

## KuWert - Vessel-based treatment of plastics to implement value chains in less developed countries and to prevent the entry of plastic into the environment and especially into marine ecosystems.

<http://www.kuwert.hs-bremen.de>

### abstract

As it is technically and economically unfeasible to reduce the amount of plastic waste in the sea there must be solutions developed to reduce the entry of plastics into the environment. Land-based solutions make a significant contribution to reducing the amount of large plastics entering into the environment and these are conventionally found in developed countries but such solutions largely do not exist in less developed countries. Here valuable waste plastic normally circulates directly into the environment where it becomes contaminated and therefore worthless. Significant amounts of plastic waste enter the sea particularly along coastal areas and via rivers.

In the "KuWert" project funded by the Federal Ministry of Education and Research (Germany) a vessel-based concept for the collection, treatment and recycling of valuable plastic waste along the coastal countries of western Africa was developed.

The project was carried out by TECHNOLOG services GmbH, renowned ship designer from Hamburg ([www.technolog.biz](http://www.technolog.biz)), the Institut für Energie, Recycling und Environmental Protection at Bremen University of Applied Sciences ([www.iekrw.de](http://www.iekrw.de)) and Nehlsen AG, a globally active waste management company ([www.nehlsen.com](http://www.nehlsen.com)). The project is supported by the University of Sierra Leone (<http://www.usl.edu.sl>) and the University of Mauritius (<http://www.uom.ac.mu>).

The start out of the project was that the existence of plastics in both highly developed and in less developed countries can produce high value recycle at the end of their useful life and this can then be sold on the market for a high price. Due to the broken value chains found generally in the market environments of less developed countries there is a lack of economically feasible and therefore a strong market for high quality plastic waste. This results in the non-existence of collection systems in which the quality and value of plastic waste is maintained.

The basic assumption in the development of the project was and still is that if a market for high quality plastic waste was established and if it was purchased at fair prices that local collection systems for recyclable plastic waste can be induced. If the price for plastic waste

collected from consumers is high enough then plastic waste will find its way into recycling systems and not into the environment.

Large plants with a capacity of tens of thousands of tons per year are required for economically feasible treatment and recycling of plastic waste into high quality recyclates.

As it would seem absurd to treat plastic waste produced in Africa in Europe for example, it is necessary for treatment plants to be installed in many other locations such as in the States of West Africa. However, none of the countries from Mauritania to the Coast of Ghana have enough plastic waste in usable quality to realise and operate an economically operable plant for the production of high quality recyclates. Additionally the political and socio-economic framework conditions do not favour any investment in that region from abroad.

Therefore, a concept for an off-shore vessel-based treatment plant to travel along the coast of West Africa was developed (see Fig.1).



Fig. 1: Potential route for a treatment platform for the treatment of approximately 10% of plastic waste produced in the larger towns along the coast between Mauritania and Ghana

The plastic waste will be collected in barges located in the larger coastal towns in the region and purchased by locally acting persons. The purchasing price of the plastic waste will be determined by quality and quantity of the waste.

On a monthly basis, the semi-submersible vessel-based treatment plant (see Fig. 2) will travel along the coast and collect the plastic waste from the barges. The treatment of the

plastic waste into recyclate will take place on the treatment platform. The high value recyclate produced will then be transferred into normal sea containers and marketed locally and internationally from the various regional sea ports.

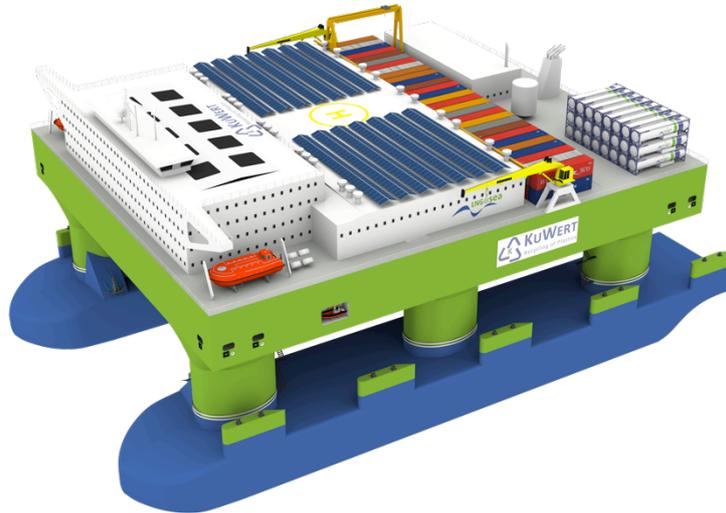


Fig. 2: Vessel-based treatment platform for high quality plastic waste

The energy and fresh water required for recyclate production will be produced onboard. A powerful cleaning system will turn waste water into process water or clean water. High calorific waste found in the treatment of plastic waste will be used in the onboard thermal recycling plant to produce energy. The electricity and heat created from the waste-heat and the onboard power-generating motors will be used to treat the plastic waste.

It is presumed that locally plastic waste to the value of 10 Million €/year could be purchased in the region. This will create over 1,000 permanent full-time jobs. Around another 250 further jobs for local employees can be created onboard the plastic waste treatment plant.

Up to 50,000 t/year of high quality recyclate can be produced and this can be sold on for the production of new plastic products. A saving of an equivalent of 1.5 Million tonnes of CO<sub>2</sub> per year could be made through the substitution of primary plastics. This includes the considerations already made for CO<sub>2</sub>-emissions at the construction stage, the maintenance and operation of the barges, and the vessel-based treatment plant with recycling/disposal at the end of utilisation.

The treatment platform can collect and recycle about 10% of the plastic waste created in the larger coastal towns between Mauretania and the coast of Ghana. The entry of plastic waste into the environment and particularly into the sea would therefore be significantly reduced (see Fig. 3).

With selling the recyclate at today's marketing prices, the costs for collection, transport and reprocessing as well as the operating and capital costs for the barges and the treatment platform would be self-generating.

Further information on this project can be found at: <http://www.kuwert.hs-bremen.de>.

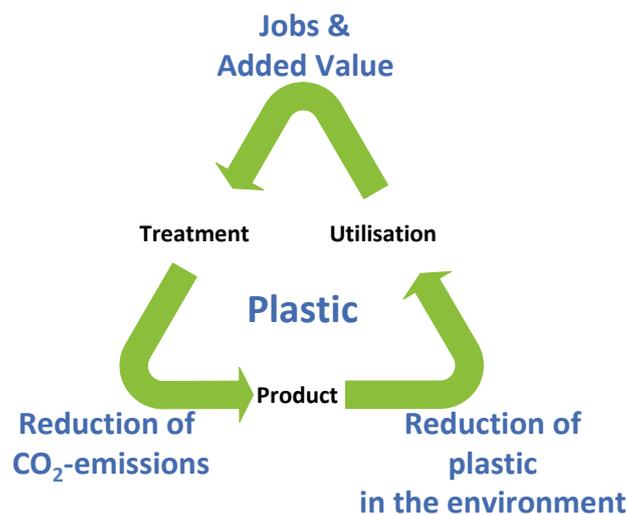


Fig. 3: Plastic circulation and the advantages of plastic waste treatment and use of recyclates

**Note on Funding:**

The project (FKZ: 033R196) is funded by the Federal Ministry of Education and Research (BMBF) as part of the research focus on "Plastics in the Environment". The research focus "Plastics in the environment - sources, sinks, solutions" is part of the Green Economy flagship initiative of the BMBF framework program "Research for Sustainable Development" (FONA<sup>3</sup>).

