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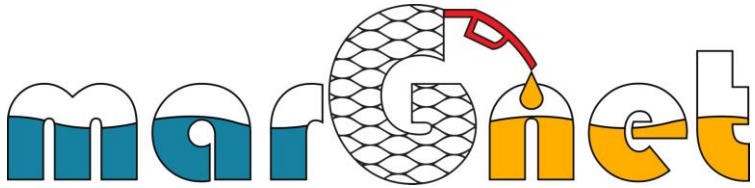
Mapping and recycling of marine litter and Ghost nets on the sea-floor



FROM MARINE LITTER TO MARINE FUEL

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SINTOL

ECOMONDO21 26 October 2021, Rimini Expo, Room Ravezzi 2 South Hall, Italy

EASME/EMFF/2017/1.2.1.12/S2/05/SI2.789314 Sustainable Blue Economy: Marine Litter

ISMAR BLUE WORLD INSTITUTE SINTOL LAGUNA PROJECT techneprojects GROWING UP PROJECTS

Co-funded by the European Maritime and Fisheries Fund

Marine Litter - definition

"Marine litter consists of items that have been deliberately discarded, unintentionally lost, or transported by winds and rivers, into the sea and on beaches. It mainly consists of plastics, wood, metals, glass, rubber, clothing and paper" [1]

Marine litter is a growing global problem which poses an increasingly serious threat to the environment, the economy and health. To rid our coasts and seas of marine litter, we need to understand its various sources, forms and impacts and come up with imaginative, concrete and ambitious solutions. Meanwhile, we must all reflect on what we choose to buy and discard to reduce the amount of litter ending up at sea" [2]

[1] European Commission
[2] K. Falkenberg former Director General for Environment - European Commission

Marine litter – other definition

- ML is a “public bad”, the opposite of a “public good” that negatively affects our welfare in a non-excludable and non-rival manner. Non-excludable means that everyone suffers to a certain degree irrespective of whether he or she contributes to the marine litter problem, and non-rivalry means that the disutility experienced by any individual exposed to marine litter does not decrease the disutility experienced by others.[3]
- Since all plastic is generated on land: ML is a consequence of waste mismanagement
- Marine litter is an example of market failure.

[3] Oosterhuis, F., Papyrakis, E., & Boteler, B. (2014). Economic instruments and marine litter control. Ocean & coastal management, 102, 47-54.

Our imaginative, concrete solution: synthesis of standardised marine fuels

- Since conventional recycling methods (mechanical) are not effective for ML (from technical to economical points of view) [4]
  1. *YOU CAN'T RECYCLE DIRTY PLASTIC*
  2. *EVERY TIME PLASTIC IS RECYCLED, THE POLYMER CHAIN GROWS SHORTER, SO ITS QUALITY DECREASES*
  3. *GLASS AND METAL CAN BE RECYCLED INFINITELY*
- ML is often retrieved accidentally during fishing activity (bycatch)
- **Within marGnet we successfully converted ML into ISO8217 [5] compliant marine gasoil (MGO) via pyrolysis: "drop in fuels for fishermen"**
- A pragmatic non idealistic approach to recycle "difficult" – "high entropy" waste
- Non monetary instrument to get stakeholders involvement: drop in fuels for fishermen, not money

[4] National Geographic Society: 7 things you don't know about plastic (and recycling): https://blog.nationalgeographic.org/2018/04/04/7-things-you-didnt-know-about-plastic-and-recycling/

[5] ISO 8217:2017 Petroleum products — Fuels (class F) — Specifications of marine fuels – DMA, DMB, DMX

