PLACES
Plastic Lifecycle Assessment Calculator for the Environment and Society

The Circulate Initiative

Frequently Asked Questions

GENERAL INFORMATION

1. What is PLACES or the Plastic Lifecycle Assessment Calculator for the Environment and Society?

PLACES is the first tool of its kind offering users the ability to assess the climate impact of current waste management practices in India and Indonesia, from open burning to recycling.

The open-access calculator tracks the greenhouse gas (GHG) emissions reductions, energy savings and water savings of waste management and recycling solutions that prevent plastic pollution in six countries – India, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. The tool allows users to calculate carbon savings based on various plastic polymers, tonnes of plastic waste, and different end-of-life (EOL) fates.

2. Who are the contributors to the development of PLACES?

PLACES has been developed by The Circulate Initiative in partnership with the Singapore Institute of Manufacturing Technology (SIMTech), Agency for Science, Technology and Research (A*STAR).

3. What was the background to developing the tool?

As investors, governments, and other actors make bigger commitments of resources towards solving the ocean plastics crisis, they must understand the scale and nature of the problem, as well as the impact of efforts to address it. Critically, decision-makers need tools that help them to focus on solutions that not only prevent plastic leakage, but also reduce emissions and align with global climate goals.

Tools, such as the US Environmental Protection Agency's Waste Reduction Model (WARM), have provided useful guidance in developed markets, but none are built on assumptions appropriate to waste management in emerging markets. For investors and project developers in South and Southeast Asia, as well as developing island nations, there is insufficient research and data available at the local levels (i.e., national, jurisdictional or project-specific) on emissions reductions and other environmental benefits of alternative waste management practices. Furthermore, the data and research that exist are largely inaccessible to cities, private investors, operators, and other interested parties. A credible, accessible, easy-to-use tool is needed to shed light on the impact potential of different interventions in emerging markets.

4. What are some of the other available resources that relate to PLACES?

The report "The climate benefits of plastic waste management in India and Southeast Asia" provides insights and key highlights of the climate benefits of investing in waste management and plastics recycling with data from PLACES.

Other resources including a summary of the technical findings for all six countries and a list of sources used for the study are available in the Resources section of this page here.

The findings from the research conducted in 2020 for India and Indonesia was published in the journal *Resources, Conservation & Recycling* and is available here.

5. What are the future plans for PLACES?

We are considering expanding PLACES by adding new regions and markets, including country-specific environmental impacts of plastic production, processing, and use, as well as exploring other impacts of plastic waste EOL management, such as human health and ecotoxicity.

If you would like to suggest ideas to develop PLACES, please email places@thecirculateinitiative.org.

6. Can I cite data from PLACES?

Yes, please attribute all data citations to "Source: The Circulate Initiative's Plastic Lifecycle Assessment Calculator for the Environment and Society (PLACES)" and direct audiences back to the website.

FUNCTION

7. What is the scope of the tool?

PLACES and the associated study include downstream plastic waste treatment from collection of plastic waste to final EOL scenarios. The resulting environmental savings from by-products and avoided production of virgin plastic, as well as avoided fuel usage in cement kilns and avoided electricity production from the grid to power waste-to-energy (WTE) plants, were accounted for through the study. The plastic waste flow was mapped based on country-specific data.

8. Why is the tool important and for whom?

The tool enables investors, waste management operators, governments, entrepreneurs, and other players in the ecosystem to integrate climate science into decision-making, set climate objectives, progress towards these objectives, and demonstrate the effectiveness of leveraging recycling to low-carbon investment portfolios.

Quantifying the environmental impact of the plastic waste treatment system in each of the six countries included in this study provides a baseline to better understand the environmental savings of investment in plastic waste recycling and other waste management solutions.

9. What can the tool do?

PLACES focuses on quantifying the impact of four plastic types (HDPE, LDPE, PP, and PET), which together make up the majority of plastic waste in the six countries. In addition, the "generic" category reflects all mixed plastic waste materials based on the status-quo composition for each country.

The tool computes the environmental benefit of recycling compared to different EOL scenarios – open dumps, open burning, co-processing at cement kilns, incineration (with or without WTE), and sanitary landfills. "Default EOL fate" represents the current EOL for plastic waste identified by mapping material flow based on country-specific data.

10. What are the uses of PLACES?

PLACES can be used for scenario modeling to inform plastic waste management and recycling decisions at a system level. For example, mapping the carbon-related impact of a strategic shift towards plastic WTE across the

region (modeled based on announced projects by the government) indicates that this will contribute to higher carbon emissions compared to the current baseline.

11. What are the limitations of the tool?

Note that this is a first attempt at assessing whether there is a positive or negative greenhouse gas impact to diverting plastic waste from the environment through recycling interventions. This tool does not inform the sole benefits of recycled plastic over virgin materials or other material alternatives, nor does it consider other forms of circular economy solutions such as refill/ reuse solutions. The tool looks at downstream plastic waste treatment from collection of plastic waste to final EOL scenarios, and thus the impact due to the production and usage of plastics is not taken into account in the associated study and PLACES.

EOL scenarios are limited to recycling, open dumps, open burning, sanitary landfills, co-processing at cement kilns and incineration (with or without WTE recovery). Chemical recycling and other advanced technologies are not considered, as there is little-to-no data on operational plants for these technologies in the six countries. The impact of exported plastic waste is also not taken into account in the associated study and PLACES.

