# A novel approach to environmental cleanup of inland water courses

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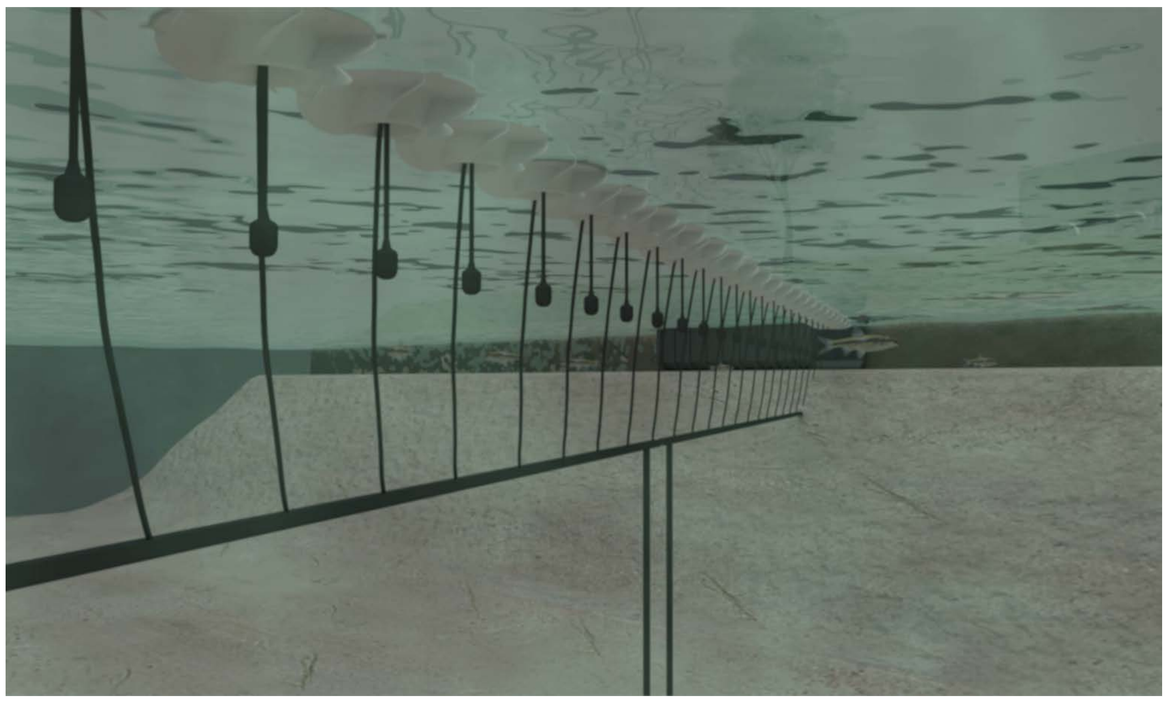

