**The Story of our Artwork**

**The sun flower story**

We were looking for an artwork which is both beautiful and beyond that plays a role in utilizing both urban contexts and private areas but not limited to just a physical structure. We were actually looking for something much more useful for the community.

The more the members of a society are connected, the more they learn from each other and they flourish, and the more successful the society becomes. As a result, from the beginning of the designing process, we take this as one of our principles, gathering people with each other and letting them experience like they are embraced by a big umbrella like a hug. We also consider the role of beauties, attraction and of course the energy that we have to produce. After some drafts we design a shading considered as a multifunctional area which is equipped by two different technologies as an energy producer. The shading design inspiration was taken from the substrate and an attempt was made to visually design a sculpture in harmony with the visual aspect of the park, so the modules are currently like flowers placed in the park and called “The sun flower” as it tracks sunlight.

This design is completely modular and scalable so that users can adapt it to the situations. For example, it could be used as a single structure in a private area or sitting together and provide a vast semi-open area to serve as a public area where different actions can be implemented. Also, we were looking for an art work that does not require much material, cost, and production time for each module, so that all people with an average income can benefit from that. In this way, in any situation, based on the amount of energy needed or the available space, by putting any number of modules together, we can achieve both the amount of energy needed and larger urban and collective spaces.

In terms of placing the combination of volumes and providing a semi-open space in the park space the following points are remarkable:

• Due to its modularity, the design is completely flexible and can cover a larger or smaller space depending on the need. In addition, the more space is allocated to it, the more the amount of energy production increases.

• The possibility of combining modules and changing the height and dimensions and forming a larger space for various uses

• The presented design is not only in parks, but due to the nature of its application, it can be used in many urban centers and urban contexts. Also, due to its modularity, it can be used in the smallest scales such as courtyards to the largest scales such as city parks.

• Our productive landscape not only serves as an energy production system, but also brings joy and pleasure to our community by providing a gathering place with various functions such as beautiful shading and cost efficiency as the principal materials such as water and organic photovoltaic are not too expensive, also they are natural, accessible and easy to be used.

• The principal materials are organic and no greenhouse or less greenhouse emission are produced

• It is equipped with a simple but remarkable technology and system which could be constructed anywhere

• It shows people the joy of producing energy and meanwhile having a place to gather and having fun

• By being in this space, everyone in all ages can learn about clean energy and the need to cooperate with each other for a better future.

There are various uses considered for the design such as a place to sit, relax, spend time with friends and family, drink and enjoy the space and fresh air, organize local markets or even small exhibitions in the open air in parks or the kleingartens. And also, sitting space and shade for the backyard of the houses are some other applications of this design. Moreover, as it was mentioned, these huge flowers can be placed in many different scales from residential to urban areas. In Mannheim park, these flowers have been placed together in one of the central places of the park where access to pedestrian and bicycle paths has been installed. At the same time, this created space has created a collective space with diverse and flexible functions with the help of the combination of modules.

**Technology used;**

The initial module of the design is like a flower, the middle part of the flower is made of a lens (following the sunlight) and we used organic photovoltaics for the leaves. Two separate techniques are used in this design, one is the use of organic photovoltaic cells (OPV) and another using water and a lens to collect sunlight in one point and use its heat to generate electricity.

OPV is a known system that, although it has a lower efficiency than conventional photovoltaics (8-16%), but because it is made of organic materials such as carbon or polymer materials, it is better for the environment. Also, these panels have the possibility to be flexible and colored or semi-transparent panels, which are completely suitable for our design, for this reason, we have used this system for use in curved shadings. These petals have different dimensions depending on the need, but usually the smallest module has a petal surface area of 5.65 square meters and its height is about 4.5 meters and the biggest module has a petal surface of 10 square meters and its height is about 6 meters.

As mentioned, a concave lens has been used for the middle part of the flower. This lens is about 2-3 meters in diameter. This lens has been used by gluing together two curved transparent plexiglass sheets, and we have filled the space between these two sheets with water. The reason for using water is to reduce the cost of making a lens, the availability of water, and also from a physical point of view, due to its magnifying feature. At the bottom of this lens, a sphere is connected to the lens with a structure at the focal point of the lens, in fact, the sunlight that collects in the focus of the lens is concentrated by this element, and the collected heat is transferred to another material, and its heat is used for generating electricity. The important point about these lenses is that the structure on which the lens is placed is made up of four bases, that can be changed in height with the help of jacks, which ultimately leads to the movement of the lens, and in this case the lens always follows the movement of the sun and gains maximum energy. The system to which this heat is supposed to be transferred is a heat exchanger to produce electricity which can be connected to the grid or it can be completely separated.

The amount of energy produced is variable based on the size, efficiency, and the number of the modules used. In general, if each OPV panel has a 12% efficiency, the smallest module (with 5-6m2 area for each petal and a lens with 2diameter) provides about 2.73 MWh per year that can be multiplied by the number of the modules in an area. As a result, based on the design (various size and the number of the flowers) in Mannheim park, each smallest module produce 2.73 MWh, the medium size produce 3.294 MWh, and the biggest module produce about 4.83 MWh. Consequently, the whole amount of the electricity production is expected to be about 162.53 MWh per year.

**How our design will support UN sustainable development goals;**

In general, our project deals with the growth and development of human relations by providing a space for people. Also, by creating a background for group activities, as well as local economic activities, it helps the individual and social development of the community and the growth of the local economy. On the other hand, in this project, by combining clean energy production solutions and technologies with a structure that humans deal with every day, it shows children and even adults how to enjoy a space and the shadow of a structure and gathering under, meanwhile, the structure provides the necessary energy for a comfortable life. Also, since the presented design is modular, simple and almost inexpensive, made of available technologies, and easy to manufacture it can be made easily available to the public and cheaply in many parts of the world. As a result, some of the items of sustainable development that can be achieved with the help of the plan are as follows:

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Goal 13. Take urgent action to combat climate change and its impacts

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

**Environmental assessment**

As it was said, the construction method, construction technology and materials required for the construction of this system, all materials are available, somewhat cheap, and the cost and duration of construction of each of the modules is very low, and only with the help of repeating these modules side by side. It is possible to produce more energy and create an urban space. Also, the selected materials have been tried to use organic materials that cause less damage to the environment in their life cycle in order to minimize the amount of greenhouse gas emissions in the life cycle of the design. Also, to reduce possible risks or issues that may occur in the future, we have considered the scale of our smallest module so that it can be adapted to any possible changes in the future. Also, in this design, special attention was paid to the dimensions so that the module has the least amount of damage and occupation on the ground and does not affect the substrate, and in terms of height, it is in such a way that it does not prevent the movement of wind and the supply of free air (the highest module is about 6m). In addition, holes were installed in the petal-shaped shadings to help the movement and flow of wind above and below the shading flowers as much as possible.