12. How easy is this calculator to use? Do you need expertise in an area to be able to use it?

The user interface has been simplified and set up for ease of use by all users. While basic knowledge of the various polymer types and EOL states are beneficial, the user does not have to be an expert in Life Cycle Assessment (LCA) methodologies to interpret the results.

13. Can I use PLACES data for other countries for which data is currently unavailable but has similar EOL for plastic waste?

Due to the unique mix of polymer shares and EOL fates, and different practices in plastic waste collection and processing in each country, PLACES results may not accurately represent the other countries for which data is currently unavailable.

14. Can I use PLACES to determine the environmental impact of multi-layered plastics waste management from GHG emissions, energy and water savings perspectives?

PLACES covers the four plastic types commonly found (HDPE, LDPE, PP and PET). While multi-layered plastics have not been quantified specifically, the environmental impact can be estimated by using the “generic” plastic waste type in the calculator. “Generic” plastic waste refers to all plastic materials based on the waste composition for that country in the year of reference.

15. Can the tool be used to apply for carbon credits for GHG protocol?

PLACES estimates life-cycle GHG emissions associated with material EOL fates in a systems-based approach; it is not a GHG inventory tool. Carbon Credit Mechanisms adopt an accounting protocol known as the GHG Protocol, which involves the development of a carbon inventory based on a single location over a designated time frame. Emission savings from PLACES are likely outside of these boundaries and refer only to specific quantities rather than quantities over a period of time. In addition carbon credits require accounting for the use-phase of the material (i.e. the product). The use-phase of a material is not currently incorporated into PLACES.

Additionally, PLACES considers a consequential LCA which takes into account the avoided production of plastics which is not aligned with the GHG Protocol.

However, the data in PLACES could be used by companies to build their own reporting tool and incorporate a materials inventory to conduct formal carbon footprinting and emissions analysis for both carbon credits and/or Science Based Targets. This would require individual customization to reconcile the data sets to be specific to a company's Scope 1, Scope 2, and Scope 3 boundaries and remove the generalities in the tool.

16. How can the GHG savings derived from PLACES be used for reporting purposes?

The GHG emissions data derived from PLACES can be used for planning, setting targets, and measuring results of anticipated GHG reduction. These should be reported as estimates and provided with the comparison of the baseline scenario. The PLACES emissions data is intended to help organizations take action themselves to manage and reduce emissions. It is not a commercial tool.

17. Can I provide feedback on the tool?

Absolutely! We recognize this is an initial attempt at quantifying a complex and difficult concept. We invite stakeholders to share their feedback and perspectives on this work to help us improve for future versions. You can submit your feedback through this email: places@thecirculateinitiative.org.

RESEARCH METHODOLOGY

18. What research methodology was adopted for developing the tool?

The tool was created in partnership with SIMTech, A*STAR using Consequential Life Cycle Assessment modeling developed with ISO 14040/14044 standards.

Peer review support was provided by members of The Circulate Initiative's Impact Metrics Working Group and country experts on plastic waste management and recycling.

19. What was the rationale behind selecting the six countries (India, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam)?

These six countries represent major markets in South and Southeast Asia where plastic waste contributions are significant today, with 86% of the plastic released into the ocean being contributed by rivers in Asia.[1] The plastic waste in these countries is also forecast to grow in the coming decades due to growth of the consumer class and higher urbanization rates of medium-sized cities.

20. When was the research conducted?

The study was conducted between 2022 and 2023 with the results based on the best data available at that time for each country.

[1] Lebreton, L., Van der Zwet, J., Damsteeg, JW., et al. (2017). River plastic emissions to the world's oceans. *Nat Commun 8, 15611* [online]. Available from: https://doi.org/10.1038/ncomms15611

21. What are the factors for which global averages have been used in this LCA study and how different are these from local data sets?

The latest available local data sets have been used wherever possible. These include the plastic waste mix, EOL fates, and electricity mix for each country to name but a few. For parameters where local data may not be available, global averages or assumptions (see Key Assumptions section) are used. For example, for WtE, the polymer-specific ecoinvent entries for treatment of plastic waste in municipal incineration, Rest of World (RoW) were used in the absence of country-specific data and the technology and geography parameters are as reported by ecoinvent for RoW.

22. What are the definitions of the key terms used in PLACES?

A glossary of the main terms used in the tool is provided below.

Term	Description
Carbon Footprint	The emission of greenhouse gasses associated with a specific material or activity.
Consequential Approach	A system modeling approach in which activities in a product system are linked so that activities are included in the product system to the extent that they are expected to change as a consequence of a change in demand for the functional unit.
Default end-of-life (EOL) Fates	Represents the baseline EOL pathways for plastic waste identified by mapping material flow based on country-specific data.
Energy Consumption	The total amount of energy used in the course of various EOL fates, and sourced from different renewable and non-renewable energy sources, including fossil fuels and biomass.
Generic	All plastic materials based on the waste composition for that country in the year of reference.
HDPE	High-density polyethylene, commonly used in milk bottles, detergent, shampoo bottles, and juice bottles.
Investment Tonnage	Represents the weight (in metric tonnes) of the different types of polymers diverted from different EOL fates due to the current/proposed recycling intervention.
LDPE	Low-density polyethylene, commonly used in shopping and garbage bags, plastic wrapping, and packaging films.
PET	Polyethylene terephthalate, commonly used in clear soft drink bottles, cups, and cooking oil bottles.
PP	Polypropylene, commonly used in food containers, straws, automotive parts, and bottle caps.

