***PANTA RHEI* – “EVERITHING FLOWS”,** HERACLITUS 500BC 23111993

Energy Technologies: VAWT in combination with PV
Annual Capacity: 8,500 MWh

Water Desalination: 160,000 litres / day on average.

***PANTA RHEI*** (everything flows: Heraclitus 500BC)

Having the privilege to look at the sea from my house I never get tired of looking at the permanently changing environment. Also observing the passing and anchored ships never loses its attraction.

Enjoying the beautiful sunset at Santa Monica Pier I asked myself if the place would benefit from another man-made, permanent object. A ship however would imply the idea of a journey, impermanence, the possibility of change. Recycling one of those enormous vessels that has transported fossil fuels and became a fossil itself seems to be a symbolical and also practical act. The oil tanker will be a platform and location for a new philosophy. It was an oil tanker. It’s not transporting oil anymore, but instead, producing energy by capturing wind, solar and wave energy to make water and energy for the city.

The ship will be fitted with a combination generators and desalination plants powered by the given energy forms: wind, waves and sun. The main wind generators will be evocative of the sails of tall ships but at the same time look like high tech wing sails of futuristic Americas Cupper. The deck will be covered with a seawater greenhouse and PV solar cells, also the energy of the waves will be used. The enormous tanks will become water storages. One compartment can be transformed into an event location. The deck-house and bridge can accommodate a research and education centre and residential accommodations for researchers and artists. The vision is to provide an educational and recreational space on the sea, close to LA that demonstrates different highly effective renewable energy technologies and discusses their application and impact. The project will at the same time generate income to work cost effective and profitable.

Additional to water and energy production the botanic garden in the greenhouse, restaurants and event/exhibition spaces will make the tanker a “must visit location”. It will be a place of research, education and wellbeing. Panta Rhei will be an iconic landmark facing the city as it produces sustainable energy in a visible way thus making visitors and tourists aware of this process.

**Visibility / Invisibility**

Very little freeboard of a loaded tanker is visible. Once the horizontal axis wind generators start to rotate, the ship will seem to have disappeared. ***PANTA RHEI,*** everything flows, is the philosophy behind the project. And it applies in two ways: everything changes as the Greek philosopher Heraclitus described the ever-present change of the world in 500BC and at the same time being on the water and experiencing the power of wind and water physically we develop awareness that this **flow** and its energy must be used.

The ship can be approached by a boat-tender service. ***PANTA RHEI*** appears to be a ship from another world and it can host all sorts of activity. The majestic ship will not sail away but there is movement in the sails and right in front of your eyes they will begin to fade and disappear like through a strange magic. The effect will just be breathtaking. The more energy it makes the less visible it is.

Generally, art introduces some aspect of style, or a degree of interpretation, something beyond superficial appearances, so that a sort of understanding is arrived at that we can’t derive at simply from staring at objects in the world. “Behind every image, something has disappeared. And that is the source of its fascination,” writes French theorist Jean Baudrillard.

**What is the role of morality and ethics in the aesthetic representation of sustainability?**

An old Tea Clipper anchoring would be a sublime thing to look at because it connects us with the journey and we know it can sail away. The PANTA RHEI project might be moored permanently but subconsciously the ship evokes the idea of potential change. In the 70ties the demolition of Santa Monica Pier in favor of a man-made island that would be the home of a resort hotel was successfully opposed in the *Save Our Pier Forever campaign*. A structure to permanently look at covering the horizon however well designed, spectacular and well intended, could be problematic. But what about an object that comes and goes, an object that can accomplish the magic act of its own disappearance?

**ENVIROMENTAL IMPACT STATEMENT**

Having circumnavigated the globe on a small sailing boat, we observed a great number of disused oil tankers, moored and rotting in the Norwegian fjords. 70% of the old tankers are simply run ashore in developing countries for disassembly. The low health, human right and environmental standards are making this practice highly profitable, but at what costs? Every day, more than 30,000 workers are risking their lives for little more than 2$ a day only on Chittagong's Beach. On a larger economic scale, everybody is paying for the tasteless profits made trough these practice. We already feel the economic effects. Substances which are costly to dispose of, such as hazardous waste, are left on the beach or set on fire, even old batteries and half-empty cans of paint stockpiled in Bangladesh, for example, are 79,000 tonnes of asbestos, 240,000 tonnes of PCBs and 210,000 tonnes of Ozone- depleting substances. Recycling a redundant tanker, refurbishing it in a responsible and sustainable way is a metaphoric gesture of positive economic impact.

One of the challenges of large scale desalination is what to do with all that salt. Dumping it in shallow areas has been shown to negatively affect local marine ecosystem. A Salinity Plume Deterrent System is designed to mix brine with ambient seawater, will dramatically reducing the salinity content and temperature to benign levels well within the tolerance of marine life. The exit water can be distributed through a Multi-Port Dispersion System, a series of ports along the bottom of the ship returning exit water to the ocean very close to its benign original salinity level and temperature.

The structure of the wing sails is built majorly out of aluminum extrusion, guaranteeing excellent performance over long periods of time and thus creating no run-offs, by products or emissions of any kind.

**TECHNOLOGY AND DIMENSIONS**

We propose to use an Aframax oil tanker 253m long, 44,2m wide, 11,6m draft, only 2m free board loaded and 40m max height for the sail generators. The system is modular, more ships are possible. A seawater greenhouse will on the deck of the tanker for seawater desalination. PV solar cells on the deck and also a Swell Actuated Reverse Osmosis System in connection with the seaward breakwater – it uses high-pressure pumps powered by the motion of waves to remove salt from ocean water. Water will be collected in the tanks and made available for the city. The produced electrical energy will add to LA’s electrical grid.

As the ship works as a research centre different methods can be combined, developed and studied. The Seawater Greenhouse technology usually offers a low cost, sustainable solution to the problem of providing water for agriculture in arid, coastal regions. The process uses seawater to cool and humidify the air that ventilates the greenhouse and sunlight to distill fresh water from seawater. The conditions in the location, the relatively cold seawater and the amount of sunlight are ideal for this technology. Thermal and Membrane desalination, passive Seawater Greenhouse technology, Membrane based as Swell Actuated Reverse Osmosis System, SAROS can be combined and compared.

The PANTA RHEI wing sails have a vertical axis and the generator below. The design uses high tech wing sails combined with a technology developed by the Swedish company **SeaTwirl** by Daniel Ehrnberg Chalmers University of Technology. The design uses the seawater itself as a roller bearing and stores energy in a water-filled torus. The company intends to use the design to enable the use of cheaper and heavier materials to lower the cost below conventional turbines, and generate energy even when the wind is not blowing.The wind turbine consists of 3 curved blades derived from wing-sails, mounted on a vertical rotating shaft or framework. Since the wind pulls each blade around on both the windward and leeward sides of the turbine, this feature spreads the torque evenly over the entire revolution, thus preventing destructive pulsations. Wing-sails are typically mounted on an unstayed spar—for lightness and strength. Possible performance at a height 40 m = 1.5 MW × 365 days × 24 hours = 13,140 MWh. The average capacity factor for a 1.5-MW wind turbine would produce in a year 13,140 MWh × 0.269 = 3,534.66 MWh = 3,534,660 kWh. The deck covered with around 2000 m2 solar cells could produce the same amount of energy. The three Wing Sail Turbines combined with PV would produce the same amount of electric energy as that is used by almost 1996 households over a year (according to data provided for Darius generators of comparable size).