Plastic pollution in Greece: how to stop it

A guide for policy-makers

EXECUTIVE SUMMARY

IN GREECE, THE MAJORITY OF PLASTIC WASTE ENDS UP ON LANDFILLS DUE TO CHALLENGES WITH WASTE COLLECTION AND MANAGEMENT AND 6% OF WASTE IS LEAKED INTO NATURE.

Greece generates approximately 700kT of plastic waste each year, or 68 kg of plastic per capita. The influx of tourists to Greece's coasts increases waste generation by up to 26% in peak season. Only 8% of waste is recycled, due to low collection rates and highly mixed waste streams, and limited recycling infrastructure. The majority of waste, 84%, ends up in landfills. Uncollected waste leads to 40kT of plastic leaking into nature each year. 11.5kT of plastic enters the Mediterranean, including 28% from sea-based sources, such as ghost finishing nets and equipment. Almost 70% of this waste makes its way back to pollute Greek coastlines each year. Greece's economy loses an estimated €26M annually due to plastic pollution, as it affects the tourism, shipping and fishing economies.

GREECE HAS PROPOSED STEPS TO REDUCE PLASTIC POLLUTION AND INCREASE CIRCULARLY THROUGH ITS NEW NATIONAL WASTE MANAGEMENT PLAN, HOWEVER, IMPLEMENTATION HAS BEEN CHALLENGING.

By 2020, Greece aims to divert 74% of waste from landfilling and recycle 70% of its plastic packaging waste. To achieve this target, Greece developed a new strategy, including proposing a 4-stream waste collection system to increase the supply of recyclable plastic, and introducing a landfilling tax. However, these initiatives have yet to be implemented due to low municipal capacity and stakeholder pushback. Going forward, Greece should focus on interventions across the value chain. Key priorities should include; reducing plastic consumption, improving waste management systems, and increasing industry responsibility. Beyond banning plastic bags, Greece should aim to implement the EU single-use directive, and holding the plastic industry to account for its plastic waste. Finally, the government should assist municipalities with eliminating waste mismanagement by providing technical, financial, and policy support. Overall, Greece has set some ambitious targets to reduce plastic pollution and will need bolder action across these areas to reach its goals.

🇬🇷 GREECE

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OVERVIEW

GREECE IS THE 8th LARGEST PRODUCER OF PLASTIC GOODS IN THE REGION, BUT STILL RELIES HEAVILY ON LANDFILLS

National facts:

population
10.8 MILLION
REGISTERED CITIZENS (2019)
10th BIGGEST MEDITERRANEAN COUNTRY
BY POPULATION SIZE

economy
€185 BILLION
GDP (2019)
57th LARGEST NOMINAL GDP IN THE WORLD
7th LARGEST ECONOMY IN THE REGION

territory
131,957 km² OF TERRITORY
INCLUDING OVER 2000 ISLANDS, BORDERING 4
COUNTRIES TO THE NORTH:
Albania, Bulgaria, North Macedonia and Turkey
13,676 km OF COASTLINE
ON THE MEDITERRANEAN

Plastic footprint overview:

global plastic goods production
0.3% PRODUCED IN GREECE
0.94 MT/YEAR
PLASTIC GOODS PRODUCED
(OF WHICH ~0.19 MT WAS PACKAGING WASTE)

plastic manufacturing
0.6 MT VIRGIN PLASTIC PRODUCED
DOMESTICALLY
OF WHICH 0.4 MT EXPORTED
(primarily polypropylene)
0.5 MT VIRGIN PLASTIC IMPORTED
0.3 MT OF SECONDARY MATERIAL IMPORTED

end of life management
0.73 MT PLASTIC WASTE GENERATED (2017)
0.61 MT undergoes linear waste treatment
(landfill)
0.07 MT RECYCLED
around **7%** OF PRODUCTION

PLASTIC LIFECYCLE

PLASTIC PRODUCTION	PLASTIC USAGE	WASTE MANAGEMENT	MISMANAGED WASTE

PLASTIC GOODS PRODUCTION [1]	PLASTIC STILL IN USE [2]	GENERATED WASTE [3]	UNCOLLECTED WASTE	COLLECTED WASTE	RECYCLED	INCINERATED	CONTROLLED LANDFILLS	UNCONTROLLED LANDFILLS	OPEN DUMP
0.9	0.2	0.7	0.1	0.7	0.1		0.6		

[1] Two main actors are needed to produce plastic goods for consumption: i. Virgin plastics producers; and ii. Manufacturers/converters of virgin plastic into a plastic good. This total production figure includes all plastic products manufactured using local and imported virgin plastic material

[2] These are plastic goods produced with a mean product lifetime greater than 1 year, and/or exported for consumption in another country

[3] This figure includes waste with a mean product lifetime from 1 year (or less) to 35 years

Source: Greece's National Waste Management Plan, UN COMTRADE database, Jambeck & al (2014), World Bank, 2018, What a Waste 2.0, Dalberg analysis.

GREECE
PLASTIC LIFECYCLE FOOTPRINT

PLASTIC PRODUCTION	PLASTIC USAGE	WASTE MANAGEMENT		MISMANAGED WASTE		
PLASTIC GOODS PRODUCTION	PLASTIC WASTE GENERATION	CONTROLLED WASTE TREATMENT	RECYCLED MATERIALS	MISMANAGED WASTE LEVELS	RECOVERED MISMANAGED PLASTIC	PLASTIC LEAKAGE IN NATURE
RANKING PER COUNTRY (of 22 countries) [1]						
0.94 MT *8th*	0.73 MT *8th*	0.68 MT *7th*	0.07 MT *9th*	0.05 MT *12th*	0.01 MT *12th*	0.04 MT *12th*
RANKING PER CAPITA (of 22 countries) [1]						
86.9 kg *7th*	67.7 kg *7th*	63.1 kg *7th*	6.4 kg *10th*	4.6 kg *16th*	0.5 kg *16th*	4.2 kg *16th*
% OF ANNUAL WASTE GENER.						
n/a	100%	84%	9%	7%	1%	6%
MED COUNTRY RANKING (kg/person/year)						
highest 155 / 87 / lowest 21	121 / 68 / 12	115 / 63 / 0	29 / 6 / 0	100 / 5 / 1	10 / 1 / 0	90 / 4 / 1

[1] Ranking calculated from highest to lowest amount, out of the 22 countries with coastlines on the Mediterranean

Source: Greece's National Waste Management Plan, UN COMTRADE database, Jambeck & al (2014), World Bank, 2018, What a Waste 2.0, Dalberg analysis.

PLASTIC WASTE MANAGEMENT

Waste is primarily managed through by municipalities, who are responsible for the collection of MSW and Blue Bin waste:

- In 2017, Greece generated 0.73 mega tons of plastic waste each year, of which 0.19 mega tons was plastic packaging waste. **26% of this is collected through the Blue Bin system** in which consumers place all dry-recyclable materials into a separate collection bin.

- Once collected, the Blue Bin materials are taken to sorting facilities, and Municipal recycling facilities (MRFs). However, due to low consumer awareness in several areas, there are challenges with waste contamination

Over 84% of all waste has a linear fate in landfills, which remain the primary waste management system in Greece.

- There are 75 active landfills across Greece, but there are some concerns that not all these meet landfill requirements, with light items such as plastic bags blowing in the wind from open-top sites.

- Greece issued an ambitious target to reduce landfilling to 26% by 2020 by diverting waste to other forms of waste treatment.

7% of waste remains uncollected due to a lack of infrastructure in certain regions and municipalities. In 2011, the European Court of Justice estimated there were 63 remaining open dumps operating in Greece, and mandated these to be shut or regenerated. Today, more than 19 are remained in operation and 29 more have not been fully restored.