Water Consumption	The amount of water that evaporates, is disposed of in water bodies, or incorporated in products.

KEY ASSUMPTIONS AND SYSTEM BOUNDARIES

23. What are some of the key assumptions that have been considered for India?

Following are some of the key assumptions that have been considered for the research for India. These assumptions are based on literature review. More details can be found in the summary report included in the Resources section of the page here.

- The proportion of plastic waste recycled by informal and formal sectors for each polymer type is assumed to be 99% informal, 1% formal.
- All landfills and dumpsites in India are assumed to be open dumps due to the lack of landfills operating under sanitary conditions in India.
- 10% of plastic waste in open dumps is openly burnt.
- The average transport distance is 5 km between collection and informal sorting, 15 km between collection and formal sorting, 50 km between sorting facility and recycling plant, 15 km between collection and open dumps, and 30 km between collection and WTE plants.
- There is no imported plastic waste – India has banned the import of plastic waste since August 2019.
- For uncollected waste, it is assumed that no transport is involved.
- Every kilogram of recycled plastic is assumed to lead to an avoided production of 0.5 kg of virgin plastic.
- Every kilogram of recycled plastic used in road construction is assumed to lead to 1 kg of avoided bitumen production.
- For the use of plastic waste to replace coal as fuel in cement kilns, the calorific values of each plastic waste type were used to determine the replacement ratio of coal.

24. What are some of the key data points that have been considered for India?

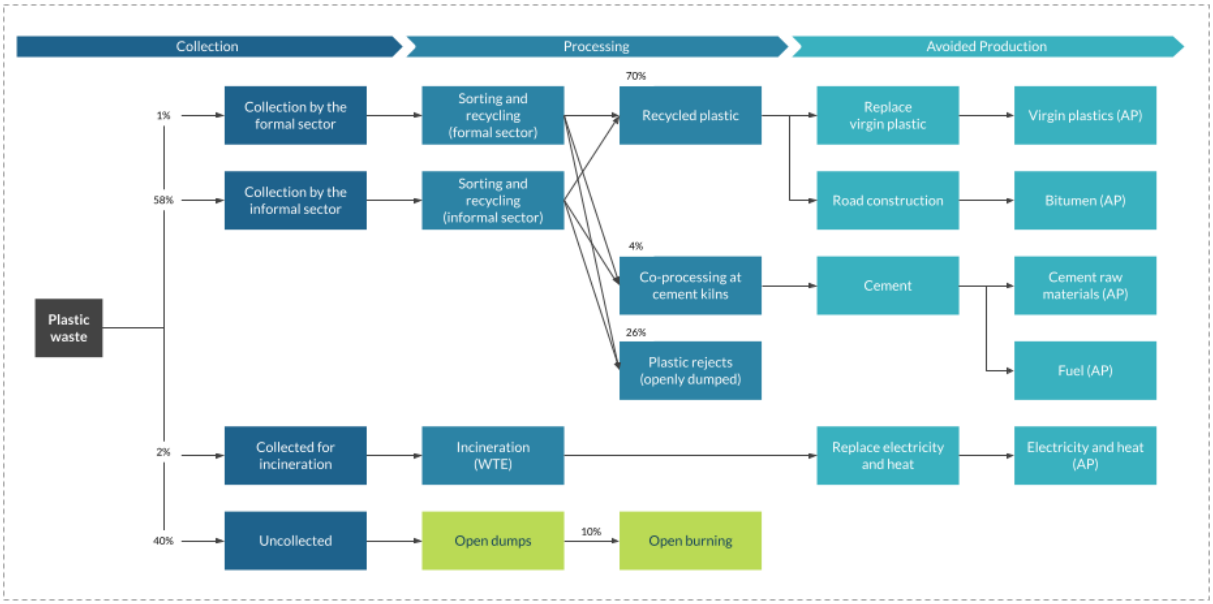
- Breakdown of recycling rates for the different plastic types:

Polymer type	Plastic waste (MT) (Source: Baynes et al., 2021)	Collected for recycling (%) (Source: Baynes et al., 2021)	Collected for recycling (MT)
PP	2.67	47.7%	1.27
HDPE	1.33	49.7%	0.66
LDPE	1.63	49.7%	0.81
PET	3.23	89.5%	2.89

Others	0.87	10.0%	0.09
Total	**9.73**		**5.72**

25. What is the system boundary for India?

Modeled System Boundary for India: Existing Waste Management (Default EOL Fates)



26. What are some of the key assumptions that have been considered for Indonesia?

Following are some of the key assumptions that have been considered for the research for Indonesia. These assumptions are based on literature review. More details can be found in the summary report included in the Resources section of the page here.

- The recycling rate for each plastic type is estimated from the breakdown of plastic types received by plastics aggregators in Java Island, based on the total collected for recycling rate of 14.5%.
- The EOL fates for recycling rejects are weighted to the three other EOL fates (Sanitary Landfill, Open Dumps, and Open Burning).
- Based on the year of reference, there were no commercial-scale incineration or WTE facilities.
- The average transport distance is 20 km between collection and all facilities.
- For uncollected waste, it is assumed that no transport is involved.

- The average plastic waste import distance is modeled as the distance between the top plastic waste import partner, the Marshall Islands, and Indonesia. Plastic waste is assumed to be shipped from the largest port in each country (based on the cargo volume handled) in the year of reference. Sea transport is assumed.
- Every kilogram of recycled plastic is assumed to lead to an avoided production of 0.5 kg of virgin plastic.
- Every kilogram of recycled plastic used in road construction is assumed to lead to 1 kg of avoided bitumen production.

