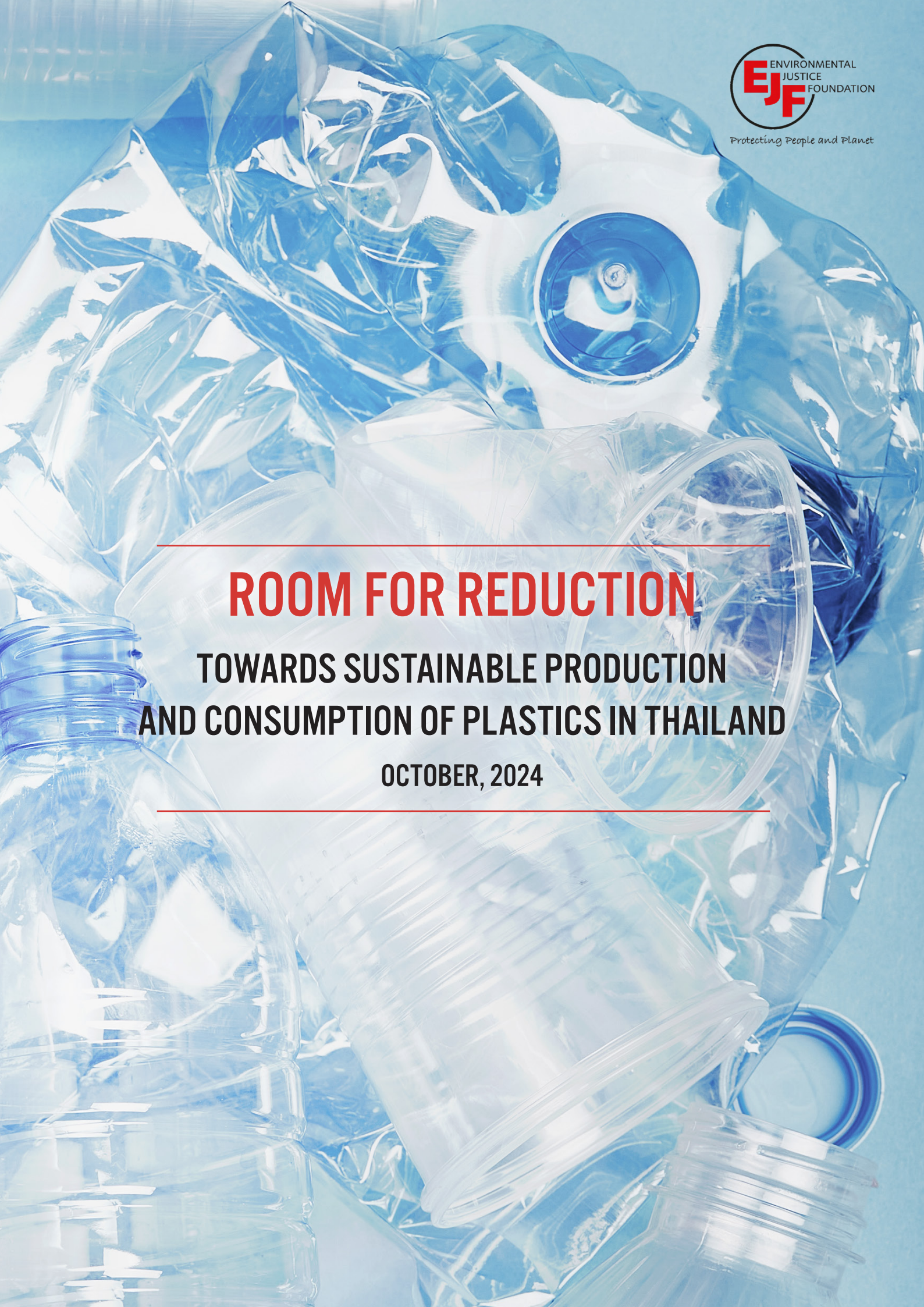


ENVIRONMENTAL JUSTICE FOUNDATION

Protecting People and Planet

ROOM FOR REDUCTION

TOWARDS SUSTAINABLE PRODUCTION AND CONSUMPTION OF PLASTICS IN THAILAND

OCTOBER, 2024

ROOM FOR REDUCTION

TOWARDS SUSTAINABLE PRODUCTION AND CONSUMPTION OF PLASTICS IN THAILAND

This is a policy briefing by the Environmental Justice Foundation (EJF) written to facilitate the Royal Thai Government's (RTG) engagement in the fifth intergovernmental negotiating committee meeting (INC-5) to establish an international legally binding instrument to address plastic pollution, including in the marine environment.

SUSTAINABLE PLASTIC PRODUCTION: HUMANITY'S URGENT MANDATE

On March 2nd, 2022, the United Nations Environment Assembly (UNEA) Resolution 5/14 mandated the intergovernmental negotiating committee (INC) of nations from around the world to develop an international legally binding instrument (ILBI) to address plastic pollution across the full life cycle of plastics, with provisions to achieve sustainable production and consumption of plastics.

This policy brief aims to communicate to the Royal Thai Government (RTG) that Thailand's current levels of plastic production and consumption are unsustainable. It details how sustainable plastic production and consumption could be calculated and achieved in Thailand. This is to help inform the RTG's engagement at the INC-5 meeting, which is slated to be the final round of negotiations for an instrument to address plastic pollution, and where the issue of plastic production is to be intensely debated.

KEY FACTS

- Greenhouse gas emissions from Thailand's primary plastic production are estimated to be **27.3 million tons of CO2 equivalent** per year. This is equivalent to the annual CO2 emissions of **5.9 million cars**, and up to **7.3%** of Thailand's annual greenhouse gas emissions - almost half the emissions from its agricultural sector.

- Based on different scenarios and datasets, EJF estimates that **Thailand has the potential to reduce its plastic production by at least 20% and up to 36%** by banning unsafe, unsustainable, or inessential plastics and implementing reuse and refill systems, or phasing out single-use plastics.

- EJF has demonstrated how refill systems can work through the implementation of its Bottle Free Seas project - 10 water refill stations were installed across Bangkok and were able to **prevent the use of one million plastic bottles** in little over a year. This project proves that reduction is very achievable, and could be scaled up rapidly.

BOTTLE FREE SEAS

DEFINITIONS

At the previous rounds of INC negotiations, sustainable production and consumption of plastics became a contentious issue. Peru and Rwanda attempted to propose intersessional work to gather relevant information and to consider options for the provision, but without success. However, for this provision to be effectively incorporated into the ILBI, it is essential that all parties come together to define and agree on what "sustainable" production truly means. EJF proposes three initial criteria for sustainable production and consumption of plastics. Plastic production and consumption must meet all three criteria to be considered sustainable.

These criteria have been defined through extensive literature review, and consideration of the proposals put forward by delegates during the INC meetings to develop the ILBI. They are not intended to predetermine the end result of the ILBI negotiations but should be regarded as an initial proposal to spark conversations.

CRITERIA 1:

Plastic production is reduced to a level that allows humanity to avert the triple planetary crises of climate change, biodiversity loss, and pollution.

CRITERIA 2:

Plastic production is at a level that does not entail the expansion of extractive or industrial activities that violate basic human rights, including the right to a clean, healthy, and sustainable environment.