marGnet depollution concept

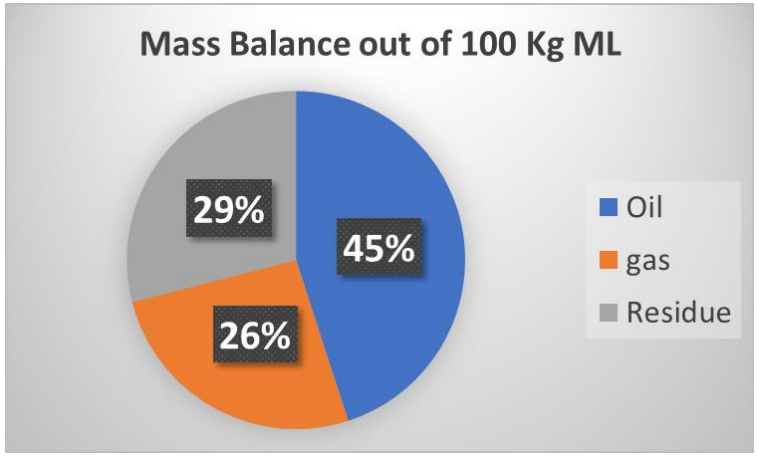
Turn ML into marine fuels

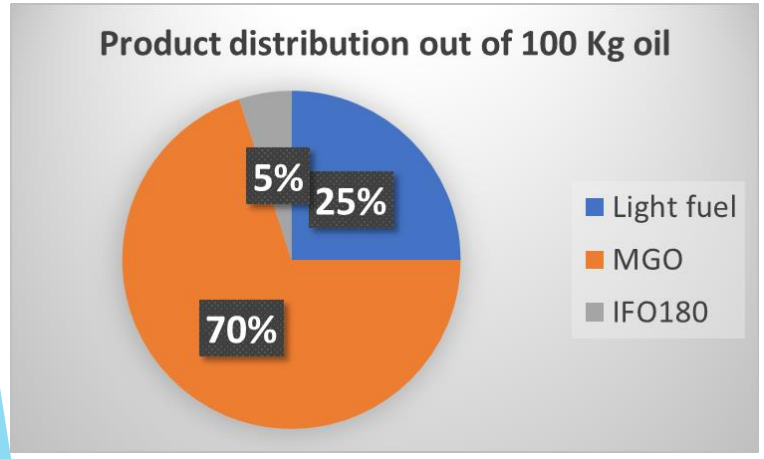
Use the fuel to power depollution

Reduce dispersed ML

Co-funded by the European Maritime and Fisheries Fund

Results [6]…… And a pinch of economy…..



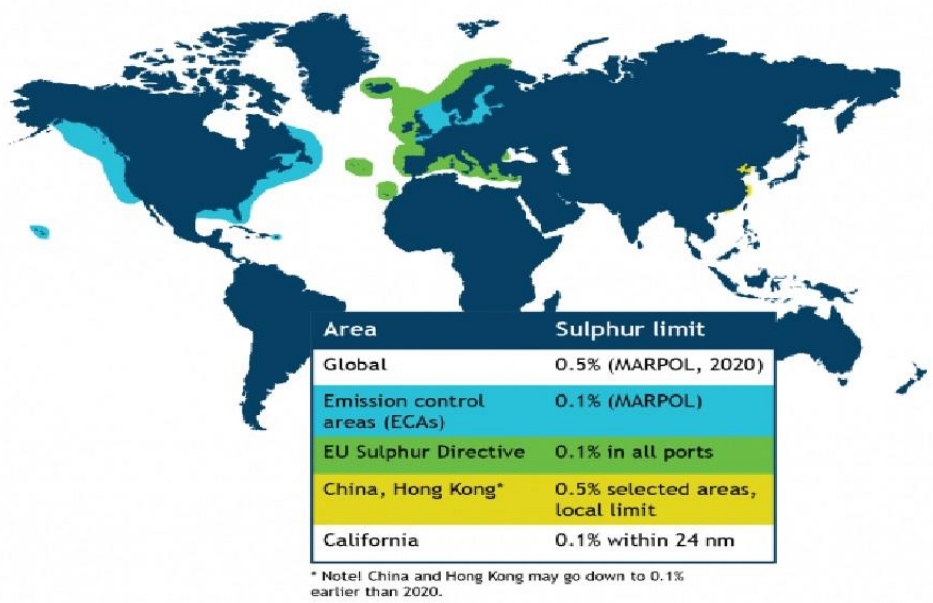


MGO demand global (2018): 65,7 Mton
MGO demand Europe (2018): 13 Mton
(source IEA – Wood MacKenzie, ship and bunker)

ML value: ~ 323 USD/ton

[6] Faussone, G.C.; Kržan, A.; Grilc, M. Conversion of Marine Litter from Venice Lagoon into Marine Fuels via Thermochemical Route: The Overview of Products, Their Yield, Quality and Environmental Impact. Sustainability 2021, 13, 9481. https://doi.org/10.3390/su13169481

