] European Commission, 'State aid: Commission approves Hungary's €45 million investment aid to BorsodChem', 28 Sept. 2018, https://ec.europa.eu/commission/presscorner/detail/en/IP_18_5941

[5] Mary Bailey, 'MOL Group inaugurates major investment project to boost polyol production', *Chemical Engineering*, 16 May 2024, https://www.chemengonline.com/mol-group-inaugurates-major-investment-project-to-boost-polyol-production/

[6] See Good Jobs First, 'Subsidy Tracker, no date, https://subsidytracker.goodjobsfirst.org

[7] Oil Change International, 'Public Finance for Energy Database: About', accessed 16 Aug. 2024, energyfinance.org.

Product sector	Consumer product	No. of countries covered	Average product price - original (US$)	Average product price - new (US$)	Average price increase (US$)	Average price increase (%)
Packaging	A bottle of 1.5L mineral water of a local brand at an average price	17	0.66	0.67	0.0037	0.67%
Packaging	A 0.5L bottle of Coca-Cola	15	0.91	0.92	0.0023	0.31%
Consumer goods (including WEEE)	iPhone 15 with 128GB memory	14	968.86	968.87	0.0079	0.00082%
Agriculture	Plastic mulch film (per kg)	5	2.74	2.86	0.1197	6.07%

Expectedly, the impact is minimal in products that use or contain low proportions of plastic such as packaging and electronics, but more marked for products that comprise almost entirely of plastic. The illustrative assessment revealed that the price increase in plastic bottles and a typical mobile phone, from a theoretical increase in the price of primary polymer by 10% due to the removal of subsidy support, is in the order of less than 1%. However, for plastic mulch film that consists largely of plastic, the impact is much higher at approximately 6%, although given the relatively low price of plastic compared to that of other materials, the overall price of the product arguably remains competitive.

Concluding remarks

The preliminary findings of this study reveal that the PPP industry potentially receives substantial subsidy support globally (possibly in excess of USD 30 billion), with the polymer industry in countries such as China and Saudi Arabia likely to observe the largest benefits. Nevertheless, a much more concerted effort is needed at both national levels and the international level to ensure adequate tracking of subsidies to the PPP industry.

This study is a work in progress that was put together to enable an informed discussion during the INC intersessional meeting in Bangkok. The aim of the study is to act as a point of reference for INC delegates and stakeholders and provide evidence to facilitate discussions. Further research and analysis will be undertaken in the next stages of the project to review, corroborate and enrich where possible and available literature permits the preliminary findings presented in this report.

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1.0 Introduction

Synthetic plastic polymers have become ubiquitous in modern life, thanks to their malleability, lightness, ability to be produced in just about any colour, or transparent, and low cost. Yet each stage of the plastics lifecycle — from hydrocarbon extraction to the refining and polymerization of hydrocarbons, and the disposal of plastic waste — contributes to the triple planetary crises: climate change, pollution, and biodiversity loss.[8] Global production of primary plastics, which are still produced almost entirely from fossil fuels, surpassed 400 million tonnes in 2016. Without serious actions to constrain that growth, that volume will continue expanding by around 3% annually.[9]

The Intergovernmental Negotiating Committee on Plastic Pollution (INC), which is tasked with developing the UN-mandated Global Plastics Treaty to end plastic pollution, including in the marine environment, is due to produce a final agreed text of an international legally binding instrument by December 2024. The negotiators have been tasked with considering what measures — across the entire life cycle of plastics, from production to recycling or ultimate disposal — could or should be pursued to contribute to that goal.

One of those possible measures is ending subsidies for the production of plastics (Box 1.1). Most experts agree that implementing demand-side measures and improving waste management will not alone be sufficient to substantially reduce plastic pollution if annual growth in plastics production continues at its current pace. Like subsidies to any industry, the presumed effect of those subsidies are to reduce the cost of producing primary plastic polymers, driving new investments and the manufacturing of primary plastic polymers, which in turn is likely lowering the final price of plastic products, particularly simple products such as packaging materials. That effect, in turn, helps make plastics compete more easily with alternative materials.

Eliminating subsidies to plastics is an attainable goal and would be consistent with efforts in other international fora, for example, in the Convention on Biological Diversity to phase out environmentally harmful subsidies and in the United Nations Framework Convention on Climate Change to reduce greenhouse gas emissions.

One major barrier to advancing discussion on the issue is a lack of more than impressionistic information on the nature and extent of those subsidies. Good data are available on the size of subsidies provided to fossil fuels, including the refining of crude petroleum, and to the consumption of fossil fuels generally, but not to the production of primary plastic polymers. This is the only initiative that we are aware of that is attempting to quantify and analyse the effects of subsidies on plastics production.

This interim report, which remains a work-in-progress and makes no claim to being complete or exhaustive, is the first attempt to fill in many of the remaining information gaps. In terms of scope, the report's focus is on the segment of the industry that is specific to the stages of production that begin with the processing of the raw materials of plastic (steam cracking of naphtha, the isolation of alkenes from raw natural gas, and the gasification of coal) through the production of basic resins, and their compounding and extrusion as plastic pellets. This is the segment of the industry that is the most geographically concentrated and dominated by a relatively small number of very large enterprises, some state-owned. Subsidies certainly are provided both upstream and downstream of that segment but are beyond the scope of this study.

The objective of this report is to help fill the information gap (to the extent possible given the proprietary nature of some of the data, the importance of state-owned enterprises in the sector, and other transparency problems).

[8] Joachim Peter Tilsted, Fredric Bauer, Carolyn Deere Birkbeck, Jakob Skovgaard, Johan Rootzén (2023), 'Ending fossil-based growth: Confronting the political economy of petrochemical plastics,' *One Earth* 6(6), pp. 607-619, https://doi.org/10.1016/j.oneear.2023.05.018.

[9] United Nations Environment Programme (2021). *From Pollution to Solution: A global assessment of marine litter and plastic pollution.* Nairobi.

We document what information is available and where there are data gaps in respect of government support provided by the top producers, including sub-national governments, in each of five world regions — Asia (eastern); Asia (southern); Western and Central Europe; Middle East and North Africa (MENA), North America, South America — in the form of direct spending (e.g., grants), concessional credit, tax expenditures, and price support for inputs.

Our estimates of government support will form the baseline for the 2nd phase of the work (September–November 2024): projecting future support under a business-as-usual scenario, and modelling the effects of subsidy reform on production, trade, and emissions.

Box 1.1. References to 'subsidies' in the International Negotiating Group's discussions to date

By Dr. Alexandra R. Harrington*

A limited number of references to subsidies have been included in the draft texts used by the International Negotiating Committee (INC) charged with developing an international legally binding instrument on plastic pollution, including in the marine environment ('the ILBI') during their 3rd session (INC-3, Nairobi, Kenya, November 2023) and 4th session (INC-4, Ottawa, Canada, April 2024), and are still included in the Compilation Document to be used as the basis of negotiations for INC-5 (Busan, Republic of South Korea, November 2024). Additionally, during the preparatory meetings for the Ad Hoc Intersessional Open-Ended Expert Group to develop an analysis of potential sources, and means that could be mobilized, for implementation of the objectives of the instrument, including options for the establishment of a financial mechanism, alignment of financial flows, and catalysing finance, several States raised the issue of subsidies as being potential elements for addressing aspects of the ILBI implementation process.

Thus far, the proposed legal provisions relating to subsidies in the ILBI can be found in binding and non-binding forms. One proposal, newly raised during INC-4, would be to include language 'recognizing that subsidies can play an environmentally harmful role throughout the lifecycle of plastics and in the plastic pollution crisis' in the ILBI preamble. While this would not be a legally binding obligation, it would be important in framing the intent of States to create and implement the ILBI and could serve as support for future decisions and measures of the Conference of the Parties for the ILBI relating to subsidies. There is a proposal to include references to subsidies in the binding, control measures on regulating primary and/or secondary plastic polymers in Part II.1 of the Compilation Document. The proposal would be for either mandatory or voluntary State Party commitments to either not grant or maintain or remove subsidies for either primary and/or secondary plastics. In Part II.13 on transparency, tracking, monitoring and labelling, there is a proposal that State Parties would be required to include information on subsidies use, phase-outs and related measures in their national monitoring obligations.

Additionally, proposed Annex X to the ILBI, which would contain 'effective measures at each stage of the plastic lifecycle', includes references to States providing information on subsidies and subsidy reform under the heading of the 'distribution/sale/consumption stage' of the full plastic lifecycle.

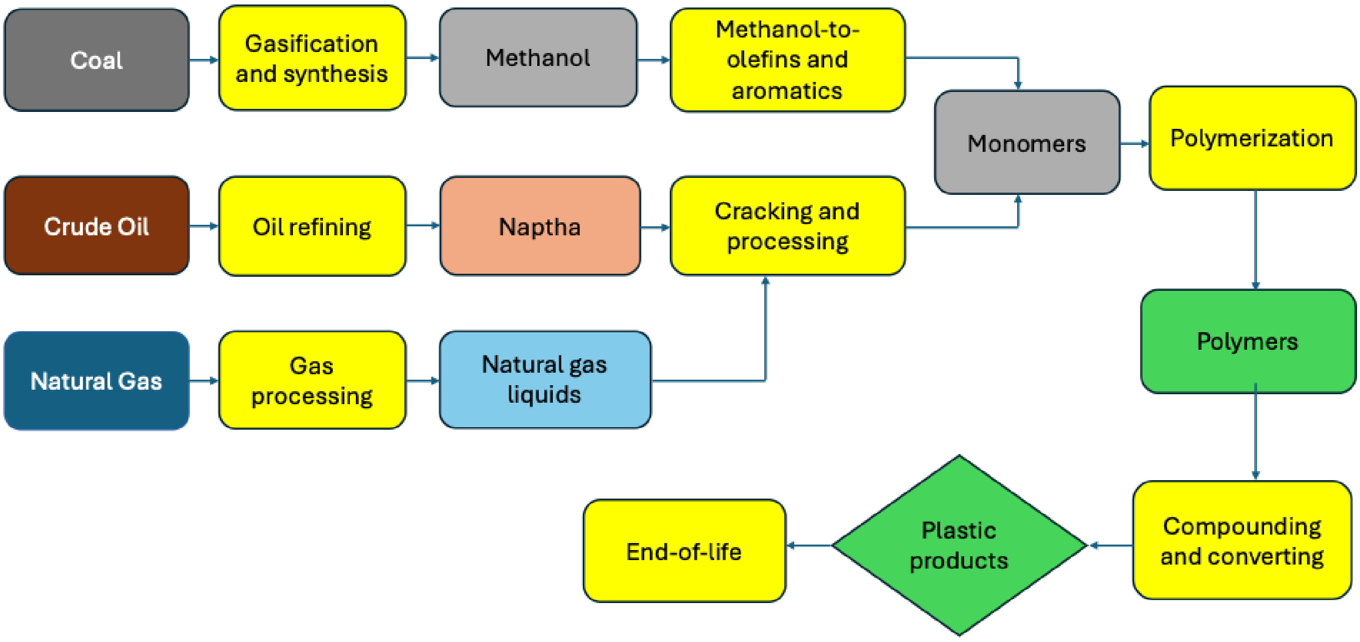
During the preparatory meetings for the Intersessional Expert Group, subsidies were discussed by some State delegations as a potential tool to use in encouraging the development of plastics alternatives and substitutes (positive or virtuous subsidies) as well as efforts to phase out and eliminate subsidies associated with the production of plastics covered by the ILBI (harmful subsidies). States also raised concerns that subsidies measures stemming from the ILBI be structured in a way that supports existing World Trade Organization (WTO) laws on the topic. These arguments reflect the positions which have consistently been voiced throughout the INC meetings to date. Notably, the Co-Chairs' Synthesis Paper in advance of the Bangkok Intersessional Expert Group meeting includes references to subsidies in potential measures that would allow for the alignment of both public and private financial flows that advance the terms of the ILBI, though they are identified as being geared toward public measures. This Synthesis Paper also highlighted the potential connections between 'elimination, phase out or reform incentives, including subsidies' and existing State commitments under the Kunming Montreal Global Biodiversity Framework to phase out certain forms of subsidies that harm biodiversity.

* Chair, IUCN WCEL Plastic Pollution Task Force.

2.0 The Plastics Industry

The raw materials for the production of virgin primary plastic polymers (PPP) are 99% derived from fossil fuels — coal, natural gas, or petroleum. The raw materials — generally hydrocarbons called alkanes, such as ethane, propane, methane, and butane — are extracted from fossil fuels in different ways. Until recently, most PPPs were produced from products of petroleum refining, particularly naphtha (a mixture of C5 to C10 hydrocarbons), but in recent years alkanes separated out from raw natural gas have increased in relative importance. In China, some PPPs are derived from methane (CH_4) obtained from gasifying coal, which in turn is oxidized to form methanol (CH_3OH).

Figure 2-1 Simplified diagram of the inputs and processes involved in producing primary plastic polymers



Source: Adapted from Figure 1 in Joachim Peter Tilsted, Fredric Bauer, Carolyn Deere Birkbeck, Jakob Skovgaard, Johan Rootzén (2023), 'Ending fossil-based growth: Confronting the political economy of petrochemical plastics,' *One Earth* 6(6), pp. 607-619, p. 608.

The process of producing PPPs thus involves breaking down the alkanes into lighter molecules, by means of heat and usually pressure and sometimes catalysts into olefins (chiefly ethylene, propylene and 1,3-butadiene) and other monomers, a process known as 'cracking'. These monomers and then stitched together through a process called polymerization into long chains of repeated molecules, i.e. polymers. The most commonly produced plastic polymers, such as polyethylene and polypropylene, are made from single monomers (Table 2-1). Polymers that are made up of two or more monomer species are called copolymers, common examples of which include acrylonitrile butadiene styrene (ABS), nitrile rubber, and polyethylene-vinyl acetate (PEVA).

Table 2-1 Leading polymers, their monomers, and examples of applications

Resin I.D. code	Polymer	Abb-revia-tion	Monomer(s)	Examples of common applications	Share of global production in 2022[1]
1	Polyethylene terephthalate[2]	PET	Ethylene glycol $(CH_2OH)_2$, purified terephthalic acid $(C_6H_4(CO_2H)_2$, dimethyl terephthalate $(C_6H_4(COOCH_3)_2$	semi-rigid packaging materials, such as water and soft-drink bottles	6.2%
2	High-density polyethylene	HDPE	Ethylene $(CH_2{=}CH_2)$	semi-rigid packaging materials, such as bottle caps and milk bottles	12.2%
3	Polyvinyl chloride	PVC	Vinyl chloride $(CH_2{=}CH\text{-}Cl)$	water pipes, window frames, films	12.7%
4	Low-density polyethylene	LDPE	Ethylene $(CH_2{=}CH_2)$	light packaging materials, such as plastic wraps	14.1%
5	Polypropylene	PP	Propylene $(CH_3\text{-}CH{=}CH_2)$	rigid food packaging, such as yoghurt pots, carpets	18.9%
6	Polystyrene	PS	Styrene $(C_6H_5CH{=}CH_2)$	rigid food packaging, insulating material	5.2%
7	Other plastics, including thermosets	—	Various monomers, depending on the plastic	baby bottles, plastic compact disks, eyeglasses, car parts, exterior lighting fixtures	15.9%

1. Share of virgin production only. Share for HDPE includes medium-density polyethylene; share for LDPE includes LLDPE.

2. PET can be produced either through the direct esterification of ethylene glycol (EG) and purified terephthalic acid (PTA), or by converting PTA to dimethyl terephthalate (DMT) using methanol and then having DMT react with EG.

Sources: • **Columns 1-4:** Payal Baheti, 'How Is Plastic Made? A Simple Step-By-Step Explanation', no date, https://www.bpf.co.uk/plastipedia/how-is-plastic-made.aspx ; • **Column 6:** Plastics Europe, 'Plastics — the fast facts 2023', https://plasticseurope.org/knowledge-hub/plastics-the-fast-facts-2023/

Many more polymers are produced than just those thermoplastics (polymers that can be melted and reformed multiple times) listed in rows 1-6 of Table 2-1, often called 'commodity plastics'. Within the broad category of polyethylene, for example are, in addition to HDPE and LDPE, medium-density polyethylene (MDPE), linear low-density polyethylene (LLPE), and metallocene (mLLDPE), each with properties such as puncture and tear resistance, or balance between toughness and stiffness, that make them better suited for particular applications.