CRITERIA 3:

Plastic polymers and products that fail to meet the safety, sustainability, and essential use criteria are no longer produced. More details about these criteria can be found in the endnote.[1]

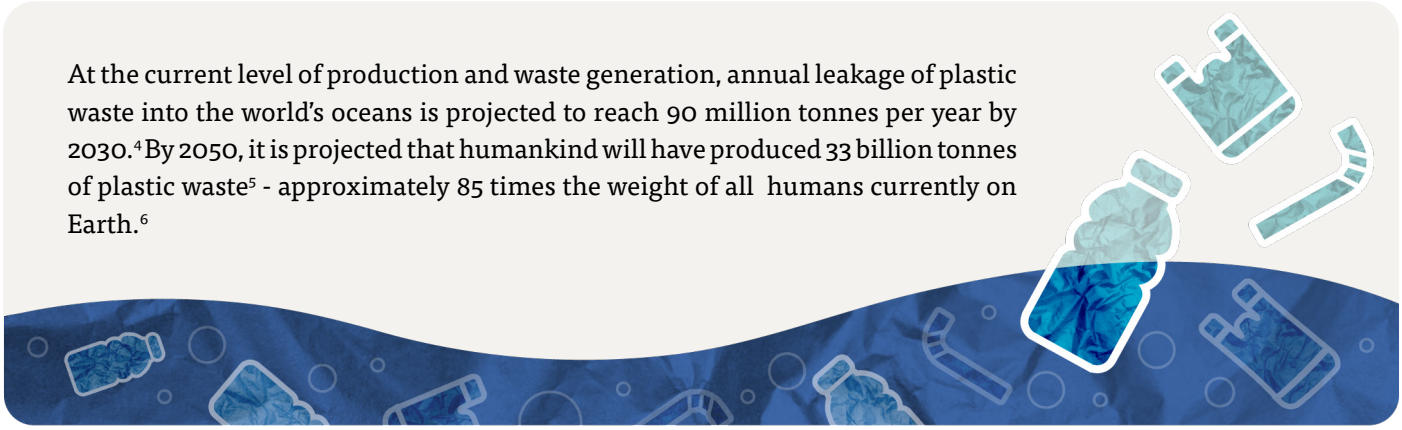
Flare stack at a petrochemical facility in Rayong province, 2024, photo by: EJF

PLASTIC PRODUCTION: AN UNSUSTAINABLE CRISIS

Scientific evidence has shown that the current level and rate of growth of global plastic production is undermining global efforts to tackle the climate crisis. A 2024 study by the Lawrence Berkeley National Laboratory (LBNL) projects that by 2050, greenhouse gas emissions from primary plastic production alone will consume **more than 25% of the global carbon budget**.[2] Extrapolating the initial results from LBNL, the Global Alliance for Incinerator Alternatives (GAIA) projects that **primary plastic production alone will consume the entire global carbon budget sometime between 2060 - 2083**.[3]

This is thrown into sharper relief by the fact that plastics are only one among many polluting sectors rapidly consuming the global carbon budget.

At the current level of production and waste generation, annual leakage of plastic waste into the world's oceans is projected to reach 90 million tonnes per year by 2030.[4] By 2050, it is projected that humankind will have produced 33 billion tonnes of plastic waste[5] - approximately 85 times the weight of all humans currently on Earth.[6]



Meanwhile existing international legal instruments only regulate 1 - 6% of chemicals in plastic production and products.[7] Unregulated harmful chemicals and microplastics have contaminated fragile ecosystems, the food chain, and the human body.[8] The human rights impacts of plastics and their production, including air pollution, plastic pellet spills, and ecosystem fragmentation have been highlighted by a report of the UN Special Rapporteur, Marcos Orellano.[9]

Today, petrochemical production, which includes plastics production, is a key driver of fossil fuel demand growth,[10] and a lifeline for an industry facing a gradual transition towards renewable energy sources. A recent report by the Institute for Energy Economics and Financial Analysis highlights that behavioural and institutional changes are likely to reduce the demand of single-use plastics. However, most major integrated oil and gas companies and petrochemical companies are investing in assets that support expanding single-use plastics,[11] a range of products that should now be avoided and phased out with robust and well-designed reuse systems. "If expansion proceeds but demand declines," the report warns, "the result is oversupply—which impairs profitability."

IS THAILAND'S PLASTIC PRODUCTION SUSTAINABLE?

To assess the status of Thailand's plastic production, and to determine what a sustainable level of production would look like for Thailand, EJF uses indicators of greenhouse gas (GHG) emissions (criteria 1), waste generation (criteria 1), pollution, biodiversity, and human rights (criteria 1 & 2), and sustainability, safety and essentiality of the plastic polymers and products (criteria 3).

This assessment is based on publicly available data. A more comprehensive assessment could be done should more comprehensive data on plastics production be publicly available. EJF sent a letter requesting this data to the Ministry of Industry and the Plastics Institute of Thailand (PIT) in September, but had not received a response by the time of publication (October).

