

Marine Debris in the Circular Economy

3a. Circular Economy Solutions for Marine Litter

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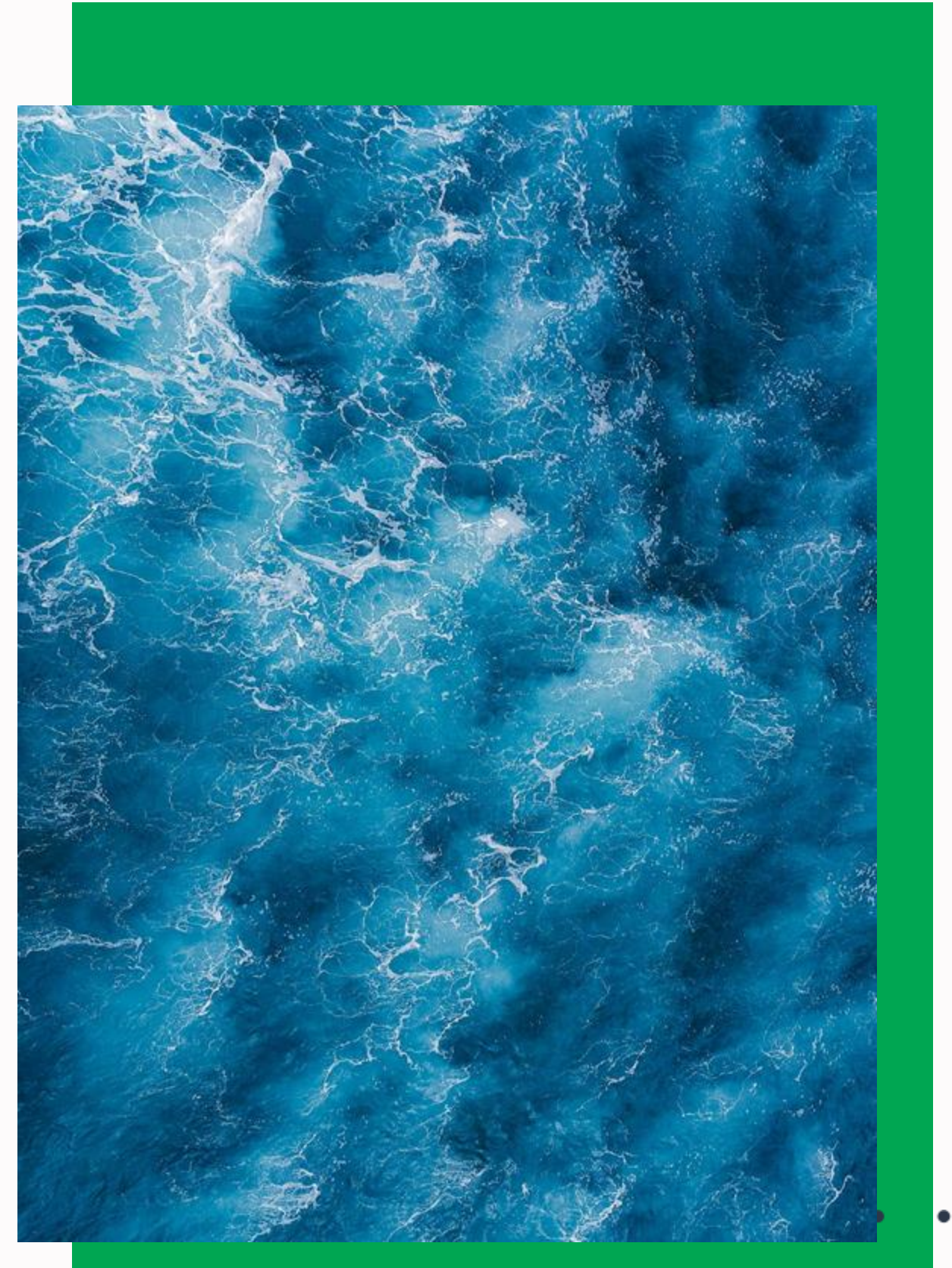
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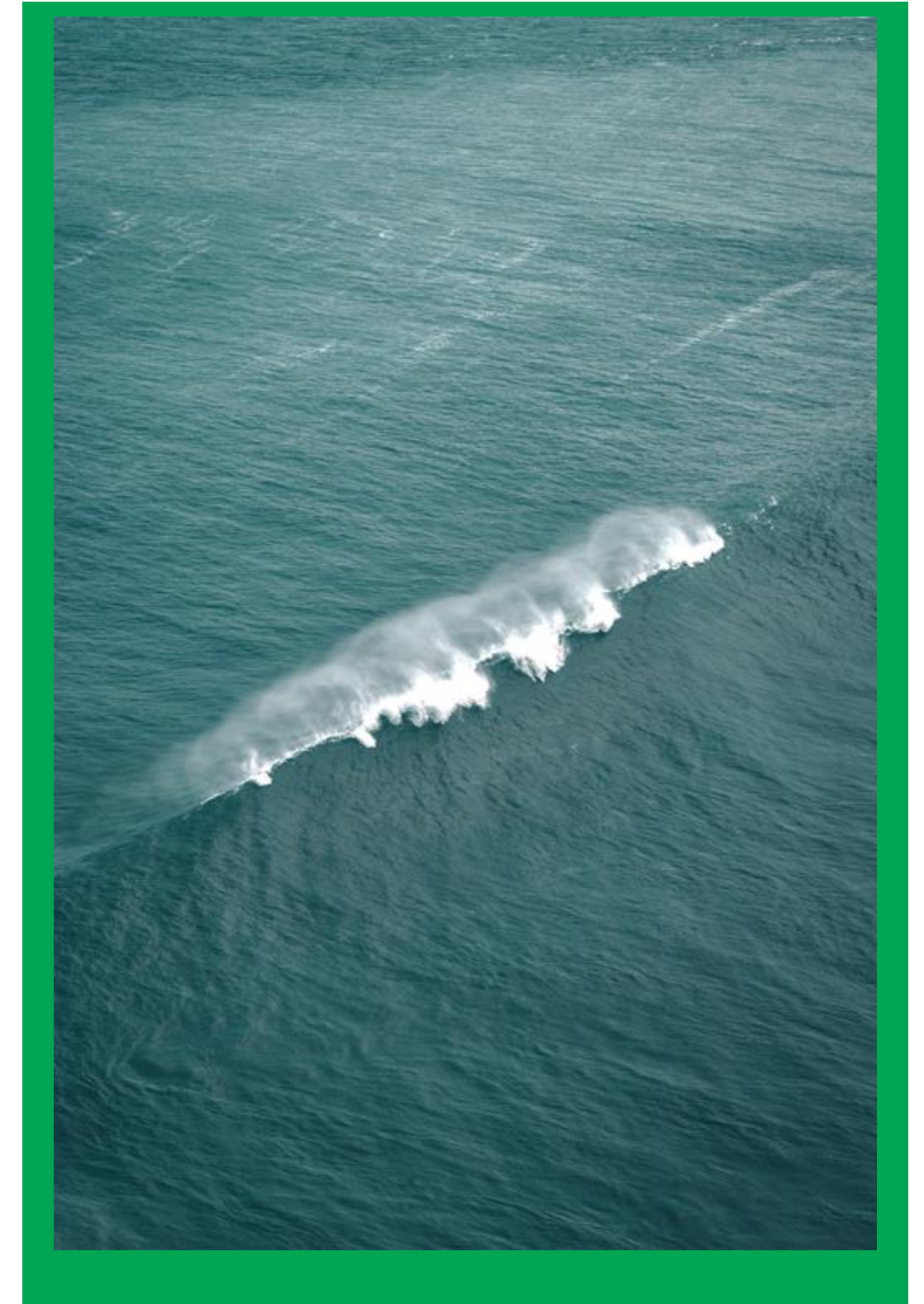
Introduction

