**LightSponge**

**It takes only a mere glimpse to a new world to spark the imagination of great possibilities and to mature ideas that have always been at the background.**

Across the water from Refshaleøen the bronze statue by Edvard Eriksen portrays the heroine of the world famous story The Little Mermaid that has inspired generations upon generations.

Accustomed to passive participation, the aquatic sponge might have acted as the underwater background to this wonderful tale. Unlike the mermaid, the sponge doesn’t seek attention and always feels much more comfortable away from the center of attention. This pragmatic creature that patiently sways with currents is oblivious to the vital service that he is rendering to the environment by relentlessly filtering water - for the sponge it's a matter of survival. Like the mermaid, a glimpse to a new world was all that it took to realize that its unique porous structure holds a valuable wisdom that transgresses the boundary between land and water. This is the untold story of the sponge following its ascent from the water.

**Printed solar technology**

The technology of Printed photovoltaic cells is based on an organic photoreactive polymer that is applied onto flexible substrates. Beyond the capacity for generating energy from sunlight, its application on plastic sheets provides interesting mechanical properties: thin, flexible, lightweight and translucent. Due to these properties, PV Plastic can potentially develop into a unique architectural element with a distinctive aesthetic and an energetic added value.

A study of the material led to the development of a structural organization that derives directly from its unique properties. A three dimensional cellular structure would provides ideal conditions for sunlight absorption due to high surface area, particularly in view of the panel's transparency and dual sidedness. The resulting solar structural skin can become a legitimate building material capable of performing at various scales - from domestic to urban to national both on and off grid.

Traditional infrastructure used for generation and distribution of energy is as environmentally harmful as it is monstrously ugly. Therefore, solar energy needs not only to be performed, but more importantly it must be witnessed and experienced in the most positive and attractive fashion. With innovative design PV plastic can provide large scale clean energy aesthetically and gracefully.

**Refshaleøen water taxi terminal**

As the city of Copenhagen reinvents itself within its physical constraints, the once iconic shipyard of Refshaleøen is transforming into a hub of fresh urban activity.

With residents that include a theater, a celebrated restaurant, an art gallery and a creative community, alongside existing and new industries, the popularity of the site increases. This urban revival is creating greater demand for convenient transport and more local amenities, more so as Refshaleøen is frequently used as a venue for events and festivals.

The lightsponge is an ideal structure for the local water taxi terminal – the gateway to Refshaleøen. It would passively demonstrate solar technology to a wide and diverse audience in a casual and unimposing manner. By maintaining its background stature it would testify that infrastructure can enhance the environment.

During daytime the structure would perform as a transient shelter for passengers while inconspicuously harvesting sunlight. At night, the structure would come to life with a dazzling LED light performance employing the power it has absorbed throughout the day.

**Zero environmental impact**

As each of the solar plastic cylinders independently collects, converts, and stores energy, the lightsponge is entirely autonomous, there is no need for cabling or any other electrical components.

As the sponge structure is inherently self supporting, only minimal foundations are necessary to anchorage it to the ground.

Structure dimensions: 15mX20m

Total PV plastic surface: 1000m2

Estimated annual output: 50kWh

**Sponge**

Sponges are [animals](http://en.wikipedia.org/wiki/Animal) of the [phylum](http://en.wikipedia.org/wiki/Phylum), meaning "pore bearer". They are multi cellular aquatic organisms which have bodies full of pores and channels allowing water to circulate through them. Sponges must rely on maintaining a constant water flow through their bodies to obtain food, oxygen and remove wastes; therefore their structure is adapted for maximal efficiency of water flow.

Out of the water, the efficiency of the structure is reversed, keeping water trapped within the pores and channels of the sponge and providing an outstanding Absorption Capability.

**Plastic Ring**

Plastic sheets are considered to be two dimensional surfaces with little to non structural capacity. The third dimension of the sheet - its thickness is usually disregarded, whereas it is well capable of becoming a structural component.

When a plastic sheet is rolled into the shape of closed cylinder it gains structural rigidity allowing the sheet to become free standing and self supporting.

**Assembly Method**

Each of the cylinders is lined with Velcro strips at both edges so as to allow for other cylinders to stick together at any given point when placed tangent to one another. The Velcro also provides the freedom for any cylinders to attach together regardless of different circumferences. When the cylinders are tightly attached together, due to the relative softness of the plastic sheets this action results in a three dimensional multicellular structural arrangement.

**Packing Circles**

 Circle packing is the study of the arrangement of circles on a given surface such that no overlapping occurs and so that all circles touch another. The associated "packing density", of an arrangement is the proportion of the surface covered by the circles; the structure is defined by the geometry and combinatorics of packing of arbitrarily-sized circles.

**Parametric Surface**

The packing circles action results in a surface that can take any given scale with a density that varies seamlessly in response to the sizes of the circles at any given location. Areas of greater density provide rigidity whereas areas of lesser density provide elasticity for the surface to bend and morph. These attributes make the surface a dynamic system that can take on board any given parameters.

**Structural System**

The Voronoi diagram offers a way to organize the cellular arrangement according to parametric units that are the result of dimensional and geographic particularities. More specifically, the cellular organization operates in a similar manner to structural coffering. No two cells are alike, they range from cylindrical, to cubic and polyhedral conditions, and help the form to arrive at structural stasis in response to forces, loads and stresses.

**The structure**

The structural skin can take any desired form whilst maintain its structural integrity independent of external means of support. When applied in an architectural scale, the skin can perform in variety of fashions. The skin can concave so as to span over large distances and act as a continuous curving multicellular roof. It can become an elaborate shading element or a canopy or a pavilion - a free standing architectural piece comprised exclusively of plastic sheets. Most importantly the Power Sponge would not only provide shade and unique aesthetics, it would have a matchless quality - the ability to transform sunlight into electric energy.