**SOLAR CLOUD**

**ENVIRONMENTAL IMPACT**

Technological, medical and social improvements have allowed humanity to develop at a pace without precedents, expecting a population of over 10 billion people in 2100. However, technological improvements are increasing our energy demands, making us dependent on large amount of terrain outside our settlements. This makes of **land optimization** a key for our future cities.

Eric W. Sanderson calculated in 2002 that 83 percent of Earth’s land surface is directly influenced by human activity.

As an answer to these challenges, a “Solar Cloud” composed by modular balloons that uses the combination of air and sun as the only lifting force is proposed. By creating buoyant clouds we achieve two things in one gesture:

-To create a buoyant cloud that allows its owners to save space wherever is located. The “Solar Cloud” works only when is needed – with solar exposure. When the sun rises, the units that form this cloud lift by absorbing solar radiation. When the sun goes down, as every solar collector, becomes impractical. Therefore the units come down and are stored in a minimum space thanks to its material flexibility.

-The greenhouse effect produced by the absorption of solar radiation allows the cloud to lift up to stratospheric levels with the use of air and sun, avoiding the usage of complex technological systems that would require more energy consumption. In addition, at stratospheric levels, the project is able to recollect almost four time more energy than standards solar collectors.

The modularity of the project allows it to grow up to any scale, making it adaptable to feed the energy demands of any settlement. Its buoyancy, allows the cloud to act as a nomadic element that can deliver energy to any settlement, cast shadows where is needed and even combat global warming by reflecting solar radiation back to space.

EMPLACEMENT STRATEGIES

In Santa Monica Bay, the “Solar Cloud” is located in front of the shoreline with any direct pedestrian connection. This is decided to avoid any intersections with emergency labors. Instead of a pedestrian access, three docks are proposed to have maritime access. In this sense, the “Solar Cloud” will form its own island that invites people to walk through its path and to observe all the energy streams that are happening on the ocean.

The path will have different functions. Firstly, it serves as the distributor of the different clouds that compose the intervention. Its modularity will allow the intervention to grow so it can fill the entire lot if desired. Secondly, it serves to harvest tidal energy thanks to a series of generator coils that, through the movement of the different modules induced by the waves, will allow to harvest this energy. Finally, it connects the different streams that the “Solar Cloud” is collecting. This is solar energy, tidal energy and water harvesting. In this way, what the “Solar Cloud” harvests is distributed to the city from a single point.

**MODULARITY**

The “Solar Cloud” is composed by a series of solar balloons in order to enhance its modularity and replicability. Moreover, this modularity makes the entire system resilient to possible damages – if one balloon breaks, is supported by the entire cloud.

An array of balloons will be composed by joining them through its vertex. Like this, we leave the faces of the units free for the sun to pass through.

**TECHNOLOGIES USED**

**Solar Balloons:**

In a quest to increase the efficiency of actual renewable energy sources, a “Solar Cloud” that is capable of gathering four times the amount of energy from the sun than conventional solar collectors is proposed. This is possible thanks to the analogue technology of solar balloons, which consist on the absorption of solar radiation to create a temperature difference between the exterior and the interior air. In other words, it creates a greenhouse effect. Solar balloons are able to reach stratospheric levels, where solar radiation is higher as there are less layers of water vapor, clouds and pollution.

**Thin-Film Solar Cell (TFSC):**

Improvements in solar energy to increase its adaptability has led to the development of a technology called Thin-Film Solar Cell (TFSC). The flexibility that this technology offers makes it ideal for the malleable materials in which the solar balloons are fabricated. By applying them on the bottom of each balloon, it will be possible to collect energy when needed and pack the unit when it has to be transported.

**Stationary generator coils:**

Similar to a dynamo, the stationary generator coils will help to take advantage of the incessant wave energy that every ocean offers. For the occasion of the “Solar Cloud” in Santa Monica, they are proposed on a structural system that plays with the movement of the main path designed to distribute the different fluxes happening in the project. The stationary generator coils will provide a continuous source of energy to the island proposed.

**Fog-Harvesting mesh:**

Evaporation is the first step in which nature transforms salt water into fresh water. By providing the “Solar Cloud” with several Fog-Harvesting meshes, it enables its capabilities of water provision. The water harvested will be conducted through the main path proposed and collected in the proposed holding tank that Santa Monica Sanitary Sewer Division is planning to construct.

The collection system proposed is not an intensive water harvesting system, as we should take into account the weight that the “Solar Cloud” is able to hold. Therefore the fog will be condensed in these fog-harvesters and guided to the main path thanks to the action of gravity. As an estimated average, on a surface of 40 square meters it can collect 200 liters per day.

**FURTHER APPLICATIONS**

The principle of buoyancy allows the “Solar Cloud” to lift up to stratospheric levels and travel large distances with the solely use of air as a lifting force. This supposes the main advantage of this system as it is extremely economic, easy to store and to transport. The existing related projects focus in the usage of different gasses to lift the solar collectors, making these technologies very expensive. All these advantages makes the “Solar Cloud” an ideal energy source for emergency settlements.

We can imagine the units that forms the “Solar Cloud” performing in multiple ways: At a micro and macro scale, they can be used as shading systems for our settlements. They will – as clouds do – reflect solar radiation back to space and cast shadows to cool the environment where they are deployed, decreasing temperatures and enabling the “Solar Cloud” as a tool to face global warming.

Moreover, with the proper equipment, they can also be used for planetary exploration to provide measurements at a very low cost price.

**ESTIMATE KWH (**162000 MWh)

According to the U.S. Department of Energy, Santa Monica is located in an area that receives a total of 1950 kWh/year per square meter. This means an average of 5,3 kWh/m2/day. A single Balloon has a surface of 56,25 m2 covered with a layer of Thin-Film Solar Cell. With an average of 5 hours of sun every day, we obtain 1825 hours of direct sun every year. Therefore each balloon produces every year an amount of 544078 kWh.

The intervention created has a total of 300 balloons, therefore the intervention produces a total of approximately 162000 MWh every year.

**DIMENSIONS AND MATERIALS**

The cubic volume is decided for two main reasons:

- It is easy to join the seams formed in most edges.

- It has a good volume / surface ratio. This means that is able to hold a considerable amount of gas while having less surface. The best volume is the sphere, but is more difficult to fabricate.

Each cube has a face of 56,25m2, formed by edges of 7,5m.

The materials are chosen due to their resistance, flexibility and .lightness. For this mockup was decided to use a High-density polyethylene (HDPE).