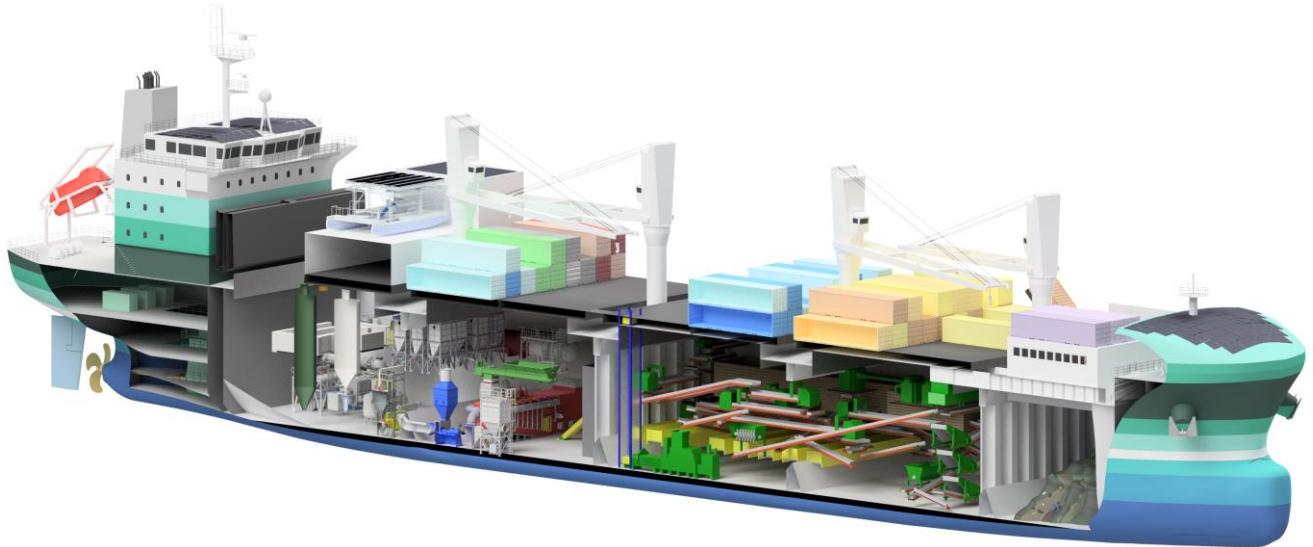


Outline Specification



1. General Description

This project describes a maritime recycling system for 60,000 t/a of plastic waste coming from municipal waste collection or collected from beaches and river deltas by a fleet of CleanUp vessels (2*Seakuh + 6*SeaHamster). The plastic waste is delivered to a transfer station, where it is placed in 40-ft containers and compacted (density 0.20 t/m³). Alternatively, the waste containers can be delivered via shuttle vessels.

The core of the MRS is the permanently anchored recycling ship *SeeElefant 2023*, which takes over the waste containers with its own loading gear. The waste is filled into the input bunker (5800 m³) with a tilting device, cleaned of impurities and fed into a shredding and sorting plant (200 t/d). Via a bale lift the grade-pure recyclates (FE, NE, PET, PEHD, PP, LDPE, wood etc.) are transferred into return containers and transported onshore for sale. Non-recyclable composites are fed to a Waste-to-Energy plant (max. 70 t/d) via a double lock. A state-of-the-art exhaust-gas filtration plant with SNCR scrubber, activated carbon filters and an emission control system ensure the compliance with European emission level reg. 2010/75/EU. A steam-driven turbine (max. 4000 kw) generates electric energy, which is fed into the local power grid via a submarine cable. The entire process plant is protected by an extensive fire protection system with sprinkler plant and water/foam monitors. Furthermore, a science laboratory is provided to analyze waste data, optimize process flow and introduce pyrolysis technology.

The *SeeElefant 2023* will be built by converting a general-overhauled bulk carrier, which will be delivered turnkey with a certified and industry-proven process plant.