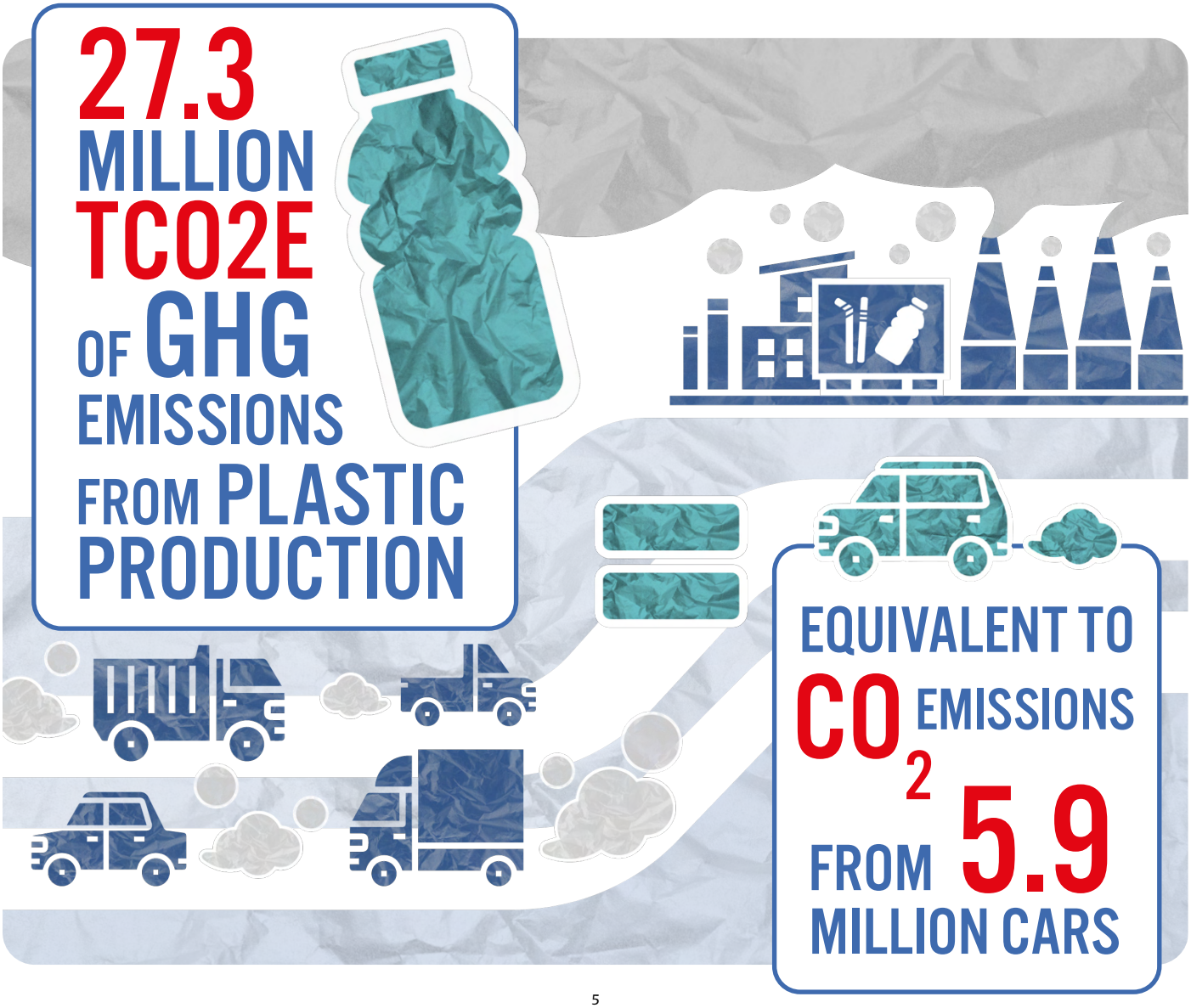
GREENHOUSE GAS EMISSIONS FROM THAILAND'S PLASTIC PRODUCTION

In order to estimate the GHG emissions from primary plastic production in Thailand, EJF uses the emission factor for the production of each polymer type according to the Thailand Greenhouse Gas Management Organisation (TGO).[12] We multiplied the emission factor of each polymer type with the estimated production quantity for each polymer type in Thailand in 2019, based on the information in the 2020 report by the PIT.[13] We use the information from the year 2019, to allow for comparison with the results of LBNL (2024), which uses data from the same year. The GHG emissions from the production of each polymer type were then added together to calculate the total GHG emissions from Thailand's plastic production process.

TGO's emission factor for each polymer type covers the phases between extraction and polymerisation. However, unlike LBNL (2024), it excludes the product shaping phase, which accounts for up to 17% of the GHG emission for the estimated global emission factor. Additionally, in the data we use, 20.4% of the plastic resins produced in Thailand in 2019 were not classified under specific polymer types. In those cases, we use the most conservative estimate (the lowest emission factor: that of polypropylene) to calculate their GHG emissions. Based on these facts, the figure presented in this policy brief should be treated as an underestimate.

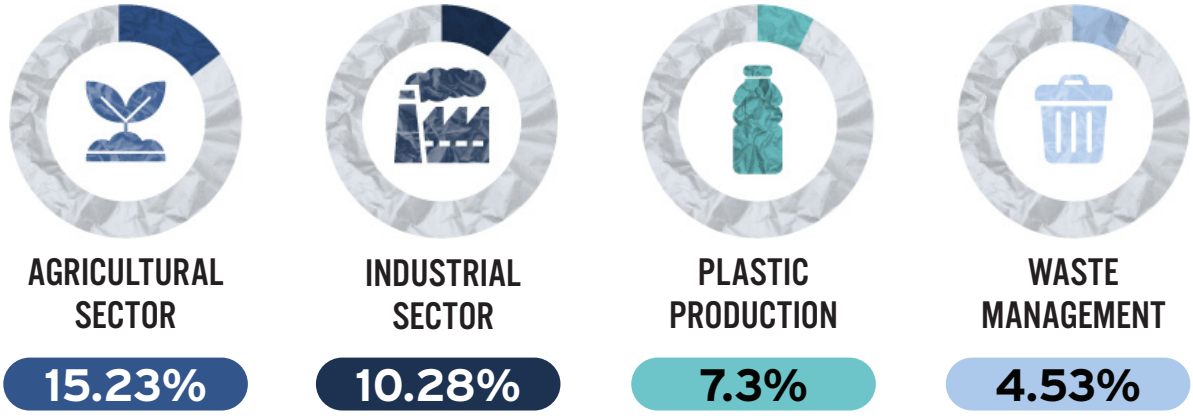
The details and limitations of our methods are outlined in appendix 1.

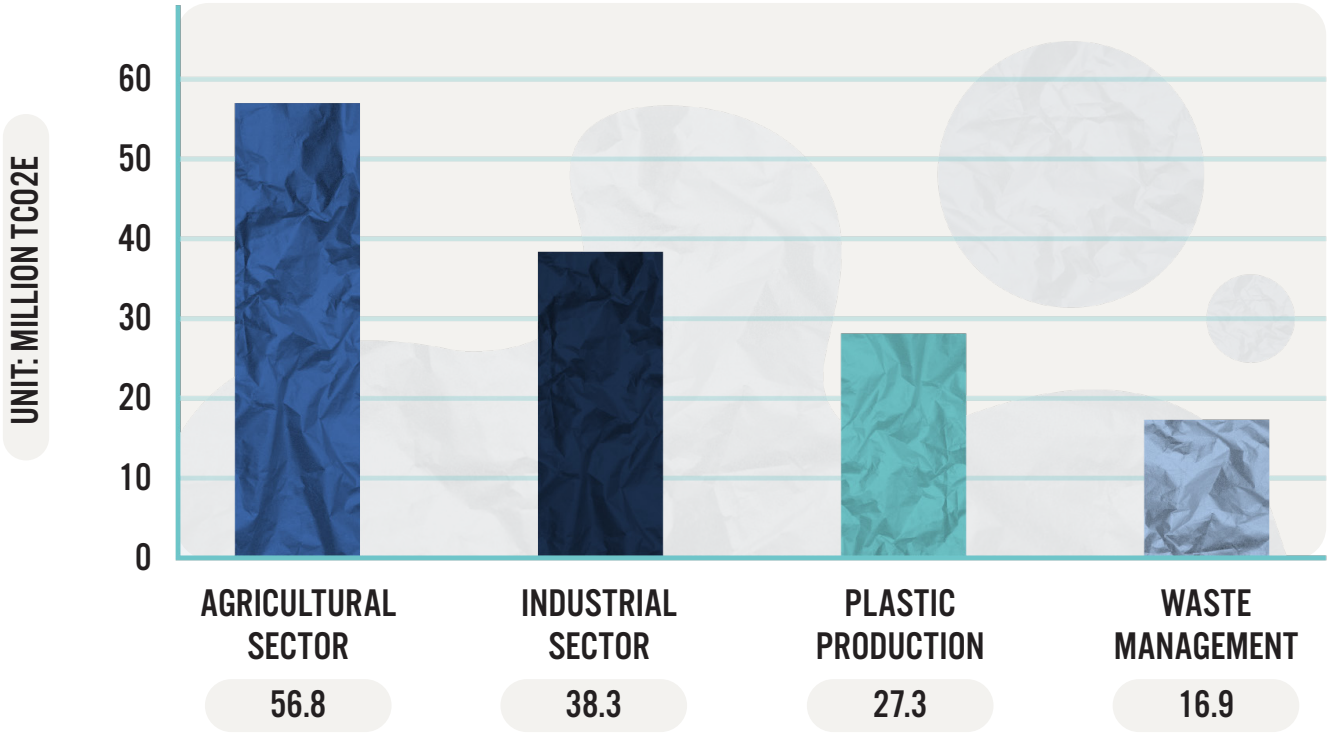
Based on these datasets, EJF estimates the GHG emission of Thailand's primary plastic production to be **27.3 million tonnes of CO2 equivalent (tCO2e) per year**. This is equivalent to the annual CO2 emissions from **5.9 million cars**.[14]