GREECE RELIES ON LANDFILLING, WITH 84% OF PLASTIC WASTE HAVING A LINEAR FATE, AND <10% RECYCLED

RECYCLED PACKAGING MATERIAL 0.07 MT

Waste for recycling is collected mainly through the Blue Bin system, a one-stop deposit point for paper, plastic, glass aluminum, tin-paper. A total of 0.05MTs of plastic were collected through the Blue Bin system in 2016 (7% of collected plastic waste). In a few locations, glass is separated through the Blue Bell system.

PLASTIC PRODUCED 0.94 MT

WASTE GENERATED 0.73 MT

WASTE COLLECTED 0.68 MT

LANDFILL 0.61 MT

NOT COLLECTED 0.05 MT

Source: EuroStat (2018), Greece National Waste Management Plan, Jambeck & al (2014), World Bank (2018), Dalberg analysis, European Commission (2013) "Commission takes Greece back to Court over illegal landfills and asks for fines"
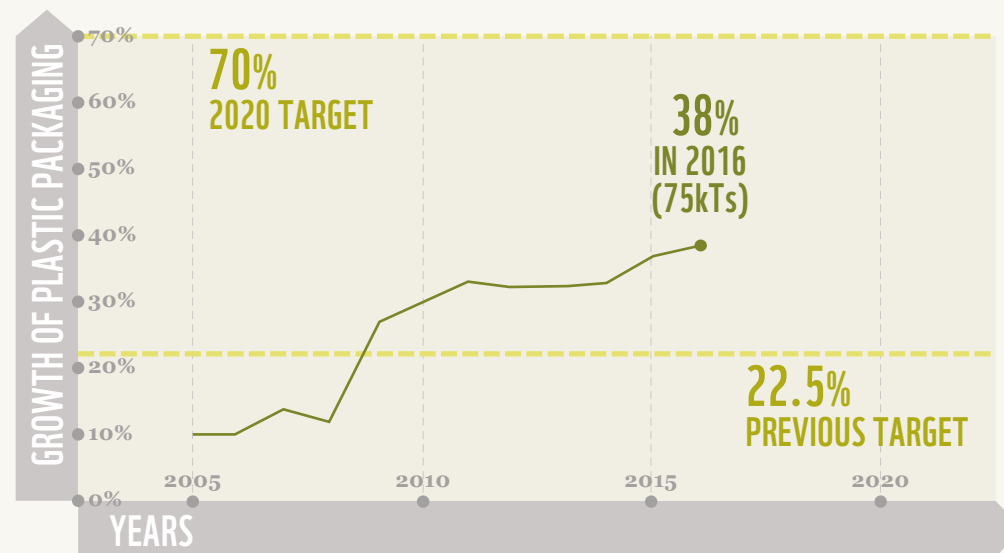
RECYCLING

Overview of Extended Producer Responsibility (EPR) schemes

- Waste is collected for recycling mainly through the **Blue Bin System** established in 2003 by H.E.R.R.Co (HERRCo, the Hellenic Recovery Recycling Corporation), a consortium owned 65% by plastic producers, and 35% by municipalities.
  - The system collects **mixed dry recyclables** (paper, plastic, glass and metal) for sorting and recovery. In 2016, **47kTs of plastic were collected through this system.**
  - Other EPR schemes (Antapodotiki, AB Vassilopoulosand Ecoelastica) collected 4.5kTs of plastic and 39Kt of tyres.
- HERRCo, the largest plastic EPR scheme, works in cooperation with 1900 companies including food products and beverages (60%), electronics, household items, etc.
  - Companies contribute **€63/t of plastic produced**, and the average annual revenue from each affiliated company averaging **€500**, for total of around **€1M**.
  - These contributions are some of the lowest in Europe. In Italy, EPR contributions are **€188/t**.
- These funds cover the cost of more than 160,000 blue bins across Greece, almost 500 collection vehicles, the establishment and running of sorting facilities (in some cases).
  - Municipalities are responsible for the collection of Blue Bin waste, which are sorted in recycling facilities. After sorting, the aggregated materials are sold to recyclers or exported to countries including Indonesia, Turkey. 19kT of plastic waste were exported in 2016.
- As EPR scaled up from 2005 to 2010, recycling grew above 22.5% thre-shold. However, since 2010, recycling has plateaued around ~35%-40%, due in part by the economic crisis.

Challenges to recycling and EPR

- The use of Blue Bins remains low across Greece. **Overall, only 6% of all plastic waste is placed in blue bins**, and therefore most plastic waste becomes lower quality and value for the recycling industry.
- An estimated **50% of waste in Blue Bins is contaminated**, due to limited consumer education around correct waste disposal.
- Participation to EPR schemes is largely **limited to larger multi-national companies**, while a large number of SMEs continued to **evade this responsibility**. HERRCo members only account for ~10% of the plastic produced (96 kTs of plastic per year).
- The target of 70% plastic packaging recycled by 2020, set by the National Waste Management plan, will be highly challenging to achieve.

GROWTH OF PLASTIC PACKAGING

70% 2020 TARGET

38% IN 2016 (75kTs)

22.5% PREVIOUS TARGET

YEARS

Sources: Eurostat 2016: Recycling rates for packaging waste. HERRCO, 2016 "Annual Report 2016."

RECYCLING

THE 'BLUE BIN' SYSTEM IS MOST EFFECTIVE IN ATTICA, CRETE AND S. AEGEAN ISLANDS, BUT REMAINS LOW OVERALL
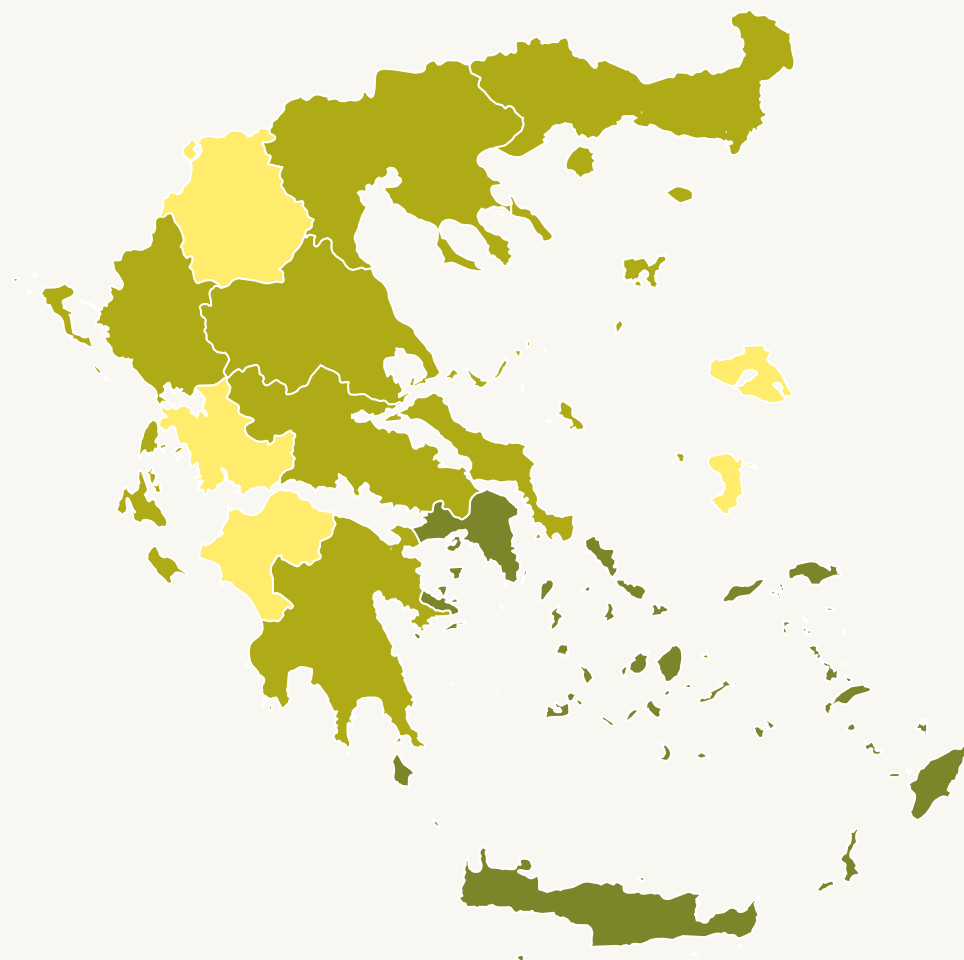
Regional overview

- Waste that is not collected through the separated Blue Bin system is at **far higher risk of being mismanaged**, given its lower economic value.