Fig. 1 3D model of the River Cleaning system, underwater view

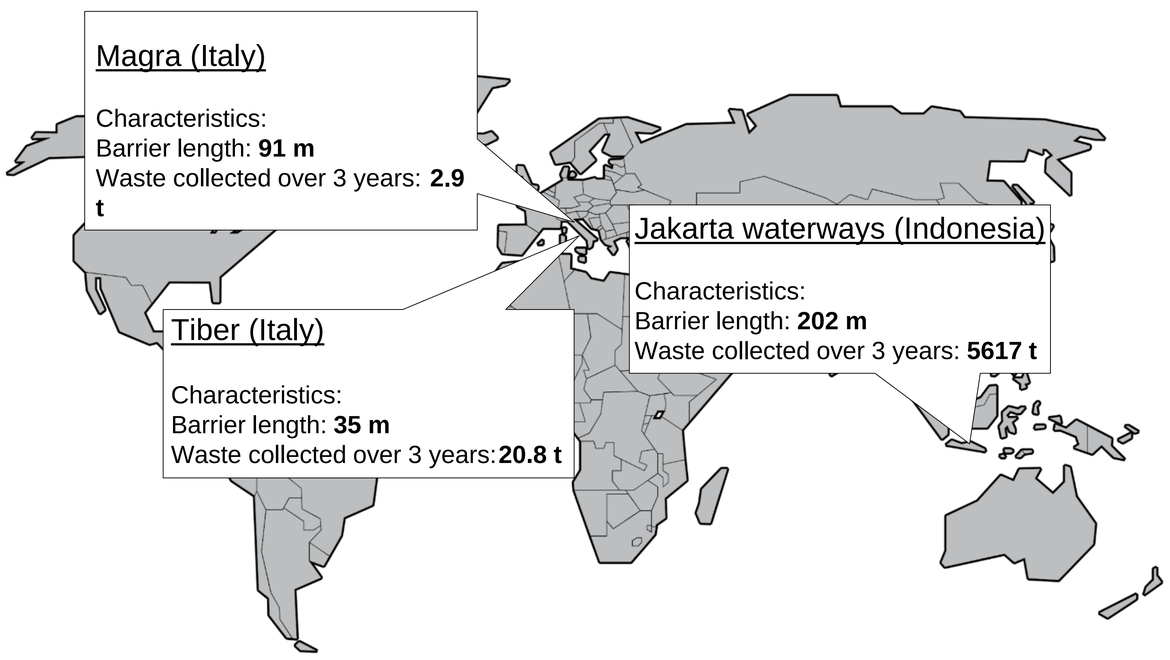


Fig. 2 Locations and characteristics of the LCA studies

## INTRODUCTION

Nowadays, about 2 million tons of plastic waste end up in inland water every year. From there, it is transported to the sea with catastrophic consequences at environmental, economic and social level. The River Cleaning system is a technology aimed at stopping and retrieving litter from water streams, without interfering with navigation and bringing minimal disruption to the ecosystem. The system uses the natural power of the stream to spin its buoying modules that move litter to the sides, from where it can be collected. The environmental benefits can be enhanced through the creation of recycle-aimed stocks, allowing circular development and credits for $CO_2$ compensation. Through the analysis of three sample locations (Magra River mouth and Tiber River mouth in Fiumicino in Italy; waterways in Jakarta), this study aims at linking environmental performance, measured with LCA tools (see Figure 3), to business and product development.

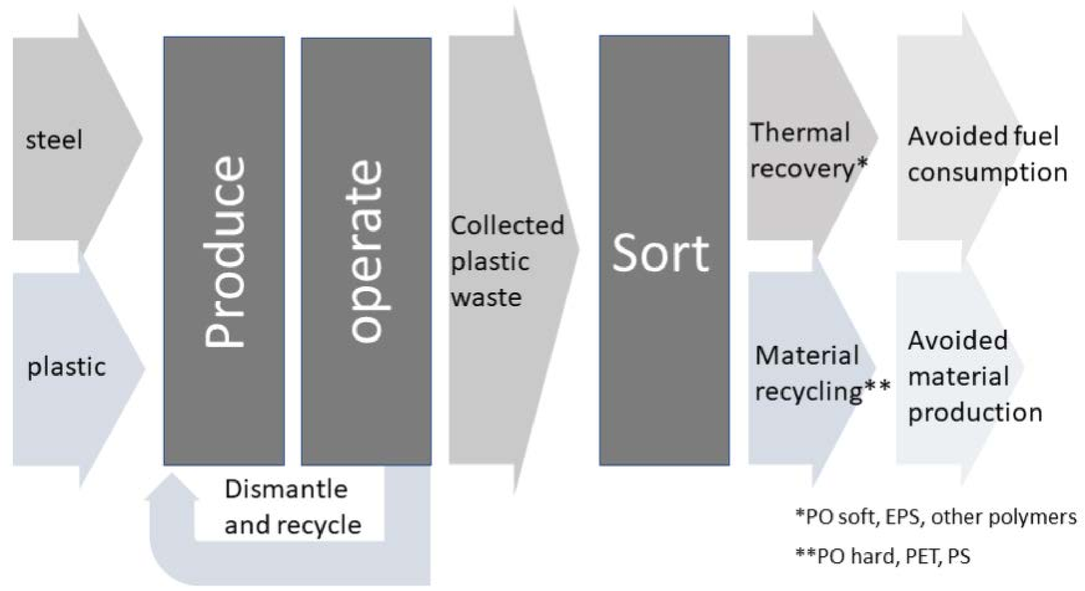


Fig. 3 System boundaries of the studies

## RESULTS

The LCA results, calculated with EF method for 1 barrier operating for 3 years, show that only high amounts of collected plastics and a proper recycling treatment ensure the desired positive climate impact. That was clearly achieved in the case of Jakarta, a densely populated area with poor waste management standards. The quantities collected and processed from the Tiber river are enough to ensure a positive impact in most considered categories, and more prominently in the climate impact. The Magra river follows the same trend, but the large number of necessary rotors affect negatively the overall result. As a rule of thumb, a collection of about 70 kg plastics per year and rotor is needed to ensure a positive climate impact. The value is influenced also by the waste composition: the higher the rate of waste for thermal recovery, the higher the weight needed to achieve a positive impact (see Figure 4 and Figure 5).

