OECD'S GLOBAL PLASTIC OUTLOOKS: MODELLING PLASTICS PRODUCTION & POLLUTION

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Workshop on Data and Harmonization to Improve the Circularity of Plastics
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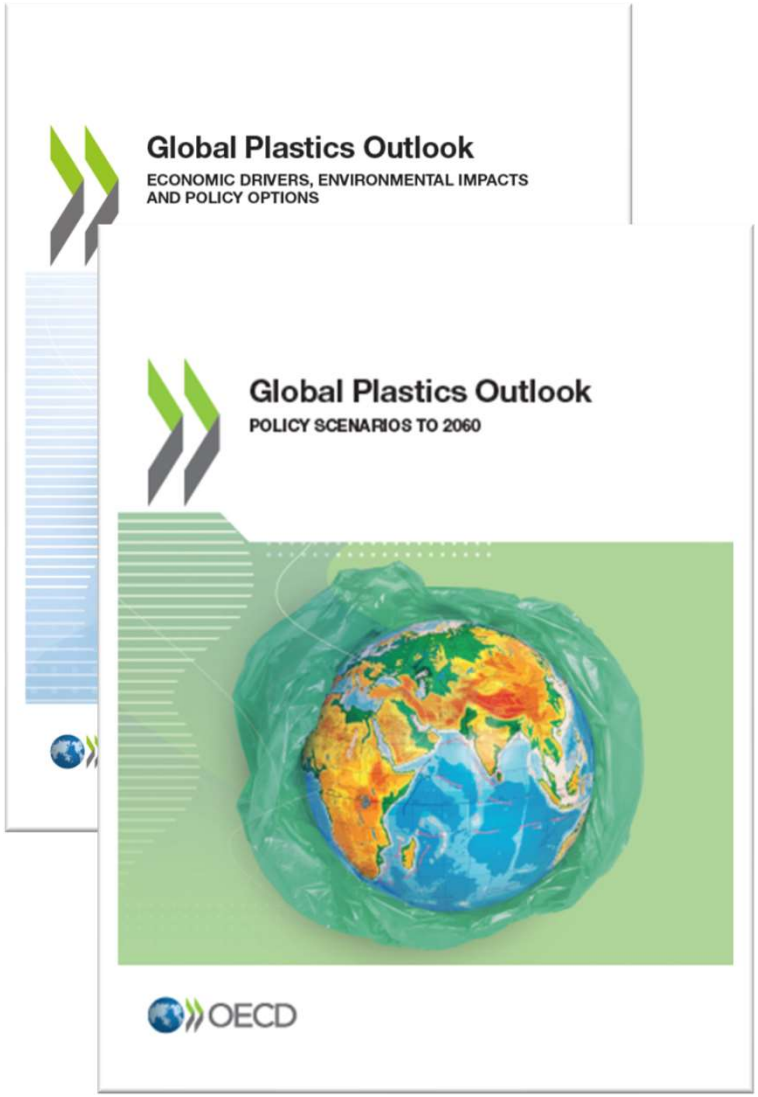
BETTER POLICIES FOR BETTER LIVES

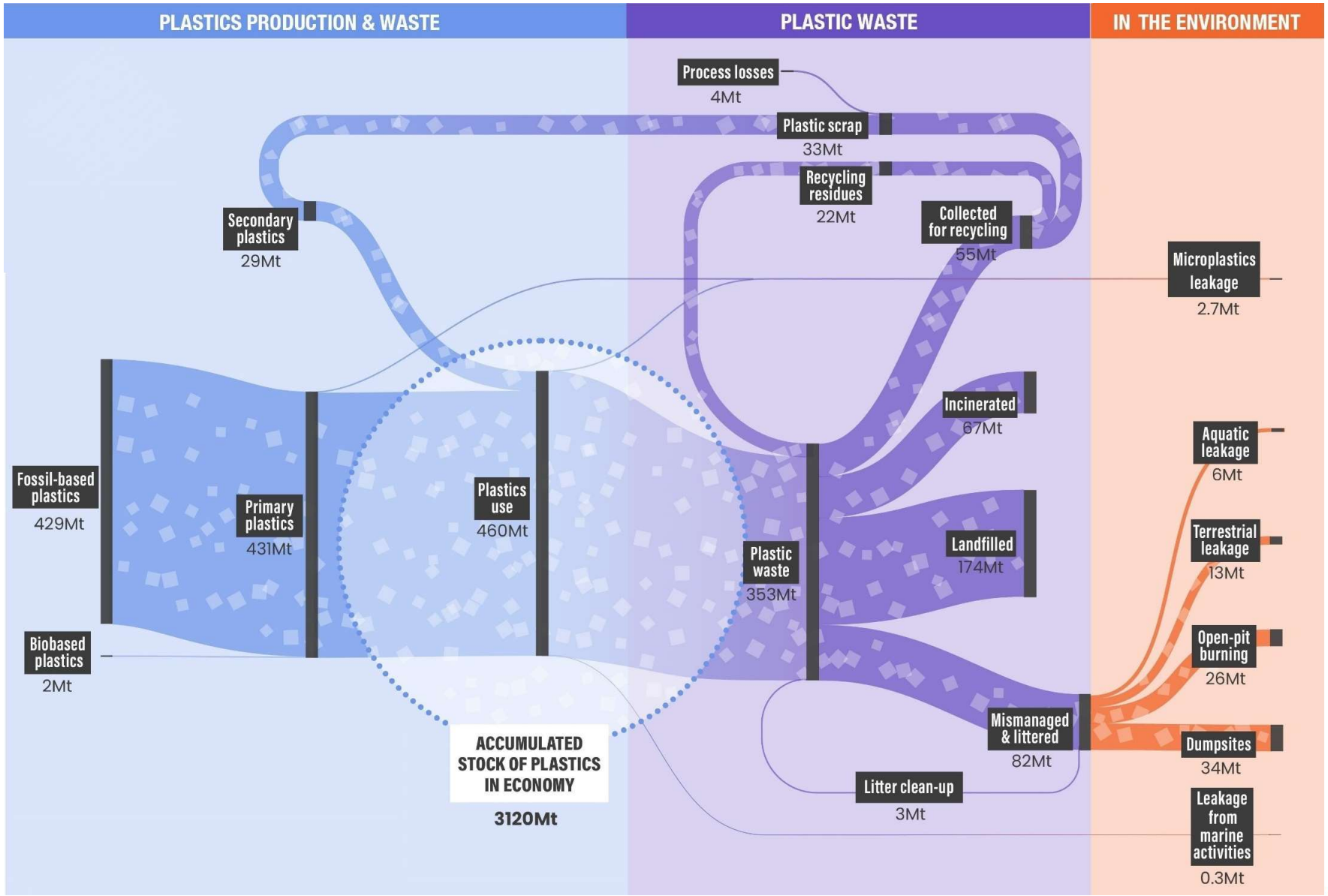
The Global Plastics Outlooks in a nutshell



