



# More than 9 billion tons of plastic have been made since the 1950s

- Made from oil (polymer hydrocarbons, often with additives)
- Mouldable
- Durable strong & robust
- Resist degradation, but will slowly break-down to Microplastics
- Recycling of plastics depends on their polymer groups, usage, properties and practical recyclability
- High in energy content















### **5 Billion tonnes?**

More than 5 Billion tonnes of plastic wastes might be accumulated in dumpsites/ landfills around the world <sup>©</sup>

This is non-recyclable and will slowly be released to the Ocean through rivers and groundwater and constitute a continuous source of Microplastics if not dealt with!



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### Improved treatment of plastic waste is urgently needed



Insufficient waste management infrastructure and treatment capacity in developing countries and emerging economies, especially connected to major river basins, landfills and industrial sites, is a major challenge.









## Objective of the project "Ocean Plastic Turned into an Opportunity in Circular Economy – OPTOCE"

OPTOCE aims to investigate how the involvement of resource and energy intensive industries, like cement manufacturing, can increase the treatment capacity for nonrecyclable plastic wastes in China, India, Myanmar, Thailand and Vietnam.



This is called Co-processing or Integrated waste management.

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# The most industrialised region

The five OPTOCE countries produce around 75% of the world's cement, steel and electric power, in tens of thousands of plants that use huge amounts of coal and contribute with a large chunk of the world's CO<sub>2</sub> emissions.

Replacing parts of the coal consumption with non-recyclable plastic waste represents a win-win opportunity.





# A super-important region



These countries have a population of 3 billion people, of which half live-in coastal areas.

They have the highest plastic consumption in the world, producing an estimated 176 000 tonnes of plastic waste per day, or around 64 million tonnes a year.

Only small quantities are handled in an environmentally sound way.



# We want to showcase the potential through local proof of concept in all OPTOCE-countries

Pilot Demonstrations will test and document the performance, i.e. describe the plastic waste co-processing capacity, environmental performance, cost- and energy efficiency, need for pre-treatment, limitations in types and volumes of plastic waste etc.

The overall aim is to provide a quantitative and qualitative assessment how the involvement of private industry can improve plastic waste management and prevent marine litter in each country.

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# **Planned Pilots in China**

MEE

BB/VG

华新水泥

CRAE

生态环境部

48.1 Million ton plastic waste is generated yearly in China.

- 1. Investigate the potential of collecting floating material from the Yangtze river, and using it as fuel in a local cement plant in Zigui town upstream the Three Gorges Dam in Hubei.
- 2. Investigate the possibilities of using non-recyclable plastic waste from the paper industry as fuel in BBMG cement plant in Jilin, NE China.

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9.5 Million ton plastic waste is generated yearly in India!

1. Investigate treatment options for mined combustible wastes from the Ghazipur dumpsite in Delhi - a project for the Government of India.

2. Compare the cost and the environmental impacts

Goa Waste Management Corporation.

of using a WtE Incinerator and a Cement kiln for



geocycle

3. Investigate the potential of using a local cement giz kiln as part of integrated waste management in

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Agra.

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### Planned Pilots in Vietnam



2.8 Million ton plastic waste is generated yearly in Vietnam.

- Investigate the possibilities of using nonrecyclable plastic waste from Vietnams biggest paper recycling plant as fuelreplacement in Hon Chong cement plant.
- 2. Cooperate with UNDP-project DWP5C in five Vietnamese cities. The non-recyclable plastic fraction will be tried co-processed in local cement industry if found feasible.





A thermal power plant operated by CLP India- CLP's plant in Jhajjar (Haryana, India) with installed capacity of 1320 MW is one of the TPPs ILFS is talking to..

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2. Provide technical assistance and build capacity about the potential of involving the cement industry in future waste management activities. Pilot in 2022?

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SCG

WORLD BANK

DOWA ECO-SYSTEM





































# OPTOCE is a pioneering project Treatment of non-recyclable plastic wastes is currently not on the world agenda, but constitute one of the biggest threats to life in Sea. To avoid that the plastic strangle us and our Oceans, we need to explore all cost-efficient options available. Our initial estimates shows that the involvement of the energy intensive industry in the five OPTOCE-countries can contribute significantly in removing non-recyclable plastic waste and at the same time replace huge amounts of coal ©

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### Avoid formation of dioxins in cement kilns

A smooth and stable kiln process, operating close to the process parameter set points is beneficial for all kiln emissions as well as energy use.

PCDD/PCDF control becomes a simultaneous effort to reduce the precursors from wastes and organics from the raw meal. Maintaining stable waste fuel and raw material feeding, smooth process conditions and sufficient oxygen concentration aids emission control.

Operators should aim to improve waste combustion conditions, especially when feeding waste to the pre-calciner, i.e. avoid overfeeding and ensuring sufficient quality of the solid wastes, i.e. particle sizes, heat and water content, as well as temperature, residence time, mixing conditions and oxygen control.

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### The following primary measures are considered to be most critical in reducing the emissions of PCDD/PCDF from cement kilns

- Quick cooling of kiln exhaust gases to lower than 200 °C in wet and long dry kiln;
- Characterize good operation and identify changes when feeding waste;
- Monitoring and stabilisation of critical process parameters, i.e. homogenous raw mix and fuel feed, regular dosage and excess oxygen, stable kiln operation and monitoring of CO;
- Pre-treat waste to make it more homogenous and create stable combustion and lower emissions;

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### Formation of dioxins in cement kilns

The primary source of formation is usually due to embedded organic compounds in the raw materials or incomplete combustion of wastes in the pre-calciner, or a combination of these two. Some raw material sources contain elevated concentrations of organic compounds which might be stripped off or volatilised when it enters the pre-heater at a temperature of around 350 °C.

Incomplete combustion of wastes in the pre-calciner may be due to over-feeding or too large particles; insufficient temperature, residence time and oxygen concentration, in combination with low energy- and high-water content of the waste derived fuels.

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### The following primary measures are considered to be most critical in reducing the emissions of PCDD/PCDF from cement kilns

- · Careful selection and control of substances entering the kiln;
- Appropriate storage, handling and feeding of waste;
- No waste feed as part of raw-material-mix if it includes organics;
- No alternative fuel feed during start-up and shut down;
- Feeding trough the main or secondary burner (>900 °C);
- Dust should be fed back to the kiln as much as possible.

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