Objective:

- To explain the key principles of the circular economy, waste prevention, product design for recyclability, and closed-loop systems. .
- To explore the innovative approaches to plastic waste management, such as extended producer responsibility schemes, deposit-refund systems, and eco-friendly packaging alternatives. .

Learning Outcomes:

- Understanding the sources and impacts of marine debris on the blue economy industries.
- Exploring the principles and strategy of the circular economy as applied to the management of marine litter.
- Analysing the role of blue economy industries in plastic pollution generation and potential solutions, and waste reduction and recycling.

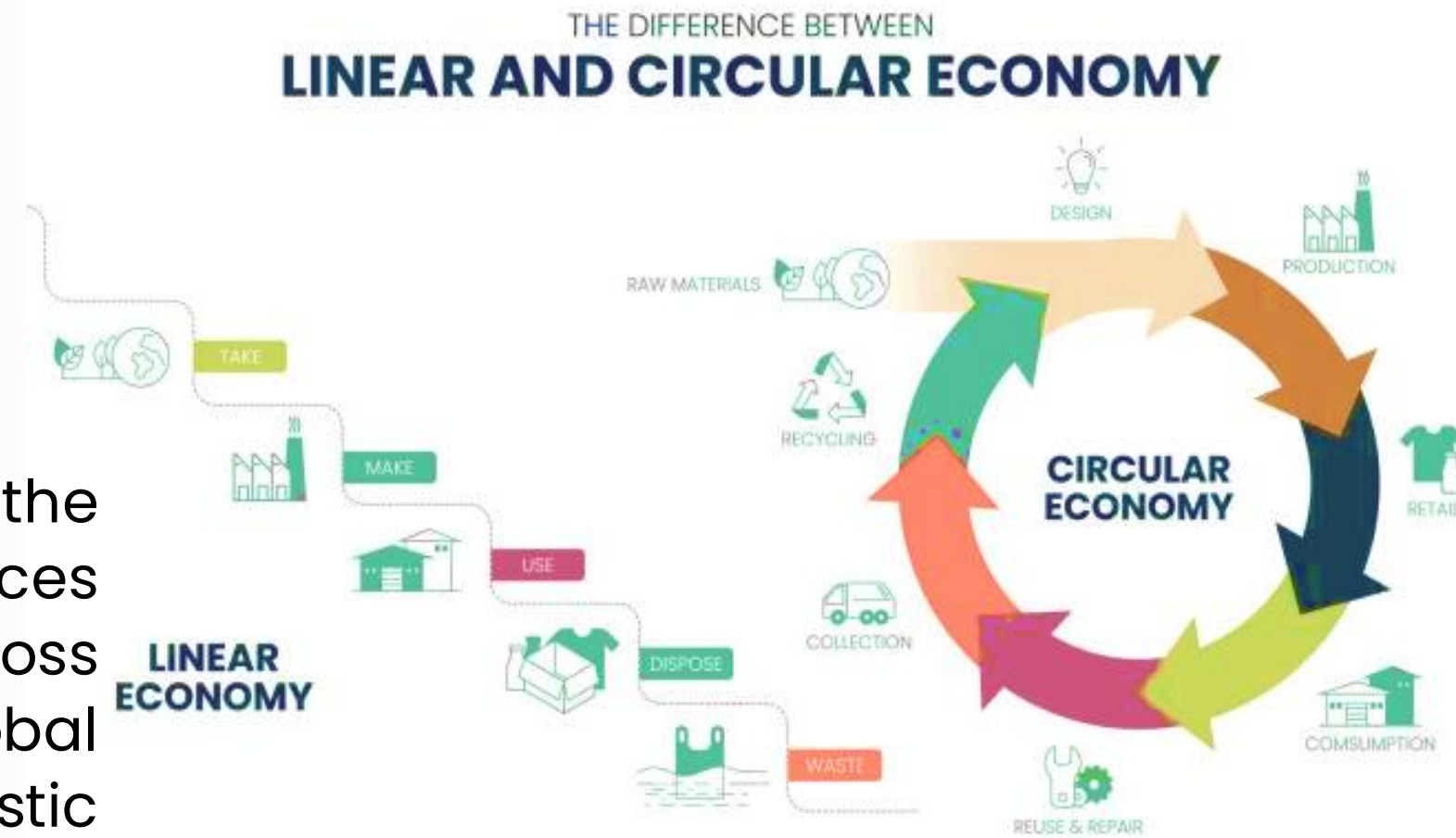


What is Circular Economy

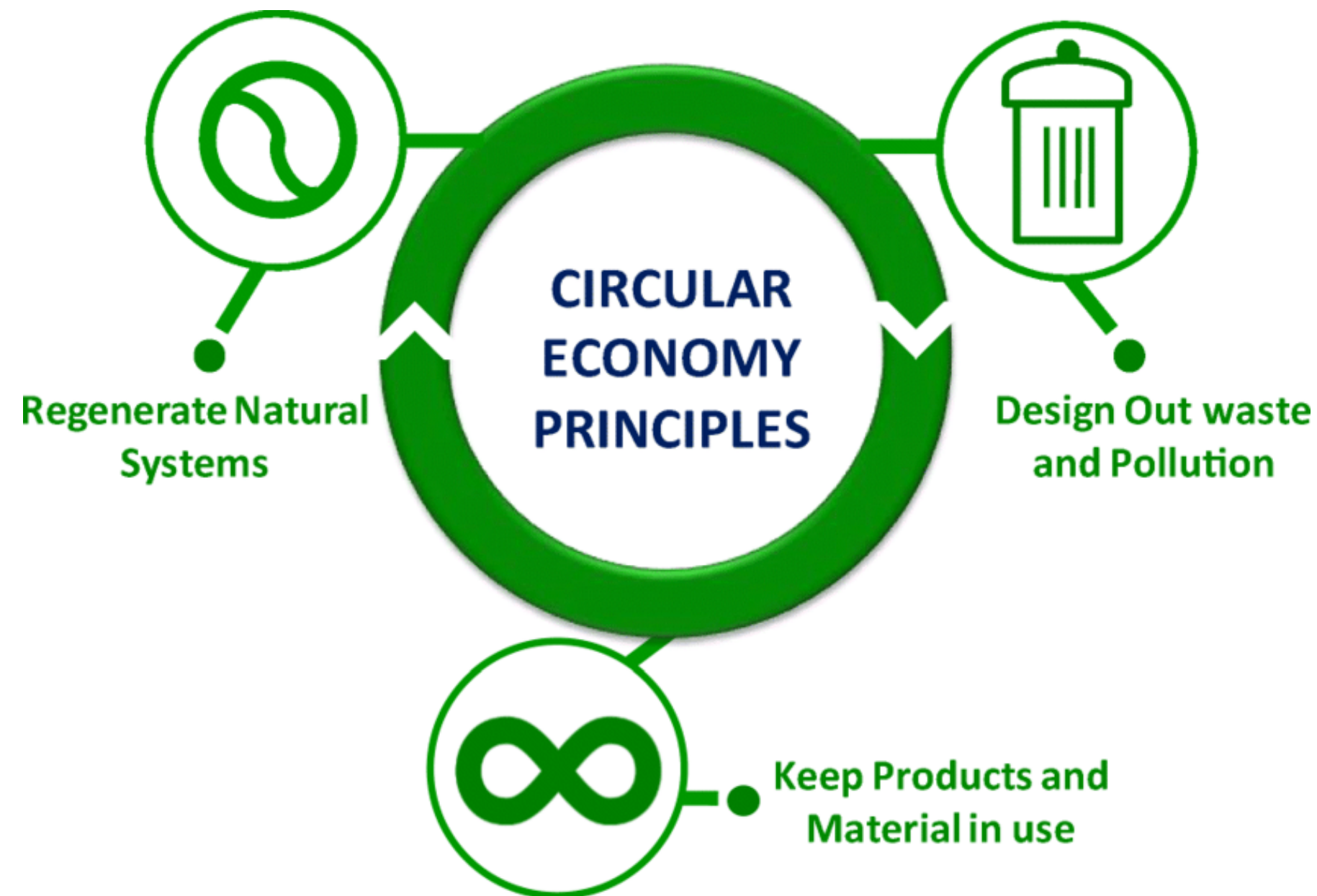
- A circular economy is a system that aims to maximize the value derived from resources while minimizing the amount of waste sent for disposal. The circular approach aims to:

1. **Maximize resource efficiency**
2. **Minimize waste and pollution**
3. **Keep materials in use for as long as possible**

- By designing products for reuse, repair, and recycling, the circular economy supports sustainable growth, reduces environmental impact, and fosters innovation across industries. One of the key strategies for addressing global challenges like climate change, biodiversity loss, and plastic pollution.
- A linear economy follows a "take-make-dispose" model that prioritizes short-term use and generates significant waste, while a circular economy focuses on keeping resources in use through reuse, recycling, and regeneration to minimize environmental impact and promote sustainability (Edirisinghe et al., 2023).