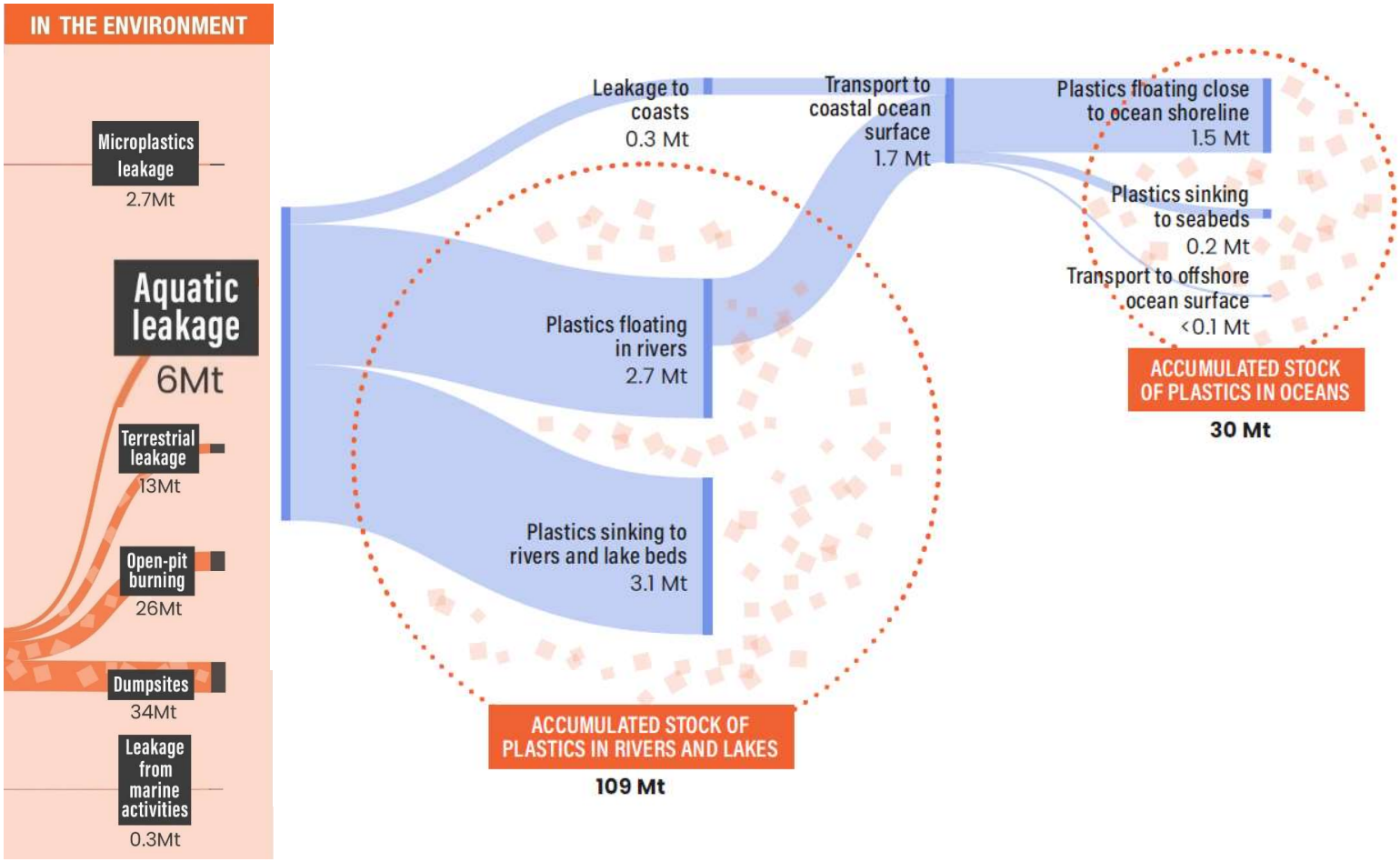
- First **comprehensive mapping of the lifecycle of plastics globally**
- **High-level of granularity**: primary and secondary production, 14 polymer categories, various applications
- **Domestic plastics policy landscape** covering 50 countries
- **Forward-looking** to 2060 with a multi-regional, multi-sectoral dynamic model
- Presents **scenarios** projecting future plastics use, waste and leakage
- **Quantifies costs** of policy packages towards eliminating leakage at regional level
- Investigates synergies between plastics and **climate policies**