- HERRCo reports the lowest per capita collection of Blue Bin Waste in **Western Macedonia, the Northern Aegean Islands and Western Greece**.

- These regions also have the lowest numbers of **collection vehicles**, respectively 4 vehicles, 10 vehicles and 22 vehicles, for the entire province.

- **188 vehicles and 45,635 Blue Bins** are in operation in **Attica**, which sees the highest recovery rate of all regions, with almost 10% of waste recovered. **Crete** and the **South Aegean islands** follow, with strong active recycling projects recovering 9% and 8% of MSW respectively.

However, overall Blue Bin recovery rates remain low, as the large majority of waste remains destined for landfill. Industry experts estimate that **over 50% of collected waste is contaminated** with non-recyclable items, due to low public awareness on recycling, and therefore must be discarded.

■ **>8**% per capita MSW recovered for through the blue bin   ■ **5-7**% per capita MSW recovered for through the blue bin   ■ **<4**% per capita MSW recovered for through the blue bin

Source: S. Liubartseva et al, 2018: "Tracking plastics in the Mediterranean: 2D Lagrangian model", Karkanorachaki et al, 2018.

PLASTIC DEBRIS

11.5 kT/year OF PLASTIC ENTERS THE MEDITERRANEAN SEA

SEA-BASED

Fisheries, aquaculture and shipping lanes result in 28% (3.2kT) of this plastic debris. Greece sees the 4th highest amount of plastic waste originating from sea-based sources in the region.

RIVERS

The Axios and Evros rivers account for 4% of waste leaked from Greece in the Mediterranean. Flowing down from North Macedonia, the Axios has recently caused tensions around polluting coasts with waste from the neighboring country.

COASTAL ACTIVITIES

Coastal activities cause 68% (7.8kT) of plastic inputs into the sea resulting from poor city waste management practices, tourism and recreational activities. **Hotspot cities include Thessaloniki, Corfu, Heraklion.**

28%

4%

68%

PLASTICS LIFECYCLE: 11.5kT LEAKED INTO THE MEDITERRANEAN SEA IN 2016, AND 67% ENDED UP ON THE COASTLINES WITHIN A YEAR

SEABED

Sea bed plastic deposits are estimated to around 11% of all plastic waste dumped in the Mediterranean. Waste on sea beds becomes almost impossible to clean up.

11%

COASTLINE

67% of the plastic pollution inputted into the Mediterranean washes back onto Greek shores within a year. This is due to Greece's having the longest coastline in the Mediterranean, and currents flowing towards its inlets and coasts. Eventually, 80% of all waste will return to coastlines in the Mediterranean.

67%

SEA SURFACE

22% of the plastic pollution remains on the sea surface 1 year after leakage, taking up to a decade to reach its final destination.

22%
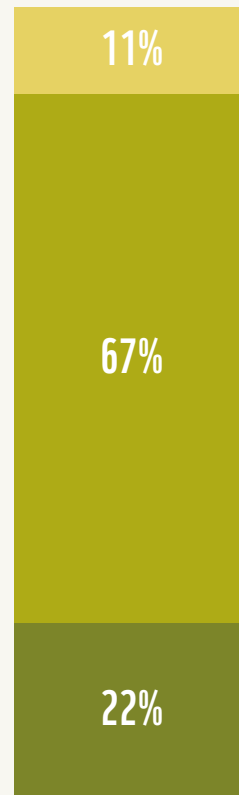
[1] Assumed that 20% of Greek mismanaged waste assumed to leak into the sea as coastline. This is double the proportion of other scope countries, as Greece has the longest coastline in the region, and majority of population is situated in coastal areas.
[2] River leakage intensity calculated based on the total river flow of Greek rivers compared to the Po river in Italy.

Source: Dalberg Analysis, Jambeck & al (2014), World Bank (2018), Liubartseva et al "Tracking plastics in the Mediterranean: 2D Lagrangian model".

PLASTIC IMPACT

IMPACTS OF PRODUCTION ARE BELOW AVERAGE, BUT GREECE'S COASTLINE RECEIVES OVER 7.7KTs OF PLASTIC YEARLY

The environmental impact of Greece's production and consumption of plastic is lower than average across the 22 Mediterranean countries:

- Given Greece's lower levels of plastic production, the energy expenditure on plastics is lower than some of its European neighbors.

- Greece has no incineration facilities, and therefore sees lower carbon emissions, only contributing ~3% of the total carbon emissions from plastics in the Mediterranean region.

Greece receives over 10% of coastal plastic pollution in the Mediterranean, despite having the longest coastline on the Mediterranean:

- Considering all of its islands, Greece has the longest coastline in the Mediterranean, however, it only receives ~10% of the total coastline pollution. This is due to high levels of waste collection on land (only 5% of waste goes uncollected) and limited exposure to large sea currents depositing waste.

	PLASTIC PRODUCTION — ENERGY CONSUMED IN OIL EQUIVALENT	WASTE MANAGEMENT — CO_2 EMISSIONS [4]	ANNUAL COASTLINE PLASTIC POLLUTION [2]	MISMANAGED WASTE — DAILY PLASTIC DEBRIS FLUX PER KM OF COASTLINE	ECONOMIC COST OF POLLUTION [3]
GREECE	12M barrels	4.9 MT	7.7kT	2.66 kgs/km *average: 5.1 kgs/km*	$25.5 milion
% OF TOTAL MED IMPACT	2.5%	2.4%	9%	n/a	8%