This is also equivalent to **7.3% of Thailand's GHG emissions in 2019** (approximately 372 million tCO2e), excluding Land Use, Land-Use Change, and Forestry. It is higher than the GHG emissions of the waste management sector (4.53%), a little less than the entire industrial sector (10.28%)[15] and almost half of the agricultural sector (15.23%).[16]

GHG EMISSIONS FROM THAILAND'S PLASTIC PRODUCTION COMPARED TO OTHER SECTORS IN 2019





Source for total GHG emissions, the agricultural sector, industrial sector and waste management: Ministry of Natural Resources and the Environment (2022)

WASTE GENERATION

Plastics cannot be endlessly recycled, and recycling and other waste management practices inevitably cause a certain degree of pollution.[17] Therefore, fundamentally, all plastics that are produced today will eventually become waste and cause pollution. Thailand is producing around nine million tonnes of plastics per year, according to the PIT's data, and all nine million tonnes of plastics produced yearly will eventually become waste or pollutants. A different estimate places annual production at 7.97 million tonnes, and estimates that up to 36% of these are single-use plastics.[18]

Recycling is often touted as the solution to the problem of plastic waste. However, as of 2018, Thailand's collection for recycling rate was only 17.6% for the key resins (polyethylene terephthalate - PET, high density polyethylene - HDPE, low density polyethylene - LDPE, linear low density polyethylene - LLDPE, polypropylene - PP).[19] If Thailand were able to improve its waste management system to match that of the European Union (EU), its plastics waste recycling rate would only improve to around 33%.[20] Thailand generates 2 million tonnes of plastic waste per year, according to the Pollution Control Department (PCD).[21] Therefore, if Thailand's waste management system matched the EU's recycling rates, it would still generate **1.34 million tonnes of plastic waste per year**.

Municipal waste landfill in Rayong province, 2024, photo: EJF

POLLUTION, BIODIVERSITY LOSS AND HUMAN RIGHTS

Plastic pollution has already impacted Thailand's ecosystems and food chains. In May 2024, an explosion at a tank storing byproducts of plastic resins production owned by the Map Ta Phut Tank Terminal Company Limited, a subsidiary of SCG Chemicals Public Company Limited (SCGC), caused the death of one worker and released pollutants into the air.[22] This followed a chemical leakage at a PET polyester factory owned by Indorama Polyester Industries (Nakhon Pathom) Public Company Limited in 2022,[23] and an explosion at an expanded polystyrene factory owned by the Ming Dih Chemical Company Limited in 2021.[24]

On September 22nd, 2024, there was a fire at the polyvinyl chloride (PVC) factory in Map Ta Phut Rayong - owned by the Thai Plastics and Chemical Public Company Limited, also an SCGC subsidiary - which sent a plume of smoke into the atmosphere. That same day, the regional environmental and pollution control office reported "elevated" levels of the carcinogen vinyl chloride in the area.[25]

"

THE RELEVANT GOVERNMENT AUTHORITIES WITH THE POWER TO PERMIT THE EXPANSION OR THE INCREASE IN THE QUANTITY OF PLASTIC FACTORIES SHOULD CONSIDER THE VARIOUS DIMENSIONS OF IMPACTS, SUCH AS ENVIRONMENTAL AND HEALTH IMPACTS, FROM AIR TO WATER POLLUTION, WHICH MAY LEAD TO DISEASES SUCH AS CANCER, AND RESPIRATORY ILLNESSES AMONG THE POPULATION.

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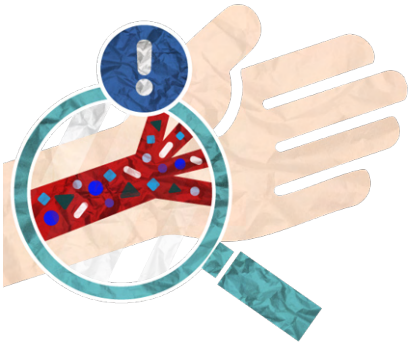
Phinyo Srisutthi, local community member monitoring the planned expansion of a plastic production factory near Ban Laeng, Rayong in 2024.[26]



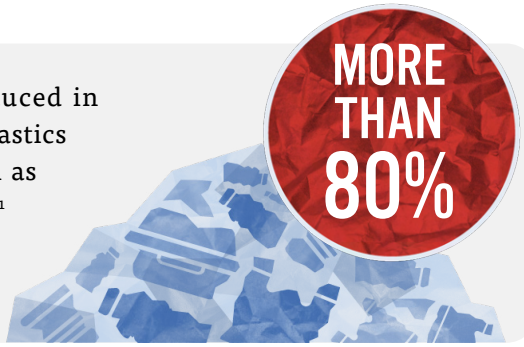
According to EJF's study of public records between September 2023 to September 2024, there were **24 cases of fires** or explosions related to plastics factories or storage in Thailand - **an average of two a month**.[27]

In 2023, a study released by Ecological Alert and Recovery - Thailand (EARTH) with the Arnika Association found contamination of persistent organic pollutants (POPs) directly linked to plastics in dust, chicken eggs, and the blood of waste workers in Kalasin province, northeast Thailand. This study shows that plastic pollution has intervened at every stage of the ecosystem and food chain, **finally entering the human body**.[28]