OVERVIEW OF THE MAIN RESULTS

The plastic lifecycle in 2019



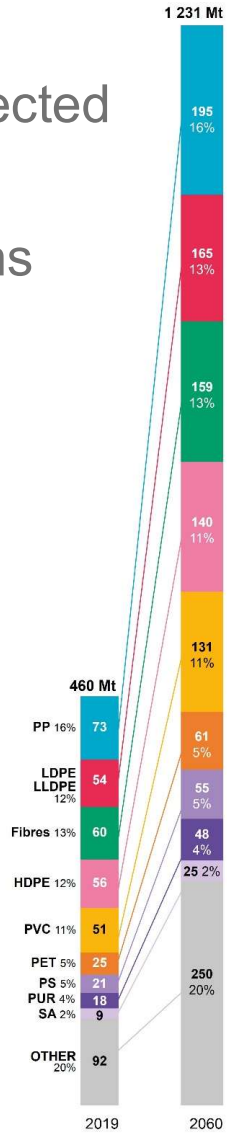
Rivers are a key pathway and sink for aquatic leakage today



Global plastics use is on course to almost triple by 2060

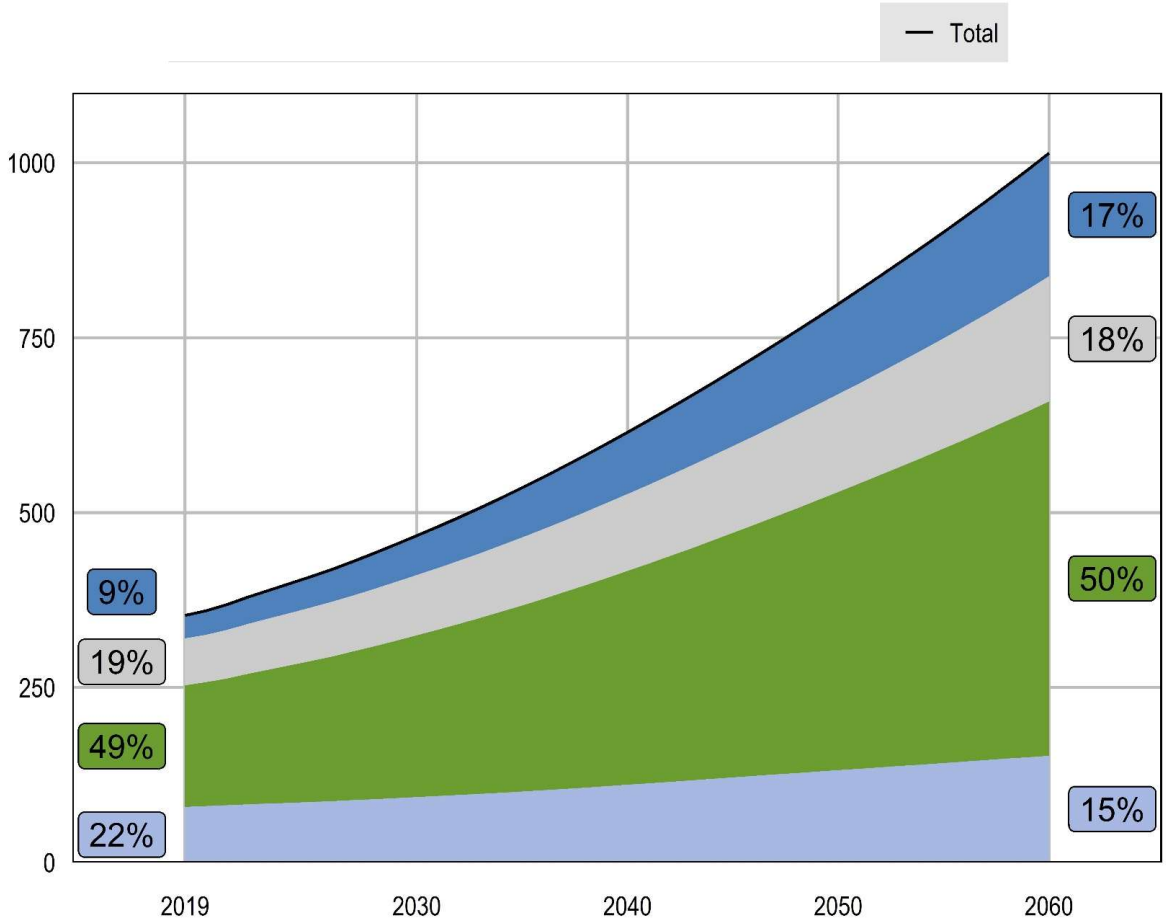
All polymers are projected to increase…

…in all applications

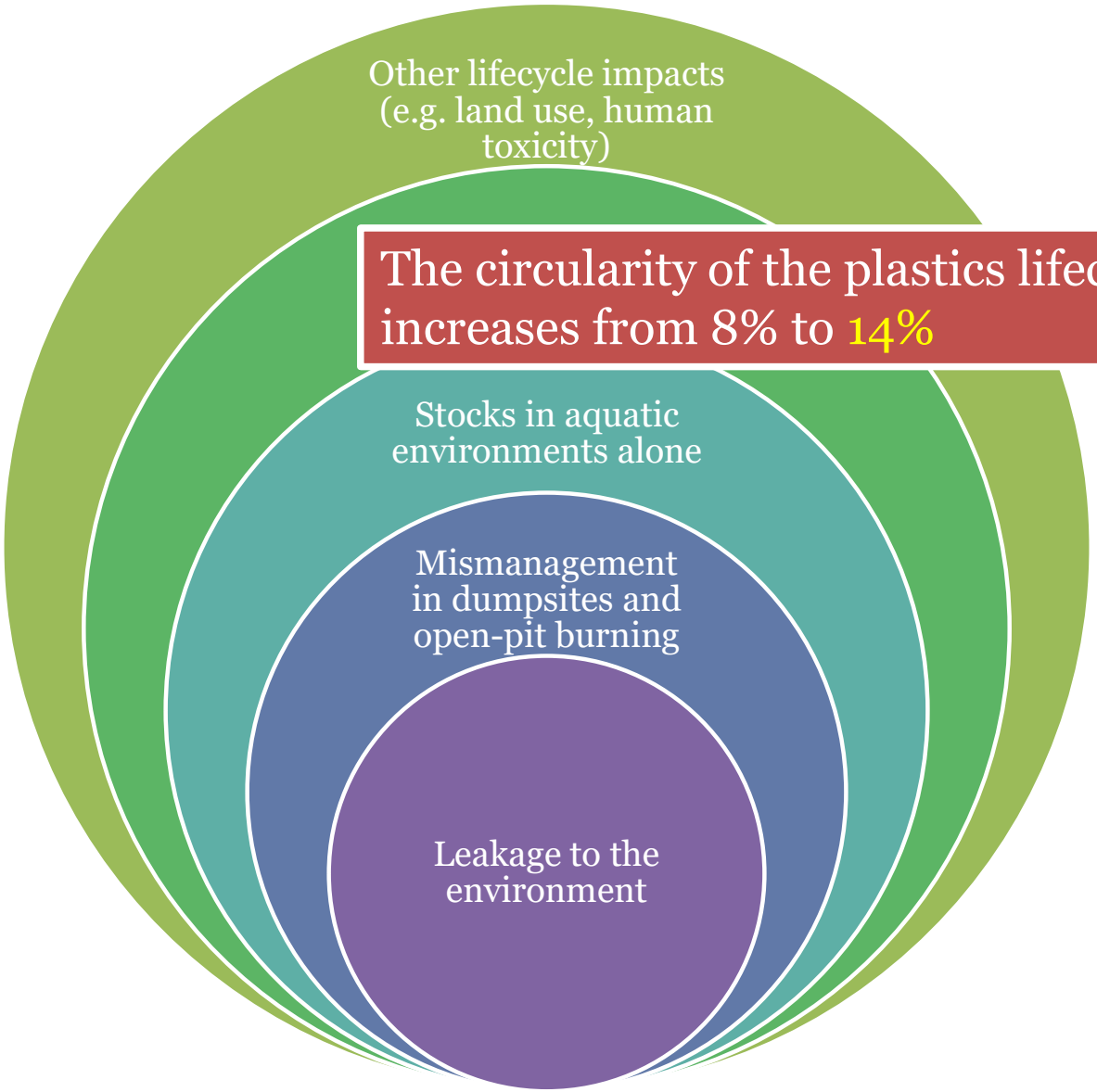


Packaging, construction and vehicles will be 2/3 of all use

Plastic waste will also triple, half will still be landfilled and unmanaged keeps increasing



How far would we be in 2060 from zero plastic pollution?



The circularity of the plastics lifecycle only increases from 8% to 14%

Doubling from 2019 levels

ar

493 Mt by 2060

115 Mt /year

44 Mt /year

The vision behind two policy packages

Regional Action

Present situation:
Current circumstances and policy landscape

How to achieve better environmental outcomes?

Gradually increasing stringency of measures

Global Ambition

Co-ordinated policy action

How do we get there?