Circular Economy



3. We strive to regenerate natural systems by using processes that restore ecosystems rather than deplete them

1. We aim to design out waste and pollution- we rethink product design to eliminate waste before it's ever created

2. We keep products and materials in use, which encourages repair, reuse, and recycling to extend their lifecycle

Circular Economy



- Circular economy solutions for marine litter fall under **Sustainable Development Goal (SDG) 14: Life Below Water**
- Prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution



Introduction of Marine Litter



Adapted from: <https://cleancoasts.org/marine-litter/>

- According to the UNEP report *Marine Litter – An Analytical Overview*, marine litter refers to any **persistent, manufactured, or processed solid material** that is discarded, disposed of, or abandoned in marine and coastal environments. (GreenFacts, 2019)
- Marine litter consists of items that have been made or used by people and deliberately discarded into the sea or rivers or on beaches; brought indirectly to the sea with rivers, sewage, storm water or winds; accidentally lost, including material lost at sea in bad weather (fishing gear, cargo); or deliberately left by people on beaches and shores.
- The waste that cannot be collected or properly managed eventually leaks into the environment and is carried to the seas by rivers. The outcome is that 75% of assessed marine areas are polluted (European Environment Agency, 2023).



Introduction to Marine Litter

- Plastic waste, ranging from microplastics to large debris, continues to accumulate in marine environments, posing a severe threat to our ecosystems.
- From entanglement and ingestion by marine species to the disruption of food chains, plastic pollution wreaks havoc on marine life (Paul et al., 2024).
- The situation is further exacerbated by the persistence of plastics, which can take hundreds of years to degrade, exacerbating the long-term environmental impact (Oliveira et al., 2020).
- To mitigate these trends, urgent global action is required, including improved waste management, plastic reduction strategies, and enhanced international cooperation to safeguard the health and biodiversity of our planet.



<https://mykindlyearth.com/the-real-impact-of-plastic-bags-on-our-environment/>



Circular Economy Insights on Marine Litter

1. Product Design for Waste Reduction

Circular economy principles promote designing products in a way that prevents waste generation. Much of the marine litter, particularly plastics, originates from inefficient product designs, such as single-use items and materials that are difficult to recycle (UNIDO, 2019).

2. Recovering Valuable Resources

Marine litter often contains materials like plastics and metals that hold economic value. With proper collection and processing, these materials can be recovered through recycling rather than remaining in the environment (Zhao et al., 2023).

3. Preventing Waste Leakage

Circular approaches aim to keep materials within the economic cycle. Marine litter reflects the failure of linear systems where waste is not recovered, resulting in environmental pollution (UNIDO, 2019).

3. Reducing Economic Losses

Inefficient waste systems, especially in plastic packaging, lead to substantial economic losses. It is estimated that more than \$100 billion per year poorly managed plastic waste, highlighting the need for circular models (World Bank, 2024).

4. Supporting Global Environmental Goals

Implementing circular strategies contributes to achieving Sustainable Development Goal (SDG) 14, which targets the reduction of marine pollution, particularly from land-based sources.