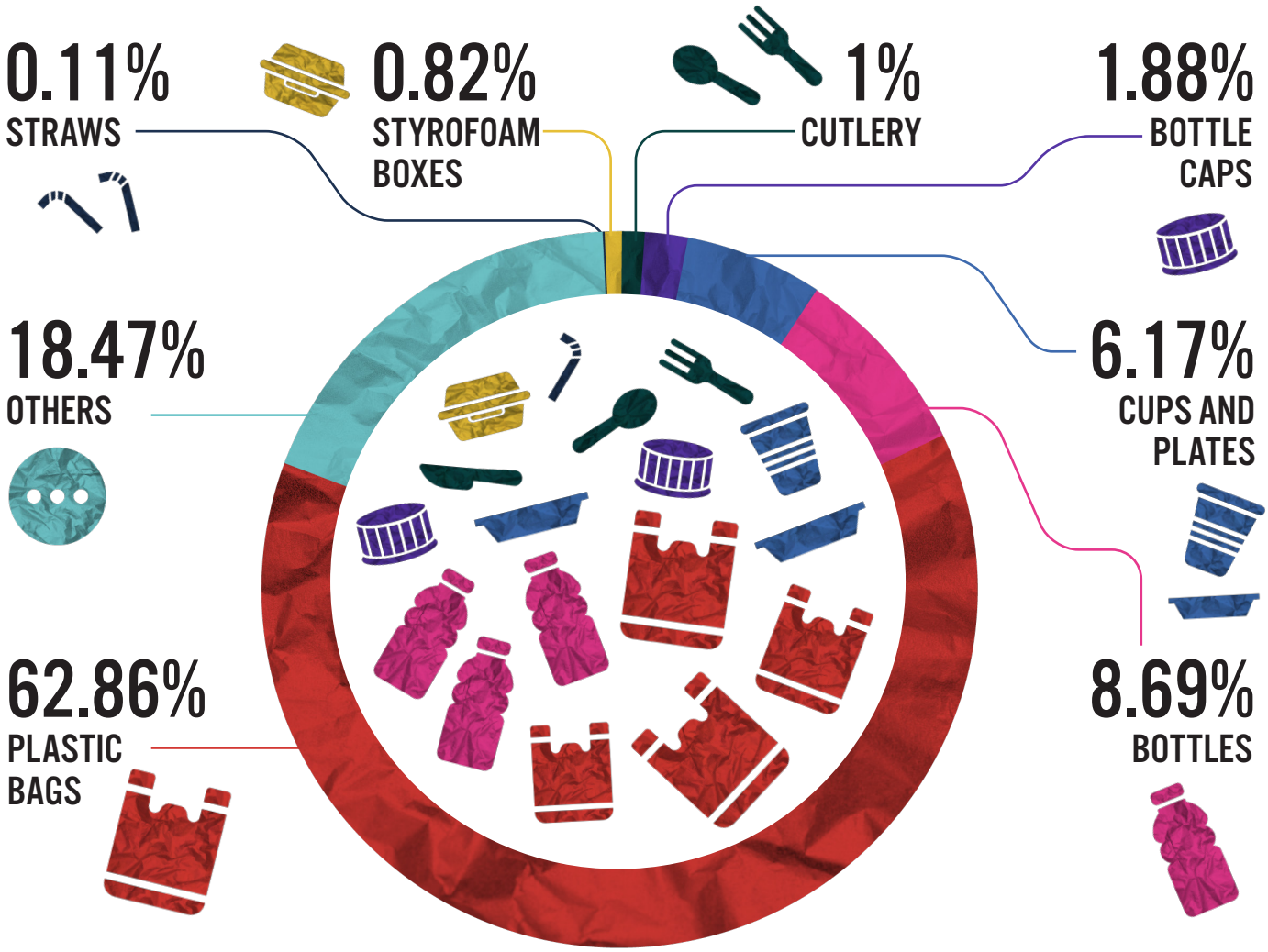
PLASTIC PRODUCTS AND POLYMERS THAT FAIL THE SUSTAINABILITY, SAFETY, AND ESSENTIAL USE CRITERIA

While the phrase "problematic and avoidable plastic products" is used in the ILBI negotiation, the criteria for such products are yet to be agreed upon. For this policy brief, EJF follows the sustainability, safety and essential use criteria proposed by the Scientist's Coalition for an Effective Plastics Treaty (SCEPT).[29] For instance, products are only essential if their "essential use" is "necessary for health, safety or is critical for the functioning of society" and "there are no available technically and economically feasible alternatives."[30]

Based on those criteria, many types of plastics that are produced in Thailand today should be phased out. More than 80% of the plastics in Thailand's landfills in 2021 included inessential plastics such as plastic bottles, plastic bags, plastic cutlery, foam boxes, straws, etc.[31] These could all be replaced by reusable products or robust reuse systems.



PROPORTION OF INESSENTIAL PLASTIC PRODUCTS FOUND IN THAILAND'S LANDFILLS IN 2021



Source: Pollution Control Department (2023) Action Plan on Plastic Waste Management Phase II: 2023 - 2027

There are also plastics that fail the sustainability and safety criteria, such as oxo-degradable plastics which release microplastics, and plastics that contain toxic chemicals that are not yet banned in Thailand. In the latter case, a study by the International Pollutants Elimination Network (IPEN) in 2023 found contamination of a type of per- and polyfluoroalkyl substances (PFAS) in clothing with polyester components sold in Thai markets.[32]

PS and PVC should both fail the sustainability and safety criteria. The previous section touched upon two recent cases where industrial accidents at PS and PVC plants endangered the environment and killed people. PVC in particular is so problematic that "some chemists say that if PVC had been developed more recently than the 1930s, it would never have been commercialised".[33] Both PS and PVC were included as products to be phased out by 2030 in the conference room paper co-signed by the delegates of the RTG at INC-4.[34]

In 2018, the RTG recognised that many of these plastic products should be phased out, and committed to ban oxo-degradable plastics, cap seals, plastic microbeads, polystyrene food containers, plastic straws, plastic bags thinner than 36 microns, and plastic cups thinner than 100 microns, by 2022.[35] Of these seven, only microbeads have seen a legal ban come into effect, and only in one product type: cosmetics.[36]

PLASTIC PRODUCTS THAT THAILAND HAS NOT BANNED

SUCCESSFULLY BANNED | PARTIALLY BANNED | NOT BANNED UNDER ANY LAW

DEADLINE TO BAN: 2019

OXO-DEGRADABLE PLASTIC

CAP SEAL

PLASTIC MICROBEAD

DEADLINE TO BAN: 2022

FOAM FOOD CONTAINERS

PLASTIC STRAWS

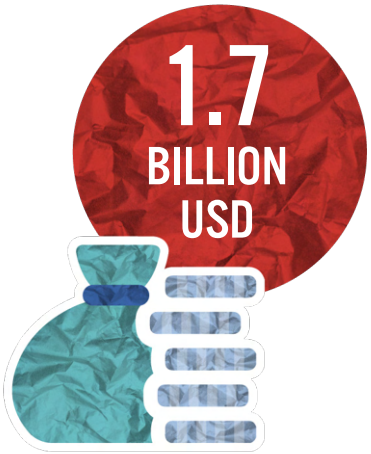
PLASTIC BAGS THINNER THAN 36 MICRON

PLASTIC CUP LESS THAN 100 MICRON

ASSESSMENT: IS THAILAND'S PLASTIC PRODUCTION AND CONSUMPTION SUSTAINABLE?

