SW Elevation, sails stowed for sunset viewing

SW Elevation, sails deployed for fog harvesting

The Challenge:

Many say the new sustainability ethos is "water is the new energy." California has recently experienced one of the most prolonged droughts in its modern history, almost certainly made worse by climate change, putting strain on water resources depended upon by industry and residents alike. Los Angeles, which obtains a mere 13% of its water from local ground well sources, depends on a vast and energy-intensive network of water transport infrastructure to move water from distant reservoirs into the city.

For Santa Monica Pier, which has already made great progress in using sustainable solar energy to meet its power needs, the next step is to ensure that water can also be sustainable sourced on-site, in a manner detrimental to neither the region's vital ecosystem, nor its prosperous and celebrated leisure and entertainment identity.

Design:

The design of regattaH2O relies primarily on a process known as fog harvesting, which has been pioneered through joint research at MIT and the Catholic University of Chile, and in practice throughout parched regions of the Atacama desert since the 1960s, to provide fresh water to residents for irrigation, cooking and consumption.2 Unlike osmotic membrane and evaporator desalination processes, which require large amounts of energy or large solar coverage respectively to extract fresh water from saltwater, fog harvesting silently and passively combs fog rich coastal air, produced as a natural part of the hydrology cycle. As fog passes through vertically oriented, fine plastic meshes, water molecules condense on the surfaces, forming droplets which cling to the mesh, slowly descending until aggregated in collection troughs where they then drain into storage basins for treatment and use.

210 (days of fog) * 12L (maximum L/m2/day) * 44,475m^2 (mesh area) = 112 million L H_2O (annual volume)

These meshes compose the sails of the regattaH_2O proposal, with collection troughs designed as veins within the sail surface, transporting harvested moisture to the mast were it can be piped to storage vessels at the Santa Monica Pier. Using data from fog harvesting experiments conducted in Chile and Peru, which share similar climatic and topographic characteristics to Southern California, results show the potential of collecting from 3L to 9L per square meter of mesh per day. Advances in net geometry developed at MIT, have shown to generate up to 12L/m2/day2. Extrapolating this rate to the scale of regattaH_2O yields truly impressive figures of 112 million liters annually.

While water is harvested passively, some electrical energy is need to operate the steering mechanisms, and deployment of the sails. This energy is extracted from the wind via a device known as a wind band, which instead of using rotating blades, relies on an oscillating strip of tensioned material, suspended between two electro-magnets. Each of the regattaH_2O masts contain eight such generating units about its length.

Power is proportional to the area of the strips, and cubic to the wind speed across the strips. Given an average annual wind speed 11km/hr, the 44 masts (collectively 352 individual wind band devices of 4m length * 0.35m width or 1.4m2 average area), have the potential to generate power output of roughly 8,000W or 70MW annually.

As a visual reference during night and low light levels, light rings beneath each wind band pulsate with the intensity of power being generated. This furthermore serves as a navigational safety device, alerting boats of their presence in the dark.