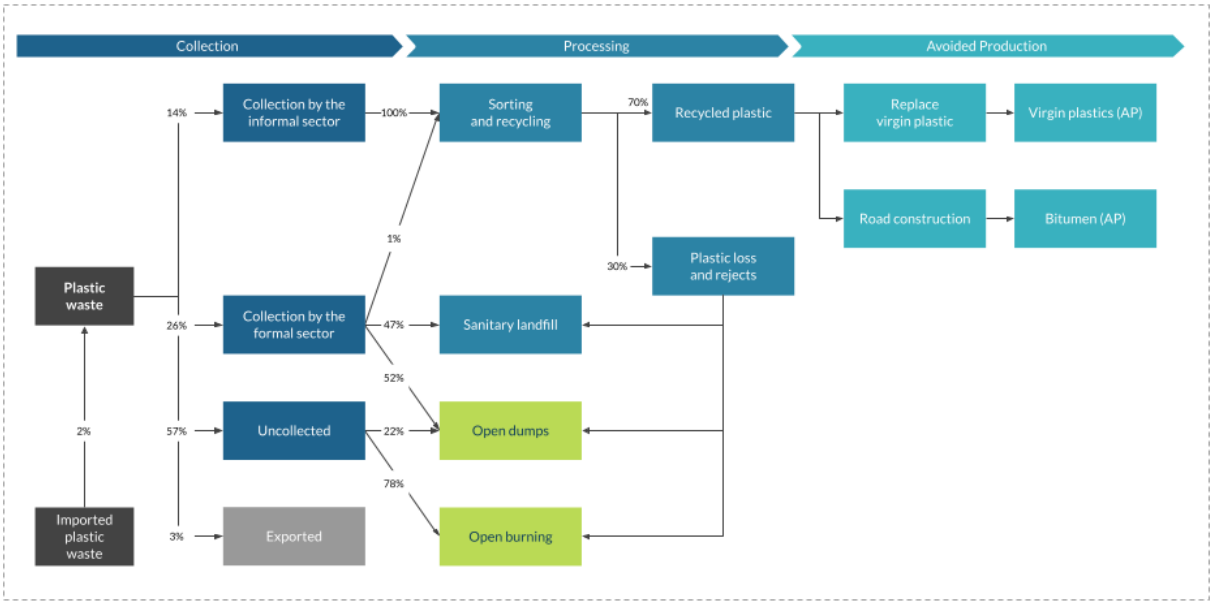
27. What are some of the key data points that have been considered for Indonesia?

- Breakdown of recycling rates for the different plastic types:

Polymer type	Plastic waste (MT) (Source: Ministry of Environment and Forestry, 2020; World Bank, 2021)	Proportion of plastic collected by aggregators in Java Island (Source: Darus et al., 2020)	Overall collected for recycling rate (Source: World Bank, 2021)	Collected for recycling (MT)	% plastic waste that is collected for recycling
PP	2.41	34%		0.38	16%
HDPE	1.18	34%		0.38	32%
LDPE	1.46	3%		0.03	2%
PET	0.94	20%		0.22	24%
Others	1.77	9%		0.10	6%
Total	**7.76**	**100%**	**14.5%**	**1.12**	

28. What is the system boundary for Indonesia?

Modeled System Boundary for Indonesia: Existing Waste Management (Default EOL Fates)



29. What are some of the key assumptions that have been considered for Malaysia?

Following are some of the key assumptions that have been considered for the research for Malaysia. These assumptions are based on literature review. More details can be found in the summary report included in the Resources section of the page here.

- There is no available data on collection rates in Malaysia.
- Each polymer's EOL fates are assumed to follow the same proportions as the EOL fates for all plastics in Malaysia, except the polymer-specific recycling rate.
- The recycling rate for "Other plastics" is assumed to be the average of the "Other plastics" recycling rates of Thailand, the Philippines, and Vietnam.
- The EOL fates for recycling rejects are weighted to the four other EOL fates (Sanitary Landfill, Incineration, Open Dumps, and Open Burning) for Malaysia.
- Based on the year of reference, incineration with WTE recovery, co-processing at cement kilns, and use of plastic scrap in road construction were not significant in Malaysia.
- The average transport distances between collection of plastic waste and recycling plant (60 km), between collection and sanitary or unsanitary landfills (50 km), and between collection and incineration plant (60 km) are assumed to be the same transport distances for the respective EOL fates in Vietnam, due to a similar proportion of collected waste streams (Incineration and Sanitary Landfills).
- For uncollected waste, it is assumed that no transport is involved.
- The average plastic waste import distance is modeled as the distance between the top three plastic waste import partners (USA, Japan, and Germany) and Malaysia. Plastic waste is assumed to be shipped from the largest port in each country (based on the cargo volume handled) in the year of reference. Sea transport is assumed.
- Every kilogram of recycled plastic is assumed to lead to an avoided production of 0.5 kg of virgin plastic.