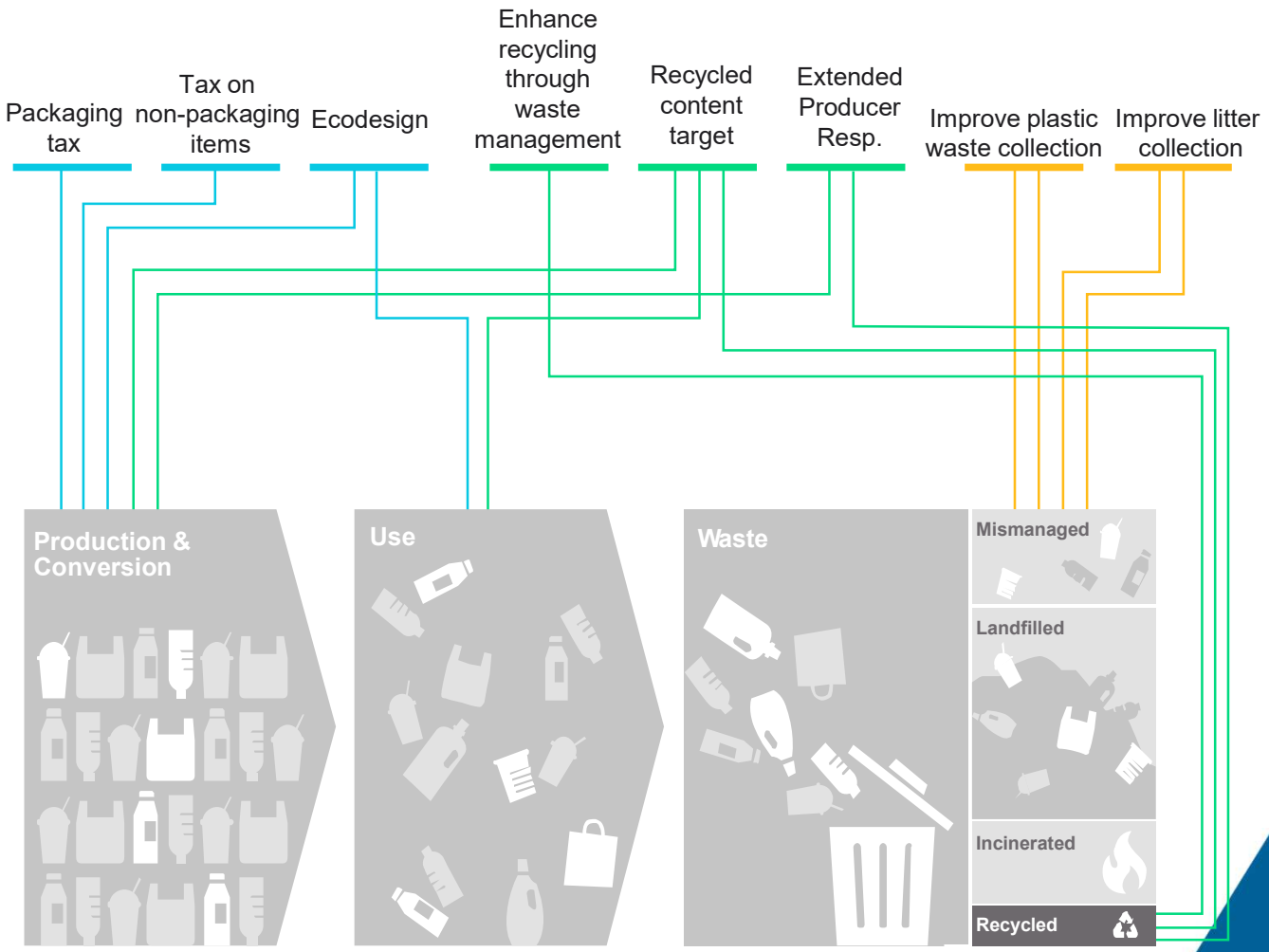
Global Goal:
Eliminate leakage

Both policy packages target the entire plastics lifecycle

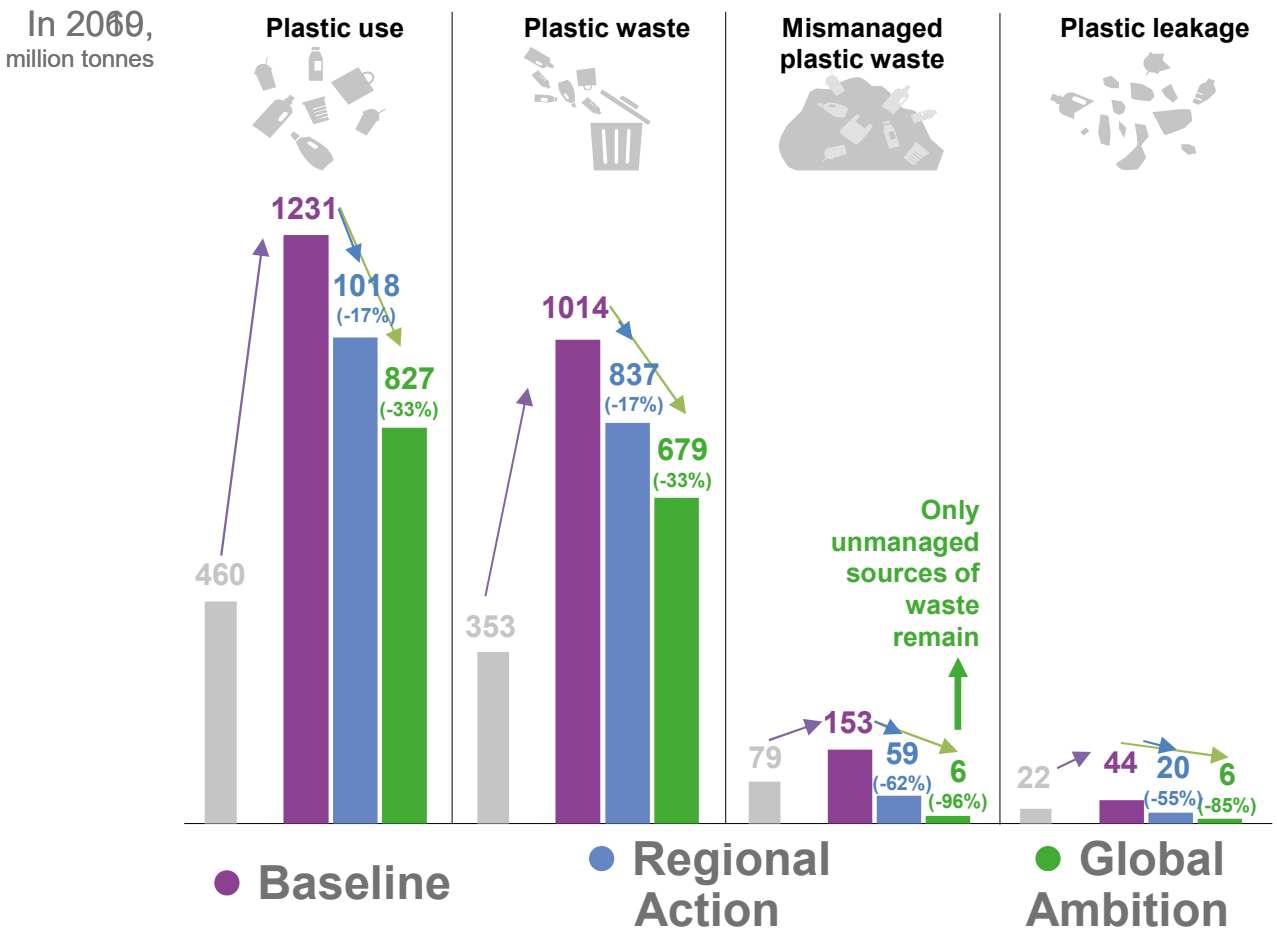
Restrain plastics demand and enhance circularity