Within the category of 'other plastics' (row 7 in the table) are various thermosetting polymers (polymers that cannot be melted and reformed), such as polyester resin, polyurethanes, polyurea-polyurethane hybrids, vulcanized rubber, bakelite, and urea-formaldehyde. Another category of polymers are so-called 'engineering plastics'. These are mainly thermoplastic materials with better mechanical or thermal properties than commodity plastics. Examples include polyamides (PA, nylons), polycarbonates (PC), poly(methyl methacrylate) (PMMA), and acrylonitrile butadiene styrene (ABS).

The division — geographically, institutionally, and economically — between the production of alkenes, monomers, and polymers is highly variable. Huge complexes exist at which petroleum is refined yielding, among other products, naphtha. The naphtha is cracked in a separate process, yielding olefin monomers and other products; and then the monomers are polymerized in yet another separate process, yielding polymer resins. All three stages are sometimes under the control of one corporate entity, but often under separate entities or various configurations of joint ventures. The refineries, crackers and polymerization plants also need not be adjacent, though if not they are usually connected by product pipelines.

This variable geometry has implications for the pricing of alkenes and monomers, and in particular transparency into the prices of these chemicals. When the process from refining through polymerization is integrated within one company, those prices are normally proprietary and therefore invisible to observers from outside the company. Some prices from arms-length transactions are collected and reported by governments, while others are available only through firms that collect such data from industry sources and charge customers for limited access.

Top companies and countries

Estimates of the country rankings of PPP depend on which polymers are included in the totals — particularly whether synthetic fibres and elastomers (e.g., polymers used in tyres) are included. Whichever definition is used, the world's top producer is China which is estimated to account for over one-third of global capacity of thermoplastics in 2024, followed by the United States, at around 13%, and then a group of countries accounting for around 5% each (India, Saudi Arabia, and South Korea), followed by a group accounting for 2–3% of global production (Brazil, Germany, Iran, Japan, Russian Federation, Chinese Taipei, and Thailand). In total, the top 4 producing countries are estimated to account for around 60% of global capacity to produce commodity plastics, the top 10 producing countries for around 75%, and the top 15 countries (investigated in this study) for 85%.[10]

The countries investigated in this study include: China, United States of America, Kingdom of Saudi Arabia, South Korea, India, Japan, Germany, Thailand, Brazil, Taiwan, Iran, Russia, Belgium, France and Mexico.

Generally, the countries with the longest histories of petrochemical manufacturing and the most expensive feedstocks tend to specialise in producing high-value polymers, whereas those with a shorter history or access to low-cost feedstocks produce commodity polymers, such as polyethylene, poly-vinyl chloride, and polypropylene. China, for example, accounts for 47% of global production of PVC, and 38% or over of the world's output of PET, polypropylene and polystyrene. The United States is the global leader in the production of LLDPE.

In terms of corporate structure, the production of primary plastic polymers and their monomers is led by multinational companies that produce a wide array of chemicals, particularly petrochemicals, and by a few multinational, integrated oil and gas companies (Table 2-2). State-owned companies, such as China's Sinopec and PetroChina, and Saudi Arabia's 70%-owned SABIC, feature among the top five producers, but most of the other significant producers are publicly listed, private-sector corporations. Many companies, both state-owned and privately owned, are subsidiaries of multinational producers or refiners of oil or natural gas. Others, such as LyondellBasell and Dow Chemical, are long-established producers of a wide variety of chemicals.

Table 2-2 Leading global producers of primary plastic polymers

Company name	Headquarters	Other countries in which it produces PPP or precursors	Controlling ownership	Parent company focus
Sinopec Corp	China		State	oil & gas
ExxonMobil Chemical Company	United States (TX)		private sector (publicly listed)	oil & gas
SABIC	Saudi Arabia	Germany, Netherlands	State	oil & gas
LyondellBasell Industries	United States (TX and the Netherlands	Australia, Belgium, Brazil, China, France, Germany, India, Italy, Spain, UK	private sector (publicly listed)	chemicals
PetroChina (CNPC)	China		State	oil & gas

[10] This ranking is based on several sources, some proprietary. The ranking below the top two producers often differs depending on the source and can change with the commissioning of a large facility in any given year.

Company name	Headquarters	Other countries in which it produces PPP or precursors	Controlling ownership	Parent company focus
Dow Chemical Company	United States (MI)	Canada	private sector (publicly listed)	chemicals
INEOS	United Kingdom	Belgium, France, Germany, Italy, Norway, United States	private sector (publicly listed)	chemicals
Braskem	Brazil	Mexico, United States	private sector (publicly listed)	petrochemicals
Formosa Plastics Corporation	Chinese Taipei	China, USA	private sector (publicly listed)	petrochemicals
Chevron Phillips	United States	Saudi Arabia	private sector (publicly listed)	oil & gas
Total Energies S.A.	France	United States	private sector (publicly listed)	oil & gas
Borealis AG	Austria	Belgium, Finland, Germany, Sweden	private sector (publicly listed)	chemicals
Shin-Etsu Polymer Co., Ltd.	Japan	United States, Europe	private sector (publicly listed)	chemicals
Reliance Industries Ltd.	India		private sector (publicly listed)	conglomerate, incl. oil & gas
Westlake Chemicals	United States		private sector (publicly listed)	chemicals

Sources: • **Overall rankings:** Polyglobe, 'Polymer capacities worldwide 2021/2026', 2021, https://www.polyglobe.net/_g/pdf/polyglobe/ePaper/Poster_2021/, based on mid-point values between 2021 and 2026;
• **Headquarters and other countries of operation:** corporate web sites, Wikipedia entries.

Corporate integration

Most of the top 10 corporations that produce thermoplastics are also leading producers of the monomers from which the polymers are wholly or partially manufactured — ethylene and propylene — and all of the 10 leading producers of these two monomers also feature among the top 12 producers of thermopolymers. They, and many other of the top producers, are members of larger corporate groups with both vertical and horizontal links in the production chain. Joint ventures among monomer and polymer producers are also commonplace, especially in respect of plants built in emerging economies.

3.0 Subsidies to PPP Producers

The WTO definition of a subsidy

The most common definition of a subsidy used internationally is that of the World Trade Organization (WTO), as set out in Article 1.1 of its 1994 Agreement on Subsidies and Countervailing Measures (SCM Agreement). That definition deems a subsidy to exist if:

> '(a)(1) there is a financial contribution by a government or any public body within the territory of a Member (referred to in this Agreement as "government"), i.e. where:
>
> > (i) a government practice involves a direct transfer of funds (e.g. grants, loans, and equity infusion), potential direct transfers of funds or liabilities (e.g. loan guarantees);
> >
> > (ii) government revenue that is otherwise due is foregone or not collected (e.g. fiscal incentives such as tax credits);
> >
> > (iii) a government provides goods or services other than general infrastructure, or purchases goods;
> >
> > (iv) a government makes payments to a funding mechanism, or entrusts or directs a private body to carry out one or more of the type of functions illustrated in (i) to (iii) above which would normally be vested in the government and the practice, in no real sense, differs from practices normally followed by governments.
>
> or
>
> (a)(2) there is any form of income or price support in the sense of Article XVI of GATT 1994;
>
> and
>
> (b) a benefit is thereby conferred.'[11]

A key part of this definition is 'a benefit [to one or more recipients] is thereby conferred'. Hence, when a government makes an equity infusion (i.e., invests its own funds) in, say, a state-owned firm; provides goods or services (other than general infrastructure); or purchases goods from a company; no subsidy is conferred if these transactions take place on the same terms as a private entity participating in the market that invests in a project with a similar profile, or sells the same goods or services, or purchases the same goods or services. Or, to put it another way, when a government accepts a return on investment lower than a private-market actor would require, or provides goods (including access to land or mineral resources) or services either for free or at a discounted price, or buys goods or services from a firm at above-market price, a benefit is considered to be conferred.

Price support under this definition excludes that which is provided by tariffs or other import barriers, because those barriers are set (and disputed) under a different WTO process. The Organisation for Economic Co-operation and Development (OECD) does consider that the effects of such barriers, which raise producer (and consumer) prices above what they would be in the absence of those barriers, constitute a form of government support. But to avoid confusion with WTO terminology, when it discusses such a transfer ('market price support to producers', or simply 'market price support') it tends to use the term 'support' rather than subsidy. The types of price support from which many producers of PPPs benefit, however, more commonly relate to the prices of chemical feedstocks or process energy.

The main purpose of the SCM Agreement is to establish rules for governing disputes among WTO members over alleged adverse trade effects caused by one of its members' subsidies. It defines three categories: prohibited, actionable, and non-actionable. One test to determine within which category a subsidy falls is whether it is considered to be 'specific'. Article 2 of the SCM Agreement sets out criteria for making such a determination. Prohibited subsidies — i.e., subsidies that are contingent upon export

[11] WTO, 'Agreement on Subsidies and Countervailing Measures', no date, https://www.wto.org/english/docs_e/legal_e/24-scm_01_e.htm.

performance or upon the use of domestic over imported goods — are deemed specific. Other types of subsidies can be determined to be specific based on such factors as:

> 'use of a subsidy programme by a limited number of certain enterprises, predominant use by certain enterprises, the granting of disproportionately large amounts of subsidy to certain enterprises, and the manner in which discretion has been exercised by the granting authority in the decision to grant a subsidy.'[12]

The issue of specificity has a bearing on how or whether price-related subsidies to industrial inputs (i.e., consumer price support) are considered actional subsidies under current SCM Agreement rules.

The main types of subsidies to PPP producers

This section describes the principal forms of government support to producers of primary plastic polymers. The WTO definition of a subsidy characterizes subsidies in terms of the transfer mechanism — e.g., grants, tax concessions, or price support. For economic analysis, the initial (or statuary) incidence of government support — i.e., to what factor of production is the subsidy directed — is also of importance. Thus this section is framed with both dimensions in mind.

Capital-related support

Government support for investments in plants that produce primary plastic polymers or their chemical inputs is provided typically through grants, loans below-market rate, loan guarantees, or the acquisition of equity.

Grants tied to investments in plants are the most transparent forms of capital-related support, and on occasion can be significant. But they are provided less commonly than the other forms.

Concessional loans and loan guarantees from public finance institutions are another mechanism by which governments support new investments. The types of institutions involved include national development banks (which often support both domestic and international projects), multilateral development banks (MDBs), and export credit agencies. The Oil Change International (OCI), an NGO, maintains 'Public Finance for Energy Database' of public finance provided from G20 countries' bilateral finance institutions and the major MDBs. By OCI's definition, such a body qualifies as a 'public finance institution' if 'national government(s) hold more than 50% of the ownership stakes and where there is a clear policy mandate that drives decisions beyond solely commercial performance.'[13]

Unlike a grant, an equity infusion by a government implies that the State has taken an ownership position in a company and that its return on that investment thus is dependent on the company's economic performance. Wholly state-owned enterprises are common in the energy sector, including petroleum refining and electricity production, but exist also in the petrochemical industry, including that part of it involved in the production of monomers and polymers. It is certainly conceivable that when a government invests public funds in such a state-owned enterprise (SOE) the enterprise behaves in the market similarly as its peers. Historically, however, SOEs have long attracted particular attention from other governments and non-state actors.[14] For example, in the founding document of the WTO's predecessor, the General Agreement on Tariffs and Trade (GATT), the contracting parties to the Agreement devoted a section of the document (Article XVII) specifically to state trading enterprises, requiring that such enterprises:

> … in accordance with commercial considerations, including price, quality, availability, marketability, transportation and other conditions of purchase or sale, and shall afford the

[12] *Ibid*, Article 2.1(c).

[13] Oil Change International, 'Public Finance for Energy Database: About', accessed 16 Aug. 2024, energyfinance.org.

[14] See for example, Teresa Ter-Minassian (2017), 'Identifying and Mitigating Fiscal Risks from State-Owned Enterprises (SOEs)', Discussion Paper No. IDB-DP-546, Inter-American Development Bank.

enterprises of the other [GATT] contracting parties adequate opportunity, in accordance with customary business practice, to compete for participation in such purchases or sales.[15]

Support to feedstocks

Some 99% of virgin polymer production is derived from fossil fuels. When petroleum is the starting point, the main feedstock hydrocarbons are products of refining crude oil: naphtha (a mixture of C5 to C10 hydrocarbons) and refinery olefins.[16] In the case of natural gas, they are natural gas liquids, which are removed from the raw natural gas stream by cryogenic expansion or condensation. Monomers and polymers made from coal involve first gasifying the coal to produce methane, and then converting the methane to methanol.

Simply put, government support to chemical feedstocks is typically provided via one of three mechanisms: (1) government intervention in the setting of prices for those feedstocks; (2) government policies, such as tax credits or rebates, that reduce the effective price paid by purchasers of those feedstocks; and (3) policies that reduce or exempt the feedstock chemicals from taxes normally applied to similar products.

Support for process energy

The production of monomers and primary plastic polymers is energy-intensive. Steam cracking, which decomposes alkenes such as ethane in furnaces at a temperature of around 850 °C, requires high-temperature heat, typically generated by the combustion of fossil fuels such as natural gas or liquefied petroleum gas (LPG), though hydrogen and electricity can also be used.[17]

The polymerisation of the monomers that emerge from the cracking process is also energy-intensive. It requires both process heat — typically provided by fossil fuels or electricity — and electricity to power machinery.[18]

As with feedstocks, government support for energy used in the processes for producing monomers and polymers is typically provided via one of three mechanisms: (1) government intervention in the setting of prices charged for fuels or electricity; (2) government policies, such as tax credits or rebates, that reduce the effective price paid by purchasers of fuels or electricity; and (3) policies that reduce or exempt the fuels or electricity from taxes normally paid by other consumers of the same fuels or electricity.

Other support

Other forms of support provided to the upstream segment of the plastics industry could include subsidies for inputs other than chemicals or energy, such as to water consumed in the production process[19] or land on which facilities are built, but also to value-adding factors, such as labour, or new knowledge (via government-funded research and development, for example). In conducting this stage of the project, we have not been able yet to investigate systematically whether producers of monomers or primary plastic polymers have benefitted from such subsidies. Examples of subsidies for training, however, have

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[15] GATT, 'The General Agreement on Tariffs and Trade (GATT 1947)', 30 Oct 1947, https://www.wto.org/english/docs_e/legal_e/gatt47_01_e.htm#articleXVII

[16] U.S. Energy Information Administration, 'How much oil is used to make plastic?', 10 Jul. 2024, https://www.eia.gov/tools/faqs/faq.php?id=34&t=6

[17] Jiwon Gu, Heehyang Kim, Hankwon Lim, 'Electrified steam cracking for a carbon neutral ethylene production process: Techno-economic analysis, life cycle assessment, and analytic hierarchy process,' *Energy Conversion and Management*, Vol. 270 (2022), 116256, https://doi.org/10.1016/j.enconman.2022.116256.

[18] Marczak, H. (2022). Energy Inputs on the Production of Plastic Products. *Journal of Ecological Engineering*, 23(9), pp.146-156. https://doi.org/10.12911/22998993/151815

[19] Significant public resources are spent on desalinizing water in the Gulf Cooperation Council (GCC) region, for example. See Mohsen Sherif, Muhammad Usman Liaqat, Faisal Baig, and Mohammad Al-Rashed (2023), 'Water resources availability, sustainability and challenges in the GCC countries: An overview,' *Heliyon*, 9(10), pp. e20543, https://doi.org/10.1016/j.heliyon.2023.e20543

often formed a (modest) part of larger incentive packages to attract corporations to invest in primary-plastic-manufacturing facilities in the United States.[20]

Price support is also provided to some producers through import protection, normally in the form of import tariffs on competing products. While the effects of these tariffs are usually to increase domestic prices, they also encourage investments in the industry in the country applying the tariffs, especially if there is a large and growing market for polymer resins and there is an opportunity for import substitution.

[20] Search for 'training reimbursement' for the chemical industry at Good Jobs First's 'Subsidy Tracker', https://subsidytracker.goodjobsfirst.org/?company_op=starts&major_industry%5B%5D=chemicals&subsidy_op=%3E&face_loan_op=%3E&subsidy_type%5B%5D=training+reimbursement&order=company&sort=&page=3

4.0 Summary of Preliminary Findings

It is estimated that subsidies to PPP production globally are currently on the order of USD 30 billion a year for the top 15 polymer producing countries, and largest in China (in excess of USD 11 billion) and Saudi Arabia (approximately USD 8 billion).

There have been some important policy changes that could lead to lower per-unit subsidies in the future, but expansion plans could mean that total subsidies remain close to current levels.