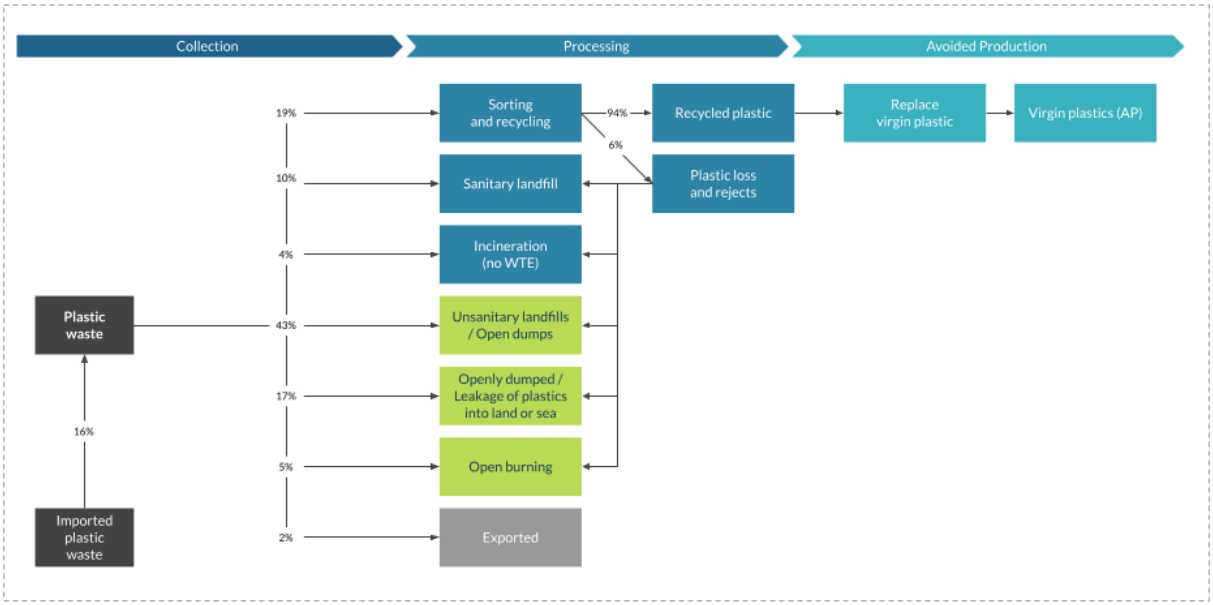
30. What are some of the key data points that have been considered for Malaysia?

- Breakdown of recycling rates for the different plastic types:

Polymer type	Plastic waste (MT) (Source: World Bank, 2021)	Plastic recycling rate (%) (Source: World Bank, 2021)	Plastics recycled (MT)
PP	0.43	30%	0.13
HDPE	0.43	28%	0.12
LDPE	0.37	10%	0.04
PET	0.18	29%	0.05
Others	0.40	3%	0.01
Total	**1.81**		**0.35**

31. What is the system boundary for Malaysia?

Modeled System Boundary for Malaysia: Existing Waste Management (Default EOL Fates)



32. What are some of the key assumptions that have been considered for the Philippines?

Following are some of the key assumptions that have been considered for the research for the Philippines. These assumptions are based on literature review. More details can be found in the summary report included in the Resources section of the page here.

- The plastic waste EOL fates and proportion for each EOL fate were assumed to follow that of packaging waste.
- The transport distance to recycling and co-processing at cement kilns in the Philippines is assumed to be the same as the transport distance for recycling in Vietnam (60 km), due to similar collection rates and urban-to-rural disparity in collection rates.
- Transport for recycling is assumed to be all by land. Based on consultations with experts from the Philippines, most recycling plants are situated on the main island of Luzon.
- For uncollected waste, it is assumed that no transport is involved.
- The average plastic waste import distance is modeled as the distance between the top plastic waste import partner, the USA, and the Philippines. Plastic waste is assumed to be shipped from the largest port in each country (based on the cargo volume handled) in the year of reference. Sea transport is assumed.
- Every kilogram of recycled plastic is assumed to lead to an avoided production of 0.5 kg of virgin plastic.
- For the use of plastic waste to replace coal as fuel in cement kilns, the calorific values of each plastic waste type were used to determine the replacement ratio of coal.

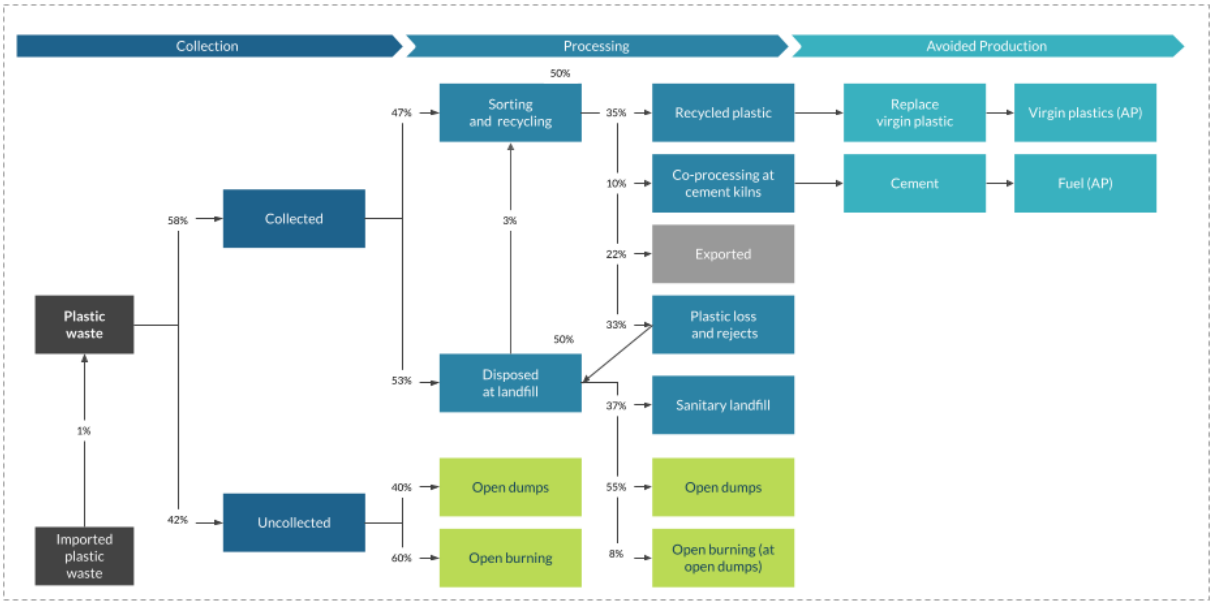
33. What are some of the key data points that have been considered for the Philippines?