[1] Data not available for Greece on the production of plastic per industry, which is used to calculate the average plastic lifetime
[2] Total plastic debris ending up on the country's coastlines each year, as showcased on the right-hand graph on slide 8
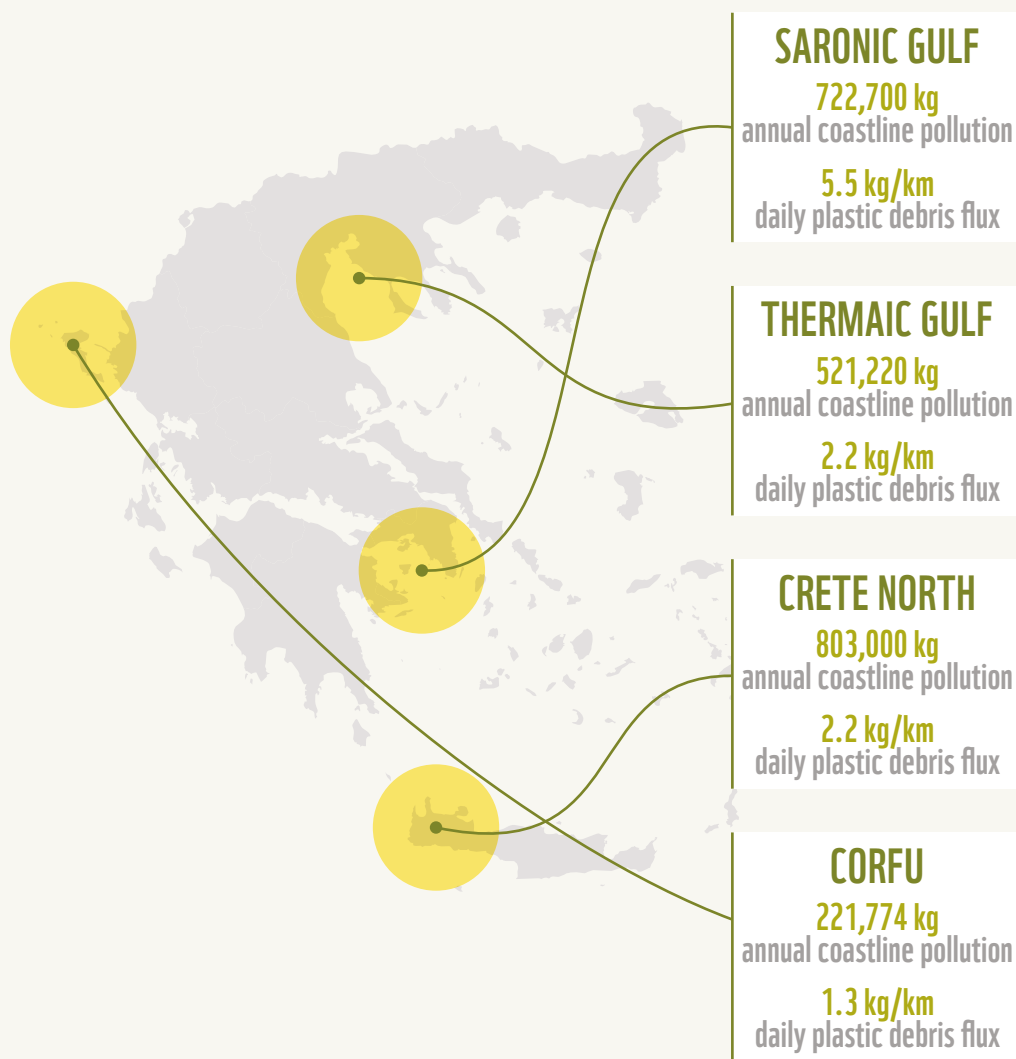[3] Economic impact of plastic pollution on Tourism, Fisheries, and Maritime Trade. Total excludes the cost of clean-up
[4] Total CO_2 lifecycle emissions from production, recycling and incineration (See Annex III for further details)
Sources: S. Liubartseva et al, 2018: "Tracking plastics in the Mediterranean: 2D Lagrangian model", Dalberg analysis.

MEDITERRANEAN HOTSPOTS

SARONIC GULF

722,700 kg
annual coastline pollution

5.5 kg/km
daily plastic debris flux

THERMAIC GULF

521,220 kg
annual coastline pollution

2.2 kg/km
daily plastic debris flux

CRETE NORTH

803,000 kg
annual coastline pollution

2.2 kg/km
daily plastic debris flux

CORFU

221,774 kg
annual coastline pollution
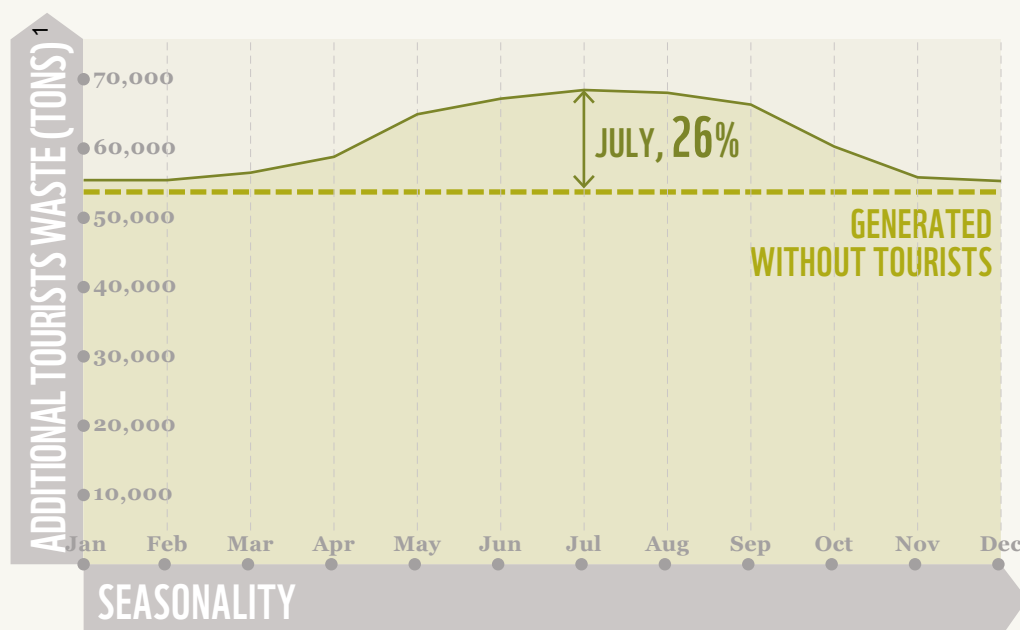
1.3 kg/km
daily plastic debris flux

- Whilst having the highest rate of Blue Bin collection, Attica region **produces almost half of all the waste in the country**, over 1.8M tons of MSW produced each year, coming primarily from the population of Athens.

- The gulf sees **limited marine circulation**, leading to high levels of plastic build-up.

- The Thermaic Gulf is polluted by city of **Thessaloniki**, whose port sees the highest level of plastic density.

- The region is also polluted by the delta of the river **Axios**, one of the largest rivers in country that travels down from North Macedonia.

- Karkanorachaki, et al. 2018. found a density of 11,804 plastic pellets (308 g) and 12,263 plastic fragments (734 g) per m2, , higher than the Greek average of 10-602 items total / m2.

- In contrast, the south of Crete was identified as relatively low-polluted areas, due to a "filtering effect" caused by complex coastlines composed of innumerable bays, inlets and small islands.

- **2.9 Million** people visited the Ionian Islands in 2017, over **10 times** the local population of these islands.

- Several landfill sites on the island, including a landfill south in Lefkimmi near the tourist report of Kavos, was declared illegal by the EU due to failure to comply with landfill regulation.

Source: S. Liubartseva et al, 2018: "Tracking plastics in the Mediterranean: 2D Lagrangian model", Karkanorachaki et al, 2018.

TOURISTS IMPACT

ADDITIONAL TOURISTS WASTE (TONS)

70,000
60,000
50,000
40,000
30,000
20,000
10,000

JULY, 26%

GENERATED WITHOUT TOURISTS

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

SEASONALITY

- **Greece sees 12 Million** international tourists arriving each year to coastal locations, with over 75% of tourism occurring between the summer months of June and September.
- **Crete, the Ionian Islands (particularly Corfu) and Central Macedonia** see the highest tourist influx, hosting almost 50% of all tourists arrivals.
  - Crete in particular sees **30% of the total tourism in Greece**, with **4 million tourist arrivals per year**, almost 7 times the local population of the island.
- Tourists in Greece generate **79k** tons of MSW annually, increasing annual waste generation by **11%**.
- Managing this additional waste could cost municipalities a **€4-€8 million**.
  - A study led by Clean Seas found that tourists in Greece has the **lowest willingness to pay for beach clean-ups** (through entry fees or municipality taxes) of the three countries in the study, and the least likely to volunteer for beach clean ups.

On the other hand, tourism can be a source of initiatives or pressure to resolve plastic pollution. Examples include:

- **'Clean Blue Paros'** - Paros island committed to become the first plastic waste free island in Greece. It joined forces with Common Seas and WWF Greece to implement a series of activities for the reduction of single use plastic consumption and the effective collection of plastic waste.
- **'Sea Change Greek Islands'** - An initiative to reduce single use plastic consumption across Greek Islands, starting with the island of Donoussa in the southern Aegean, and will be followed by Sikinos and Kefalonia.
- **'Blue Flag certifications'** - 395 beaches have earned this certification, which includes a criteria on beach cleanliness from litter. Hotels often support the efforts required to reach these certification, as a key tourism draw.
- '**Alonissos without Plastic Bags'** -A campaign started by the tourism industry on this island, long before the national ban on free plastic gabs, requiring local businesses not to order or offer plastic bags, offering paper or cloth bags instead.
- **Healthy Seas and Ghost Fishing** – An initiative partnering with diving companies based in Santorini to remove lost finishing gears from the seas, to make seas safer for marine life, which divers expect to see.