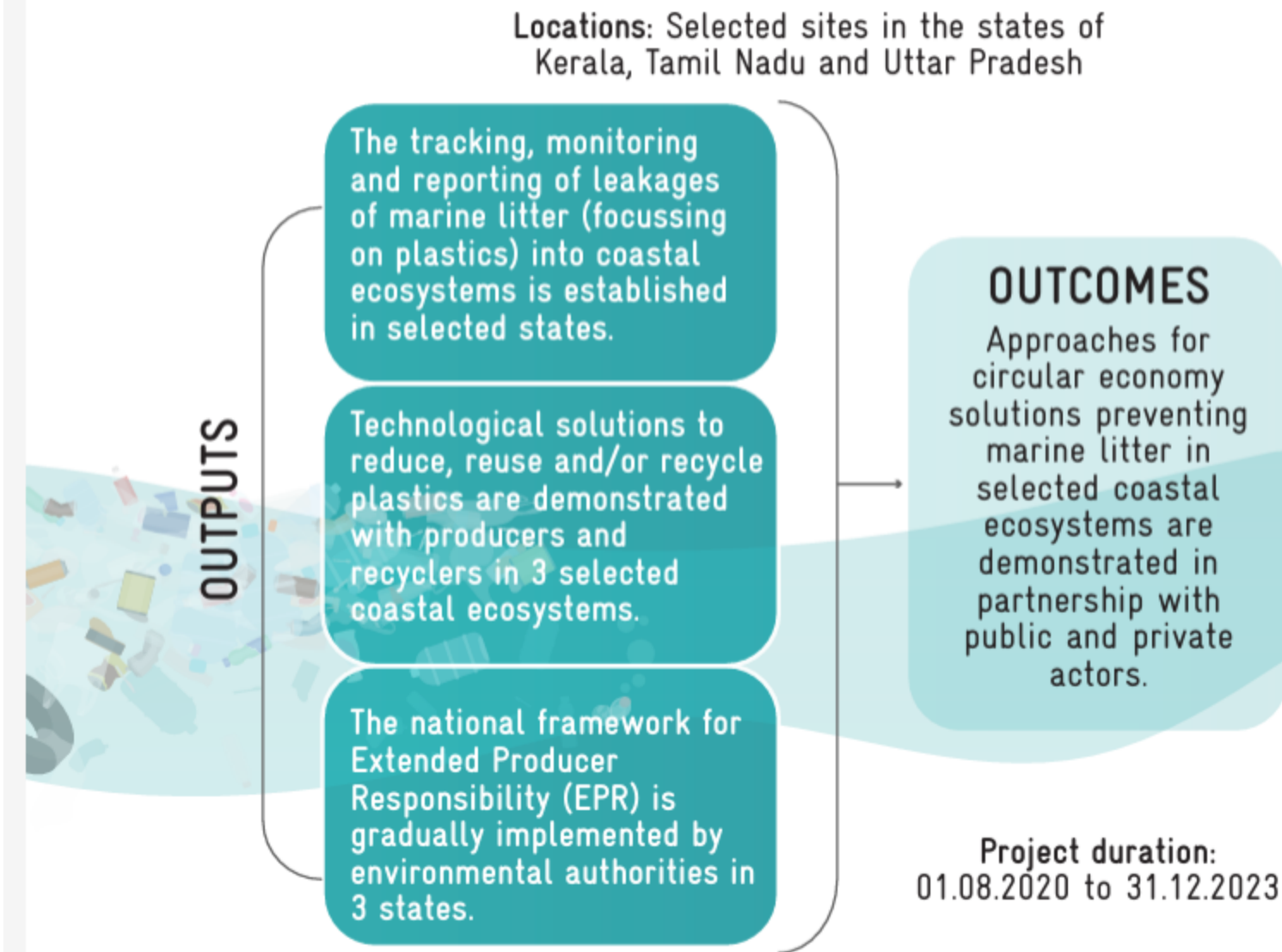


<https://www.marinebiodiversity.ca/how-marine-plastic-waste-becomes-valuable-the-circular-economy-solution/>



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Principle of Circular Economy



Example of waste prevention of marine litter (Circular economy solutions: Preventing marine litter in ecosystems, 2022)

1. Waste Prevention

- Waste prevention is a central strategy in the circular economy, aiming to reduce environmental impact by **avoiding waste generation at its source** (Islam et al., 2024).
- This approach prioritizes **designing products and systems** that use fewer resources, last longer, and are easier to repair, reuse, or recycle.
- Waste prevention is the most effective action within the waste hierarchy, as it directly reduces the volume of materials entering the waste stream and minimizes the need for downstream treatment and disposal.