2. Main Data

Classification: transfer: DNV +1A1 Bulk Carrier + AMS
 stationary operation: floating establishment

Dimensions		Machinery	
Length o. a.	178,33 m	Main Engine	6 cyl. , 2-stroke
Length b.p.p.	171,00 m	Output (MCR)	7860 kW at 129 rpm
Breadth	27,80 m	Service Speed	14,0 kn
Depth	15,60 m	Gensets	3 x 900 kW / 900 rpm
Draft _{design}	9,80 m	Electric system	440 V - 60 Hz
Draft _{recycling mode}	6,50 m	Accommodation	area (complete) = 558 m ²
Light Ship _{after conversion}	10.175 t		25 Cabins, 28 WC's
Deadweight _{recycling mode}	14.000 tdw		
Fluids		Input bunker	5800 cbm
HFO	1.330 t	Freshwater	220 t
Diesel MDO	270 t	Ballastwater	14.700 t

3. Ships Equipment

Cargo crane	4* el.-hydr. cranes 30 t SWL / 20m outreach
Provision crane	1* el.-hydr. crane 5 t SWL / 8,5m outreach
Hatch covers	el.-hydr. 4* l = 20,2 m x 23,3 m + 1* 12,0 m x 20 m
Anchor / Mooring	anchors: 2* bow a' 7800 kg, 1* stern a' 7800 kg 4* mooring winch, electro-hydraulic, constant tension
Livesaving appliances	1* freefall lifeboat 25 P. with recovery device
Navigation	1* navigation equipment for worldwide service incl. 2* Radar, ECDIS, MF/HF-plant, VHF, AIS, DGPS
Propeller	1* FPP propeller of Ni-Al-Bz, diam.= 5,50m
Bowthruster	none
Steam boiler	1* comb. Oil-fired / exhaust gas boiler (1,6 / 1,2) t/h
Pumps	2* el. ballast pumps a' 800 m ³ /h 2* el. general service pumps a' 650 m ³ /h 4* el. fire extinguishing pumps a' 35 m ³ /h
Fire fighting equipment	1* CO ₂ extinguishing system for machinery space 1* fire detection system for hotel tower 1* fire detection system for cargo area 1* water extinguishing system with monitors 1* sprinkler system for cargo holds 1* water / foam system for cargo deck

4. Input Logistic

The waste / valuable material mixture comes from different sources: either onshore from municipal waste collecting activities or waste pickers and offshore from special collecting boats working on river deltas and beaches. The waste will be delivered to a transfer station, recorded in terms of weight and quality, deminished by impurities, pressed by a stationary compactor, loaded into 40-ft. containers and transported onto the ship with the ship-owned cargo gear. The transfer station and the special collecting boats belong to our scope of supply.

The containers with plastic waste are emptied into the first hold with 5860m³ (bunker) by the ship-owned crane and a tilting device. The inhomogeneous input material is homogenized in the bunker by means of a portal grab crane and added to the feed feeder of the sorting plant.

5. Sorting plant

The sorting plant with a capacity of 10 t/h is divided into the following process steps: dosing and conditioning with crushing and classification, sorting by automatic picking systems with manual quality control and baling of the products.

Afterwards, the material is divided into 4 grain classes by means of a three-stage classification. These grain classes are sorted separately for the respective recyclable materials in separate process lines with aggregates such as air separators, FE-NE separators and near-infra-red separators according to the state of the art (BAT). These are metals (FE and NE), plastic types PET, PEHD, PP and LDPE. Furthermore, some other fractions e.g. wood, glass, paper and other materials can be sorted by manual sorting in the two existing sorting cabins. Due to its flexibility, the sorting plant can also adapt to other waste collection mixtures and sort them according to the generally valid quality criteria. The sorted recyclable fractions are in turn loaded in bale form into waiting sea containers which are then made available for collection on land. Wood, glass and other materials for material recycling are made available for collection in bulk. The non-recyclable residual materials are fed to the thermal recycling plant on the ship via a twin-lock-system with push-floor to fulfill damage stability requirements.

6. Waste-to-Energy plant with (WtE)

The waste-to-energy plant (WtE) has the objective of thermally treating the non-recyclable sorting residues from the mechanical sorting plant and using them to generate electrical energy.

Depending on the composition of the waste mixture, 10%-30% of the non-recyclable materials are fed to the WtE plant. This corresponds to 1-3 t/h at 300 working days.

The process of the WtE plant can be divided into the main process steps of feeding, incineration, steam generation in the water-steam cycle, generation of electricity, flue gas cleaning and emission monitoring.

The waste is fed via a lock system and conveyor belts to an intermediate bunker and then to the incinerator. This is divided into two combustion chambers. In the primary combustion chamber (PCC) the waste fuel is fired, mixed with combustion air and completely burned to ash at high temperatures. The secondary combustion chamber (SCC) ensures complete burnout of the flue gases and sufficient temperature to achieve the legally required (according to the EU) residence time of more than 2 seconds above 850°C. The hot flue gas from the combustion process enters the steam generator, and the superheated steam thus produced is fed to the turbine set, which generates electric energy from it.