PLASTIC ECONOMIC IMPACT

TOURISM
ESTIMATED IMPACT: € 18 MILLION

- Plastic pollution might compromise tourist flow to particular marine areas, and threaten new private sector investment in hotel developments, etc. in these areas.
- Coastal tourism makes up **42%** of Greece's annual GDP from tourism, and provides almost 333,500 jobs in accommodation, transport and other activities.
- Almost **12 million tourists** visited Greece's coastal locations in 2017.

FISHERIES
ESTIMATED IMPACT: € 1 MILLION

- Marine pollution can **clog boat engines and fishing nets** leading to disruption of the fishing industry. The largest cost to the industry is related to **vehicle damage and additional maintenance caused by collision with plastic debris, and delays caused by fishing nets filling up with plastic** rather than fish.
- Marine plastic pollution reduces both the **supply of, and demand for, seafood** due to animal deaths and concerns that animals have ingested plastic.

MARITIME TRADE
ESTIMATED IMPACT: € 6.7 MILLION

- Greece's maritime industry is made up of transport, port facilities and shipbuilding activities.
- Transport is particularly vulnerable to **collisions with plastic pollution, entanglement of floating objects with propeller blades and clogging of water intakes for engine cooling systems**. Costs are incurred by **vessel downtime, delays and additional maintenance costs**.
- **Port facilities** are also at risk of damage from plastic pollution, including **clogging port waterways, creating delays incurring clean up costs**.

COST OF CLEAN-UP
ESTIMATED IMPACT: € 10 MILLION

- Shoreline cleaning range costing $100 per ton collected by volunteer-led initiatives, to in excess of $20,000 per ton for dense waste and heavy fishing gears.
- McIlgorm et al. found that the **average shoreline clean-up cost estimate across studies has an average of US$1500/ton (~€1300/ton)**.

■■■ ECONOMIC LOSS   ■ POTENTIAL COST

THE IMPACT AND COSTS OF MARINE PLASTIC POLLUTION ARE NOT TYPICALLY BORNE BY THE POLLUTERS, BUT BY COASTAL COMMUNITIES, LOCAL MUNICIPALITIES AND DIRECTLY AFFECTED INDUSTRIES.

[1] Cost to industry is calculated based on the methodology used in McIlgorm et al, 2011., taking the proxy of cost to the fishing and shipping industries from from Takehama, 1990.
Sources: European Commission 2018,'Blue Economy Report', WEF, 2017,'Travel and Tourism Competitiveness Report', World Bank.

CURRENT POLICIES REGARDING PLASTICS

PLASTIC PRODUCTION

PLASTIC USAGE

WASTE MANAGEMENT

MISMANAGED WASTE

EXISTING INITIATIVES

national level

Plastic Usage

Ban on free plastic bags: customer levy of € 0.04 in 2018, €0.09 in 2019, aiming to reduce bag consumption from an average of 296 per person per year.
Results: some retailers selling thicker plastic bags for lower price.

EU single use directive: it is unclear how this will be implemented.

Waste Management

EPR Law 2939/01: obliges producers to finance collection and recycling through a number of EPR schemes

New Recycling Law 4496/2017: sets out a national plan for a 4-stream collection system (paper, glass, metals, plastics) and new targets of 74% waste diverted from landfill.
Results: implementation remains a challenge due to higher costs, more logistics and stakeholder pushback.

Landfill tax 4042/2012: set a 35 €/t tax on landfilling untreated waste, to reach 60 €/t, but was never rolled out.
Result: a new 10 €/t announced as part of the circular economy

Mismanaged Waste

2020 EU Waste Directive: reaching 50% of MSW prepared for re-use or recycling by 2020.
Result: considered 'at risk' of missing the target in 2016, due to high levels of landfilling.

Closing of illegal dump sites: in 2011, 63 illegal dumpsites were recorded as still active, but the government has made active efforts to close or convert these.
Results: difficulty monitoring sites

Directive (EU) 2018/852: increasing plastic recycling target to 55% in 2030, but it remains unclear how this will be implemented.

municipal level

Local initiatives against plastic usage: voluntary initiatives to reduce plastic consumption.
Results: plastic-free islands (Paros)

LIFE+ Pay as you throw: tariff scheme piloted in Vrilissia, Elefsina.
Results: expected to increase recycling for packaging by 15%

Blue bin system by municipalities: municipalities are responsible for blue bin collection, with support and funding from HERRCo.
Result: in 2017, the system collected 73,4kt of plastic (including industrial and commercial waste and recovering for mechanical sorting facilities). ~8% of all plastic waste

Municipal clean-up operations: a number of municipalities joined up with NGOs to clean beaches in locations such as Naxos, Hydra, Athens coast, etc.
Results: the debris flux on Greek beaches is lower than average

■ industry   ■ policy-makers   ■ consumers   □ to be implemented

Initiatives tend to focus downstream on improving waste management and clean-up. While these are important elements, there have only been limited laws on reducing plastic usage or supporting alternatives to virgin plastics.
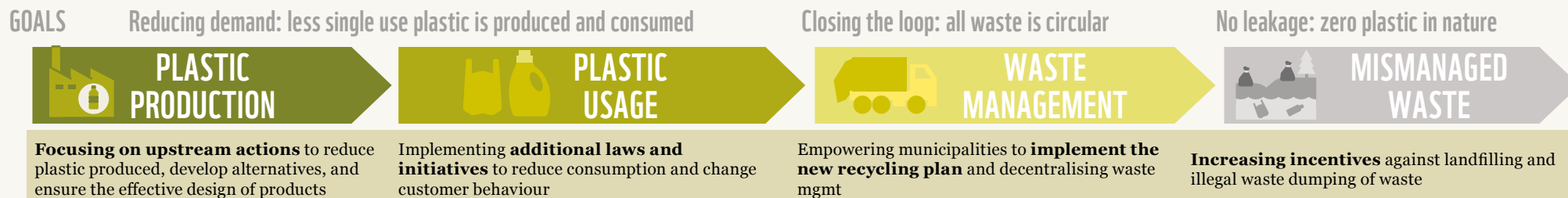
GOALS

Reducing demand: less single use plastic is produced and consumed		Closing the loop: all waste is circular	No leakage: zero plastic in nature
PLASTIC PRODUCTION	**PLASTIC USAGE**	**WASTE MANAGEMENT**	**MISMANAGED WASTE**
Focusing on **upstream actions** to reduce plastic produced, develop alternatives, and ensure the effective design of products	Implementing **additional laws and initiatives** to reduce consumption and change customer behaviour	Empowering municipalities to **implement the new recycling plan** and decentralising waste mgmt	**Increasing incentives** against landfilling and illegal waste dumping of waste