- Breakdown of recycling rates for the different plastic types:

Polymer type	Plastic waste (MT) (Source: WWF, 2020)	Plastics recycled (MT) (Source: WWF, 2020)	% plastic waste recycled
PP	0.39	0.078	20%
HDPE	0.22	0.044	20%
LDPE	0.24	0.000	0%
PET	0.24	0.061	25%
Others	0.73	0.000	0%
Total	**1.82**	**0.183**	

34. What is the system boundary for the Philippines?

Modeled System Boundary for the Philippines: Existing Waste Management (Default EOL Fates)



35. What are some of the key assumptions that have been considered for Thailand?

Following are some of the key assumptions that have been considered for the research for Thailand. These assumptions are based on literature review. More details can be found in the summary report included in the Resources section of the page here.

- The formal and informal collection rates of total recycled plastic waste are assumed to be the same as those of packaging plastic waste (85.9% of collected plastic waste is through the formal sector, 14.1% informal). All informally collected plastic waste is assumed to be for recycling.
- The EOL fates for recycling rejects are weighted to the four other EOL fates (Sanitary Landfill, Incineration with WTE, Open Dumps, and Open Burning) for Thailand.
- Based on the year of reference, co-processing at cement kilns and use of plastic scrap in road construction were not significant in Thailand.
- For uncollected waste, it is assumed that no transport is involved.
- The average plastic waste import distance is modeled as the distance between the top plastic waste import partner, Japan, and Thailand. Plastic waste is assumed to be shipped from the largest port in each country (based on the cargo volume handled) in the year of reference. Sea transport is assumed.
- Every kilogram of recycled plastic is assumed to lead to an avoided production of 0.5 kg of virgin plastic.

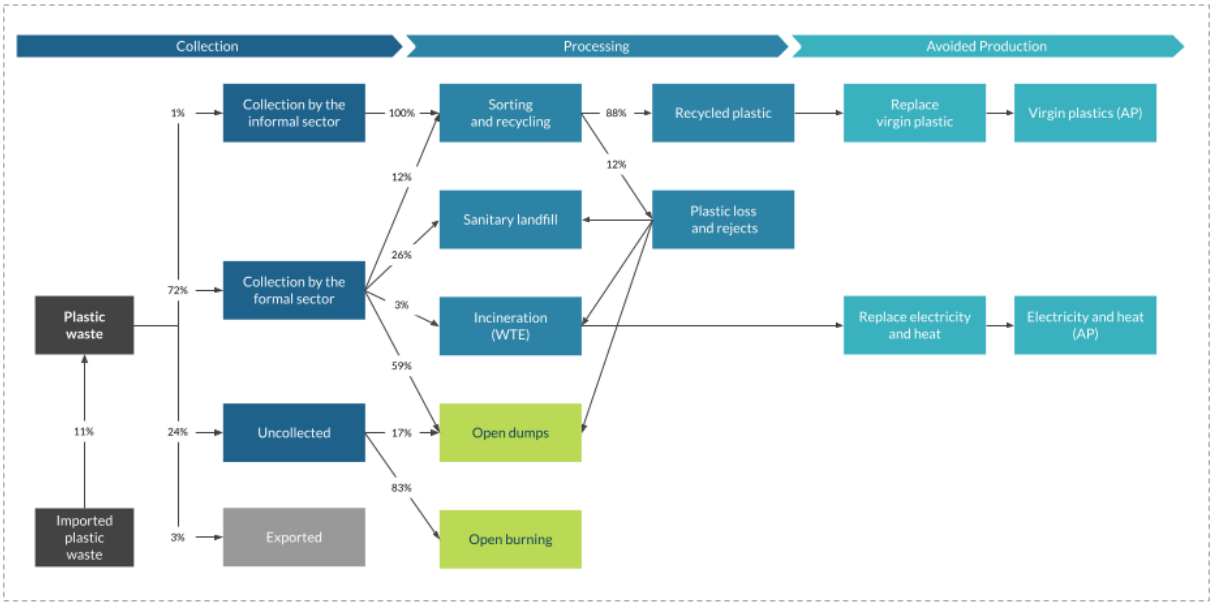
36. What are some of the key data points that have been considered for Thailand?