Principle of Circular Economy



2. Product Design for Recyclability

Designing for recyclability ensures that products can be efficiently recovered, reused, or remanufactured at the end of their life, reducing waste and conserving resources. It involves:

•Material Selection

Choosing single (mono) materials over complex composites makes recycling easier and more effective. Utilizing materials supported by established recycling systems enhances product circularity (Martínez Leal et al., 2020)

•Eco-friendly Materials

Incorporating biodegradable or bio-based materials reduces environmental impact and supports regenerative systems. This aligns with circular principles of restoring natural systems (Eelager et al., 2025).



Principle of Circular Economy



3. Regenerate nature

Closed-loop systems aim to **retain materials within the economy** and prevent them from leaking into the environment, especially oceans. They are essential for tackling marine litter by transforming waste into valuable inputs that benefit nature (Kara et al., 2022).

•Recycling

Converts marine plastic waste into secondary raw materials for new products. Technologies like bottle-to-bottle recycling and chemical recycling are being piloted in coastal regions.

•Reusing

Extends product life through repair, remanufacturing, and reducing the need for new materials, and preventing waste generation.

•Resource Recovery

Extracts usable materials from waste streams, including compostable organics and recoverable plastics, to re-enter production cycles.

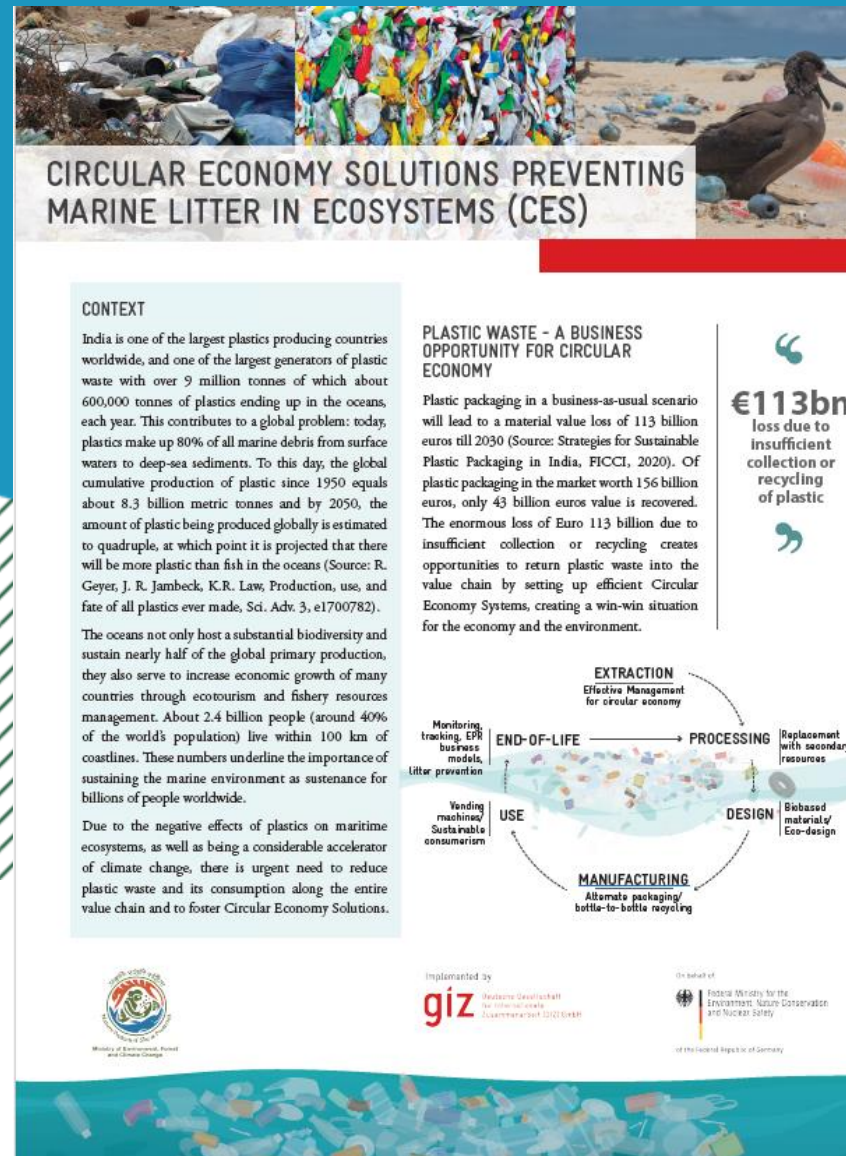


Conclusion

- Circular economy strategies offer a strong solution to tackle marine litter by changing how we produce, use, and manage materials.
- Instead of a "take-make-dispose" approach, circular systems focus on using fewer resources, reducing plastic waste, and reusing materials whenever possible.
- Applying these principles helps protect marine ecosystems, creates new economic opportunities, and supports climate resilience. To make a lasting impact, continued innovation, supportive policies, and active public involvement are crucial.



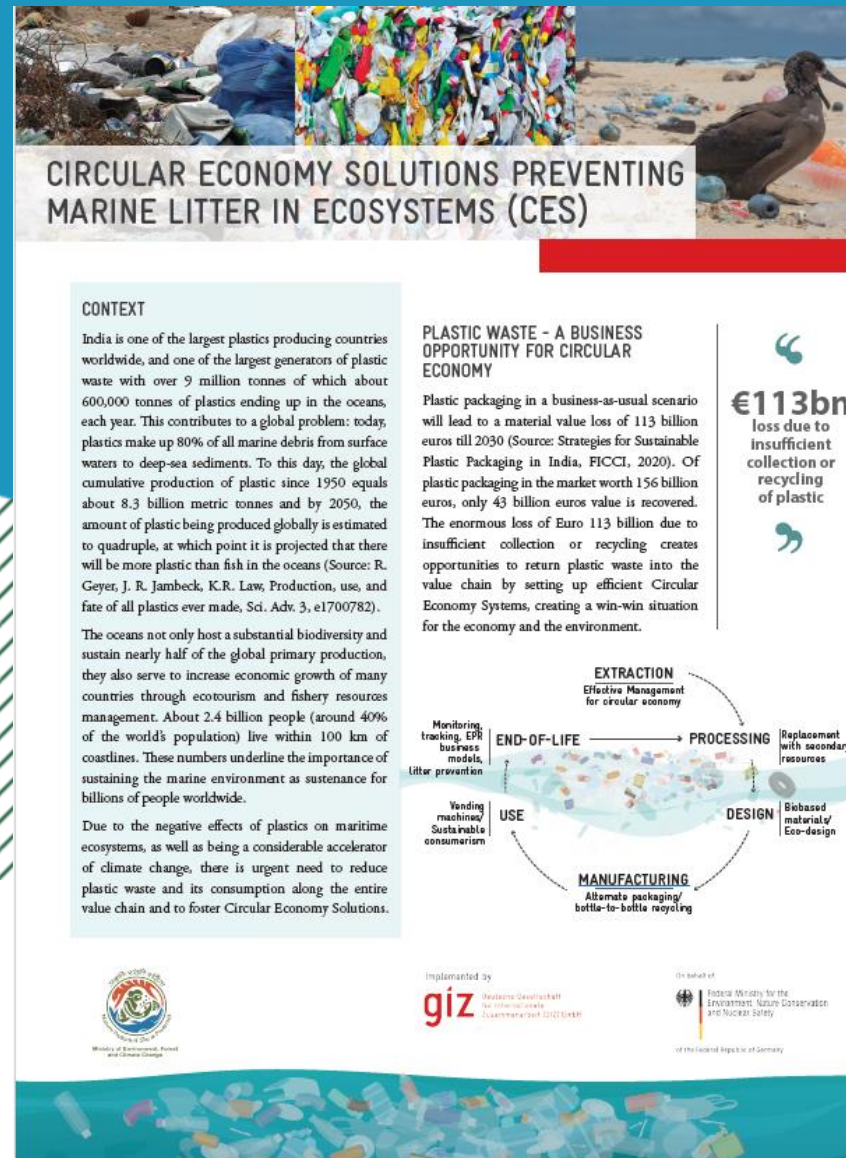
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THANK YOU

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