EXAMPLE BEST PRACTICE INITIATIVES

national level

PLASTIC PRODUCTION	PLASTIC USAGE	WASTE MANAGEMENT	MISMANAGED WASTE
Develop **design requirements** on the recyclability of plastic packaging (e.g. connecting plastic caps to bottles, etc.)	Implement additional **single-use item bans, such as disposable eating containers and utensils** and **micro-plastics** in cosmetics, and consider **deposit refund schemes**	**Improve EPR** to require higher mandatory contributions (currently at € 63/t), include SMEs, the informal sector and reform HERRCo's to focus on financing rather an implementing body	Enforce and increase **the landfill tax** to reach the objective of 74% waste diverted from landfill
Provisions of non-virgin plastic material in public procurement, in order to stimulate a market for **secondary materials and alternative feedstock** (whilst conducting lifecycle analysis on their impact)	Ensure **penalties** are in place for the non-adherence to these laws	Technical support to municipalities to implement the **4-stream recycling systems** as per the national plan, including trainings and citizen awareness campaigns	Continue using technology to identify **illegal dumping sites** and end waste flow into these facilities
	Work with **industries**, starting with those participating in HERRCo, to reduce unnecessary packaging		
	Work with local businesses operators, including the tourism industry to further minimize the use of plastic in tourist hotspots	Target municipalities with **low levels of blue bin collection** with additional bins, vans, financing and a plan to switch to 4-streams	Create **accountability mechanisms for locally mis-managed waste**, including audits and penalties for municipalities with low efficiency

municipal level

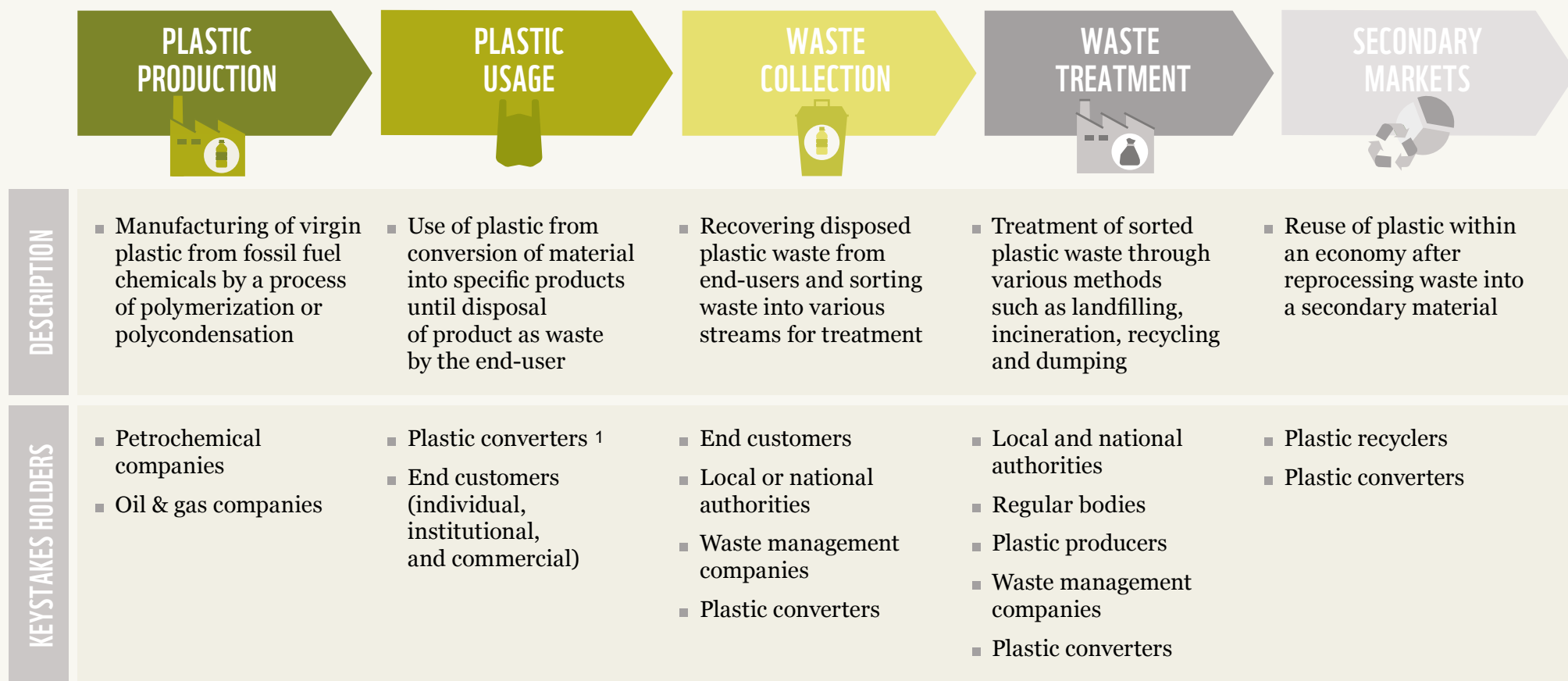| PLASTIC PRODUCTION	PLASTIC USAGE	WASTE MANAGEMENT	MISMANAGED WASTE
	Scale up **pay-as-you-throw** initiatives, and develop a **green points** system to reward customers and organisations making efforts.	Develop **seasonal waste management plans** for islands and coast-line of particularly high tourist influx.	

■ industry   ■ policy-makers   ■ consumers

PRIORITY ACTIONS – POLICY LANDSCAPING ANALYSIS

FOCUS AREA	POTENTIAL IMPACT	FEASIBILITY AND TIMEFRAME	PRIORITY ACTIONS
1. ENCOURAGE REDUCED CONSUMPTION BY INDUSTRIES AND CONSUMERS. ■ Imposes stricter bans, e.g. on thicker plastic bags and the 10 items in the single-use directive ■ Enforce higher penalties on the failure to adhere to plastic bans. *Value chain segment targeted:* **production** · **usage** · waste manag. · mis-manag. waste	■ **Reducing** the total amount of **plastic waste generated** ■ **Effective behavior change**, reducing e.g. Greece's annual plastic bag consumption from 296 per capita to ~40 per capita. ■ **Promoting sustainable tourism practices** to prevent in influx of waste leakage in high season *Medium impact on plastic in nature*	■ **Feasibility: achievable** Public interest in reducing plastic use and waste is growing, building on the EU single use directive momentum ■ **Timeframe: medium** The passing of the single-use plastics directive can help accelerate the pace of new legislation, but effectively implementing such laws is lengthy. *Low difficulty to implement*	■ Campaign for a **binding agreement** on the 10 EU directive items to ban. ■ Leverage the EU single-use directive to lobby for **stricter enforcement** of bans, particularly in areas susceptible to leakage (e.g. rivers, coasts) ■ Develop **citizen education** and awareness initiatives around the importance of plastic ban
2. SUPPORT MUNICIPALITIES ON THE NEW WASTE MGMT. PLAN ■ Implement 4-waste stream waste collection methods ■ Increase waste management *Value chain segment targeted:* production · usage · **waste manag.** · mis-manag. waste	■ Achieve the targets of 74% **waste diversion and 26% landfilling.** ■ **Empower** municipalities to improve their waste mgmt., practices through training and additional financing. ■ Achieve **consumer behavior change** on waste disposal. *High impact on plastic in nature*	■ **Feasibility: challenging** While the new recycling plan has already been approved, it will be given pushback from various stakeholders. ■ **Timeframe: long** Given challenging logistics of implementing a 4-stream recycling system, and necessary infrastructure. *Medium difficulty to implement*	■ Identify and focus programs on municipalities with high need, but also strong local contact and support (e.g. Common Seas and WWF work on Paros Island). ■ Support municipalities in piloting separated waste collection (e.g. yellow bins for paper, red bins for plastic).
3. INCREASE ACCOUNTABILITY OF PLASTIC INDUSTRIES: ■ Increase EPR contributions, ■ Develop enforcement mechanisms for SMEs and the informal sector. ■ Lobby key stakeholders to support the 4-stream collection system *Value chain segment targeted:* production · usage · **waste manag.** · **mis-manag. waste**	■ Increase the capacity of all municipalities to collect separate waste streams Improve rates of *raccolta differenziata* to reach the national goal of **X%** nationally through better citizen education *Medium impact on plastic in nature*	■ **Feasibility: medium** Industry stakeholders have limited incentives to change the current blue bin system or increase contributions. ■ **Timeframe: short** Industries can implement initiatives far more quickly than the public sector, once the business case is realized *Medium difficulty to implement*	■ Focus on articulating the **economic case** to reduce plastic pollution ■ **Mobilize consumers** to put pressure on plastic producers to take greater responsibility for plastic waste. ■ Lobby the government to provide fiscal incentives for innovation around recyclability and alternative materials.