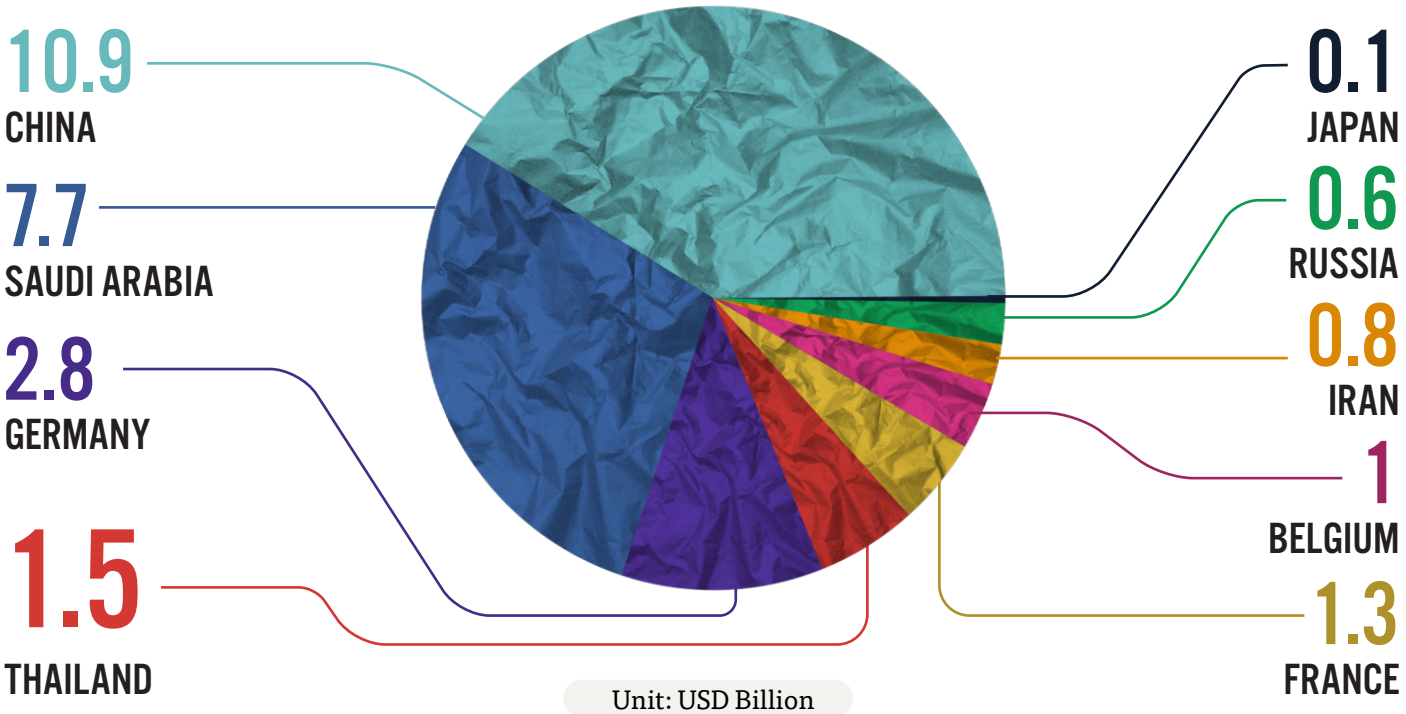
CRITERION	INDICATORS
CRITERION 1 TRIPLE PLANETARY CRISIS	☐ Thailand's plastic production generates greenhouse gases equivalent to **7.3% of its annual GHG emissions** - almost half of the agricultural sectors' annual GHG emissions. ☐ Even if its recycling rate matched the EU, Thailand would still generate **1.34 million tonnes** of plastic waste annually. ☐ Plastic pollution has entered **the ecosystem, the food chain, and the human body** of the Thai people.
CRITERION 2 HUMAN RIGHTS, POLLUTION, BIODIVERSITY	☐ Plastic pollution has entered **the ecosystem, the food chain, and the human body.** ☐ Toxic chemicals have been found in consumer products, such as clothing.
CRITERION 3 SUSTAINABILITY, SAFETY, ESSENTIAL USE	☐ **More than 80%** of plastic waste found in Thailand's landfills are inessential products. ☐ Thailand has **failed to ban 6 out of 7 plastic products** targeted by its own roadmap.

In addition to Thailand's primary plastic production failing to meet the sustainable production and consumption criterion, **Thailand's public sector contributes significantly to maintaining the profitability of the industry.** According to a 2024 report by the Quaker United Nations Office and Eunomia, Thailand ranks among the top providers of subsidies to the primary plastics polymer production industry. According to the report, Thailand provided 1.5 billion USD (aproximately 51 billion baht[37]) of feedstock subsidies and 0.2 billion USD (6.8 billion baht[38]) of energy subsidies to polymer producers in 2022. This means Thailand ranks fourth in the world in terms of feedstock subsidies and fifth in the world in terms of energy subsidies, on par with Japan, China, and Russia.[39]



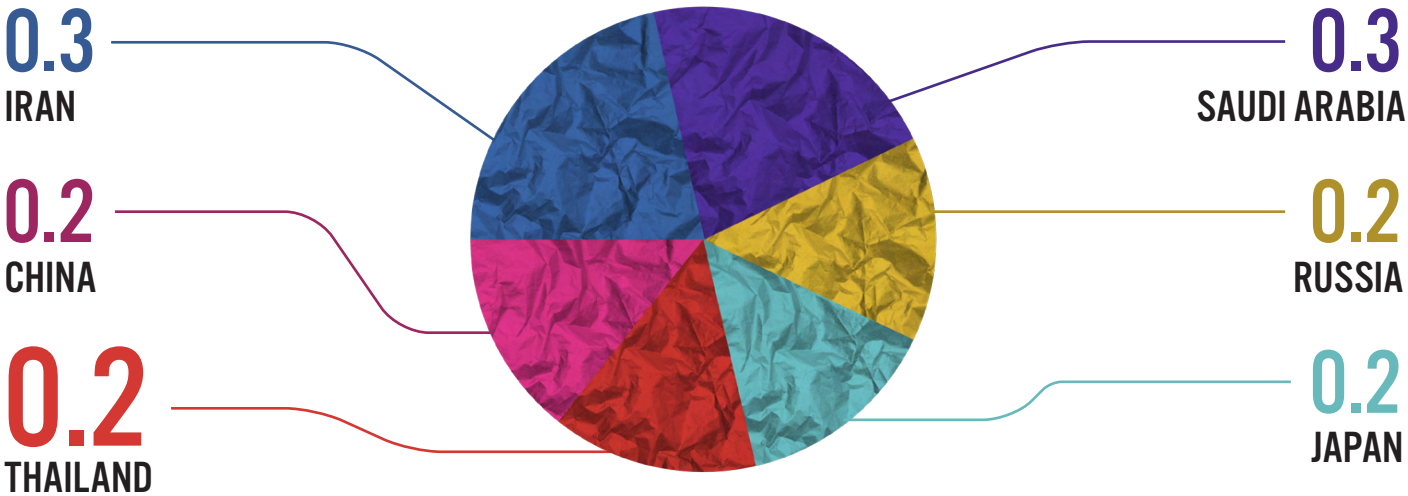
THAILAND'S PLASTICS SUBSIDIES COMPARED TO OTHER COUNTRIES

RANKING FEEDSTOCK SUBSIDIES BETWEEN MAJOR POLYMER PRODUCING COUNTRIES IN 2022



Unit: USD Billion

RANKING ENERGY SUBSIDIES BETWEEN MAJOR POLYMER PRODUCING COUNTRIES IN 2022



Unit: USD Billion

Source: QUNO & Eunomia (2024) Plastic Money: Turning Off the Subsidies Tap (Phase 1)

ROOM FOR REDUCTION

Thailand's plastic production and consumption could become sustainable with the appropriate systemic changes. The following section will calculate the potential quantity of plastics that Thailand could reduce by following criterion 3 for sustainable production and consumption. Production reduction goals based on criteria 1 and 2 would require much more data than currently available. Therefore, the potential for reduction presented in this section should be treated as an underestimate of what Thailand could and should aim to achieve, once the other two criteria are applied.

For this section, EJF uses data from 2018, the year with the most complete datasets across the board. For the consumption data for each type of plastic resin, we use the data from the 2021 World Bank report ***Market Study for Thailand: Plastics Circularity Opportunities and Barriers***.[40] Since this is consumption data, not production data, the reduction potential proposed also includes the reduction of imports, which also feeds consumption.