- Breakdown of recycling rates for the different plastic types:

Polymer type	Plastic waste (MT) (Source: IUCN, 2020)	% plastic waste collected for recycling (Source: IUCN, 2020)	Collected for recycling (MT)
PP	0.41	22%	0.09
HDPE	0.83	14%	0.12
LDPE	1.60	0%	0.00
PET	1.30	16%	0.21
Others	1.03	8%	0.08
Total	**5.16**		**0.50**

37. What is the system boundary for Thailand?

Modeled System Boundary for Thailand: Existing Waste Management (Default EOL Fates)



38. What are some of the key assumptions that have been considered for Vietnam?

Following are some of the key assumptions that have been considered for the research for Vietnam. These assumptions are based on literature review. More details can be found in the summary report included in the Resources section of the page here.

- The informal collection rate and the other numbers that are affected by the informal collection rate are presented as a range due to uncertainties around whether the 5% informal collection rate obtained from data sources accurately reflects the local realities for the whole of Vietnam. However, based on a sensitivity analysis on the extremes of these ranges, since the effect on the LCA analysis results is not significant, the LCA calculations in the study utilize the informal collection rate of 5% based on existing data sources.
- The proportion of plastic waste recycled by informal and formal sectors for each polymer type is assumed to follow the national figures of 2018 (33% is collected through the formal sector, 67% informal). All informally collected plastic waste is assumed to be for recycling.
- The incineration rate of formally collected plastic waste is assumed to be the same as the incineration rate for municipal solid waste (13% of collected plastic waste).
- The national average of the proportion of all landfills being sanitary or unsanitary (open dump) is assumed to be the same as urban areas (31% of landfills in Vietnam are sanitary, 69% unsanitary).
- The open dump rate of formally collected plastic waste excludes an unknown quantity of waste disposed of at unverified dumpsites, which is included under “Uncollected,” as defined by the data source.

- The EOL fate for recycling rejects is weighted to the four other EOL fates (Sanitary Landfill, Incineration, Open Dumps, and Open Burning) for Vietnam.
- Based on the year of reference, incineration with WTE recovery, co-processing in cement kilns, and use of plastic scrap in road construction were not significant.
- The average transport distances between collection of plastic waste and recycling plant (60 km), between collection and sanitary or unsanitary landfills (50 km), and between collection and incineration plant (60 km) are assumed to be the same as Hanoi.
- For uncollected waste, it is assumed that no transport is involved.
- The average plastic waste import distance is modeled as the distance between the top plastic waste import partner, Japan, and Vietnam. Plastic waste is assumed to be shipped from the largest port in each country (based on the cargo volume handled) in the year of reference. Sea transport is assumed.
- Every kilogram of recycled plastic is assumed to lead to an avoided production of 0.5 kg of virgin plastic.

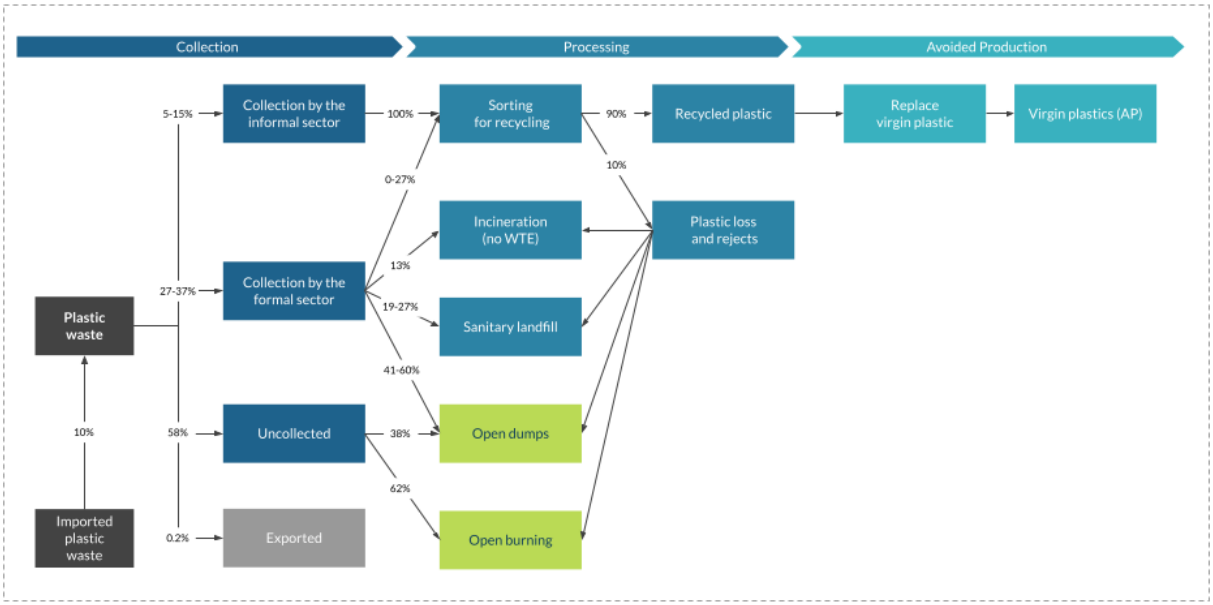
39. What are some of the key data points that have been considered for Vietnam?