ANNEX I – THE PLASTICS VALUE CHAIN AND STAKEHOLDERS

	PLASTIC PRODUCTION	PLASTIC USAGE	WASTE COLLECTION	WASTE TREATMENT	SECONDARY MARKETS
DESCRIPTION	■ Manufacturing of virgin plastic from fossil fuel chemicals by a process of polymerization or polycondensation	■ Use of plastic from conversion of material into specific products until disposal of product as waste by the end-user	■ Recovering disposed plastic waste from end-users and sorting waste into various streams for treatment	■ Treatment of sorted plastic waste through various methods such as landfilling, incineration, recycling and dumping	■ Reuse of plastic within an economy after reprocessing waste into a secondary material
KEYSTAKES HOLDERS	■ Petrochemical companies ■ Oil & gas companies	■ Plastic converters [1] ■ End customers (individual, institutional, and commercial)	■ End customers ■ Local or national authorities ■ Waste management companies ■ Plastic converters	■ Local and national authorities ■ Regular bodies ■ Plastic producers ■ Waste management companies ■ Plastic converters	■ Plastic recyclers ■ Plastic converters

[1] Manufacturers of plastic products in all plastic markets (e.g. packaging, building and construction, transport) that convert virgin plastic into a specific products for use within the economy. These plastic products can be combined with other non-plastic materials during the conversion process
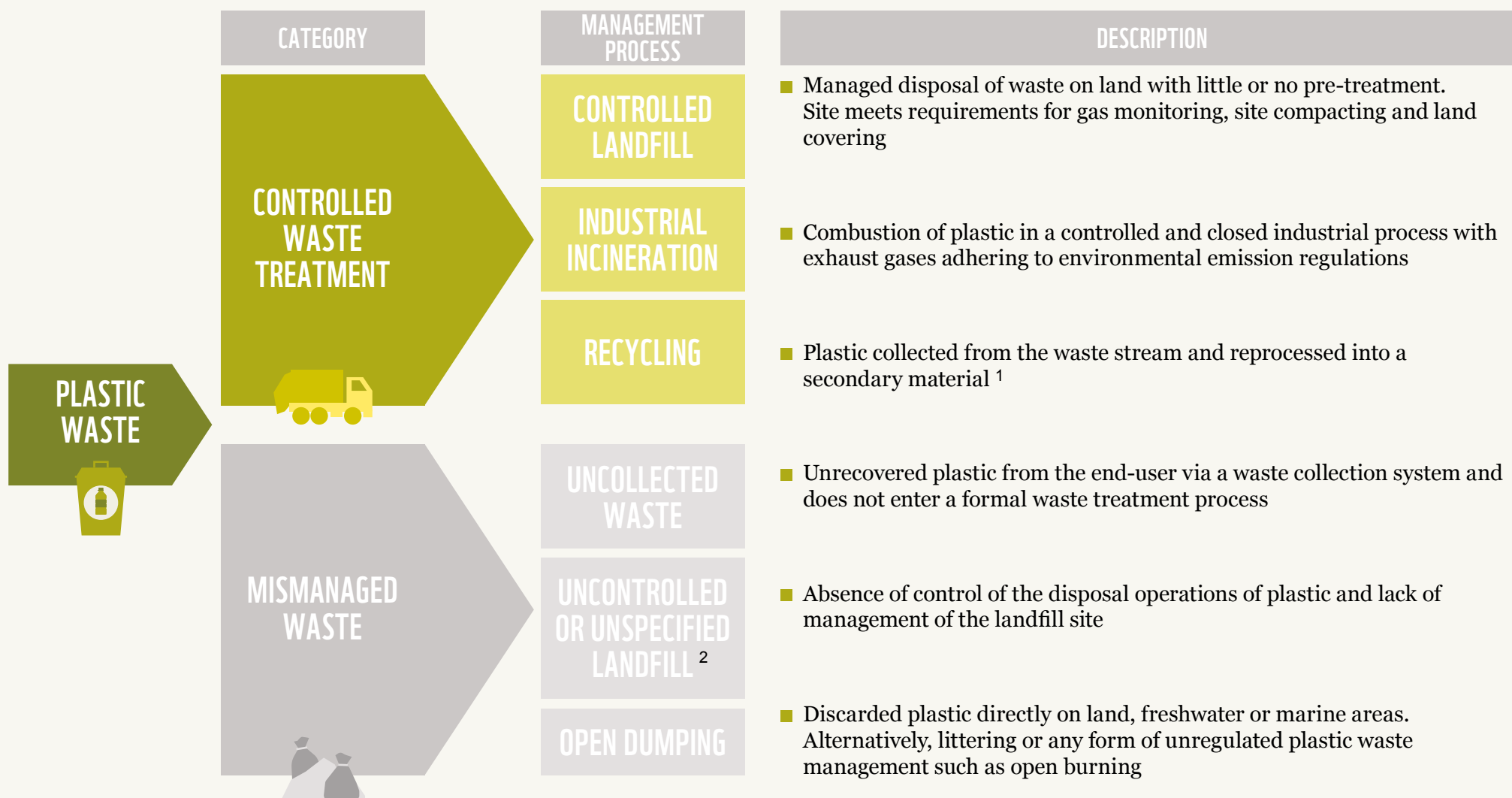
ANNEX II – GLOSSARY

TERMS

■ Controlled landfill	A landfilling process which is subject to a permit system and to technical control procedures in compliance with the national legislation in force.
■ Uncontrolled landfill	A landfilling process which fails to meet certain standards and technical control procedures, and therefore is at risk of leakage or contamination.
■ Open dump	Illegal land disposal sites at which solid wastes are disposed of in a manner that does not protect the environment, and are therefore susceptible to leakage, open burning, and are exposed to the elements, vectors, and scavengers.
■ Controlled waste treatment	All legally compliant waste treatment operations, including controlled landfilling, waste-to-energy (incineration) and recycling.
■ Secondary material production	The total amount of secondary plastic product extracted from the plastic recycling process, averaging at 55% of the material inputted for recycling.
■ Recycling	All plastic collected for recycling from the waste stream. This figure is not adjusted for actual material losses during reprocessing into a secondary material. These material losses result from collected plastic considered as not recyclable due to additives preventing recycling or food contamination, etc.
■ Mismanaged waste	All plastic left uncollected, openly dumped into nature, littered, or managed through uncontrolled landfills.
■ Recovered mismanaged waste	Mismanaged waste that re-enters the controlled waste management process through waste-pickers, clean up operations, or any other method.
■ Bio-degradable	A product that can be broken down by microorganisms (bacteria or fungi) into water, naturally occurring gases like carbon dioxide (CO_2) and methane (CH_4) and biomass.
■ Blue Economy	Represents all economic activities related to oceans, seas or coastal areas. It covers established sectors such as fisheries, shipbuilding and tourism as well as emerging industries, including ocean energy and biotechnology.