A much more concerted effort is needed at both national levels and the international level to ensure adequate tracking of subsidies to the industry.

4.1 Preliminary findings on the scale of feedstock and energy subsidies to the PPP industry

This section provides initial, indicative estimates on the level of subsidisation that the PPP industry may be benefiting from in the world's largest polymer producing countries. The research focuses on feedstock and energy subsidies.

4.1.1 Methodology

4.1.1.1 Feedstock subsidies

Fossil fuel derived feedstock subsidy rates (in USD per tonne of feedstock) were estimated by using data from the IMF's Fossil Fuel Subsidies Data: 2023 Update database[21]. The database contains country-level electricity and fuel pricing data disaggregated by fuel type and end-user. Subsidy rates were calculated by subtracting the price paid by the consumer for a product from the cost of supply of that product. Where the number obtained was positive (i.e., the consumer price was lower than the cost of supply), it was assumed that a subsidy was provided. The following three streams (as disaggregated in the IMF database) were used to estimate the rate of potential polymer feedstock subsidies for the different sources of feedstock:

- 'Oil products – other', which includes streams such as naphtha, heating oil and other oil-derived products. This category therefore excludes common fuels such as gasoline, diesel, kerosene and LPG.
- 'Natural gas – other', which includes products obtained from natural gas that are not used for energy applications such as fertilizers, polymer feedstocks and other chemicals.
- 'Coal – other', which includes coal tar, fertilisers (e.g., ammonia) and polymer precursors among other chemicals.

As the proportion of polymers that are derived from either oil, natural gas or coal is not well documented, particularly for individual countries, the split among the polymer feedstock sources used to produce a polymer was based in this analysis on the consumption rates of 'oil products – other', 'natural gas – other' and 'coal – other' recorded in the IMF database for each country. The consumption rates of these different streams were converted to mass, and it was assumed that the same quantity of polymer feedstock is obtained per tonne of fossil-fuel stream. Although it is recognised that this method may not accurately reflect the exact proportion of feedstock that is derived from the different fossil fuel sources, it was considered to be a reasonable approximation to allow calculation of initial subsidy estimates that considers the specificities of each country. For example, this method takes into account that China consumes large quantities of coal, particularly in comparison with other major polymer-producing

[21] IMF Fossil Fuel Subsidies Data: 2023 Update, https://www.imf.org/-/media/Files/Topics/energy-subsidies/EXTERNALfuelsubsidiestemplate2023new.ashx

countries, and therefore a larger proportion of polymer feedstock is likely to come from coal. Nevertheless, alternative methods and data sources will be reviewed to refine this estimation at the later stages of this project.

In addition, the level of subsidy support presented in this report assumes that all products that are derived from the above three fossil fuel sources benefit equally from subsidies. In other words, the estimated subsidy rates were assumed to apply equally to all products derived from each stream. Although it is acknowledged that different products may benefit from varying levels of subsidisation in each country, the available data at this stage of the project are not granular enough to allow further disaggregation of subsidy rates by product.

Country and polymer specific production volumes were then obtained using production capacity data from Polyglobe[22]. The capacity data were converted to production volumes using assumed plant availability rates.

Monomer consumption rates were also estimated using data from literature (i.e., tonnes of monomer consumed per tonne of polymer produced). However, the conversion efficiencies of any precursors used to produce monomers were not established due to the complexity of the supply chain and of the precursor production processes. This is likely to underestimate the real level of subsidisation to a degree because any unaccounted for inefficiencies or losses in the production process of monomers would increase the consumption of potentially subsidised precursors.

The estimated subsidy rates by country and feedstock source, production volume by country and polymer, and monomer consumption rates by polymer were combined to obtain an estimate of the level of subsidisation by country and polymer. At this stage of the project, polymer production capacity data was only available for 2024, and historical estimates assume that the same production capacity applied in previous years. Therefore, historical capacity and subsidy support is likely overestimated, with the magnitude of overestimation increasingly exaggerated in earlier years.

The focus of the study at this stage is on feedstocks derived from fossil fuels. For example, PVC is produced from the polymerisation of vinyl chloride (VCM), which, when produced via the ethylene-based production route, stoichiometrically comprises circa 45% ethylene. Therefore, the consumption of fossil-based feedstock to produce PVC was assumed to be 45% multiplied by a monomer consumption factor obtained from the literature. Although this approach is likely to understate the full level of subsidisation for the production of polymers that require non-fossil-based feedstocks, the bulk of polymer production is derived from fossil fuels so it is likely that the impact on the subsidy levels estimated here will be low.

4.1.1.2 Process energy subsidies

The type of energy consumed (e.g., electricity, natural gas, oil, etc.) and the rate of consumption can vary widely by polymerisation process. For the purposes of this work, the type, split and consumption rate of the electricity or fuel used to supply energy to different polymerisation processes was largely based on the work of Karali, N., Khanna, N., & Shah, N. (2024)[23]. The data and assumptions from this work were used to obtain energy consumption rates by fuel type and polymer in GJ consumed per tonne of polymer produced.

The above consumption rates were then combined with the Polyglobe data on polymer production volumes to obtain total energy consumption by energy source, polymer and country.

Similar to feedstock, the estimation of the subsidy rates for process energy used in polymerisation plants was based on IMF's Fossil Fuel Subsidies Data: 2023 Update database. Subsidy rates were calculated by subtracting the price paid by industrial consumers for an energy source from the cost of supply of that energy source. Where the number obtained was positive, it was assumed that a subsidy was provided.

[22] https://www.polyglobe.net/login.asp

[23] Karali, N., Khanna, N., & Shah, N. (2024). Climate Impact of Primary Plastic Production. Lawrence Berkeley National Laboratory. Report #: LBNL-2001585. Retrieved from https://escholarship.org/uc/item/12s624vf

The following three energy sources were used to estimate the rate of potential energy subsidies for the different polymerisation processes and countries:

- 'Electricity – industrial' includes the prices of electricity consumed by industry.
- 'Natural gas – industrial' includes the prices of natural gas consumed by industry.
- 'Oil products – other' as already discussed, this category includes a range of products, including heating oil consumed by industry.

The IMF dataset provides energy subsidy rates for industry in general. In the modelling exercise, it was assumed that these rates would apply to different industrial sectors equally (including for polymerisation plants); however, this may not be true in practice as it is likely that different industrial sectors may benefit disproportionately from energy subsidies. Therefore, it is possible that polymerisation plants receive a higher or a lower subsidy rate compared to other industries which would impact the estimates presented here. However, there is a substantial lack of data on the energy prices paid by different industrial sectors, therefore a more accurate estimation of subsidies to the polymer industry is not possible without more granular data.

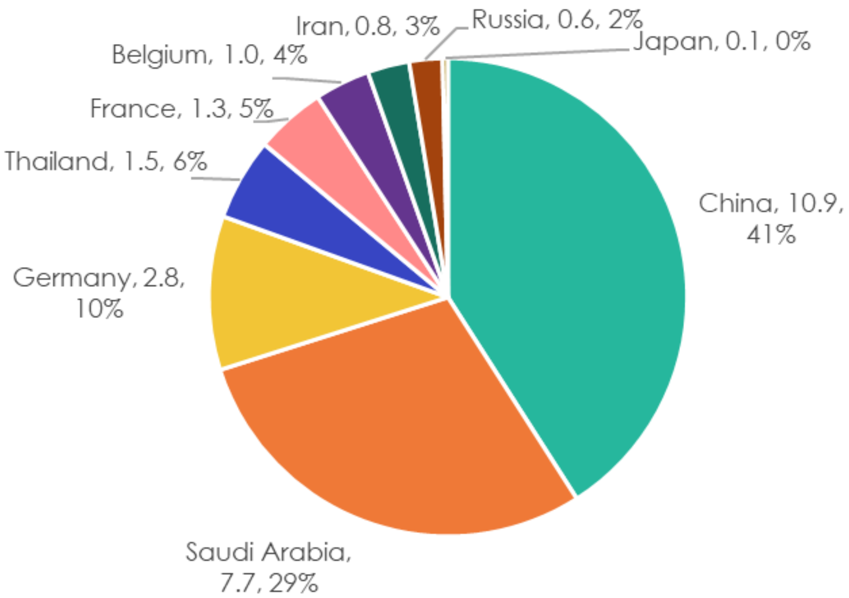
Subsidy estimates were finally obtained by combining the data on total energy consumption by energy source, polymer and country with the IMF energy subsidy rate data. As Polyglobe data were only available for 2024, the results shown in this report likely exaggerate the historical energy consumption of the industry, which has continued to grow steadily over the years. Because the subsidies were calculated as a function of energy consumption, it is therefore likely that historical subsidy estimates are also inflated in this regard.

4.1.2 Findings

4.1.2.1 Feedstock subsidies

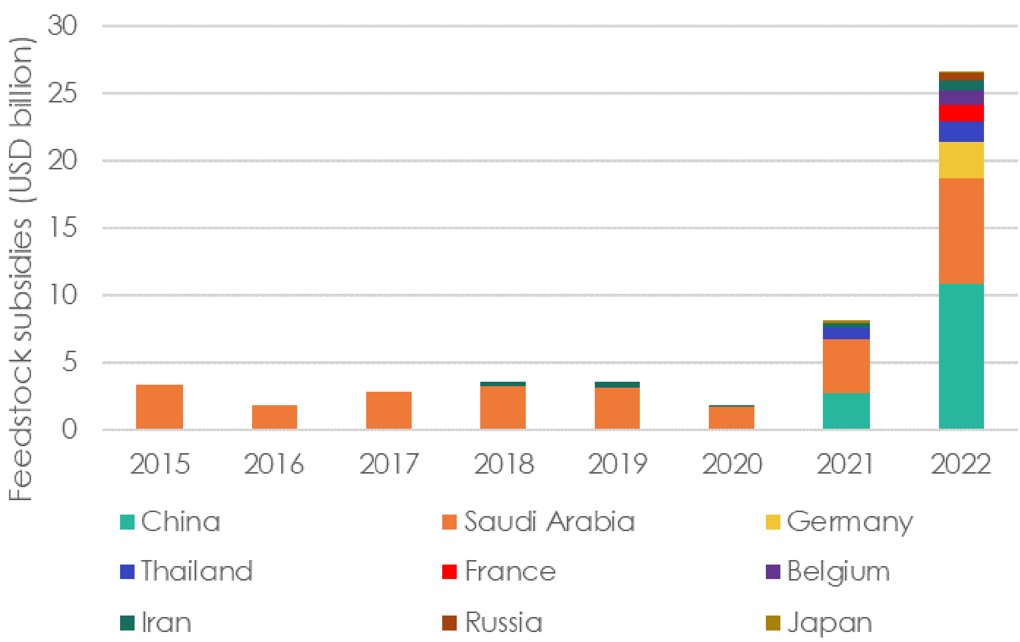
The feedstock subsidy support to the polymer production industry in the 15 top polymer producing countries by volume (for the polymers investigated in this work) is estimated to have amounted to approximately USD 26.4 billion in 2022 (subject to the limitations of the methodology of this study as discussed in section 4.1.1). China is the largest polymer producer by capacity, also providing the largest level of subsidisation with almost USD 11 billion (41% of the total). Saudi Arabia was second, providing nearly USD 8 billion (29% of the total), with Germany coming third with feedstock subsidies valued at almost USD 3 billion (10% of the total). Based on the methodology used in this study, some of the major polymer producing countries including the USA, South Korea, India and Brazil appear to have not provided any substantial feedstock support to the polymer industry.

Figure 4-1. Share of feedstock subsidies among major polymer producing countries (2022 USD billion)



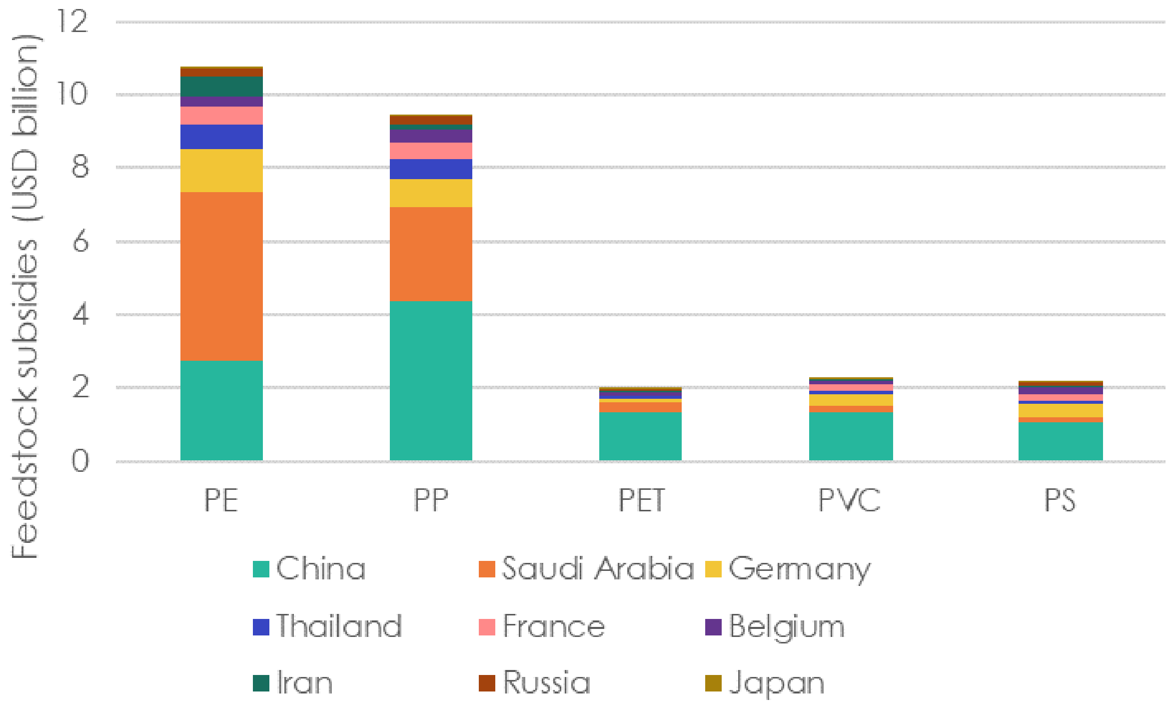
Although historical subsidy support levels should be viewed with caution due to the lack of historical polymer production capacity data availability, which means that historical subsidies were estimated using 2024 polymer production capacity data and are therefore likely inflated, the modelling revealed (Figure 4-2, below) that most countries appear to have started providing feedstock support to the industry from 2021 onwards (likely due to the aftermath of the Covid-19 pandemic), with only Saudi Arabia, and to a lesser extent Thailand, consistently providing support throughout the years.

Figure 4-2. Estimated feedstock subsidies provided in major polymer producing countries



It is to be expected that common polymers such as PE and PP would receive the highest levels of subsidisation (particularly when fossil fuel-based feedstocks are considered). This is because these polymers make up the largest share of polymer production globally. Although estimating subsidies to specific polymers with a high level of accuracy was not possible at this stage of the project due to lack of feedstock-specific pricing data, an indicative estimate of the level of subsidisation received for each polymer in the top 15 polymer producing countries can be found in Figure 4-3.

Figure 4-3. Feedstock subsidies by polymer and country in 2022 (USD billion)

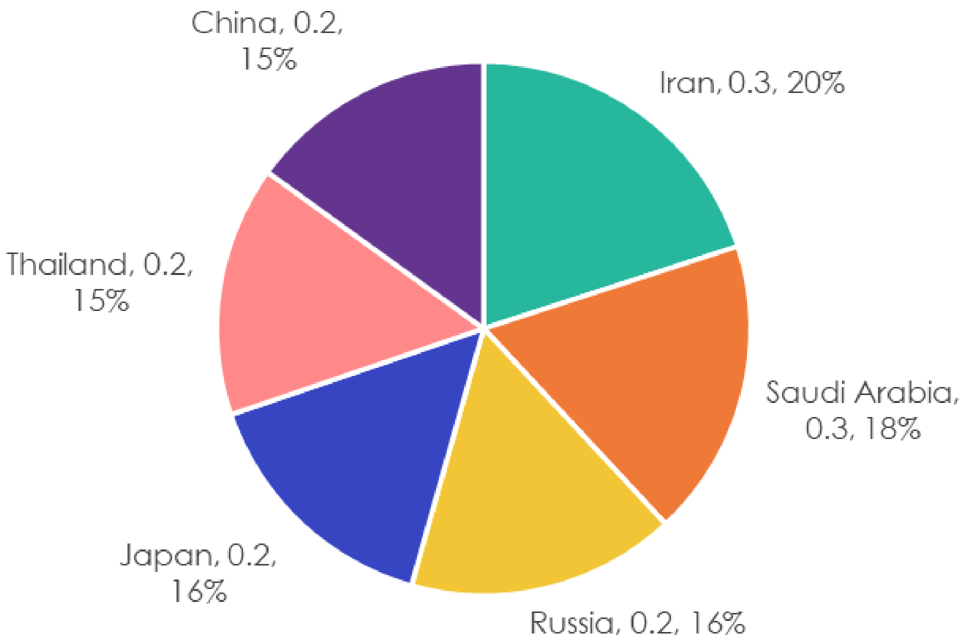


4.1.2.2 Process energy subsidies

Government support for energy used in PPP processes in the top 15 polymer producing countries was estimated to be approximately USD 1.5 billion in 2022. Energy subsidies provided to support the production of precursors (e.g., monomers) was not estimated, therefore the true level of subsidisation of energy use across the supply chain of polymer production is expected to be substantially higher.