The LCIA show that the barrier environmental burdens are predominantly linked to the materials used in the barrier itself (see Figure 6).

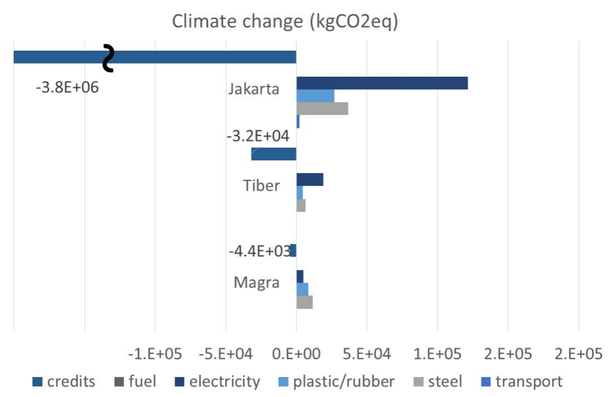


Fig. 4 LCIA results, selected categories

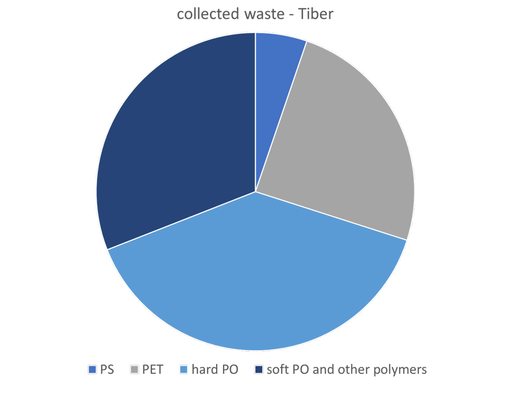


Fig. 5 Composition of collected waste and contribution of each waste category to the credits for the Tiber river

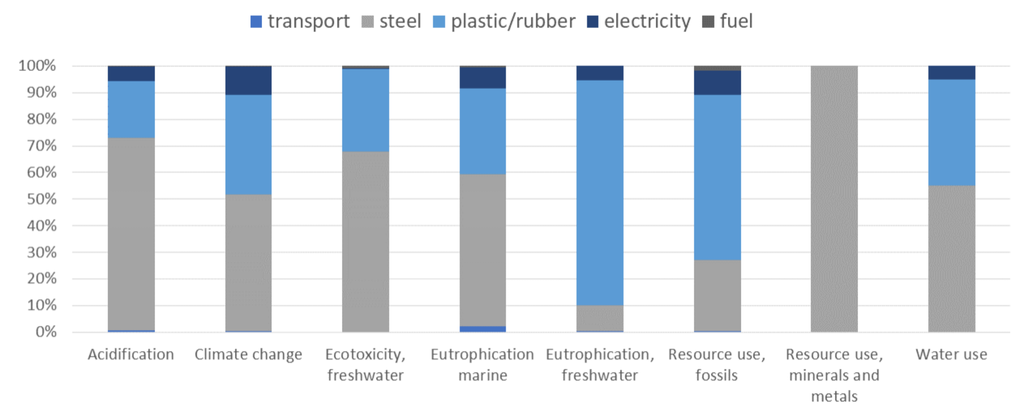


Fig. 6 Impact of the barrier over the whole lifetime, grouped by inputs.; collected waste is excluded from this analysis

## CONCLUSIONS

The LCA studies provide insightful information for business development processes as they highlight the most important factors needed to achieve an overall positive environmental impact. The results can also guide future technical developments to minimize the impact related to the barrier manufacturing, for example enabling easy disassembly and reuse thanks to an ecodesign approach, or testing 3D print for the plastic rotors. Clean up strategies in a region must take into account many more environmental and socio-economic factors to be effective, but LCA studies could locate the factors critical for a positive impact, thus helping to screen potential adopters/regions.

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