For the purpose of this brief, we assume that the cut in consumption will result in an equivalent cut in domestic production, without taking imported resins into consideration.In practice, the percentage of production reduction we proposed could also be distributed to import reduction.

Many of the plastics produced in Thailand today can be defined as unsafe, unsustainable, or inessential. A report by the Environmental Investigation Agency (EIA) has suggested that a list of polymers of concern could include PS, polycarbonate (PC), polyurethane (PU), and PVC - also known as the "dirty quartet". These could be subject to elimination under the ILBI.[41]

MEASURES TO BAN CERTAIN POLYMERS AND PLASTIC PRODUCTS

This policy brief presents scenarios for plastic production reduction that include the banning of certain plastic polymers and types of plastic products, such as PVC and single-use plastics. EJF recognises that some of these polymers and products are currently used in essential applications, such as healthcare and emergency relief.

We do not recommend immediate halts to the production and use of these plastics without clear alternatives for essential applications. However, we do not believe that these highly unsafe and unsustainable plastics should be considered "essential", simply because they are currently used in essential applications.

EJF advocates that the RTG consider the reduction potential that could come from banning these polymers and types of plastic products, set an ambitious but reasonable timeframe for phasing them out, and prioritise research to find safe and sustainable alternatives. In the case of single-use plastic packaging, such alternatives could be the implementation of robust reuse/refill systems. In the case of PVC in the medical field, healthcare networks and professionals around the world are already researching viable alternatives.[42]

An example of inessential plastics is single-use plastic packaging materials. Much of these could be replaced by a robust reuse system, without requiring material alternatives. According to the Ellen MacArthur Foundation, a system change from a rigid single-use packaging system to a rigid returnable packaging system could reduce plastics by **54 - 76%**.[43]

To calculate the potential for reduction in Thailand's plastics supply chain, EJF first assumes a scenario where all of the dirty quartet are banned. This would entail a reduction of 515,000 tonnes and 231,000 tonnes of plastic resins from PVC and PS respectively. A measure to ban these two plastics in Thailand alone could remove **746,000 tonnes** of plastic resins per year.

We then assume a scenario where single-use packaging is replaced by a robust reuse system. Using the low-end of the Ellen MacArthur's Foundation modelling (to account for differences in products and circumstances), we assume that such a transition would reduce plastic resins used to produce packaging by around **50%**.

Then, using the 2018 consumption data for each type of plastic resin by the packaging sector in Thailand as reported by the World Bank,[44] we estimate that plastics resins used for packaging could be reduced by **207,550 tonnes** for PET packaging, **340,500 tonnes** for PP packaging, **230,100 tonnes** for HDPE packaging, and **354,100 tonnes** for LDPE/ LLDPE packaging.

In a scenario where Thailand successfully bans PVC and PS, and is able to implement a reuse and refill system and infrastructure, the consumption of plastic resins would fall by **1.88 million tons** - or 20% of Thailand's plastic production in 2018.[45]

Therefore, around 20% of Thailand's annual plastic production can be removed by following criterion 3 of EJF's definition of sustainable production and consumption alone.

It should be further noted that even within the scope of criterion 3, this number is likely an underestimate, since it does not take into account the reuse potential of products outside the packaging sector, nor does it take into account the potential reduction from increased repairability, especially for products such as polyester fabrics.

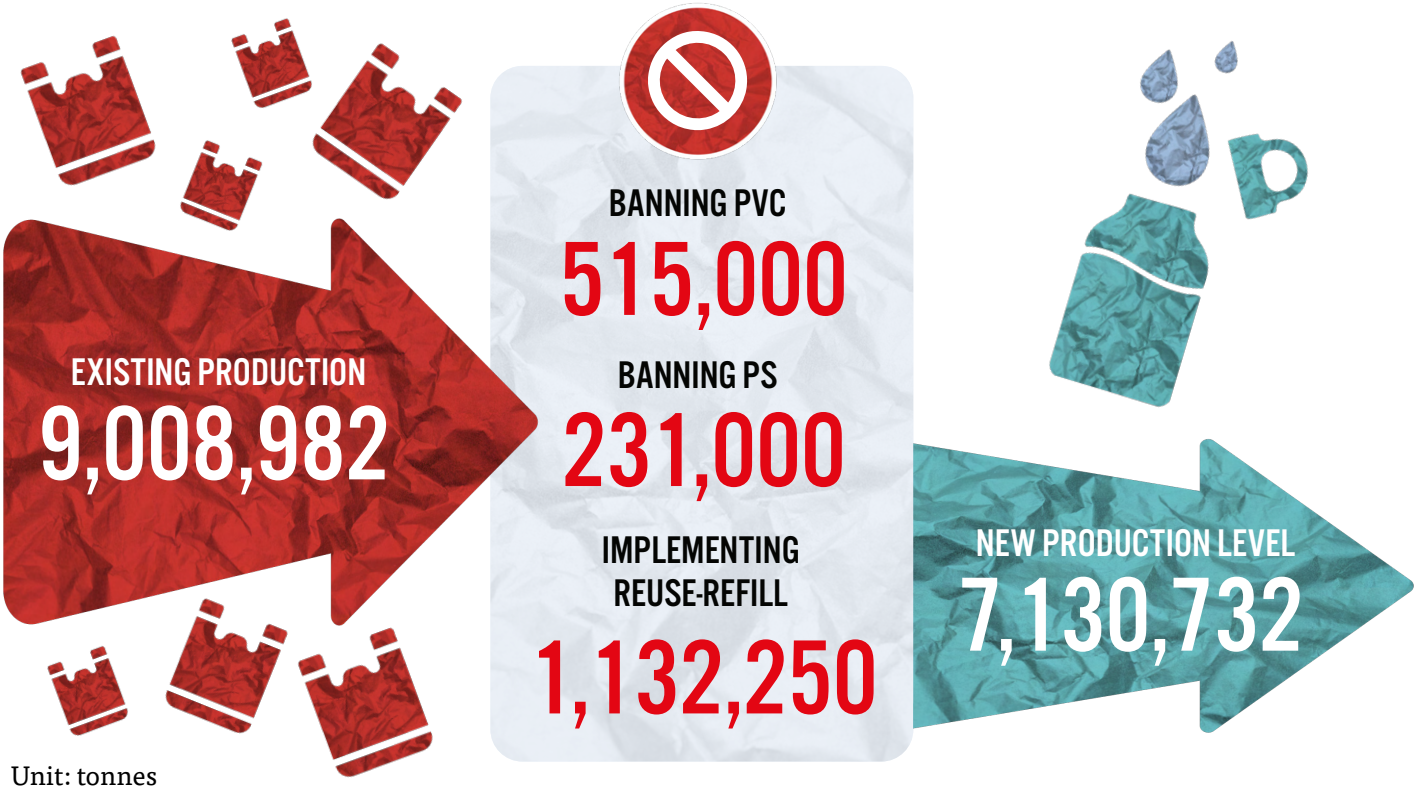
20% REDUCTION SCENARIO

	BUSINESS-AS-USUAL CONSUMPTION	SUGGESTED REDUCTION	PRODUCTION REDUCED BY
PVC	515,000	100%	515,000
PS	231,000	100%	231,000
PET	415,100	50%	207,550
PP	681,000	50%	340,500
HDPE	460,200	50%	230,100
LDPE / LLDPE	708,200	50%	354,100
TOTAL	3,010,500		1,878,250

Unit: tonnes

Another scenario could also be considered: According to the plastic material flow and value chain analysis conducted by Chulalongkorn University under the SEA-Circular program, Thailand's plastic production stood at 7.97 million tonnes in 2019. The analysis notes that resin production for single-use plastics was 2.9 million tonnes.[46] This means that **by setting a target to ban all single-use plastics, Thailand could reduce its plastic production by up to 36%**.