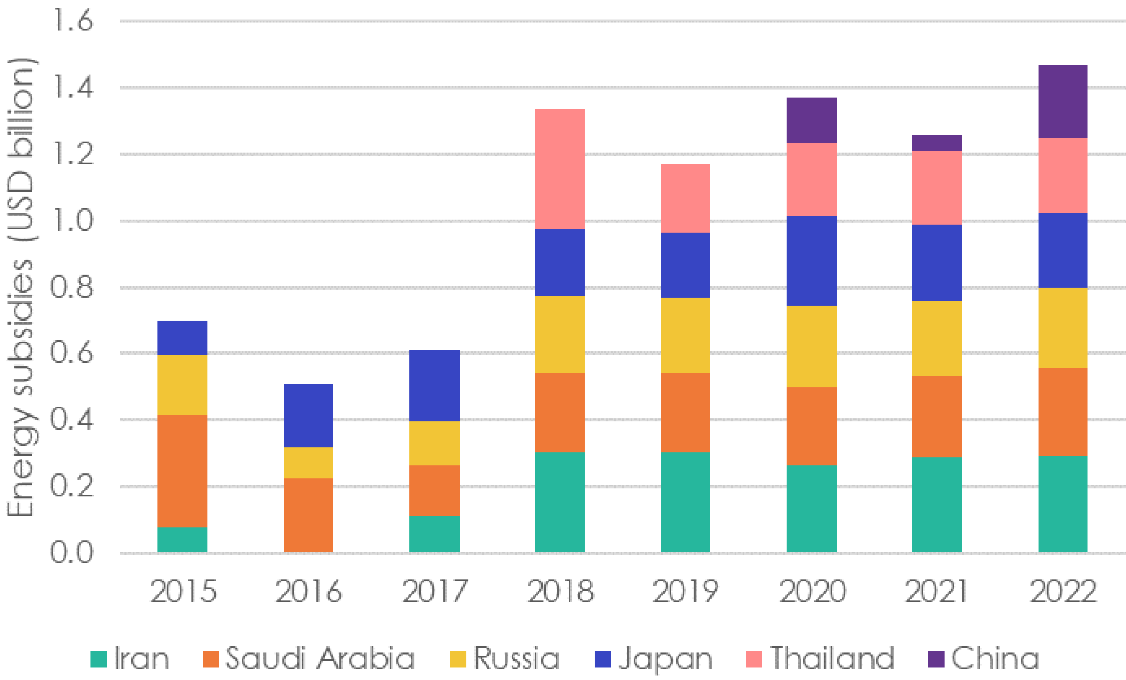
The country that provided the highest energy subsidies was Iran, providing circa USD 0.3 billion (20% of all energy subsidies in the top 15 polymer producing countries). Iran was closely followed by Saudi Arabia, which also provided nearly USD 0.3 billion in 2022 (18%). Russia, Japan, Thailand and China followed closely, each providing around USD 0.2 billion of subsidies, making up 15-16% of total subsidies in the top 15 countries each (Figure 4-4). No other major polymer producing countries were identified as providing any substantial levels of energy subsidies to the polymer production industry.

Figure 4-4. Share of energy subsidies among major polymer producing countries in 2022 (USD billion)



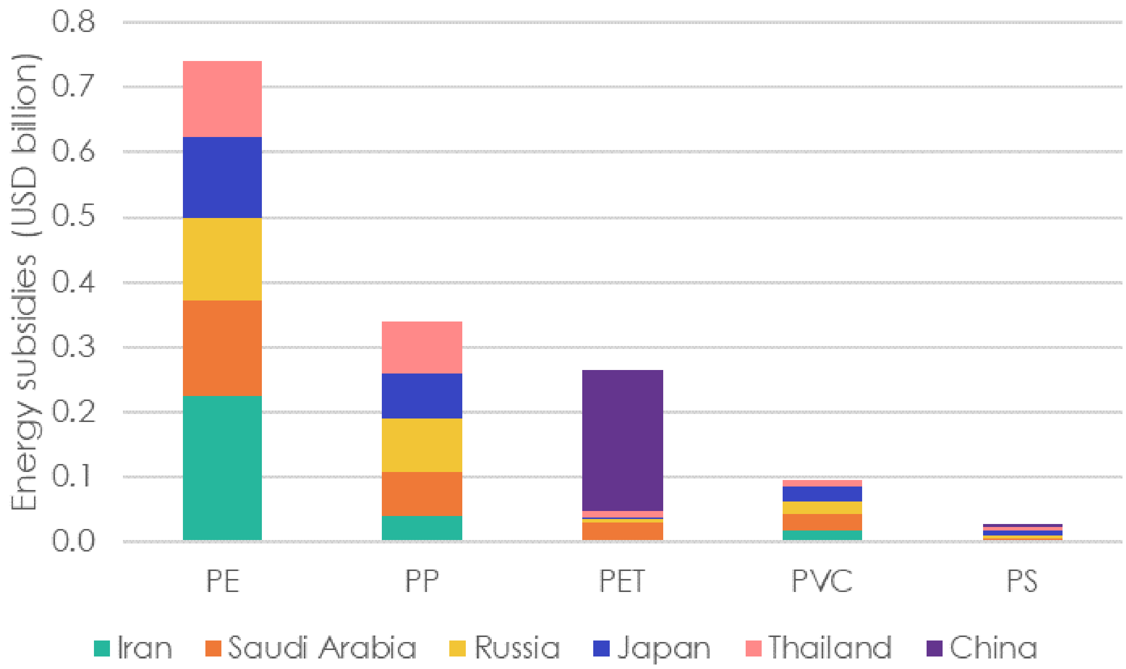
Although historical subsidy support calculations are based on polymer production capacity data from 2024, and so historical subsidy support levels may be exaggerated, substantial energy subsidies appear to have historically been provided by most countries that were identified as major subsidy providers in 2022, with the exception of Thailand and China which seem to have only started to provide energy subsidy support to industry from 2018 and 2020 onwards, respectively (Figure 4-5). Iran appears to have increased the level of energy support provided to its industry substantially since 2018.

Figure 4-5 Estimated energy subsidies provided in major polymer producing countries



Focusing on the types of polymers that potentially benefitted the most from subsidies in 2022, PE is likely to have seen the largest benefit, with subsidies reaching circa USD 0.7 billion, followed by PP at around USD 0.3 billion (Figure 4-6). PET was estimated to also potentially benefit from comparably high subsidies (circa USD 0.3 billion) when considering the global PET production volume compared with that of PE and PP, which was driven primarily by a high natural gas consumption in PET production processes and a high subsidy rate for natural gas for industrial applications in China. The level of energy subsidy provided to different polymer production processes in different countries is a function of the total production volume of the polymer, the type of energy consumed by the polymer production process and the subsidy rate received for that energy type in each country.

Figure 4-6 Energy subsidies by polymer and country in 2022 (USD billion)



4.2 Other forms of government support

During this initial stage of the research project, the limited time available did not allow for a systematic search for grants provided by governments of countries, or subnational units thereof, in which production of primary plastic polymers takes place. However, it did identify several notable examples. The Government of the Province of Alberta, Canada, under its Alberta Petrochemicals Incentive Program (APIP), offers grants of up to 12% of a project's eligible capital costs.[24] These grants have ranged from several tens of millions to several hundreds of millions of U.S. dollars, and for one plant expansion under consideration could exceed USD 1 billion (See Appendix 1.3)

Similarly, in recent years, Hungary's government has provided investment aids to facilities involved in the plastics polymer value chain. In 2018, for example, it approved a EUR 45 million investment aid to BorsodChem Zri, in connection with a EUR 142 million new facility for the production of aniline, an organic compound used in the production of rubber and urethane foams.[25] More recently, the Hungarian government provided a EUR 37.9 million (USD 42 million) investment grant for a EUR 1,300 million facility to

[24] Government of Alberta, 'Alberta Petrochemicals Incentive Program', accessed at https://www.alberta.ca/alberta-petrochemicals-incentive-program. Prior to this programme, the Province provided a succession of support policies, starting in 2006, to incentivise the transformation of ethane, methane or propane feedstocks into higher-value petrochemical products.

[25] European Commission, 'State aid: Commission approves Hungary's €45 million investment aid to BorsodChem', 28 Sept. 2018, https://ec.europa.eu/commission/presscorner/detail/en/IP_18_5941

produce polyol (a chemical widely used in the production of polyurethane), along with a EUR 93.6 million (USD 104 million) corporate tax credit, which can be claimed once the investment is operational.[26] In the United States, both the federal and state governments have provided grants for facilities that manufacture polymers or their precursors, though tax concessions are more commonly used, especially by sub-national governments.[27] These typically take the form of property-tax abatements, or measures that reduce corporate income tax. Although the latter are strictly speaking related to income and not investments, they are usually offered as a specific incentive to invest.

It was not possible to identify all instances of public funds used to help finance new or expansions of PPP plants. However, an analysis of the 'Public Finance for Energy Database'[28] shows that the principal value of the loans and loan guarantees provided by the included G20 governments and multilateral development banks in connection with facilities intended for the production of monomers or polymers totalled over USD 28.3 billion over the years 2013–22, or an average of USD 2.8 billion a year. To the extent that these loans or guarantees were provided on more favourable terms than the companies could have obtained through private financial institutions — which is likely — a benefit was conferred. To estimate the subsidy-equivalent value of these transactions one would have to compare the net present value of the cost of financing the borrowed amount with the value had the debt been procured from a private-sector bank. However, performing such a calculation would require more information than this study was able to obtain so far.

Finally, it is clear that subsidies conferred through tax abatements, reductions, and exemptions are significant in some countries. In the United States alone, support provided to the plastics industry by state and local governments, mainly in the form of tax benefits, have averaged over USD 800 million in some years (Appendix 1.8).

4.3 Preliminary findings on the impact of subsidy removal on consumer goods prices

This section presents the results of an illustrative analysis, aimed at demonstrating the impact of removing subsidies to plastic production on the prices of consumer goods.

4.3.1 Methodology

Selecting product categories

This analysis focusses on selected product categories to enable a comparison of the impact of subsidy removal across countries and across different types of plastic-containing consumer goods. The following product types were selected for the analysis:

- a bottle of water
- a bottle of soft drink
- a mobile phone
- agricultural mulch film

These product categories were chosen because price data for comparable versions of the product was readily available across countries. In addition, these product categories give coverage across fast-moving consumer goods and consumer durables, as well as across products with different shares of plastic content.

[26] Mary Bailey, 'MOL Group inaugurates major investment project to boost polyol production', *Chemical Engineering*, 16 May 2024, https://www.chemengonline.com/mol-group-inaugurates-major-investment-project-to-boost-polyol-production/

[27] See Good Jobs First, 'Subsidy Tracker, no date, https://subsidytracker.goodjobsfirst.org

[28] Oil Change International, 'Public Finance for Energy Database: About', accessed 16 Aug. 2024, energyfinance.org.

Data collection

Data were collected from the following sources to perform the analysis:

- **Retail prices**: Retail prices of consumer goods were gathered from the websites of major retailers in the selected countries, via direct email requests to product retailers, or from cross-country retail price tracking websites, e.g., GlobalProductPrices.com.
- **Product weight, main polymer in the product and share of polymer in the overall product weight:** Where available, information on the weight and composition of products was obtained from the technical specifications given in product listings on retailer websites. Where this information was not given, product weights and composition were estimated using alternative sources, e.g. the manufacturer's technical specifications, or other technical reports.
- **Polymer prices:** Average polymer prices, 2015-2022, in 7 world regions[29] were obtained from previous research carried out by Eunomia.

Data analysis

The collected data were used to estimate:

- The cost of plastic in the product, based on the product's weight, the share of polymer in the overall product weight and the price of the polymer.
- The share of the overall product retail price accounted for by the cost of the plastic in the product.

Then, an illustrative analysis was performed to demonstrate the impact of removing subsidies to plastic production on the price of the different types of consumer goods.

- For the purposes of this analysis, it was assumed that the removal of subsidies to plastic production would increase polymer prices by 10%.
- The increase in the price of plastic in consumer goods, due to the assumed increase in polymer prices, was estimated.
- Then, the increase in the overall product price of consumer goods was estimated.

4.3.2 Findings

Table 4-1 presents the impact of a 10% increase in polymer prices, due to the removal of subsidies to plastic production, on product prices for a selection of consumer products.

Table 4-1: Impact on consumer product prices from removing subsidies to plastic production

Product sector	Consumer product	No. of countries covered	Average product price - original (US$)	Average product price - new (US$)	Average price increase (US$)	Average price increase (%)
Packaging	A bottle of 1.5L mineral water of a local brand at an average price	17	0.66	0.67	0.0037	0.67%

[29] North America, Africa, Latin America and the Caribbean, Greater Europe, Middle East, APAC, Russia and the Caspian.

Product sector	Consumer product	No. of countries covered	Average product price - original (US$)	Average product price - new (US$)	Average price increase (US$)	Average price increase (%)
Packaging	A 0.5L bottle of Coca-Cola	15	0.91	0.92	0.0023	0.31%
Consumer goods (including WEEE)	iPhone 15 with 128GB memory	14	968.86	968.87	0.0079	0.00082%
Agriculture	Plastic mulch film (per kg)	5	2.74	2.86	0.1197	6.07%

Source: Eunomia analysis.

In the case of fast-moving consumer goods such as a 1.5-L bottle of mineral water or a 0.5-L bottle of Coca-Cola, the plastic content of the product is contained in the packaging, and accounts for a small share of the overall product weight (estimated at 2.13% and 3.8%, respectively). For these products, the average price increase resulting from a 10% increase in polymer prices is less than 1%. Across the 17 countries[30] for which retail price data was gathered for a 1.5L bottle of mineral water, a 10% increase in polymer prices was estimated to increase the overall product price from USD 0.66 to USD 0.67, equivalent to a 0.67% price increase. Across the 15 countries[31] for which retail price data was gathered for a 0.5L bottle of Coca-Cola, a 10% increase in polymer prices was estimated to increase the overall product price from USD 0.91 to USD 0.92, equivalent to a 0.31% price increase.

In the case of a high-value consumer good such as a mobile phone, the plastic content of the overall product weight is higher (40% in an iPhone 15), but the share of the plastic price in the overall product price is very small (estimated in the range 0.0067% - 0.0124% for an iPhone 15). Therefore, an increase in polymer prices resulting from the removal of subsidies has minimal impact on the retail price of the final product. Across the 14 countries[32] for which retail price data was gathered for an iPhone 15 with 128GB memory, a 10% increase in polymer prices was estimated to increase the overall product price from USD 968.86 to USD 968.87, equivalent to a 0.00082% price increase.

In contrast, for products such as plastic mulch film used in agriculture, the entire product is plastic and the share of the plastic price in the overall product price is larger (estimated in the range 23–79%). Therefore, an increase in polymer prices resulting from the removal of subsidies has a more significant impact on the retail price of the final product. Across the 5 countries[33] for which retail price data was gathered for plastic mulch film (per kg), a 10% increase in polymer prices was estimated to increase the overall product price from USD 2.74 per kg to USD 2.86 per kg, equivalent to a 6.07% price increase.

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30 Belgium, Brazil, Canada, China, Germany, India, Indonesia, Iran, Japan, KSA, Kuwait, Mexico, Oman, South Korea, Taiwan, Thailand, USA.

31 Belgium, Brazil, Canada, China, Germany, India, Indonesia, Japan, KSA, Kuwait, Mexico, Oman, South Korea, Thailand, USA.