ANNEX III – METHODOLOGY FOR THE CALCULATION OF EACH DATA METRIC IN THIS GUIDEBOOK

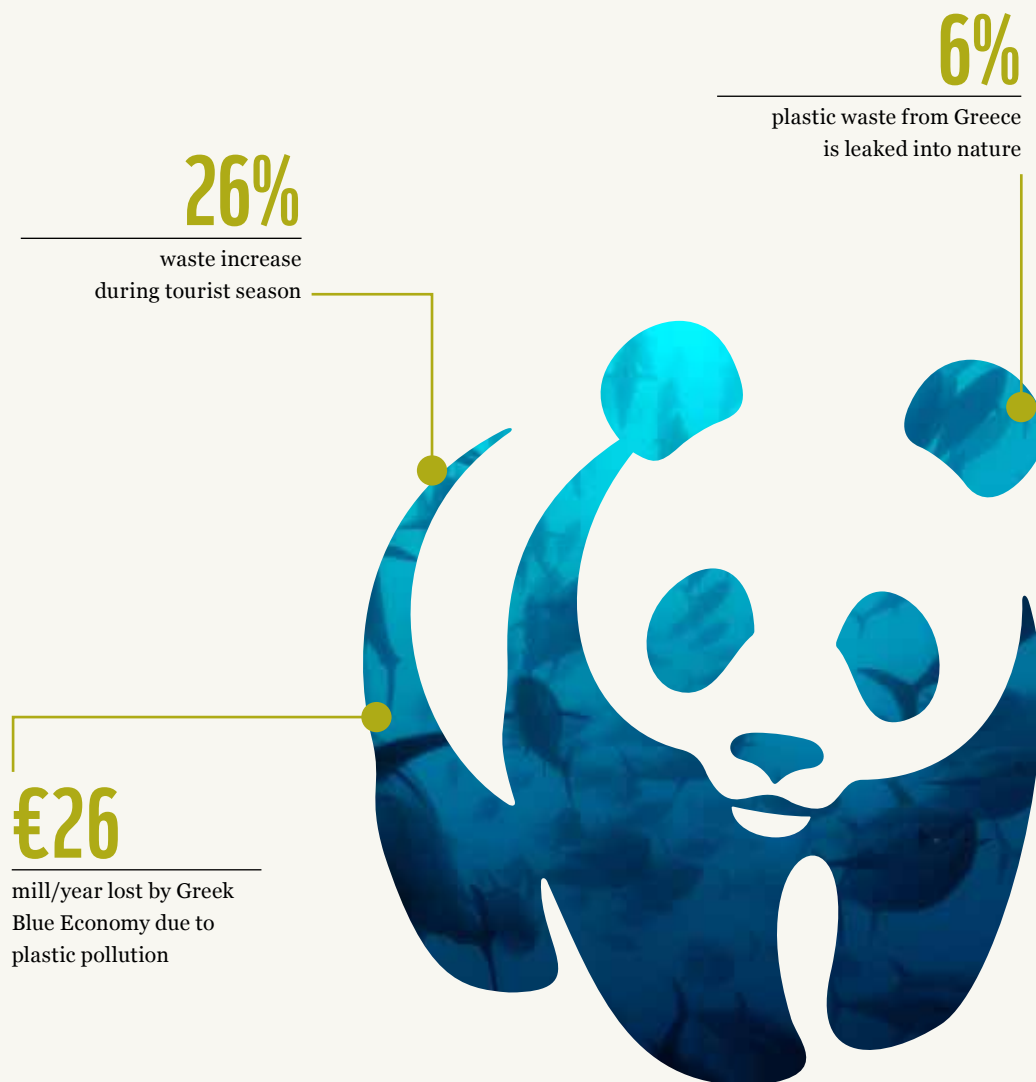| SECTION	METRIC	METHODOLOGY
PLASTIC LIFECYCLE (MT)	■ Plastic produced	Collected national-level data on total production of PP, PET, HDPE, LDPE, PCV and PS. Plastics are used in many products that are imported and exported and limited public data exists separating these goods into their raw materials used. This plastic goods production data by country is not adjusted for international trade (import and export) of these products. If national plastic goods data unavailable, calculated based on the ratio of global plastic production to plastic waste for 2016 in the WWF global plastics report (78%).
	■ Waste Generation and Management	Collected national-level data on total plastic waste generation per annum, or total waste MSW waste generation and percent composition of plastic within MSW. Also collect national-level data on plastic management (percentages of plastic waste collected landfilled, incinerated, recycled or openly dumped). Data validated with relevant WWF national offices.
	■ Mismanaged waste	Calculated by adding the total waste which goes uncollected, openly dumped and sent to uncontrolled landfills. Data on uncollected waste is taken from the World Bank 'What a Waste 2.0' Database.
	■ Waste recovered or leaked into nature	Calculated using the proxy of 90% of mismanaged waste ending up in nature, based on the study completed by Jenna Jambeck Research Group, 2015. We assume the rest of the waste is recovered through clean-up operations, etc.
	■ Waste leaked into the Mediterranean	- For countries whose coastline are only on the Mediterranean, this figure is calculated based on the proxy that 10% of plastic waste becomes marine litter, as found in the analysis completed by Jenna Jambeck Research Group, 2015. - For countries with multiple coastlines, this figure also takes into consideration the proportion of waste generated by regions with coastlines on the Mediterranean.
	■ Waste leaked by source (sea-based, rivers, coastal)	Collected data on sea-based sources and major rivers from S. Liubartsevaa et al, 2018. Where data is missing for other major rivers, annual plastic flux is calculated as a ratio between the Po River's drainage basin, and its annual plastic flux. Coas tal sources represent the remainder of annual leakage.

SECTION	METRIC	METHODOLOGY
PLASTIC IMPACT	■ Energy consumed in oil equivalent (M, barrels)	Calculated based on the weighted average of energy required to make a kilogram of global plastic (PP, PET, HDPE, PS, PCV), converted into barrel of oil equivalent.
	■ Average age of plastic life (years)	Calculated based on national data collected on the production of plastic per industry, and the average lifetime of plastic goods in each industry, as found in peer-reviewed research completed by Roland Geyer et al, *"Production, Use, and Fate of All Plastics Ever Made"*, 2017
	■ CO_2 emissions (MT)	Calculated based on the average CO_2 emissions caused by plastic production, incineration and recycling, as reported by SITRA, 2018: *"The Circular Economy a Powerful Force for Climate Mitigation"*.
	■ Annual coastline plastic pollution (kT)	Calculated based on the daily plastic debris flux (kg/km) multiplied by the total length of the coastline and 365 days. This differs from the total plastic leaked into nature as it doesn't include plastic on the sea-bed and sea-surface.
	■ Daily plastic flux (kg/km)	Collected data from S. Liubartsevaa et al, 2018: "Tracking plastics in the Mediterranean: 2D Lagrangian model".
	■ Economic cost of pollution (M, €)	Calculated based on the methodology used in McIlgorm et al, 2011 to estimate the cost of plastic pollution to the APAC region, which takes the proxy of cost to the fishing and shipping industries from Takehama, 1990.
	■ Cost of waste generated by tourists (M, €)	Calculated based on the proportion of waste generation caused by tourists, which was calculated based on national statistics on tourist arrivals and departures. The cost uses the World Bank estimated cost of $50-100/T of waste in an advanced system.

ANNEX IV – PLASTIC WASTE SYSTEM ACTIVITIES CAUSING CONTROLLED AND MISMANAGED WASTE

CATEGORY	MANAGEMENT PROCESS	DESCRIPTION
CONTROLLED WASTE TREATMENT	CONTROLLED LANDFILL	Managed disposal of waste on land with little or no pre-treatment. Site meets requirements for gas monitoring, site compacting and land covering
	INDUSTRIAL INCINERATION	Combustion of plastic in a controlled and closed industrial process with exhaust gases adhering to environmental emission regulations
	RECYCLING	Plastic collected from the waste stream and reprocessed into a secondary material [1]
MISMANAGED WASTE	UNCOLLECTED WASTE	Unrecovered plastic from the end-user via a waste collection system and does not enter a formal waste treatment process
	UNCONTROLLED OR UNSPECIFIED LANDFILL [2]	Absence of control of the disposal operations of plastic and lack of management of the landfill site
	OPEN DUMPING	Discarded plastic directly on land, freshwater or marine areas. Alternatively, littering or any form of unregulated plastic waste management such as open burning

PLASTIC WASTE

[1] Not accounting for plastic losses during the recovery process
[2] Unless explicitly specified as "controlled" or "sanitary" landfills, we consider all other landfills as uncontrolled.
Source: Dalberg analysis, Jambeck & al (2015), World Bank (2018), SITRA (2018), European Commission (2001)

6%
plastic waste from Greece
is leaked into nature

26%
waste increase
during tourist season

€26
mill/year lost by Greek
Blue Economy due to
plastic pollution

Why we are here
To stop the degration of the planet's natural environment and
to build a future in which humans live in harmony with nature.

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