Results: Sulfur and CO2 reduction in marine fuels → extension «de facto» of ECAs



1. Sulfur level of marGnet MGO: 0,0196 % (ECAs limit 0,1%)
2. Produced MGO of marGnet can be classified as "Ultra-low sulfur fuel oil" (ULSD) being below 0,1 %
3. marGnet fuel can reduce S emission outside ECAs
4. ***Non-recycled-plastic-derived ULSD fuel could be considered at a minimum carbon neutral with the potential to offer a GHG reduction [7]***
5. Approx. avoidance of 0,5/0,75 ton CO2 per ton of marGnet MGO [8]

IMO INTERNATIONAL MARITIME ORGANIZATION

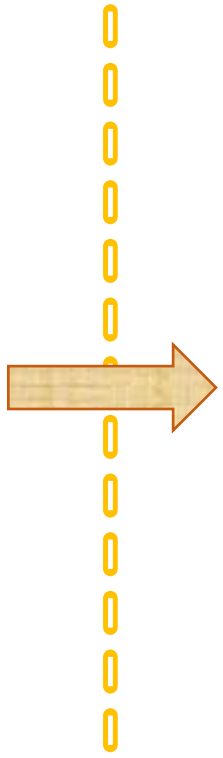
International Convention for the Prevention of Pollution from Ships (MARPOL)

[7] Benavides, Pahola Thathiana, et al. "Life-cycle analysis of fuels from post-use non-recycled plastics." Fuel 203 (2017): 11-22.
[8] From third party survey within marGnet project activity

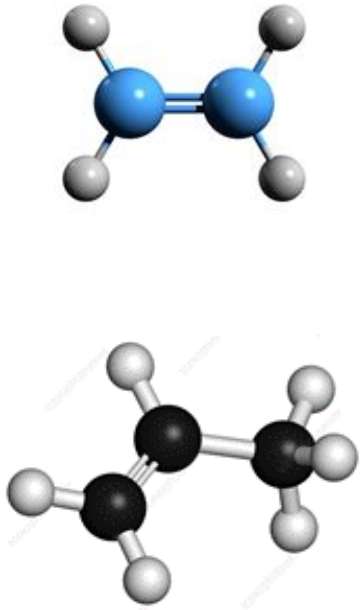
Future outlook: marine plastics to olefins

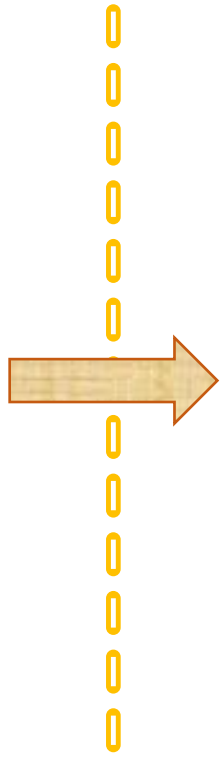
«*high entropy waste upcycle*»

PRODUCTS FROM ML
(including gas)



STEAM CRACKING





POLYMERIZATION

2nd Generation raw polymers

«Chemical route»

Closing the mass balance: zero waste generation. Example of circularity

Turn ML into ISO marine fuels

ML collected as bycatch
By fishermen

Stabilized solid residue

Armourstone in ports (EN 13383/13242/13450)

"nothing is created, nothing is destroyed, everything is transformed"
Antoine Laurent Lavoisier

In the circular economy, waste doesn't exist
….or not??.....

- Uncertainty on legal status of ML:
  - Which type of waste classification? European Waste Catalogue, dangerous/non dangerous, etc..
  - Which type of permit? (Italian decree "Salva Mare")
  - Who pays?
- Uncertainty about chemical recycling regulatory framework
- End Of Waste: is the output still classified "waste"? Or a product? Or a fuel?
  - If it is waste, permit from regulator authority required: fishing boats are equated to waste incinerators (!!)
- Authorized fuels (All. X d.lgs. 152/2006): second generation fuels are not included in the list
  - Therefore, even if compliant with ISO they cannot be used because don't come from an oil refinery. Why? Barrier to entry to a market; protectionism; defence of oligopoly?
- Avoid ideology, use a pragmatic approach: nothing is created, nothing is destroyed, everything is transformed. Better a fuel in the tank than a litter in the sea!

“There could be more plastic than fish in the ocean by 2050”*

Thank you!

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Sewage surfer © Justin Hofman. Wildlife Photographer of the Year 2017
*Ellen MacArthur Foundation, World Economic Forum Dec.2017

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