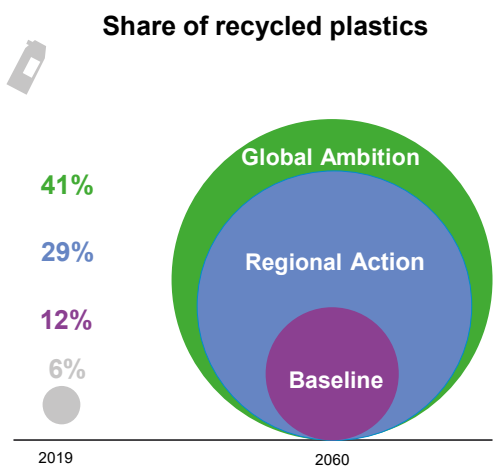
Enhance recycling

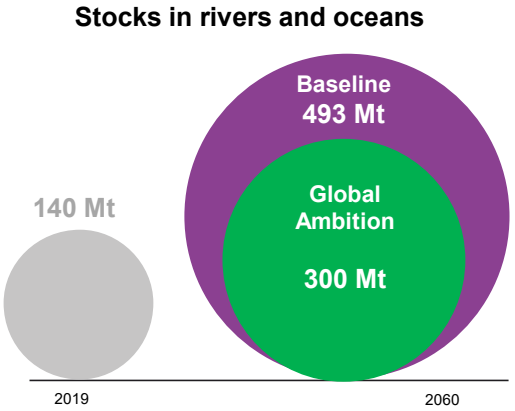
Close leakage pathways



Combining policies that target different lifecycle stages can drastically reduce plastics leakage