BANNING PVC & PS AND IMPLEMENTING REUSE-REFILL SYSTEMS



Unit: tonnes

BANNING SINGLE-USE PLASTICS

Unit: million tonnes

SINGLE-USE PLASTICS BANNED

NEW PRODUCTION LEVEL

The two scenarios presented in this policy brief are based on two different data sets. In order to more effectively model sustainable production of plastics, the Thai government must work with plastic producers to ensure that information on the current levels of plastic production and its feedstock are made publicly available, with consistent data sets accessible by all sectors of society.

SUCCESS ON THE GROUND: BOTTLE FREE SEAS

In 2023, EJF began a pilot project to reduce the use of single-use plastics in Thailand. **The Bottle Free Seas project** installed 10 water refill stations around Bangkok, in collaboration with the Bangkok Metropolitan Authority (BMA), the private sector, and civil society. Between July 2023 - September 2024, these 10 refill stations were able to **prevent the use of over one million plastic bottles**.

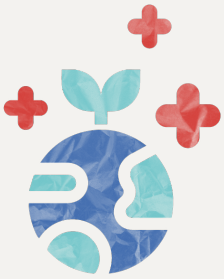
The Bottle Free Seas project represents a proof of concept that goes beyond the above modelling, proving that reduction is possible with an ambitious goal and a multi-stakeholder approach. Given the success of the project, the BMA has already committed to installing a further 200 stations across the city.

A refill station under the Bottle Free Seas project, 2023

CONCLUSION

At past INC meetings, the reduction of primary plastic production has been portrayed as difficult or impossible. While it is a challenging goal, the breaches of the triple planetary crisis, including the clear and present danger of climate change, tell us that **reducing plastic production and consumption to a sustainable level is an urgent mandate for humanity - and it is possible.**

INC-5 presents an opportunity for countries around the world to take up this mandate. **The reduction of plastic production to a sustainable level must be included as a mandatory provision in the ILBI**. This will provide the basis for countries around the world, including Thailand, to enact legislation and action plans to achieve this objective.



As a plastic-producing country, Thailand has a special responsibility to contribute to these efforts to achieve sustainable production. This policy brief has shown that taking such actions would bring Thailand much closer to its climate commitments, which has been one of the key environmental policies of the past and current cabinet. Most importantly, there is great potential for production reduction, and a transition from a single-use culture to a reuse ecosystem is not only a possibility, but a reality that is already taking shape.

RECOMMENDATIONS

EJF RECOMMENDS THAT THE RTG SHOULD:

- Work with delegates at INC-5 to ensure that the ILBI contains provisions to reduce plastic production to a sustainable level.
- Work with delegates at INC-5 to ensure that the ILBI contains provisions to ensure transparency in the plastic and petrochemical supply chain, including mandatory reporting of plastic production quantities to produce baseline data and for future monitoring.
- Work with delegates at INC-5 to ensure that the ILBI contains provisions to eliminate plastic products that fail the safety, sustainability, and essential use criteria.
- Work with delegates at INC-5 to ensure that the ILBI contains provisions for mandatory reuse, refill, and repair systems and infrastructure targets, and guidelines to implement them.
- Work to produce domestic legislation or support existing draft legislations that contain provisions that fulfil the goals in recommendations 1 - 4.
- Eliminate plastics subsidies through a phased out approach, targeting the most damaging plastic polymers and products first. Criteria for determining damage may be drawn from the proposed initial criteria in this brief.
- Instead, divert plastics subsidies to support start-ups and other businesses actively working on promoting and implementing reuse, refill, repair and other reduction-enabling infrastructure across Thailand.
- Work with academics, practitioners, civil society, and all relevant stakeholders to find alternatives to unsafe, unsustainable, and inessential polymers and products. Some of these works may be sector-specific; for instance, engaging healthcare professionals to eliminate PVC from the sector.
- Work with the Plastics Institute of Thailand and other members of the private sector to ensure that data on plastics and petrochemical production is provided to the public in an easily accessible, transparent manner.
- Hold petrochemical companies to account for accidents and impacts that they have on surrounding marine ecosystems, the livelihoods of fishers, local communities, and citizens, and secure access to remedies for those affected throughout the life cycle of plastics, mobilising the ‘polluter pays’ principle.

APPENDIX 1: METHODS AND LIMITATIONS

GHG emissions estimation: To calculate the total GHG emissions from Thailand's primary plastics production, we began by calculating the total GHG emissions for the production of each polymer type, where the production data is available. To calculate the production data for each polymer type in 2019, we used the number for the total plastic resins production as reported by the Plastics Institute of Thailand (PIT) in their 2020 Plastics Facts & Figures report: 9.027 million tonnes or approximately 9.0 million tonnes.[47]

Different sources give different estimates on the proportion of each polymer type for the year 2019, and the PIT report does not provide this proportion for 2019, only the estimated proportion for 2020. Since the report states that the share structure of different plastic resins between these two years are "not different", we multiplied the 2020 estimated proportion of each polymer with the total amount of plastic resins produced in 2019 (9.0 million tonnes) to estimate the production data for each polymer type in 2019. We were able to access the production data for PP, HDPE, LLDPE, LDPE/EVA, and PVC. The rest are grouped under "other".

The TGO's database[48] provides estimates of polymer-specific emission factors for the extraction and production phases of all the five polymers mentioned above. For those grouped under "other", we use the most conservative estimate, which is the emission factor for PP. We also used the TGO's estimate for the emission factor of LDPE for the calculation of the GHG emissions of LDPE/EVA production in Thailand. In both these cases, discrepancies in feedstocks and carbon intensity of each plastics type were a limitation of our estimates. However, for the category of "other", these discrepancies will likely make our calculation an underestimate.

TGO's emission factor for each polymer type covers the phases between extraction and polymerisation. However, unlike LBNL (2024), it excludes the product shaping phase, which accounts for up to 17% of the GHG emission for the estimated global emission factor.

The table below shows the different data used for our calculation.

Polymer type	Emission factor according to TGO (tCO2e/t)	Estimated share structure of each polymer type for 2020 (assumed to be the same as 2019) (%)	Estimated 2019 production data for Thailand (million t) Column D percentage multiply by total plastic production in 2019 (9.027 million t)	Polymer-specific GHG emission (million tCO2e)
PP	1.88	23.7	2.14	4.03
HDPE	6.71	21.2	1.91	12.83
LLDPE	2.13	18.5	1.67	3.57
LDPE/EVA (use LDPE's emission factor)	2.63	6.5	0.59	1.54
PVC	2.13	9.7	0.88	1.87
Others (use PP's as conservative estimate)	1.88	20.4	1.84	3.46
Estimated total GHG emissions from primary plastics production in Thailand for 2019				27.30
Percentage to Thailand's GHG emission (372.71686 million tCO2e) [49]				7.32%

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