**CRACK ON THE GROUND**

**THE CONCEPT**

Climate change is real and the mankind is responsible. Where there were giant lakes and rivers before, there are deserts now. Where there were deserts before, there are floods now. The landscapes, cities and environment are changing rapidly affecting people and the Earth. We can see huge cracks on the ground caused by global warming. For that reason, we have to change the way that we have produced energy during last centuries, and of course, we have to stop to consume fossil fuel.

The first step is to become conscious and awaken.

Our work is aimed at showing how the Earth reacts to human impact and is also an invitation to take a moment to reflect upon. The project is a metaphor and also an architectural synthesis of changes in landscape, for that reason it looks like a bottom of a lake without water because of drought. We took that esthetic idea and we created a new public space in the form of a crack, where people can live a spatial experience of a place that constantly changes.

**HOW IT WORKS**

*“Return to the source”* means for us come back to be in contact with natural recourses: **sun and water.**

We integrated these two elements in one system in order to produce clean and renewable energy to transfer to the grid. As a matter of fact, our design is simple and pragmatic, we combined two tested and known technologies that use sun and water to create a whole new interpretation of power renewable plant: (1) **Photovoltaic solar panels**, and(2) **Pumped-storage hydroelectric powerplant.** With our design we capture energy from nature (sunlight) to convert it into electricity, to store it and to transmit the electricity power to the grid, as explained step by step below.

1. **To capture sunlight and to convert it into electricity:** The first part of our system is composed by **3,200 square meters** of high capacity **Photovoltaic solar panels** (20% efficiency each one), which have the capacity to produce **1,478,400 kWh** per year (estimated annual electricity generated). Each 1 m2 of those solar panel has the ability to produce 462 kWh per year, according to monthly average 264 W/m2 solar irradiance in Abu Dhabi.
2. **To store electricity energy and to transmit it to the grid:** The second part of our system is composed by a **Pumped-storage hydroelectric powerplant,** which has the capacity to store the electricity like a big “battery” (but without batteries) and generate new electricity in order to inject it into the grid.

**What are the advantages?** One of the most common problems in every solar renewable energy system is that the electricity demand increases at night, when sun is not available to produce electricity. That situation makes it necessary to store the energy from the moment that it is produced during the day until the moment that it is used at night. One common solution for that problem is the use of **batteries**, but this solution increases the costs, needs a big space available and, what is even more relevant, produces waste and substances toxic for the environment, issues that are to be avoided.

On the other hand, a **Pumped-storage hydroelectric powerplant** allows us to store the electricity that come from the sun to use it at night in the following way:

1. First, the system has two connected reservoirs of water, the upper and other lower reservoirs. We use the elevation between them to use the potential energy of water.
2. The electricity generated from the sun is used to pump water to from the lower reservoir to the upper reservoir during the day.
3. At night, when the demand increases or when sun energy is not available, water falls from upper reservoir and runs through turbine creating new electricity.
4. Finally, clean and renewable energy (electricity) is injected into the grid.

This technology has a **75% efficiency**. That’s means we can generate at night 75% of the electricity that we spend storing energy. That percentage is a huge achievement if we consider that the plant can produce electricity at night without emission of greenhouse gas.

**CAPACITY**

As a result, our project has the ability to generate **1.4 GWh** per year of electricity during the day. This amount of electricity reduces to **1.1 GWh** per year at night (75% efficiency). In relation to the nameplate capacity or installed capacity of our design, we estimate it in **1.3 MW**.

**MATERIALS**

The project uses three main materials: (i) Photovoltaic solar panels in the south faces where we have to cover 3,200 square meters of surface; (ii) Concrete which is used to build the vertical elements of the project and also the underground spaces. **For interior spaces, we have combined the red sand of the local field with traditional concrete in order to produce a connection with the local landscapes**. This allows us to design familiars interior and public spaces for the people. For exterior spaces we use modern concretes; and (iii) A combination between wood and grass for open exterior spaces.

**SIZE AND DIMENSIONS**

Length: 270 meters

Width: 15 to 30 meters

Height: 20 meters

Depth: Variable Dimensions

**ARCHITECTURAL SPACE**

The Crack is a new kind of architectural space where people will be able to experiment a constantly changing public space. So, the ability to modified the use of this space allows us to live different sort of moments and activities every day and every hour, even at night. We have designed a shaded space to increase comfort for visitors and reduce heat absorption at the plaza. Also, we have reduced the evaporation of the water because of the shadows. When the upper reservoir (the Crack) is empty, visitors will be able to walk through the space and many different sport or artistic activities will take place there. On the other hand, when upper reservoir is full, people will be able to see the landscape and even practice aquatic sports inside the crack.

**INVESTMENT**

We have estimated an order of magnitude of conceptual cost in a total of **USD 25,000,000** divided as follows:

|  |  |
| --- | --- |
| **Item** | **USD** |
| Photovoltaic solar system | 4.000.000 |
| Civil works | 12.000.000 |
| Pump/turbine system | 6.000.000 |
| Architecture | 3.000.000 |
| Total | **25.000.000** |
| **$/W** | **19** |

**We estimate $19 USD per watt of installed capacity**

**CONCLUTION**

We have designed a new interpretation of a power plant using two tested and known technologies that allow us to capture energy from the nature (sun) and store it and transmit to the grid without emission of greenhouse gases. At the same time, we have created a new public space where people have the possibility to live a new experience in connection with natural resources such are sun and water. Also, it is a place where people will be able to think and reflect about climate change and enjoy a space that changes every day (changing the way that it will be used and the activities that can be conducted over there). The changing functionality of that place is also an invitation to think about the way that the *climate change* is modifying our planet.

**ENVIRONMENTAL IMPACT STATEMENT**

**(environmental impact summary)**

The project is a power renewable plant, which has a capacity of 1.3 MW and it is also a public space in the city. It is located in a field of 25,000 square meters in the middle of Masdar city. During the construction phase of the project, the main impact over the environment will be the air pollution, because it will require to excavate a lot of cubic meters of ground. In order to reduce this contamination, we propose to use water trucks to wet roads at the construction site. All the debris will be treated to reduce the contamination. In relation to underground water, we propose to reduce it during the phase of construction and then return it to its normal level. The bottom of the project will be waterproof in order to avoid contamination of its waters.

In relation to the city, our project has a connection with the urban net, especially for the pedestrians who will be able to walk across the project. Also, it is important to consider that one of the streets of the context needs to pass through the project by the underground.