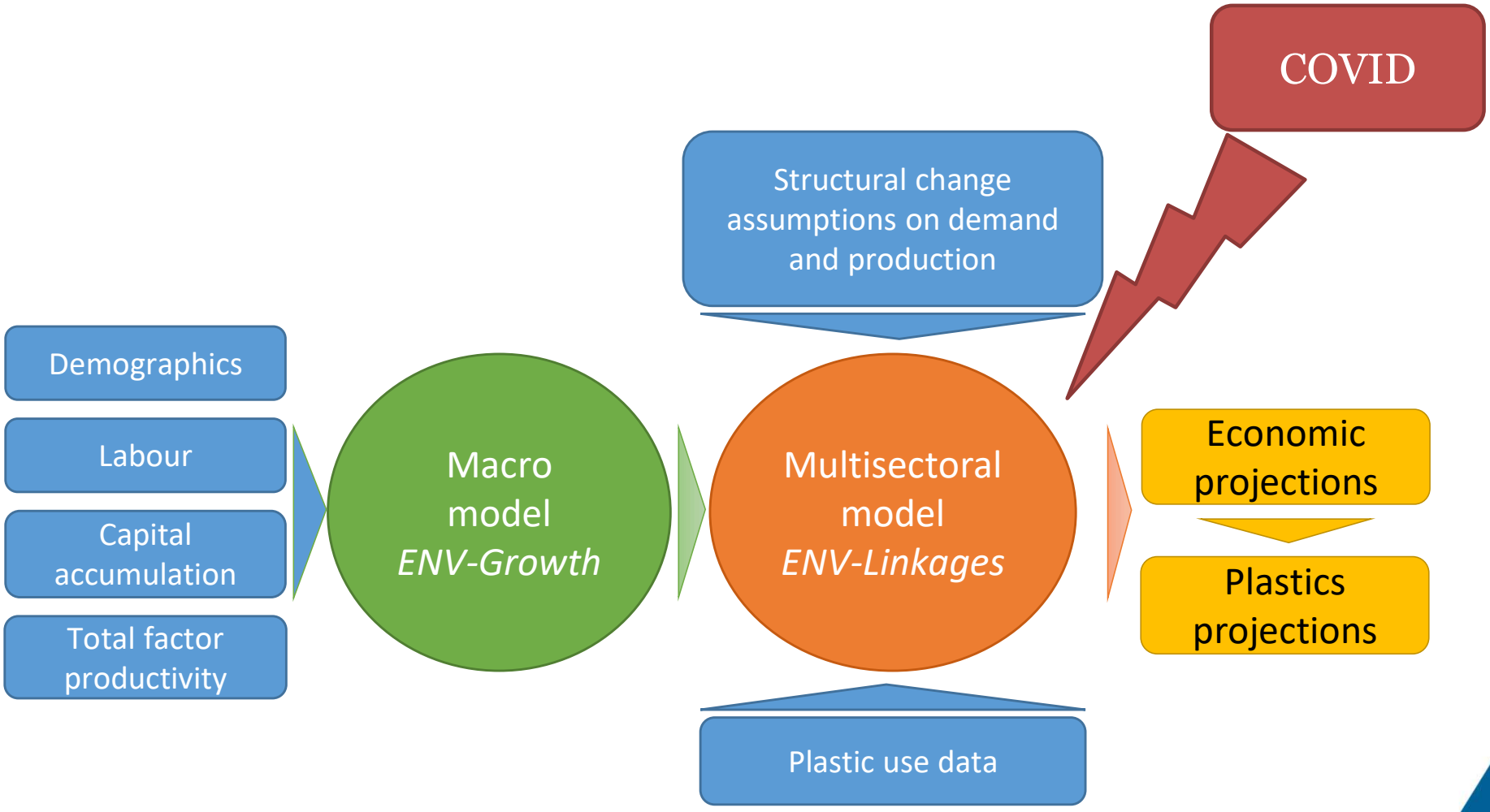




MODELLING AND DATA

Modelling methodology

- Global assessment with ENV-Linkages



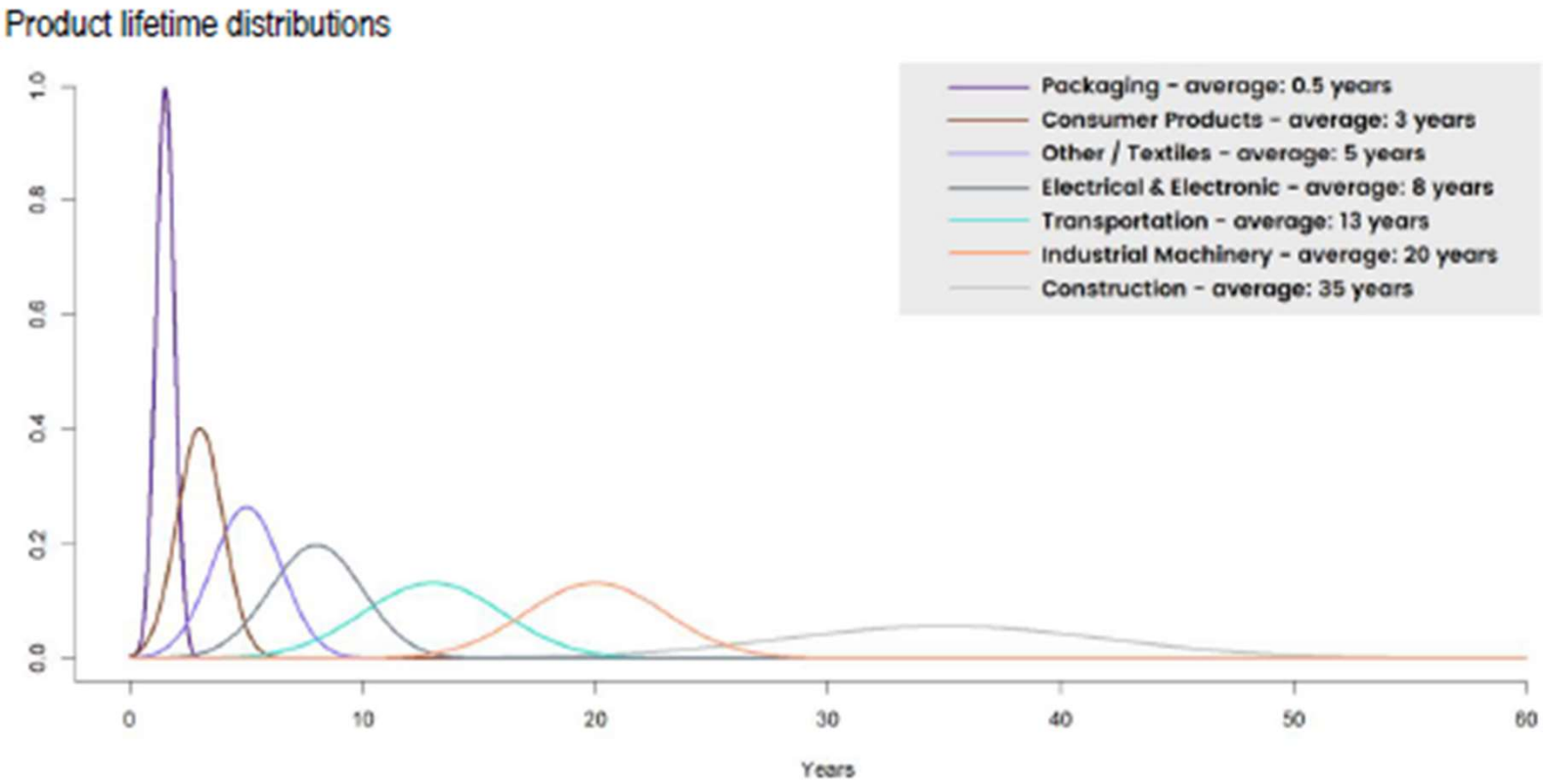
Overview of the methodology to model plastic flows

1. DRIVERS OF PLASTIC USE	• *Project sectoral and regional economic developments using a global CGE model (15 world regions)*
2. PLASTIC VOLUMES	• *Associate plastic volumes to sectoral demand in CGE*
3. PLASTIC WASTE	• *Calculate waste flows, based on product lifetimes*
4. PLASTIC WASTE MANAGEMENT	• *Break down waste by waste management (recycled, incinerated, landfilled, mismanaged)*
5. ENVIRONMENTAL IMPACTS	• *Estimate environmental impacts: plastic leakage to the environment, greenhouse gas emissions, lifecycle impacts*

Modelling plastics flows

Input sectors	Applications	Output sectors	Polymers*
Plastic products	Building & construction	Construction	ABS, ASA, SAN; bioplastics; HDPE; LDPE, LLDPE; PP; PS; PUR; PVC; other
	Consumer & institutional products	Accommodation and food service activities; air transport; education; health; insurance; lumber; non-metallic minerals; Business services; other manufacturing; public services; land transport; pulp, paper and publishing; real estate; textile; water transport	ABS, ASA, SAN; bioplastics; HDPE; LDPE, LLDPE; PP; PS; PUR; PVC; other
	Electrical/electronic	Electrical equipment; electronics	ABS, ASA, SAN; bioplastics; HDPE; LDPE, LLDPE; PP; PS; PUR; PVC; other
	Industrial/machinery	Fabricated metal products; iron and steel; nonferrous metal; Machinery and equipment	HDPE; LDPE, LLDPE; PP; PUR
	Packaging	Food products; chemical products	Bioplastics; HDPE; LDPE, LLDPE; PET; PP; PS; PUR; PVC; other
	Personal care products	Chemical products	HDPE; PET
	Transportation - other	Motor vehicles; public services; other transport equipment	ABS, ASA, SAN; bioplastics; Fibres; HDPE; LDPE, LLDPE; PP; PUR; PVC; other
	Other	Other sectors	Other
Chemicals	Marine coatings	Other manufacturing, other transport equipment	Marine coatings
	Road markings	Construction	Road markings
	Textile sector - clothing	Textiles	Bioplastics; fibres
	Textile sector - others	Textiles	Fibres
	Transportation - tyres	Plastic products	Elastomers (tyres)

Modelling waste: a lifetime distribution approach



Source: adapted from Geyer, Jambeck and Law (2017[1]).