This generated electrical energy is used for the self-consumption of the entire ship incl. process plant. The excess energy is fed into the public grid via a shore power cable. The flue gas treatment consists of three stages. The first stage is the NO_x reduction stage. The SNCR scrubber uses Urea as an additive, which is injected in the second combustion chamber. In the second treatment stage, the acidic pollutants contained in the flue gas are bound by the addition of hydrated lime. Heavy metals and organic pollutants are adsorbed by activated carbon powder (PAC) added to the flue gas. The final stage is a filter system that separates the loaded dust particles and disposes them in the filter hopper. The cleaned flue gas is discharged through a stack.

A continuous emission monitoring system (CEMS) is used to monitor emissions. This will control the compliance with the relevant European directives, e.g. IED and Directive 2010/75/EU. The WTE plant will be operated on 300 days /year for 24 h/d with a max. electr. output of 4 MW.

7. Scientific laboratory, pyrolysis technology and plastic collecting boats

A scientific laboratory for waste analysis and process optimisation is installed at the end of the cargo area. A pyrolysis plant for the transformation of plastic to oil with a maximum capacity of ...t/d is installed beside the scientific laboratory. Furthermore 8 plastic collecting boats of a proven type (2*SeeKuh + 6*SeeHamster) are delivered.

8. Interfaces

Input plastic waste: from municipal collection	= 57.000 t/a (95%)
from CleanUp boats	= 3.000 t/a (5%)
<u>Working times:</u> Transfer station	= 16 h/d – 300 d/a
Sorting plant	= 20 h/d - 300 d/a
Waste-to-Energy plant	= 24 h/d – 300 d/a

	Science / Pyrolysis	= 8 h/d – 300 d/a
<u>Container:</u>	High-cube FEU's for input waste	= 40 FEU's
	High-cube FEU's for recyclates	= 30 FEU's
	Open-top container for disruptive waste	= 4 Roll-Cont.
	Open-top cont. for incineration residuals	= 4 Roll-Cont.
<u>Output sources:</u>	electric energy	=..... Kwh/a
	single-variety recyclates (cap. depending from waste composition)	= FE, NE, PET, PEHD, PP, LDPE, wood etc.

Limits of supply: This project includes 1*turn-key *SeeElefant 2023*, 1*transfer-station, 1* dredger, 1* truck, 70*FEU-container 9'6", 8 roll-container open-top, 2* forklift, 8*cleanUp-boat (2* Seekuh, 6*Seehamster).

Not included are construction of roads and parking lots, onshore transport devices, connection to the local electricity grid, waste shuttle boats + mooring pillars (if required) and fees for harbour resp. anchorage.

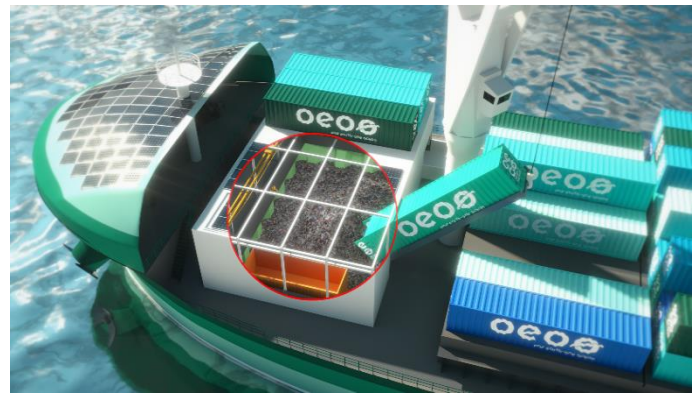
**** All figures are preliminary. End of Outline Specification ******



Plastic recycling system with SeeElefant, transfer-station and CleanUp-boat



transfer-station



bunker with tilting device



bale lift and single-variety containers



science laboratory



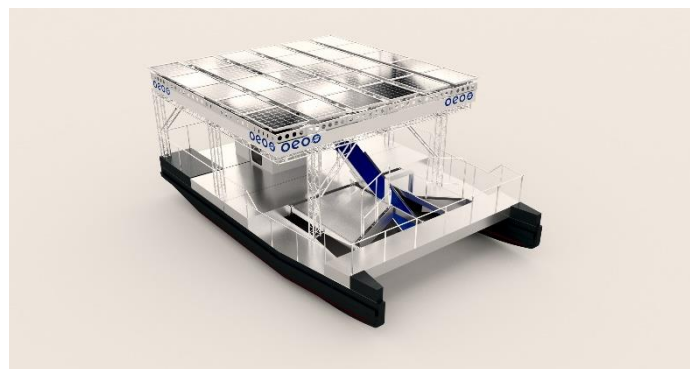
sorting plant



Waste-to-Energy plant



flue gas filter plant



CleanUp-boat SeeKuh