32 Belgium, Brazil, Canada, China, Germany, India, Indonesia, Japan, KSA, Kuwait, Mexico, Oman, South Korea, USA.

33 Canada, China, India, Iran, USA.

5.0 Conclusion

The preliminary findings of this study reveal that the PPP industry potentially receives substantial subsidy support in a number of countries across the world. Nevertheless, a much more concerted effort is needed at both national levels and the international level to ensure adequate tracking of subsidies to the PPP industry.

This study is a work in progress, created to facilitate informed discussions during the INC intersessional meeting in Bangkok. It is intended to serve as a reference point for INC delegates and stakeholders, providing evidence to support and guide discussions. Further research and analysis will be undertaken in the next stages of the project to review, corroborate and enrich where possible and available literature permits the preliminary findings presented in this report. More specifically, the study will, in the next stage, aim to:

- Critically cross-examine the preliminary findings included in this report by conducting additional research on the potential subsidy rates received by the PPP industry.
- Improve the accuracy of historical estimates by identifying historical polymer-specific production capacities and polymer and energy consumption in different countries.
- Examine whether feedstock and energy subsidy estimates can be enhanced by encompassing the cost of previous, closely linked production processes in the estimates (e.g., energy subsidies to highly energy intensive monomer production industry).
- Project future support under a business-as-usual scenario, and model the effects of subsidy reform on production, trade, and emissions.

The continued investigation and analysis will help to further elucidate the complex dynamics of government support within the PPP industry, ultimately contributing to more informed policy decisions and international agreements aimed at addressing plastic pollution and its impacts.

Appendix

A.1.0 Appendix: Country profiles

The various country chapters included in this Appendix are those that the project was able to produce in the limited amount of time available for the first stage of the project. The authors' intention for the second stage of the project is to expand this section to include details on the structure of each industry and the government support policies in each of the leading 10-15 producers of primary plastic polymers.

A.1.1 Belgium

Belgium produces no crude petroleum nor natural gas, hence is totally dependent on imports of both forms of energy. It is, however, a major refining hub, ranking 2nd among producers of refined products in the EU.[34] The country imports natural gas via several cross-border pipelines, subsea pipelines, and an LNG terminal located in Zeebrugge.

Belgium is home to a cluster of petrochemical facilities, most of which are located within the Port of Antwerp. The area sits at the centre of a network that includes dedicated pipelines that transport naptha, natural gas condensates, ethane and propane within the Benelux countries, France, and Germany.[35] Antwerp itself hosts three operating steam crackers with a total capacity of 2,240 thousand tonnes per annum (ktpa) of ethylene.[36] That capacity is expected to increase to 3,690 ktpa with the completion of INEOS Project ONE at the end of 2026 — one of the largest steam crackers in the world, and Europe's largest petrochemical plants to be built in three decades.[37]

Eight of the world's top 10 chemical companies have plants in Belgium, producing mainly for export.[38] Collectively, chemicals, plastics and pharmaceuticals account for one-third of Belgium's total merchandise exports.[39] In 2022 Belgium produced 6.9 million tonnes of plastics derived from fossil fuels, ranking second in the EU after Germany.[40]

The Government of the Flanders region offers various forms of support to attract investments in strategic industries, including 8% grants, though in the case of large enterprises the grants are limited to only companies investing in a regional support zone. The government also offers grants to cover up to 20% of the costs of training personnel. These grants are capped at EUR 500,000 per enterprise per project, except for projects deemed of exceptional importance because of their sustainability or climate benefits, in which case they can receive up to EUR 1 million per enterprise per calendar year.[41] Eligible

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[34] International Energy Agency, 'Belgium', https://www.iea.org/countries/belgium/oil

[35] Flanders Investment & Trade, 'Chemical industry in Flanders', no date, https://invest.flandersinvestmentandtrade.com/en/sectors/chemicals

[36] Petrochemicals Europe, 'Cracker Capacity', no date, https://www.petrochemistry.eu/about-petrochemistry/petrochemicals-facts-and-figures/cracker-capacity/

[37] INEOS, 'Positive decision by minister Demir ends uncertainty and unleashes start of project of the future at port of Antwerp', 7 January 2024, https://project-one.ineos.com/en/news/positive-decision-by-minister-demir-ends-uncertainty-and-unleashes-start-of-project-of-the-future-at-port-of-antwerp/

[38] The European Chemical Industry Council, 'Belgium', update of July 2024, https://cefic.org/a-pillar-of-the-european-economy/landscape-of-the-european-chemical-industry/belgium/#

[39] *Ibid.*

[40] Plastics Europe, 'Plastics — the *fast* Facts, 2023', 18 October 2023, https://plasticseurope.org/knowledge-hub/plastics-the-fast-facts-2023/

[41] Flanders Investment & Trade, 'Flanders offers government grants for large transformation investments', no date, https://invest.flandersinvestmentandtrade.com/en/investing-in-flanders/grant-incentives/flanders-offers-support-large-transformation-investments

research or development projects can also benefit from research subsidies (25 to 60% of the project budget) or development subsidies (25 to 50% of the project budget).[42]

At the international level, INEOS Olefins Belgium NV (INEOS) is benefitting from a financial guarantee of EUR 700 million from UK Export Finance for its EUR 4 billion Project ONE steam cracker, to be built in Antwerp. Export credit agencies from Italy and Spain are also involved.[43] Running at full capacity, the facility will convert 1,910 kta of ethane extracted from U.S. shale gas into 1,450 kta of ethylene, as well as smaller quantities of other high-value chemicals, such as propylene. The ethane feedstock will be shipped in very large ethane carriers (VLECs) from northeast and Gulf of Mexico ports in the United States.[44]

A.1.2 Brazil

With the development of its enormous offshore oil and natural gas deposits, Brazil has in recent years become one of the world's leading producers of crude petroleum. It has been a net exporter of crude oil since 2006 but a net importer of petroleum products since at least the early 2000s.[45] The country also produces natural gas, manly associated gas from oil fields, most of which it consumes domestically. Imports of natural gas, both by pipeline from other South American countries and in the form of LNG meet the remaining 25% of its consumption.[46]

Two companies, Braskem and Innova, dominate PPP production in Brazil. Braskem was founded in 2002 through the merger of six companies from the Odebrecht conglomerate (now known as Novonor) and the Mariani Group, and has since grown to become the world's sixth largest producer of thermoplastic resins. Novonor holds a 38.3% state in Braskem, and the state-owned energy corporation, Petrobras, another 36.1%.[47] In addition to its facilities in Mexico and the United States, Braskem operates six PPP-manufacturing facilities across five Brazilian states, with a total capacity of 9,800 ktpa. Innova operates two polymer-producing plants in two states (Table 5-1).

Table 5-1 Braskem's and Innova's primary polymer-making facilities in Brazil.

State	City	Polymers	Other products
Braskem			
Alagoas	Marechal Deodoro	PVC	—
Bahia	Camaçari	PP, LDPE, LLDPE, HDPE, EVA, UTEC, PVC	Basic chemicals and petrochemicals
Rio de Janeiro	Duque de Caxias	PP, LDPE, HDPE	Basic chemicals and petrochemicals

[42] Flanders Investment & Trade, 'R&D support in Europe's innovative heart: Flanders is your one-stop shop for R&D subsidies', no date, https://invest.flandersinvestmentandtrade.com/en/investing-in-flanders/grant-incentives/why-vlaio-your-one-stop-shop-rd-subsidies

[43] Shiba Teramoto, 'Ineos receives financial backing from UK Government for Europe's largest petrochemical plant', *Chem Analyst News*, 7 Mach 2024, https://www.chemanalyst.com/NewsAndDeals/NewsDetails/ineos-receives-financial-backing-from-uk-government-for-europe-25762

[44] UK Export Finance, 'Category A project supported: INEOS Project One, Belgium', 14 April 2023, https://www.gov.uk/government/publications/category-a-project-supported-ineos-project-one-belgium/category-a-project-supported-ineos-project-one-belgium;

[45] IEA, 'Brazil: Oil', no date, https://www.iea.org/countries/brazil/oil

[46] IEA, 'Brazil: Natural gas', no date, https://www.iea.org/countries/brazil/natural-gas; Snam, 'South America gas pipeline', no date, http://www.snamatlas.it/world_of_gas?focus=14

[47] Frederico Fernandes, 'Viewpoint: Braskem sale could shift Petrobras' stategy', 26 Dec. 2023, *Argus*, https://www.argusmedia.com/en/news-and-insights/latest-market-news/2522481-viewpoint-braskem-sale-could-shift-petrobras-stategy

State	City	Polymers	Other products
Rio Grande do Sul	Triunfo	PP, LDPE, LLDPE, HDPE, PE based on ethylene from sucrose	Basic chemicals and petrochemicals
São Paulo	Paulínia	PP	—
São Paulo	Cubatão	LDPE	—
Innova			
Amazonas	Manaus	PS, EPS	—
Rio Grande do Sul	Triunfo	PS	ethylbenzene, styrene

Sources: Braskem, 'Braskem around the world', no date, https://www.braskem.com.br/around-the-world; Innova, 'Industrial plants and headquarters', https://www.innova.com.br/en/about-us/#nossas-unidades.

The Government of Brazil protects its internal market for PPPs with a 12.6% *ad-valorem* most-favoured nation (MFN) import tariff applied on most primary forms of polymers under HS headings 39.01 (polymers of ethylene), 39.02 (polymers of propylene), 39.03 (polymers of styrene), 39.04 (polymers of vinyl chloride or of other halogenated olefins), 39.05 (polymers of vinyl acetate or of other vinyl esters; other vinyl polymers in primary forms), and 39.06 (acrylic polymers in primary forms). By contrast, it applies 0% MFN tariffs on naphtha (HS 2710.12 ex) and feedstock olefins (HS 2711.14: liquified, propylene, ethylene, butylene and butadiene; and HS 29.01–.04: ethylene, propylene, butylene, styrene, etc.) imported into the country.[48] The effect of a combination of tariff-free feedstocks and border protection for polymer resins is to stimulate domestic production of polymers relative to imports.

In addition, under its Special Regime for the Chemical Industry (Reiq), revived in August 2023, the Brazilian Government extends several tax and other incentives to its chemicals industry, including manufacturers of plastics, to 'enhance the competitive landscape' for its chemical businesses.[49] In addition to restoring previous tax concessions, the new version of the Reiq introduced supplementary credits for companies willing to invest in expanding their existing production capacities or embarking on the establishment of new plants.'[50] It also reduces or exempts PIS (Programa de Integração Social – Profit Participation Contribution), PASEP (Programa de Formação do Patrimônio do Servidor Público – Public Servant's Assets), and Cofins (Contribuição para o Financiamento da Seguridade Social – Social Security Financing Contribution) taxes on imports or sales of chemical products used as inputs to the petrochemical industries, including ethylene, propene, butene, butadiene, ortho-xylene, benzene, toluene, isoprene and paraxylene.

It is too early to know the value of the tax breaks introduced under the new Reiq, but the Global Expenditure Database estimates that the total value of the discounts on the PIS/PASEP tax break amounted to an estimated USD 45 million in 2022, most of which accrued to the petrochemical industry.[51]

[48] European Commission, 'Access2Markets database', Version of 15 July 2024, https://trade.ec.europa.eu/access-to-markets/en/home.

[49] Global Product Compliance, 'Brazil's chemical industry regains special tax regime', 23 Aug. 2023, https://www.gpcgateway.com/common/news_details/MTA1Ng/MTQ/QnJhemls .

[50] *Ibid*.

[51] Redonda, A., von Haldenwang, C., & Aliu, F. (2024). Global Tax Expenditures Database [data set], Version 1.2.2. https://doi.org/10.5281/zenodo.10796848

A.1.3 Canada

Canada is a major producer of fossil fuels. The leading Canadian Province in the production of of crude hydrocarbons is Alberta (accounting for around 80% of the total), followed by the Provinces of Saskatchewan, Newfoundland and Labrador, and Nova Scotia. Alberta also hosts several large refineries and natural-gas processing facilities that provide feedstock to nearby petrochemical plants.

Three manufacturers dominate polymer resin production in Canada currently: Nova Chemicals Corporation, Dow Chemical Canada ULC, and Heartland Polymers (a subsidiary of Inter Pipeline). Nova Chemicals and Dow, both multinational corporations, also jointly own an ethane cracker and ethylene storage facility in Fort Saskatchewan, Alberta, called E3, which has been the subject of a legal dispute between the two parties.[52] Since July 2009, NOVA Chemicals has been wholly owned by Mubadala, a wholly owned global investment vehicle of the government of the Emirate of Abu Dhabi.[53]

Table 5-2 Primary polymer-manufacturing facilities in Alberta, Canada.

Company	Province	City, County	Polymer(s)	Capacity in 2024 (ktpa)	Other products
Heartland (Inter Pipeline)	Alberta	Redwater, Strathcona County	PP	525	
Dow Chemical	Alberta	Fort Saskatchewan	PE		ethylene
Dow Chemical	Alberta	Prentiss	PE		
NOVA Chemicals	Alberta	Joffre	LLDPE, MDPE, HDPE	1000	ethylene hydrogen, carbon dioxide, propylene, butadiene and benzene

1. NOVA Chemicals, 'Joffre, AB, Canada', no date, https://www.novachem.com/locations/joffre-ab-canada/

Source: Corporate web sites.

For several years the Government of the Province of Alberta has been providing grants to companies 'to attract investment in new or expanded market-driven petrochemical facilities' of up to 12% of a project's eligible capital costs, under the Alberta Petrochemicals Incentive Program (APIP).[54] Its funded projects have included a CAD 408 million grant to the Heartland (Inter Pipeline) CAD 4 billion propane-to-polypropylene plastic facility (awarded in 2021), and a CAD 32 million grant to Dow Canada (awarded in 2022) to support a CAD 300 million expansion of its ethylene production facility in Fort Saskatchewan.[55] In November 2023, Dow announced that it and its partner companies would invest CAD 11.6 billion to expand its facility's capacity and install carbon capture and storage equipment. The Province's Premier indicated that the APIP would provide the project with a 12% grant of up to CAD 1.8 billion (USD 1.3

[52] Jus Mundi, 'Nova Chemicals v. Dow Chemical', 13 July 2023, https://jusmundi.com/en/document/decision/en-nova-chemicals-corporation-v-dow-chemical-canada-ulc-reasons-for-decision-of-the-court-of-appeal-of-alberta-2023-abca-217-friday-14th-april-2023

[53] Nova Chemicals, 'Company History and Development', archived from the original on 24 April 2013, retrieved 5 Aug. 2024, https://web.archive.org/web/20130424110548/http://www.novachem.com/Pages/company/company-history-development.aspx

[54] Government of Alberta, 'Alberta Petrochemicals Incentive Program', accessed at https://www.alberta.ca/alberta-petrochemicals-incentive-program. Prior to this programme, the Province provided a succession of support policies, starting in 2006, to incentivise the transformation of ethane, methane or propane feedstocks into higher-value petrochemical products.

[55] *Ibid*.

billion at the time), paid out in three instalments, once the project was completed.[56] That is in addition to up to CAD 0.4 billion (USD 0.3 billion) worth of investment tax credits on offer under a Canadian Federal Government programme to support carbon capture utilization and storage and the production of clean hydrogen.

Under an additional scheme, the Heartland Incentive Program, participating Albertan municipalities can provide tax exemptions valued at 1–2.5% of a project's total eligible capital cost for new projects or expansions within the energy value chain.[57] In the case of Sturgeon County, for example, projects meeting defined ESG criteria can apply for municipal tax exemptions of 2.5%, while other projects may access exemptions of 1.5%.[58] To date, both the Heartland (Inter Pipeline) and Dow Path2Zero expansion have accessed the HIP.[59]

In addition to participating in the Heartland Incentive Program (HIP), in June 2021, the County Council of Strathcona approved a new Industrial Area Incentive Program that allows new projects and expansion projects within the energy sector that choose to locate in Strathcona County, and meet eligibility criteria, to apply for a tax exemption equivalent to up to 1% of total eligible capital costs.'[60] This incentive applies only to the Strathcona Industrial Area, which is not participating in the HIP, and the incentive is not stackable with it.[61]

A.1.4 China, People's Republic of

China is the world's leading producer of coal, but a relatively minor producer of crude oil and natural gas. Over the past 25 years, its annual production of oil has varied between 8 and 9 exajoules (EJ) — just 10% of its coal production in energy terms. To meet its domestic requirements for petroleum products it therefore imports roughly twice as much crude oil and petroleum products as it produces. China's domestic production of natural gas has, by contrast, been growing over time, from less than 1 EJ in 2000 to an expected 8 EJ in 2024.[62] Imports via pipeline (40%) and LNG (60%) furnish around 40% of domestic consumption.[63]

China is, by far, the largest producer of polyethelene and polypropylene in the world. As of the end of 2023, its capacity to produce these two polymers was 65,500 ktpa (Table X). Almost 40% of that capacity is owned by the China Petroleum and Chemical Corporation, (the Sinopec Group), which is wholly owned by the China State-owned Assets Supervision and Administration Commission, or the China National Petroleum Corporation (CNPC), the majority of which is State-owned. The Sinopec Group is the world's largest oil refining, natural gas and petrochemical conglomerate, and CNPC's subsidiary, PetroChina, is Asia's largest oil and natural gas producer. Other significant producers include Rongsheng (via its subsidiary, Zhejlang Petrochemical), China Energy, and China Coal. A large number of smaller scale, mainly domestic manufacturers, account for slightly less than one-third of total national capacity for producing both PE and PP.