Modelling primary and secondary plastics – calibration of economic databases

	Region	Share of secondary technology in 2015 (in tonnes)
OECD America	USA	3.9%
	Canada	4.6%
	Other OECD America	6.8%
OECD Europe	OECD EU countries	9.0%
	OECD Non-EU countries	5.9%
OECD Pacific	OECD Asia	6.3%
	OECD Oceania	2.4%
Other America	Latin America	7.5%
Eurasia	Other EU	4.9%
	Other Eurasia	3.5%
Middle East and Africa	Middle East & North Africa	3.5%
	Other Africa	4.5%
Other Asia	China	7.3%
	India	6.5%
	Other non-OECD Asia	4.8%

- Two production technologies producing one good
- Shares applied to GTAP sectors (rpp → plp + pls)
- Cost shares from Exiobase
  - Primary uses most of the fossil fuels
  - Secondary uses about half of chemical sector inputs

Modelling primary and secondary plastics – volumes & dynamics

- Calibrated coefficient at base year applied to growth of overall demand for plastics (rpp/chm inputs to other sectors)

- Secondary production grows with secondary economic flows (as processed scrap is assumed to be used)
  - Calibration of initial volumes: waste collected for recycling + loss rates → fixed point methodology
  - Check ex post of scrap availability

Input data: plastic production

Category	Variable	Source
Production	Primary and secondary economic split	OECD ENV-Linkages model, based on GTAP10 (Aguiar et al., 2019[5]) split using Exiobase for cost structure (Stadler et al., 2018[8]), Grand View Research (2020[9]) data for total shares (in tons).
	Plastic sectors	OECD ENV-Linkages model projections, resulting from mapping of sectoral/polymer flows to economic baseline. Secondary plastics incorporates recycling loss rates from the literature (Cottom et al., 2022[10]; Chruszcz and Reeve, 2018[11]; Roosen et al., 2020[12]; VinylPlus, 2019[13]).
Use by region, application and polymer	Historical use	Global consumption from Geyer, Jambeck and Law (2017[14]) for 1950-2014. Regional split based on waste weight estimates from Kaza et al. (2018[15]) The split by polymers and applications per region is based on weight estimates from Ryberg et al. (2019[16]) in 2015, and is constant for 1950-2014.
	Use	For the calibration year (2015), primary plastics use by polymer and application from Ryberg et al. (2019[16]) has been associated to different sectors and regions in the OECD ENV-Linkages model. Secondary plastics use stems from waste generation (derived in the model), recycling rates (see below) and recycling loss rates from the literature (Cottom et al., 2022[10]; Chruszcz and Reeve, 2018[11]; Roosen et al., 2020[12]; VinylPlus, 2019[13]). For future years, OECD ENV-Linkages model projections result from the mapping of sectoral/polymer flows to economic baseline.

Input data: plastic waste

Category	Variable	Source
Waste by region, application and polymer	Historical waste	OECD ENV-Linkages model, based on historical consumption (for 1950-2015), and product lifespans from Geyer, Jambeck and Law (2017[14]).
	Waste	OECD ENV-Linkages model projections, based on product lifespans from Geyer, Jambeck and Law (2017[14]).
Waste management end-of-life fates	Recycling share	For 1980-2019: Country sources (Table A A.5), Geyer, Jambeck and Law (2017[14]), and Kaza et al. (2018[15]). Rates for non-MSW assumed to match MSW.
	Incineration share	For 1980 -2019: Geyer, Jambeck and Law (2017[14]) and Kaza et al. (2018[15]) Rates for non-MSW assumed to match MSW.
	Sanitary landfilling	Cross country regression (residual) based on What a Waste 2.0 (Kaza et al., 2018[15]) (*) Rates for non-MSW assumed to match MSW, when excluding littering.
	Littering share	(Jambeck et al., 2015[17]) for share in MSW and zero for non-MSW.
	Mismanaged share	Cross-country regression based on Kaza et al. (2018[15]) (*) Rates for non-MSW assumed to match MSW, when excluding littering.

Input data: plastic environmental impacts

Category	Variable	Source
Environmental impacts	Total leakage of macroplastics and microplastics to the environment by category	Based on plastic consumption, waste and waste management projections from OECD ENV-Linkages model, adapted from Ryberg et al. (2019[18]) methodology. The central estimate for macroplastic leakage from mismanaged waste (the largest source of leakage) is equal to the average between the estimate provided with the methodology of Ryberg et al. (2019[18]) and the estimate provided by Leeds University (Cottom et al., 2022[10]).
	Plastic leakage and accumulation in aquatic environments	Based on waste management projections from OECD ENV-Linkages model, and the leakage estimates described above, adapted from the Lebreton and Andrady (2019[19]) methodology.
	Plastic leakage to air from terrestrial transport	Based on transport projections from OECD ENV-Linkages model, adapted from Evangeliou et al., (2020[20]) methodology.
	GHG emissions for plastic lifecycle	Based on plastic consumption, waste and waste management projections from OECD ENV-Linkages model, based on Zheng and Suh (2019[21]).

Trade in plastics waste

- Incorporated trade in plastic waste per application and polymer type
- Volumes of plastic waste exports and imports are calculated based on UN Comtrade data:
  - Total exports of plastic waste per country and polymer are estimated using the share of plastics exports (Comtrade) to plastic waste (output of ENV-Linkages).
  - Exports are split into partner countries and polymers using the country and polymer weights in 2019 for projections, and historical data for the years before
  - Imports(r,rr) = Exports (rr,r)
- The end-of-life fates of plastic waste traded flows differ from the domestically treated waste: 50% of traded plastic waste is recycled, and the remaining is distributed across the other waste streams following the same proportions of end-of-life fates as domestically treated waste excluding littering.

Databases and linkages

- Data is open and downloadable:
  - https://www.oecd.org/environment/plastics/
  - https://stats.oecd.org/ (under Environment > Global Plastic Outlook)
  - https://www1.compareyourcountry.org/global-plastics-outlook/
- The CGE model was soft-linked with several environmental models and methodologies:
  - DTU model of environmental leakage
  - Plastic leakage to terrestrial and aquatic environments (SPOT model, Leeds U)
  - Plastic leakage to aquatic environments (Laurent Lebreton)
  - Particulate matter emissions from tyre and brake wear (NILU)
  - Effects of higher penetration rates of biobased plastics (Neus Escobar and Wolfgang Britz)
  - Health and environment impacts from the life cycle of plastics (Ghent University)

Thank you

Find out more at: www.oecd.org/environment/plastics

Contact: ruben.bibas@oecd.org

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