- Breakdown of recycling rates for the different plastic types:

Polymer type	Plastic waste (MT) (Source: IUCN, 2020)	% plastic waste collected for recycling (Source: IUCN, 2020)	Collected for recycling (MT)
PP	1.15	5%	0.06
HDPE	0.43	16%	0.07
LDPE	1.53	38%	0.58
PET	1.97	9%	0.18
Others	1.11	3%	0.03
Total	**6.18**		**0.92**

40. What is the system boundary for Vietnam?

Modeled System Boundary for Vietnam: Existing Waste Management (Default EOL Fates)



INTERPRETATION OF THE RESULTS

41. What is the "carbon footprint" included in the results and how should it be interpreted?

Carbon footprint measures the emission of GHG (carbon dioxide equivalent) associated with a specific material or activity. This includes the energy used and transportation during the processing activities.

A positive number for carbon footprint represents the carbon dioxide equivalent from all GHG emissions generated from activities that are harmful to the environment. A negative number means a potential offset of emissions to the environment.

42. What is the "energy consumption" included in the results and how should it be interpreted?

Energy consumption indicates the total amount of energy used in the course of various EOL fates, and sourced from different renewable and non-renewable energy sources, including fossil fuels and biomass. Depending on the energy sources and consumption, this can be a large contributor to the carbon footprint.

A positive number for energy consumption represents the use of energy that depletes these energy sources. A negative number represents potential generation or offsetting the use of energy from the system.

43. What is the "water consumption" included in the results and how should it be interpreted?

Water consumption measures the amount of water that evaporates, is disposed of in water bodies, or incorporated in products.

A positive number for water consumption represents the use of water, which reduces water availability. A negative number represents potential generation or offsetting the use of water from the system.

44. What is "initial environmental impact" and how is it calculated?

"Initial environmental impact" refers to the environmental impact of plastic waste going to the original EOL fate. It is obtained by calculating the environmental impact generated by the original EOL fate, from which plastic waste would be diverted. The tonnes of polymer are multiplied by the relevant environmental impact factors to obtain the result.

Users can choose from the following list of EOL scenarios to divert their waste:

India	Indonesia	Malaysia	Philippines	Thailand	Vietnam
Default EOL Fates	Default EOL Fates	Default EOL Fates	Default EOL Fates	Default EOL Fates	Default EOL Fates
100% Open Dumps	100% Open Dumps	100% Open Dumps	100% Open Dumps	100% Open Dumps	100% Open Dumps
100% Open Burning	100% Open Burning	100% Open Burning	100% Open Burning	100% Open Burning	100% Open Burning
100% Incineration (with WTE)		100% Incineration (without WTE)		100% Incineration (with WTE)	100% Incineration (without WTE)
	100% Sanitary Landfill	100% Sanitary Landfill	100% Sanitary Landfill	100% Sanitary Landfill	100% Sanitary Landfill
100% Cement Kilns			100% Cement Kilns		

45. What is "recycling environmental impact" and how is it calculated?

"Recycling environmental impact" refers to the environmental impact of recycling the plastic waste, including the impact from waste processing, transport, and savings from avoided production of virgin polymers and other products when plastics are recycled. The tonnes of polymer recycled will be multiplied by the relevant environmental impact factors to obtain the result.

46. What is "environmental savings" and how should the results be interpreted?

"Environmental savings" refers to the cumulative environmental impact of the avoided impact from diverting plastic waste from the original EOL fate and the recycling environmental impact. It is calculated by subtracting the "Recycling Environmental Impact" values from "Initial Environmental Impact". Calculations will display the resulting (net) GHG emissions, energy consumption, and water consumption for each polymer.

A negative result under "carbon footprint," for example, means that the carbon footprint of recycling operations is greater than the GHG benefit of diverting plastics from the original EOL fate.

47. Why is there a negative value for carbon footprint, energy consumption, and water consumption in the initial environmental impact and recycling environmental impact?

The calculator accounts for sources of emissions (i.e., burning of plastic waste) and emission sinks (i.e., avoided consumption of electricity or fuel). A negative value indicates that the selected management practice results in the net reduction or avoidance of carbon emissions, energy, and water from a life-cycle perspective.

48. Can I determine how much carbon I am reducing by sending plastic waste to a certain EOL fate, such as co-processing at cement kilns?

PLACES can calculate the amount of avoided environmental impact by diverting the plastic waste from a particular EOL fate ("Initial Environmental Impact" figure). However, PLACES is unable to calculate the environmental impact of sending the plastic waste from that particular EOL fate to another EOL fate, except for recycling.

49. Is the environmental impact of virgin plastic production included in the output?

The embodied environmental impact for production of virgin plastics is not included. For this study, the upstream raw material extraction and production of plastics have been excluded, as these processes are common across all plastics, regardless of their EOL fates. This allows the study to focus solely on comparing the impact of waste collection and treatment.

50. Why are the results different for all countries?

The results differ due to the difference in polymer share, assumptions (including transport distances between collection of plastic waste, and different recycling and disposal facilities), EOL fates, and practices in plastic waste collection and processing in each country. The country's electricity mix/energy grid can also contribute to the different results.

51. Why is there a difference in results between the first version of the calculator and the updated India and Indonesia calculator?

The data for plastic waste generated, polymer share, and their EOL fates have been updated based on the latest data available. The results are therefore different in this version compared to the previous one.

Amongst other factors contributing to the difference in results is the update to the emissions factors from the previous database (Ecoinvent v3.6, 2019) to the current database (Ecoinvent v3.9, 2022), which are generally slightly higher across the board. Avoided heat from plastics sent to incineration with WTE capability has been included in the updated calculations for India. For Indonesia, the impact due to sea transport is also lower in the current version as the sea transport distance for plastic waste imports is shorter and there is a lower percentage of imports.