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[56] Lisa Johnson, 'Dow's Alberta petrochemical megaproject to get billions in government support', Edmonton Journal, 29 Nov. 2023, https://edmontonjournal.com/business/dows-alberta-petrochemical-megaproject-to-get-billions-in-government-support.

[57] Heartland Incentive Program, 'incentives: Learn about stackable incentives', https://industrialheartland.com/invest/incentives/

[58] Sturgeon County (Alberta), 'Investment Incentives', https://www.sturgeoncounty.ca/business-investment/invest/incentives/.

[59] Communication with Alberta's Industrial Heartland, 6 August 2024.

[60] Shane Jones, 'Tax breaks add to county's energy sector attraction plans', *Sherwood Park News*, 29 June 2021, https://www.sherwoodparknews.com/news/local-news/tax-breaks-add-to-countys-energy-sector-attraction-plans

[61] Communication with Alberta's Industrial Heartland, 6 August 2024.

[62] • **2000:** IEA, China, *Op. cit.*; • **2024:** Cindy Liang, 'China 2024 LNG imports expected to rise 8.1% on year to 77 mil mt: CNPC ETRI', S&P Global, 29 Feb. 2024. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/lng/022924-china-2024-lng-imports-expected-to-rise-81-on-year-to-77-mil-mt-cnpc-etri

[63] *Ibid*.

Table 5-3 China's PE and PP manufacturing capacity as of end-2023.

Group or company	Polyethelyne polymers					PP	Total	Share of Total
	FDPE[1]	HDPE	LDPE	LLDPE	Total PE		PE + PP	
Sinopec	2,670	2,120	1,080	730	6,600	6,940	13,540	21%
CNPC	3,510	2,970	461	790	7,731	4,630	11,901	18%
Rongsheng	900	650	400	—	1,950	1,800	3,750	6%
China Energy	750	—	570	—	1,320	2,830	3,170	5%
China Coal	600	—	370	300	1,270	1,300	2,570	4%
Taiwan	—	1,460	250	300	2,010	520	1,730	3%
Oriental	—	—	—	—	—	1,600	1,600	2%
Sinopec-SK (Wuhan) Petrochemical (foreign JV)	—	600	—	300	900	700	1,600	2%
Fujian Refining & Petrochemical (foreign JV)	900	—	—	—	900	670	1,570	2%
Hengli Group	—	400	—	—	400	850	1,250	2%
Other foreign joint ventures	450	491	200	—	1,141	1,060	2,201	3%
Other, mainly domestic manufacturers	2,430	3,050	—	900	6,380	11,990	20,610	31%
Total	**12,210**	**11,741**	**3,331**	**3,320**	**30,601**	**34,890**	**65,491**	**100%**

1. Full-density polyethylene.

Data source: Chinapolymer, 'Production capacity for PE & PE in China', https://chinapolymer.info/main/index, accessed 7 August 2024.

According to the consulting service, JLC International, China's PE manufacturing capacity is expected to expand by almost 22,000 ktpa by the end of 2028, with the largest growth in FDPE, HDPE, and LDPE and EVA (Table 5-4).

Table 5-4 China's planned new PE manufacturing capacity, 2024-28.

Year	Polyethylene polymers					Total PE
	FDPE	HDPE + UHMWPE[2]	LDPE + EVA[3]	LLDP + m-LLDPE	PE (non-specified)	
2024	1,400	1,900	2,000	450	340	6,090
2025	1,800	3,000	2,150	700	-	7,650
2026	2,750	2,200	1,050	400	450	6,850
2027	-	-	-	600	-	600
2028	-	350	-	300	-	650
Total, 2024-28	**5,950**	**7,450**	**5,200**	**2,450**	**790**	**21,840**

1. As of May 2024.

2. Ultra-high-molecular-weight polyethylene.

3. Ethylene vinyl acetate.

Data source: JLC International, 'Evolution and forthcoming changes in China polyethylene markets', May 2024, https://www.scic.sg/images/4._Evolutions_and_Forthcoming_Changes_in_China_Polyolefin_Markets_Stoney_ShiJLC_Network_Technology.pdf

China also is the world's leading producer and consumer of PVC resins, PET, and styrenics. As of mid-2024, its PVC production capacity was 28,500 ktpa, accounting for around 45% of the global total.[64] Some four addition PVC plants, with a total capacity of 1,600 ktpa, are expected to come on line in China during the second half of 2024.[65] The majority of China's PVC (80% in 2022) is produced via the calcium carbide method (which uses coal as a feedstock[66]), and 20% via the ethylene method.[67] According to the industry analyst, Polyglobe, China's production capacity for PET was around 12,000 ktpa in 2021, and is expected to grow to around 13,000 ktpa by 2026; Polyglobe's corresponding figures for styrenics are circa 8,500 ktpa in 2021 and 10,500 in 2026.[68]

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[64] Ella Peng, 'Current status and trends of PVC in China', 15 July 2024, https://www.linkedin.com/pulse/current-status-trends-pvc-china-ella-peng-bv7dc/

[65] 'China's Zhenyang achieves on-spec PVC production', 10 Jan. 2024, *Argus*, https://www.argusmedia.com/en/news-and-insights/latest-market-news/2526100-china-s-zhenyang-achieves-on-spec-pvc-production

[66] In this method, coal and limestone are subjected to high temperatures to produce calcium carbide. The latter is then exposed to water under the action of a mercury chloride catalyst to produce acetylene. The acetylene, in combination with hydrogen chloride, is then used to synthesize vinyl chloride monomer. See Poly PVC, 'Ethylene process VS calcium carbide process: PVC process competition', 3 July 2024, https://www.polypvc.com/news/Ethylene-process-VS-calcium-carbide-process-PVC-process-competition.html

[67] Chemdo, 'Introduction about PVC capacity in China and globally', 7 May 2022, https://www.chemdo.com/news/introduction-about-pvc-capacity-in-china-and-globally/#:~:text=China's%20total%20production%20capacity%20is,and%2020%25%20are%20ethylene%20method.

[68] Polyglobe, 'Polymer capacities worldwide 2021/2026', 2021, https://www.polyglobe.net/_g/pdf/polyglobe/ePaper/Poster_2021/.

A.1.5 India

India produces both petroleum and natural gas domestically, around half offshore, but it depends heavily on imports of both forms of energy. Natural gas enters the country exclusively in the form of LNG through around a dozen LNG terminals [tbc], half of which are located in the State of Gujarat.[69]

India's petroleum refining industry is the second-largest in Asia, after China. The largest and most integrated refineries are located in the State of Gujarat, including two with around 700,000 barrels per day capacity owned by Reliance Industries Ltd., India's largest private-sector corporation, a multinational conglomerate whose businesses include energy, petrochemicals, natural gas, and synthetic fibres. Almost half of the country's 21 other refineries are owned by the Indian Oil Corporation, a multinational oil and gas company owned by India's Ministry of Petroleum and Natural Gas.[70]

In June 2023, PlastIndia — the 'apex body' of major associations, organizations, and institutions connected with plastics — reported that, as of as of end-2022, there were 59 plants in the country producing primary thermoplastic polymers, with a total capacity of 18,190 ktpa (Table 5-5). PPP production is dominated by Reliance Industries Ltd. and the Indian Oil Corporation, combined accounting for over half of total PPP-making capacity. The largest concentration of plants (measured by annual capacity) is in the western coastal states of Gujarat and Maharashtra. Gujarat is also the starting point of several pipelines that supply crude oil, petroleum products, and natural gas north-eastwards towards Delhi and beyond.

Table 5-5 Main primary polymer-making capacity in India as of December 2022, ktpa.

	Polymer								
Company	**PET**	**LDPE**	**LLDPE**	**HDPE**	**PVC [1]**	**PP**	**PS [2]**	**Engin-eering**	**Total**
Reliance Industries Ltd.	1008	650	1230	600	750	3165	–	–	7403
Indian Oil Corporation	–	–	350	300	–	1280	–	–	1930
ONGC Petro Additions Ltd.	–	–	340	720	–	340	–	–	1400
Haldia Petrochemicals	–	–	200	500	–	390	–	–	1090
GAIL (India)	–	–	310	500	–	–	–	–	810
IVL Dhunseri	720	–	–	–	–	–	–	–	720
INEOS	–	–	–	–	–	–	78	445	523
Mangalore Refinery & Petrochemical	–	–	–	–	–	440	–	–	440
HPCL Mittal Energy (HMEL)	–	–	–	–	–	440	–	–	440
Chemplast	–	–	–	–	365	–	–	–	365
Supreme Petrochem Ltd.	–	–	–	–	–	–	344		344

[69] U.S. Energy Information Administration, 'India: Executive summary', 17 Nov. 2022, https://www.eia.gov/international/analysis/country/IND.

[70] *Ibid*.

Company	Polymer								
	PET	LDPE	LLDPE	HDPE	PVC [1]	PP	PS [2]	Engin-eering	Total
Brahmaputra Cracker & Polymer	–	–	–	220	–	60	–	–	280
Others (PET & BoPET)	1727	–	–	–	–	–	–	–	1727
Others (PVC)	–	–	–	–	487	–	–	–	487
Others (styrenics)	–	–	–	–	–	–	94	–	94
Others (engineering plastics)	–	–	–	–	–	–	–	56	56
Total	**3 455**	**650**	**2 430**	**2 840**	**1 602**	**6 115**	**516**	**501**	**18109**

1. Including chlorinated polyvinyl chloride (CPVC).

2. Including expanded or extruded polystyrene (EPS).

Data source: Plastindia Foundation, *Plastics Industry Status Report – India – 2021-22 & 1H 2022-23 Update* (Mumbai, 2 June 2023), pp. 38–41, https://plastindia.org/plastic-industry-status-report/report-india/

In terms of polymers, India's PPP capacity has been dominated by various forms of polyethylene (PET, HDPE, LLDPE, and LDPE), followed by polypropylene (roughly one-third of the total). The industry is expanding quickly, however: as of early 2023 its announced projects planned for completion by the end of 2027 (or with no specified date) would add another 18,100 ktpa to India's PPP capacity, doubling what was in place at the end of 2022. Nearly 45% of that capacity is planned to be for the production of polypropylene, and another 30% for PVC.

Table 5-6 Planned new primary polymer-making capacity in India as of early 2023, ktpa.

Completion year	Polymer						Total
	PET	HDPE	HDPE & LLDPE	PE	PVC [1]	PP	
2022		450	800			500	1750
2023	344				100	670	1114
2024						1920	1920
2025			800	450	3535	790	5575
2026							0
2027				1030		4150	5180
Subtotal	**344**	**450**	**1600**	**1480**	**3635**	**8030**	**15539**
Planned, or date not available	**724**				**1822**		**2546**
Total	**1068**	**450**	**1600**	**1480**	**5457**	**8030**	**18085**

1. Including chlorinated polyvinyl chloride (CPVC).

Data source: Plastindia Foundation, *Plastics Industry Status Report – India – 2021-22 & 1H 2022-23 Update* (Mumbai: Plastindia, 2 June 2023), pp. 48–49, https://plastindia.org/plastic-industry-status-report/report-india/

Support for PPP is provided by both the central and sub-national state governments of India, via numerous forms, depending on the state. The central government's overarching policy falls under the direction of its Department of Chemicals and Petrochemicals (DCPC) in the Ministry of Chemicals and Fertilizers. Since the mid-2000s, the DCPC has signalled that it seeks to make India a hub for the production of petrochemicals and other chemicals. In 2007 it created a new framework for designating particular areas as Petroleum, Chemical and Petrochemical Investment Regions (PCPIRs). As of 2022, three PCPIRs had been established in the country with the aim of attracting and promoting investment in the industry through the prevision of 'high-class infrastructure which creates a competitive environment conducive to setting up new firms'.[71] A total of INR 243,027 crores (around USD 30 billion) has been invested in three PCPIRs over the past 15 years.[72] The Union Government also proposes Viability Gap Funding up to 20% for units proposed in the PCPIR.[73] And it is considering extending the 'Performance Linked Incentives (PLI) Scheme'[74] to the chemical and petrochemical sector.[75]

India also has a policy of encouraging the formation of what it calls 'plastic parks' through the creation of 'a supportive ecosystem through a cluster development approach, accumulating and synergizing the capacities of the domestic plastic processing industry'. Basically, plastic parks are designated industrial zones devoted to plastic enterprises and allied industries, such as material and machinery suppliers, plastics processors, and plastic recyclers.[76] As of 2022, the government had approved ten such plastics parks.

A study by the Institute for Competitiveness[77] identifies, but does not quantify the value of, numerous support policies that were available to the chemicals or petrochemical industries in 13 Indian states (Table 5-6). The policies include investment incentives, subsidies for electricity, and exemptions of or waivers from land tax, stamp duty and other taxes. It is not discernible from the report which ones are specific to plastic polymer production.

Under its 'Stand-Up India' programme, for example, the government of the State of Gujarat administers a special 'Scheme of Financial Assistance to [the] Plastics Industry' comprised of two components: 1) an interest subsidy of up to 7% of loans for five years for fixed capital investment in building new plants and machinery, and related assets; and 2) a 80% reimbursement of the net VAT paid for the first five years of commercial operation.[78]

Financial assistance has also been provided bilaterally by other countries and via multilateral banks. According to Oil Change International's 'Public Finance for Energy Database', Reliance Industries Ltd. received several loans or loan guarantees from foreign export credit agencies during the years 2013-17 (Table 5-7). And, in 2015, the OPaL SEZ Petrochemical Complex received a loan of USD 85 million to help with its refinancing.

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[71] Kaya *op cit*.

[72] Department of Chemicals and Petrochemicals, India, 'Annual Report 2023-24', 24 Jul. 2024, p. 17 https://chemicals.gov.in/sites/default/files/Reports/annual_report_english.pdf

[73] PriceWaterHouseCoopers Ltd., 'India: A global manufacturing hub for chemicals and petrochemicals', March 2021, india-a-global-manufacturing-hub-for-chemicals-and-petrochemicals.pdf (pwc.in)

[74]The PLI Scheme offers eligible companies financial incentives based on their achievement of predetermined production targets in the designated sectors.

[75] Govt to consider PLI scheme for chemicals and petrochemicals industry: FM, ET EnergyWorld (indiatimes.com)

[76] Varsha Patel, 'Finance, Plastics & Land: What are Plastic Parks? Inside the Assam Plastic Park', 10 Feb. 2022, https://www.cenfa.org/finance-plastics-land-what-are-plastic-parks-inside-the-assam-plastic-park/

[77] Amit Kapoor and Subhanshi Negi (2022, September), *India's Booming Chemical and Petrochemical Industry: Understanding Industry Landscape* (New Delhi: Institute for Competitiveness).

[78] *Ibid.*

Table 5-7 International public finance for petrochemical plants in India, 2013-15.

Recipient or project name	Fiscal Year	Products	Country	Institution	Mechanism	Amount (millions of current USD)
Reliance Industries Ltd.	2013	unspecified petchems	USA	export credit agency	guarantee	1 000
Reliance Industries Ltd.	2013	unspecified petchems	USA	export credit agency	loan	1 000
Reliance Industries' Petrochemical Expansion Project	2014	unspecified refinery & petchem products	USA	export credit agency	guarantee	220
Reliance Industries Ltd.	2014	paraxylene, ethylene production, purified terephthalic acid (PTA), synthetic rubber (PBR/SBR)	Japan	export credit agency	loan	330
Reliance Industries Ltd	2015	unspecified petchems	UK	export credit agency	guarantee	217
OPaL SEZ Petrochemical Complex Refinancing	2015	ethelene, propylene, LLDPE/HDPE, HDPE & PP	India	export credit agency	loan	85
Reliance Industries Ltd. #1	2017	unspecified	Canada	export credit agency	loan	20
Reliance Industries Ltd. #2	2017	unspecified	Canada	export credit agency	loan	39
Reliance Industries Ltd.	2017	unspecified	Canada	export credit agency	loan	19

Data source: Oil Change International, 'Public Finance for Energy Database', Version of 24 July 2024, energyfinance.org

A.1.6 Russian Federation

The Russian Federation is the most expansive country in the world, and controls the largest share of the world's petroleum and natural gas reserves. It is also the world's 2nd-leading producer and top exporter of natural gas.

