ESTHER

CONCEPT

ESTHER captures the ephemerality of motion through water and air, harnessing these to generate purified water and clean energy.  The design is conceived as two parts, an underwater point absorber buoy that harvests wave energy, and a piezoelectric torque generator ‘mast’ that collects wind energy as it sways above water.

This two part design takes inspiration from synchronized swimming, as epitomized by the classic ‘aquamusicals’ of Esther Williams from the golden years of Hollywood in the 1940s and 50s.  Like the swimmers in an aquatic ballet, ESTHER elegantly moves in unison above and below water, creating a spectacle of the periodic movements of the tides and the forces of the wind.  This dynamic movement is accentuated by the reflective fiberglass material which creates a play of shadows across the surface of the water.  At the same time, the water is mirrored on the masts, reflecting a fragment of the sea into the horizon.  The form of the masts were derived from the abstraction of a synchronized swimmer’s leg and aerodynamic sailing spars.

The eccentric spacing created by the elliptical formation allows viewers from the Santa Monica pier to understand the installation as an object rather than a non-directional field, much as the bodies of synchronized swimmers collectively form an elaborate pattern.  The tops of the masts light up at night allowing observers to enjoy the installation at all times of the day and in all weather conditions.  The light is amplified by a fresnel lens on top of the mast that powers a small solar updraft tower.  Unlike the CETO system, which is fully submerged and advertises its low visual impact, ESTHER attracts the viewer’s attention highlighting the power generation taking place and hopefully encouraging heightened interest and awareness in clean energy.

TECHNOLOGY

The technology used in the underwater point absorber buoy is the CETO system developed by Carnegie Wave Energy. Point absorber buoys typically float on the surface of the water and are tethered to the sea bed by cables.  They generate electricity from the rise and fall of swells, creating a vertical motion to power hydraulic pumps, which is then transmitted via underwater cable to an on-shore power house.  The CETO system uses part of this electricity created to desalinate water and is fully submerged, unlike other point absorber buoy systems, eliminating the potential for the environmental impacts such as minor collision risk for birds and roosting sites.

We propose scaling down this technology so that it is of an appropriate size given the relatively shallow water and proximity to the shoreline, so that each buoy generates 100 k/w per day, so the entire installation 6600 k/w per day.

The masts employ the technology developed for the Windulum, a piezoelectric wind turbine. Piezoelectricity is electricity generated by the compression and expansion of ceramic plates.  The Windulum comprises of a solid state generator with a tall flexible shaft capable of flexing in all directions.  The shaft is comprised of alternating rigid plates and embedded elasotmeric piezoelectric ceramic disks which compress and stretch when blown in any direction. This torque transforms wind into electricity without any generators while eliminating any potential hazards to birds posed by traditional wind turbines.

Piezoelectric wind turbines have typically been fairly small, at a scale of 10 centimeters which is sufficient to power small electronic devices.  According to the developers of Windulum, the technology is scalable up to 80m. Our installation consists of 50m stalks which could potentially generate up to 1320 k/w per day.  By creating monumental piezoelectric turbines ESTHER will hopefully raise awareness of this alternative source of wind energy.

ENVIRONMENTAL IMPACT

The movement of the point absorber buoy system may affect marine life habitats and the EMF and acoustics generated by the electrical transmission cables may be of concern.  There is also the potential for aquatic wildlife to become entangled in the underwater cable lines.  Energy removed from the waves could potentially affect the shorelines, which should be taken into consideration when siting the buoys.