The historic center of natural gas production in Russia is the Yamalo-Nenets Autonomous Okrug (District) in northwestern Siberia, accounting for 90% of the country's production; currently the industry is expanding into the adjacent Nenets Autonomous Okrug and the marine shelfs of the Barents and Kara Seas, as well as the Okhotsk and Caspian Seas.[79] Crude oil production is more dispersed across the country.

Russia's petrochemical industry is clustered in six regions — along the Caspian Sea, in northwestern Russia, western and eastern Siberia, and the Far East of the country (around Vladivostok). Its polymer output in 2019 was dominated by polyethylene, polypropylene, PVC, PET, and various types of synthetic rubber

[79] GlobalData Oil and Gas Intelligence Insights, 'Russia natural gas production: data and insights', *Offshore Technology*, July 11, 2024, https://www.offshore-technology.com/data-insights/russia-natural-gas-production/?cf-view&cf-closed

(Table 5-8).[80] The Government's aim is to increase combined annual production of polyethylene and polypropylene to 11 million by 2030; it had already attained a production level for the two polymers of 7.1 million tonnes in 2022.[81] Production of polystyrene may also increase, according to earlier projections.

Table 5-8 Production of polymers and rubbers in Russia, 2016, 2019, and 2020-35 forecast, ktpa.

Product	2016	2019	Forecast		
			2025	2030	2035
Polyethylene (PE)	1719	1772	6230	7053	7093
Polypropylene (PP)	1410	1456	2446	3196	3196
Polyvinyl chloride (PVC)	789	956	970	970	970
Polyethylene terephthalate (PET)	583	613	798	798	798
Polystyrene (PS)	492	500	656	825	825
Polycarbonate	71	65	65	65	65
Thermo-elastoplastics	73	75	135	135	135
Synthetic cis-butadiene rubber	300	319	319	319	319
Butadiene–styrene rubbers	183	222	270	270	270
Butadiene–acrylonitrile rubber	41	43	43	43	43
Ethylene–propylene rubber	3	3	3	3	3

Data Source: E. A. Golyshevaa, O. V. Zhdaneeva, V. V. Korenev et al., 'Petrochemical Industry in Russia: State of the Art and Prospects for Development', *Russian Journal of Applied Chemistry*, 2020, Vol. 93, No. 10, pp. 1596–1603, p. 1598https://www.researchgate.net/publication/347551687_Petrochemical_Industry_in_Russia_State_of_the_Art_and_Prospects_for_Development

The production of polymers in Russia is dominated by one firm, Sibur, the largest integrated petrochemicals company in the Federation. Its polymer-manufacturing subsidiaries include, from largest to smallest, Nizhnekamskneftekhim (83% owned by Sibur), which operates the country's biggest petrochemicals plant by capacity, Kazanorgsintez (64% owned), ZapSibNeftekhim (100% owned), Poliom (a 50% joint venture with the Gazprom Neft Group), and Tomskneftekhim (100% owned).[82] Nizhnekamskneftekhim produces a wide variety of monomers and polymers, and accounts for over 40% of global production of synthetic isoprene rubber.[83]

[80] E. A. Golyshevaa, O. V. Zhdaneeva, V. V. Korenev et al., 'Petrochemical Industry in Russia: State

of the Art and Prospects for Development', *Russian Journal of Applied Chemistry*, 2020, Vol. 93, No. 10, pp. 1596–1603. https://www.researchgate.net/publication/347551687_Petrochemical_Industry_in_Russia_State_of_the_Art_and_Prospects_for_Development

[81] Alexander Novak, 'Russia to increase large-capacity polymer output to over 11 mln tons by 2030', Tass (Rusian News Agency), 6 Feb. 2024, https://tass.com/economy/1742597

[82] [Place-holder] Wikipedia, 'Sibur', no date, https://en.wikipedia.org/wiki/Sibur; Statista, 'Leading polymer producers in Russia from 2019 to 2020, by revenue', 24 Jan. 2022, https://www.statista.com/statistics/1267328/highest-earning-polymer-producers-russia/

[83] Sibur, 'Products', no date, https://www.sibur.ru/nknh/en/products/

Price support

The petrochemical industry benefits from low prices for both its feedstock and its process energy.

Other support

Various polymer-producing plants that have been or are being built in Russia in recent years have benefitted from loans or loan guarantees extended by state-owned financial institutions, particularly export credit agencies. Those included in Oil Change International's 'Public Finance for Energy Database' sum to over USD 7 billion during the 2015–2022 period. Over half of this public finance was provided to support the development by SIBUR Holding and China's Sinopec of a facility, the Amur Gas Chemical Complex (GCC), planned for Russia's Amur region (near the China-Russia border). The facility, Amur Gas Chemical Complex (60% owned by SIBUR, 40% by Sinopec), which will have the capacity to produce 2,300 ktpa of polyethylene and 400 ktpa of polypropylene, is looking for other financial backers (possibly Russia's Project Finance Factory) and is expected to become operational in 2027.[84]

Table 5-9 Loans and loan guarantees issued by state-owned financial institutions between 2015 and 2022 for facilities in Russia engaged in the manufacturing of monomers or polymers.

Identifier	Year	Recipient and project	Loan or guarantee provider	Type of financial support	Amount (USD millions)[1]
3412	2015	Construction of a polypropylene plant (recipient unclear)	Germany	export credit (guarantee)	243
3977	2016	Construction of 2 polyethylene units as part of the Zapsib 2 petrochemical project.	France	export credit (loan)	529
4065	2016	To SIBUR Holding and Sinopec for the development of a basic polymer production facility in the Amur region with the capacity to produce 2,300 ktpa of polyethylene (PE) and 400 ktpa of polypropylene (PP).	Italian Export Credit Agency (SACE)	export credit (guarantee)	81
6194	2017	Design and supply of a modular butene production unit for an industrial polymer production facility.	France	export credit (loan)	71
6342	2017	To Irkutsk Oil Co. (INK) for its new ethylene and polyethylene production plant at Ust-Kut in the Irkutsk Region.	Japan Bank for International Cooperation (JBIC)	export credit (loan)	522
7291	2017	To SIBUR Holding and Sinopec (see above).	Italy	export credit (loan)	161
7397	2017	To SIBUR Holding and Sinopec (see above).	China	export credit (loan)	1,115
132	2018	To SIBUR for the financing of environmental protection and safety measures at the ZapSibNefteKhim polyolefin complex	New Development Bank	multilateral loan	300
9765	2019	To construct a gas chemicals facility at Ust-Luga (Leningrad Region) with the capcity to produce up to 3,000 ktpa of polyethylene.[2]	Russian state development corporation and investment company (VEB)	loan	1,751

[84] Nicholas Seifield, 'SIBUR's Amur Gas Chemical Complex Seeks Support from Project Finance Factory', ChemAnalyst, 10 Jan. 2024, https://www.chemanalyst.com/NewsAndDeals/NewsDetails/sibur-amur-gas-chemical-complex-seeks-support-from-project-finance-factory-24435

Identifier	Year	Recipient and project	Loan or guarantee provider	Type of financial support	Amount (USD millions)[1]
3068	2021	To SIBUR Holding and Sinopec (see above).	Italy	export credit (guarantee)	1,113
3149	2021	To SIBUR Holding and Sinopec (see above).	China	loan	1,115
6504	2022	To Irkutsk Oil Co., for its new ethylene and polyethylene production plant in Ust-Kut in the Irkutsk Region	Japan	export credit (loan)	218

1. All amounts are nominal U.S. dollars and rounded to nearest million dollars.

2. Note: OCI qualifies this loan with 'There is some uncertainty about the funding amount and whether it overlaps with another VEB-supported natural gas project in Ust-Luga.'

Source: Oil Change International, 'Public Finance for Energy Database,' Version of 24 July 2024, energyfinance.org.

A.1.7 Saudi Arabia, Kingdom of (KSA)

The Kingdom of Saudi Arabia controls the second-largest proven reserves of petroleum in the world. It ranks as the world's third-leading producer of crude oil and one of the largest net exporters of petroleum. It also is the country with the lowest production costs. It is also the world's ninth leading producer of natural gas. The KSA has over time become a major centre of petroleum refining, which in turn has given rise to a large petrochemical industry. The country also extracts large volumes of natural-gas liquids from its natural gas, which are then used mainly in making petrochemicals. The vast bulk of the KSA's petrochemical output, especially of monomers and polymer resins is exported.

Polymer production in the KSA is dominated by a few interconnected companies. Saudi Aramco (commonly known as simply 'Aramco'), the country's state-owned petroleum and natural gas company, supplies crude oil to the country's refineries, and natural gas to its power plants. In recent years, Aramco has expanded its operations into petrochemicals, including PPPs. Its biggest project to date has been its investment in the Sandara project, the largest chemical complex ever built in the world in a single phase. The project, a 65%/35% joint venture between Saudi Aramco and U.S.-based Dow Chemical Company, was approved in 2011. A few years later, in June 2020, Aramco acquired a 70% stake in Saudi Basic Industries Corporation (SABIC) in a deal worth USD 69.1 billion, elevating it to one of the preeminent producers of petrochemicals in the world. SABIC, in turn, is the largest investor in Saudi Kayan, owning 35% of its shares.[85] More recently, Saudi Aramco increased its stake in Petro Rabigh, a local joint venture with Sumitomo Chemical Co., to 60%, adding another significant petrochemical producer to its portfolio.

Diversified ownership is also common in the part of the industry controlled by non-state firms. The Saudi Industrial Investment Group (SIIG), for example, owns equal or controlling shares in two petrochemical facilities with Chevron Phillips Chemical Co. LLC, which itself is owned 50% by Chevron Co. and 50% by Conoco Phillips Chemical, both U.S.-based multinational oil companies. Similarly, Tasnee (formerly the National Petrochemical Industrialization Company) produces polymers through the Saudi Polyolefins Company (SPC), a joint venture formed between Tasnee (which owns 75%) and LyondellBasell (a 50/50 joint venture between the Royal Dutch Shell Group and BASF), one of the world's largest plastics, chemical, and refining companies.[86] LyondellBasell also holds a 25% share of the Al-Waha Petrochemical Company, a subsidiary of the Sahara Petrochemicals Company (Sipchem).[87]

[85] GiB Capital, 'Equity Research report: KSA Petrochemical Sector', 29 Jan. 2023, p. 20, https://argaamplus.s3.amazonaws.com/b500c879-3914-4974-b033-583b7a273ec8.pdf

[86] Gulf Oil & Gas, 'Saudi Polyolefins Company (SPC)', no date, https://www.gulfoilandgas.com/webpro1/prod1/suppliercat.asp?sid=9166; The Saudi British Bank, *The Al Yamamah Economic Offset Programme*, Nov. 2008, https://shellnews.net/rayfoxwebsite/al-yamamah%20offset%20programme.pdf

[87] PPlus, 'Al-Waha Petrochemical Company', 20 May 2024, https://portfolio-pplus.com/EntityMains/Details/1185

Saudi Arabia has diversified the variety of polymers it manufactures. Besides basic monomers and polymers (Table 5-10), it produces plastic precursors, such as mono-ethylene glycol, engineered plastics, and copolymers, such as polyethylene-vinyl acetate (EVA), nitrile rubber, and acrylonitrile butadiene styrene (ABS).

Table 5-10. Production capacity of PE, PP, PS and PVC manufacturers in Saudi Arabia, latest data.

Company		Polymers				Other products
		PE	PP	PS	PVC	
Advanced Petrochemical Company[1]		—	1,250	—	—	propylene (843 ktpa)
Alujain Corp[2]		—	400	—	—	—
Rabigh Refining and Petrochemical Company (Petro Rabigh)[3]		985	700	—	—	ethylene, propylene oxide (200 ktpa), mono-ethylene glycol (600 ktpa), paraxylene (1340 ktpa), benzene, and various refined petroleum products
Saudi Basic Industries Corporation (SABIC)		*	*	*	*	monoethylene glycol (MEG), methyl tert-butyl ether (MTBE), benzene, urea, ammonia and PTA
Sahara Petrochemicals (Sipchem)		*	450	—	—	methanol, butanol, acetic acid, and vinyl acetate monomer
Saudi Industrial Investment Group (SIIG)[4]		1,100	400	200	—	ethylene (1220 ktpa), styrene (750 ktpa), propylene (585 ktpa), benzene, cyclohexene,
Saudi Kayan[5]		700	350	—	—	monoethylene glycol, polycarbonate (260 ktpa), and bisphenol A
Tasnee[6]	**Saudi Polyolefins Company (SPC)**	—	720	—	—	propylene (450 ktpa)
	Saudi Ethylene and Polyethylene Co. (SEPC)	800	—	—	—	ethylene (1000 ktpa) and propylene (285 ktpa)
Yanbu National Petrochemical Company (YANSAB)[7]		800	400	—	—	monoethylene glycol, MTBE, and benzene

1. Sum of existing capacity and a new, 800 ktpa expansion being built by Advanced's 85%-owned subsidiary, Advanced Polyolefins Company (APOC), expected to come on stream by Q3 2024.

2. Polymer capacity refers to that of the National Petrochemical Industrial Company (NATPET), which is 76.4% owned by Alujain.

3. A joint venture between Saudi Aramco (60% of shares) and Sumitomo Chemical (15%). Stock-market investors own the remaining 25% of the company's shares. Polymer capacities refer to the situation as of September 2022. PE includes generic polyethylene (900 ktpa) and LLPDE (85 ktpa).

4. Polymer capacity refers to the output of the Saudi Polymers Company (SPCo), which is 65% owned by SIIG and 35% by Chevron Phillips Arab Company. Monomer capacities include also Jubail Chevron Phillips, which is 50% owned by SIIG,

5. 35% owned by SABIC. PE includes HDPE (400 ktpa) and LPDE (300 ktpa).

6. SPC is 75% owned by Tasnee, and SEPC is 45.34% owned by Tasnee. PE cacpacity for SEPC includes HDPE (400 ktpa) and LLPDE (400 ktpa).

7. Polymer capacities refer to the situation as of September 2019. PE includes HDPE (400 ktpa) and LLPDE (400 ktpa).

Data sources: • **Products:** Aljazira Capital, *Oil & Petrochemicals Monthly — December 2023*, 22 Jan. 2024, p. 9 ; • **Advanced:** https://advancedpetrochem.com/about/ • **Alujain** and **Saudi Kayan:** GiB Capital, 'Equity Research report: KSA Petrochemical Sector', 29 Jan. 2023, https://argaamplus.s3.amazonaws.com/b500c879-3914-4974-b033-583b7a273ec8.pdf • **Petro Rabigh:** Petro Rabigh, 'Rights Issues Prospectus – 2022', Oct. 2022, pp. 70–71; • **Sabic:** 'Sabic prioritises Asia contract customers: Update', 18 Sep. 2019, https://www.argusmedia.com/en/news-and-insights/latest-market-news/1979542-sabic-prioritises-asia-contract-customers-update; • **SIIG:** http://www.siig.com.sa/subsidiary-saudi-polymers-company/; • **Tasnee:** Tasnee, 'Petrochemical products', https://www.tasnee.com/en/products/petrochemicals

Price support

The Saudi government has for decades fixed methane and ethane feedstock prices, generally below market prices observed elsewhere. Other feedstock chemicals, such as propane and butane, are sold at a discount to the market price. On 1 January 2024 Saudi Aramco raised its prices of methane and ethane to, respectively, USD 1.75/mmBtu and USD 2.50/mmBtu (increases of 40% and 43%).[88] The previous change in the ethane price, from USD 0.75 to USD 1.75 per mmBtu, had taken place in December 2015. The prices of propane and butane remained unchanged, pegged at a 20% discount to the free-on-board (FOB) price of these fuels exported from the Port of Ras Tanura. This discount means that the profit margin for polypropylene manufactured using propane purchased from Saudi Aramco is larger than that from using purchased propylene.[89]

Other support

Skovgaard et al. (2023), point out that, in addition to the funds invested in the aforementioned Sandara project by the two joint-venture partners (USD 4.39 billion by Saudi Aramco, and USD 2.37 billion by Dow Chemical), the USD 20 billion project benefitted from many billions of U.S. dollars worth of loans and loan guarantees from state-owned financial institutions, including development banks and export credit agencies (Table 5-11), as well as private financing from a large consortium of commercial banks.[90]

Table 5-11. Loans and loan guarantees issued in 2013 for the Sandara Chemical Company's petrochemicals production complex in Jubail Industrial City II, Saudi Arabia.

State financing	Amount (USD millions)	Private financing sources[1]	Amount (USD millions)	Loan guarantee source	Amount (USD millions)
Saudi Public Investment Fund	1,300	Abu Dhabi Commercial Bank[2]	220	K-Exim (Korea)	80
Islamic Development Bank	220	Arab National Bank[3]	220	K-Sure (Korea) [4]	500
Export–Import Bank of the United States	5,000	Banque Saudi Fransi[5]	220	Euler Hermes (Germany)	425
Export Development Canada	84.62	Saudi British Bank (SABB)[6]	220	UKEF (UK)	700
KfW (Germany)[7]	84.62	Citigroup	84.62	Istituto Credito Official (Spain)	225

[88] Aljazira Capital (2024), *Impacts of Feedstock Price Hikes on Petrochemical & Cement Industries*, Riyad, Saudi Arabia, p. 2. https://argaamplus.s3.amazonaws.com/acf37816-5efc-417e-a37f-f244da353b50.pdf

[89] GiB Capital, 'Equity Research report: KSA Petrochemical Sector', 29 Jan. 2023, p. 28, https://argaamplus.s3.amazonaws.com/b500c879-3914-4974-b033-583b7a273ec8.pdf

[90] Jakob Skovgaard, Guy Finkill, Fredric Bauer, Max Åhman, Tobias Dan Nielsen, 'Finance for fossils – The role of public financing in expanding petrochemicals', Global Environmental Change, Vol. 80 (2023), 102657, https://doi.org/10.1016/j.gloenvcha.2023.102657

1. In addition to those listed, the project also benefitted from loans of USD 84.62 million each from the Credit Agricole Group, Credit Agricole Group, Barclays Bank, BNP Paribas, Goldman Sachs, HSBC, JP Morgan, MUFG Bank, Standard Chartered Bank, and Sumitomo Mitsui Banking Corporation.

2. 60% owned by the state-owned Abu Dhabi Investment Council.

3. The Arab National Bank, which is based in Saudi Arabia, is 40% owned by the Arab Bank Group, a Jordanian bank in which 17.2% is held by the national social security corporation.

4. The Public Finance for Energy Database notes that K-Exim's 2013 annual report cites a loan of USD 320 million and an $80 million gurantee, whereas a K-Exim news release cites a loan of USD 400 million.

5. 16.2% held by Kingdom Holding Co..

6. Now Saudi Awwal Bank (SAB), following the merger of SABB with Alawwal Bank in March 2021

7. The Public Finance for Energy Database gives a value of USD 200 million from the KfW IPEX-Bank, whereas IJ Global lists funding of USD 84.62 million by KfW (not KfW-IPEX).

Sources: Adapted from Table 2 in Jakob Skovgaard, Guy Finkill, Fredric Bauer, Max Åhman, Tobias Dan Nielsen, 'Finance for fossils – The role of public financing in expanding petrochemicals', Global Environmental Change, Vol. 80 (2023), 102657, https://doi.org/10.1016/j.gloenvcha.2023.102657; cross-referenced with Oil Change International, 'Public Finance for Energy Database', Version of 24 July 2024, energyfinance.org.

More recent public support includes a USD 85 million loan from the Islamic Development Bank in 2015 to help finance a second phase of the Petro Rabigh petrochemicals plant, and an SAR 3 billion (USD 800 million) eight-year loan from the Saudi International Development Fund (SIDF) in 2020 to help finance a new propane dehydrogenation (PDH) unit and a polypropylene (PP) plant being built by Advanced Petrochemical Company's 85%-owned subsidiary, Advanced Polyolefins Company (APOC). The PDH plant will have a capacity to produce 843 ktpa of propylene and 800 ktpa of polypropylene. Commercial operations at the plant are expected in the second half of 2024.[91]

A.1.8 United States

The Environmental Integrity Project, an NGO, maintains a list of 124 existing plastics plants in the United States that manufacture polymer resins, including polyethylene, polyethylene terephthalate (PET), polypropylene, polyvinyl chloride (PVC), and polystyrene.[92] Its inventory also includes plants that manufacture the chemical ingredients or precursors for polymer resins (benzene, chlorine, ethylene, propylene, styrene, etc.), plants that manufacture catalysts used in the production of plastics, and proposed plant expansions and new facilities. Altogether, the manufacturing capacity of existing, expanding, and proposed plants producing PE, PET, PP, PVC, or PS is around 58,500 ktpa, led by PE (31,400 ktpa), PP (10,800 ktpa), and PS (9,500 ktpa). The leading producer is Formosa Plastics, followed by ExxonMobil Chemicals, Chevron Phillips Chemical, and Dow Chemicals. Together the top 12 producers account for 87% of existing and planned U.S. capacity. In the cases of PET, PS and PVC, just two, three or four companies account for between 84% and 98% of U.S. capacity.

A distinguishing characteristic of the U.S. market is that eight of the 12 largest U.S. polymer producers — Braskem (Brazil), Formosa Plastics (Chinese Taipei), Groupa Alfa (Mexico), Indorama (Singapore), Ineos (UK), LyondellBasell (Netherlands), Shintech (Japan), and Total Energies (France) — are headquartered in other countries. Aramco (Saudi Arabia) operates one polymer plant and two monomer plants on its own, but its joint ventures with ExxonMobil and Total Energies elevate it to the ranks of one of the leading U.S. producers of monomers (ethylbenzene, ethylene, propylene, and styrene).

The vast majority of monomer and polymer plants are located in Texas and Louisiana, close to, and often integrated with, oil refineries and oil and natural gas production. Several plants have also been built near the Ohio River — in Kentucky, Ohio, Pennsylvania, and West Virginia — to take advantage of natural gas

[91] Oil Change International, 'Public Finance for Energy Database', Version of 24 July 2024, energyfinance.org.

[92] Environmental Integrity Project, 'Plastic Plants Inventory', Ver. 2 July 2024, https://environmentalintegrity.org/plastics-plant-inventory/

produced through hydraulic fracturing, or fracking, from the Marcellus Shale formation. There is also a cluster of plants that produce PET in North and South Carolina.

Table 5-12. Capacity of the 12 companies manufacturing main polymer resins in the United States[1]

Company	PET	PE	PP	PS	PVC	Total
Formosa Plastics	–	3,740	2,360	–	1,553	7,653
ExxonMobil[2]	–	4,757	1.718	–	–	6,475
Chevron Phillips Chemical	–	5,621	–	755	–	6,376
Dow Chemical	–	5,004	–	–	–	5,004
LyondellBasell[3]	–	4,190	509	–	–	4,699
Westlake	–	1,267	—	—	3,039	4,306
Ineos	–	1,196	1,579	592	–	3,367
Shintech[4]	–	—	—	—	3,339	3,339
TotalEnergies	–	1,025	1,200	660	—	2,885
Indorama[5]	2,847	–	–	–	–	2,847
Braskem	–	40	2,147	–	–	2,187
Groupa Alfa	1,641	–	–	168	–	1,809
Other companies	90	4,553	1,303	64	1,516	7,525
Total	4,578	31,392	10,816	2,239	9,447	58,471

1. Including plants undergoing expansion and proposed plants.

2. Including a plant jointly owned with Saudi Aramco that produces PE.

3. Including a plant jointly owned with Sasol that produces PE.

4. A wholly owned subsidiary of Shin-Etsu (Japan).

5. Including a proposed plant jointly owned with Alpek and Far East New Century that will produce PET.

Data source: Environmental Integrity Project, 'Plastic Plants Inventory', Ver. 2 July 2024, https://environmentalintegrity.org/plastics-plant-inventory/

Price support

The U.S. federal government has not regulated the prices of petroleum fuels or natural gas or any of their derivatives since, respectively, the late 1970s and early 1990s. However, from 1975 through December 2015, it did maintain a ban on the exportation of most crude oil from the United, with some limited exceptions.[93] The effect of this ban was to keep more domestic crude oil within the country than otherwise would have been the case, likely depressing its price. A subsequent analysis by the U.S. Government's General Accountability Office determined that, following the ending of the ban, profit margins for refiners (i.e., the difference between the costs a refiner would pay for its crude oil and the earnings it would receive from the sale of refined products) 'likely decreased as the prices refiners paid for domestic crude oil increased relative to international prices'.[94]

Similarly, under U.S. law, the U.S. Department of Energy (DOE) must approve all natural gas exports. However, the policy, which mainly affected exports of LNG, was to promptly approve exports to countries with which the United States had a free trade agreement (such as Canada and Mexico), without conditions. By contrast, for exports to countries with which the United States did not have a free agreement (which includes China, Japan, and European countries), the DOE had to make a finding that

[93] These exceptions applied mainly to exports of crude oil to Canada for consumption or use therein.

[94] U.S. Government Accountability Office, *Effects of the Repeal of the Crude Oil Export Ban*, October 2020, p. 16.

the exports were 'not inconsistent with the public interest'.[95] Under the Obama Administration, these restrictions were eased, and the more liberal export policy continued under the Trump Administration, resulting in a rapid expansion of LNG exports, from zero at the beginning of 2016 to 13 billion cubic feet (370 million cubic metres) a day as of mid-2024.[96] The effects of the earlier restrictions, combined with increasing domestic production, is likely to have kept prices for natural gas (and therefore natural gas liquids) in the U.S. domestic market lower than had LNG exports taken place. A 2014 study by the U.S. Energy Information Administration of the effects on U.S. markets of increasing LNG exports, for example, found that the average prices for natural gas paid by industrial consumers in the continental United States under a 12 billion cubic feet per day scenario would be about 4% higher than with no LNG exports.[97]

This study did identify one state-level measure related to the prices of inputs. A USD 14 billion facility in western Pennsylvania built by Shell has benefitted from a package of tax measures worth USD 1.65 billion. One of these is a tax credit of USD 2.10 per barrel (USD 0.05 per U.S. gallon) or USD 0.86 per million British thermal units (MMBtu), of ethane purchased from Pennsylvania companies and extracted from natural gas produced in the state.[98] That compares with the average spot price of ethane in the United States over the period May 2023 through April 2024 of around USD 0.55 per U.S. gallon.[99]

Other support

A March 2024 report from the Environmental Integrity Project (EIP), *Feeding the Plastics Industrial Complex: Taking Public Subsidies, Breaking Pollution Limits*, examined 50 facilities built or expanded between 2012 and 2023 and determined that they had benefitted from various forms of support from state and local governments, ranging from grants to property-tax abatements, totalling almost USD 9 billion over the period (Table 5–13).

Table 5-13. Top 10 U.S. manufacturing plant recipients of state and local subsidies, 2012-2023

State	County or parish	Parent company or companies and location of corporate headquarters	Plant name	Primary chemical feedstock(s)	Product(s)	Total government support received, 2013–2022, millions of U.S. dollars (nominal)
LA	Calcasieu	LyondellBasell (USA) & Sasol (South Africa)	Lake Charles Complex	ethane	ethylene, PE, and others	3,490
PA	Beaver	Shell (UK)	Monaca	ethane	ethylene, PE	1,650

[95] Mary Anne Sullivan and Kyle Simpson, 'LNG exports - A rare case of policy continuity from Obama to Trump', Hogan Lovells, 8 May 2017, https://ehoganlovells.com/cv/3b3f8f2fb9130ff94bb78c9f60c9a96cd99be774

[96] U.S. Energy Information Administration, 'STEO Between the Lines: U.S. LNG exports will increase next year as two export terminals come online', 11 July 2023, https://www.eia.gov/outlooks/steo/report/BTL/2023/07-LNG/article.php

[97] U.S. Energy Information Administration, *Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets*, October 2014, pp. 14 and 38. https://www.eia.gov/analysis/requests/fe/pdf/lng.pdf

[98] *Ibid*, p. 14.

[99] See 'Ethane Price(C2H6)' at https://www.binance.com/en/price/ethane#.

State	County or parish	Parent company or companies and location of corporate headquarters	Plant name	Primary chemical feedstock(s)	Product(s)	Total government support received, 2013–2022, millions of U.S. dollars (nominal)
LA	Iberville	Shintech (Japan)	Plaquemine	ethane	ethylene, PVC, and others	533
LA	Calcasieu	Westlake (USA) & Lotte (South Korea)	Lake Charles	ethane	ethylene, MEG	498
TX	Brazoria	Dow (USA)	Freeport	ethane, propane	ethylene, PE, PP, and others	393
TX	San Patricio	ExxonMobil (USA) & SABIC (Saudi Arabia)	Gulf Coast Growth Ventures	ethane	ethylene, PE	249
LA	Iberville	Dow (USA)	Plaquemine	ethane, propane	ethylene, PE, PP, and others	230
TX	Chambers	Enterprise (USA)	Mont Belvieu	propane	PP	176
LA	Ascension	BASF (Germany)	Geismar	ethane	ethylene oxide, ethylene glycol, and others	160
LA	Ascension	Shell (UK)	Geismar	ethane	ethylene oxide, ethylene glycol, and others	145

Source: Environmental Integrity Project (2024), *Feeding the Plastics Industrial Complex*, p. 15, accessed at https://environmentalintegrity.org/reports/feeding-the-plastics-industrial-complex/ on 28 April 2024.

Several ethane crackers and polymerization plants that have been constructed or are under construction in the United States have benefitted from loans or guarantees provided by foreign export credit agencies, especially Canada's, or bilateral lending institutions. Three out of the seven listed in Table 5-14 appear to relate to the same ethane cracker and derivatives complex in Westlake (near Lake Charles), Louisiana. In total, these plants benefitted from over USD 1 billion finance from public institutions.

Table 5-14. Loans and loan guarantees issued by state-owned financial institutions between 2014 and 2022 for facilities in the United States engaged in the manufacturing of monomers or polymers.

Identifier	Year	Recipient and project	Loan or guarantee provider	Type of financial support	Amount (USD millions)[1]
1736	2014	Sasol Chemicals (USA) LLC, for construction of an USD 8.1 billion plant in Lake Charles, Louisiana, that includes an ethane cracker and a polymerization plant.	Canada	export credit (loan)	86
3274	2014	Westlake, for the development of a 1,500 ktpa ethane cracker and derivatives complex in Westlake, Louisiana.	Canada	export credit (loan)	222
3282	2014	Westlake(?), for a 1,540 ktpa, single train ethane cracker and ethylene derivative units (including two polyethylene plants and an ethylene oxide or ethylene glycols unit), as well as associated infrastructure and utilities, near Westlake, Louisiana.	Canada	export credit (loan)	86
5133	2016	Braskem S.A., for rehabilitation of polypropylene and other petrochemical plants operated in the U.S.	Japan	export credit (guarantee)	135
5205	2017	Yuhuang Chemical, for the development of a USD 1.5 billion methanol manufacturing complex in St James Parish, Louisiana.	China	export credit (loan)	200
8482	2017	Westlake, for a 1,500 ktpa ethane cracker and derivatives complex in Westlake, Louisiana.	Germany	bilateral (loan)	222
2953	2018	Chevron Phillips Chemical Company (renewal and refinancing of credit facilities)	Canada	export credit (loan)	20
10284	2022	Golden Triangle Polymers Company[2], for a USD 8.5 billion, 2,080 ktpa ethane cracker unit and two 1,000 ktpa HDPE units, to be built in Orange County, Texas.	Korea	bilateral (loan)	300

1. All amounts are in nominal U.S. dollars and rounded to the nearest million dollars.

2. Insurance (100% of political risk, and 90% of commercial risk) provided by Nippon Export and Investment Insurance (NEXI) for a loan extended by Sumitomo Mitsui Banking Corporation.

3. A joint venture between QatarEnergy (49%) and Chevron Phillips Chemical Company (51%). See NZ Energy, 'Golden Triangle Polymers Plant, US', 21 April 2023, https://www.nsenergybusiness.com/projects/golden-triangle-integrated-polymers-facility/?cf-view&cf-closed

Source: Oil Change International, 'Public Finance for Energy Database,' Version of 24 July 2024, energyfinance.org.

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