**Solar flower**

**Main idea:** We have used the concept of flowers in the design of this modular and scalable system; According to the demands of the competition to provide sustainable urban infrastructure beautifully and attractively so that people can communicate with it and feel a sense of mutual connection.

The basic idea of this design is inspired by the functional process of flower petals and leaves, which absorb rainwater with special mechanisms and convert solar energy into the kind of energy that can be used for plant growth and metabolism. **(UN sustainable development Goal No.9)**

Also, flowers represent the eye-catching beauty of the world

**Not preventing the flow of wind**: We have also tried to make the best use of the wind in the region by generating energy from it without blocking its path.

**Functionality along with beauty:** In the designing process, it has been tried to use a balanced combination of beauty with the least amount of energy waste, so that there is a proper balance between the functionality of clean energy production infrastructure and its beauty, which makes the city more beautiful and connects people with this kind of infrastructures which are often coarse. **(UN sustainable development Goal No.17)**

**Comprehensibility:** This design, according to the concept of flowers, its terminological and aesthetic meaning, as well as the uses defined in it, make it possible for people of different ages, nationalities, and races to communicate with each other and the design; In a way, the act of giving flowers to each other represents peace and specifically, in our design, it shows global peace

**Materials:** Considering that the use of recyclable materials has many benefits for the environment, Reclaimed or Recycled Steel has been used for the overall structure of the design, which has a good ability to control the pressure, it is 100% recyclable and significantly reduces the ecological impact of new construction and it is relatively cheap. We can use HempCrete to cover the flower stem because of its unique features; It is a concrete-like material created from the woody inner fibers of the hemp plant. The fibers are bound with lime to create concrete-like shapes that are strong and light. Hemp concrete is lightweight, dramatically reducing the energy used to transport the blocks. Hempcrete is sturdy, has good thermal and acoustic insulation qualities, and is fire resistant. Additionally, **ITS BIGGEST SUSTAINABLE** **PROPERTY** is that **IT IS CO2 NEGATIVE, meaning it absorbs more CO2 than it emits**. (Hemp itself is a fast-growing and renewable resource)

**Make people interested in agriculture along with energy saving:** The considered agricultural land use and the possibility that each leaf can be rented like an agricultural land provides the possibility of connecting people from any social and financial class with this design. **(UN sustainable development Goal No.2)**

Also, the shadows created by the leaves will provide suitable spaces for outdoor educational classes about agriculture, clean energy, etc.; The land around our design can be used for agriculture and planting, and the shadows produced can be a very suitable space for people to gather, enjoy drinking a cup of coffee, have fun, and spend their leisure time, which strengthens the sense of solidarity and closeness between people and improves the quality of life and communication

**Use of solar energy:** According to research, photovoltaic cells have the highest efficiency of solar energy production in Germany. These cells are installed on leaves that are placed at variable and adjustable angles and heights.

In each leaf, there are 50(residential) – 102 (urban) Bifacial photovoltaic cells of AXITEC company (Model: AXIbipremium XQ HC MT) with an average production of 660 Wp, which can produce 144.5 (residential) – 294.9(Urban) MW electricity per leaf per year. **(UN sustainable development Goal No.7) For instance a 16-meter-height flower with 10 leaves can produce up to 2949 MW electricity energy per year**

In each designed flower, the orientation of the cells and leaves can be changed and adjusted in the best direction to face the sunlight.

**Use of wind energy:** To use wind energy in this design, a combination system of rotating blades connected to a turbine with a vertical axis **(VAWT)** of helical type is used.

This system, which consists of a vertical wind turbine with a height of 2 meters and a radius of 0.5 meters, is connected to rotating plates (joined with the blades on the stem) from its central vertical axis. The blades that rotate around the body of the design with the wind, make the axis rotate and intensify the movement of the axis connected to the turbine and ultimately increase the efficiency of this turbine; According to the average wind speed of 3.2 meters per second in the region, this combined system can produce 15-KW.h of electricity. **(UN sustainable development Goal No.7)**

**Beneficial use of rainwater:** The vessels in the designed leaves, which are the supporting structures of the photovoltaic system, have pores on their surface, through which the rainwater collected on each leaf flows to the structural pipes, and then is transferred to the main vessel. After that, the collected water is transferred to the stem (body of the designed flower) and stored in a storage that is placed inside the ground. (It is buried under the ground, which greatly reduces the energy loss based on the thermal exchange of the stem, and it is also more suitable in terms of aesthetics). Then this stored water is pumped when needed and used to irrigate crops as well as cool the air in the environment and improve the climate quality of the region. **(UN sustainable development Goal No.6)**

**Uses of the leaves**

The leaves of this design are intended for three types of applications:

**1- Energy production from sustainable sources (Energy farms) (UN sustainable development Goal No.7)**

**2 - vertical farms (vertical agriculture) (UN sustainable development Goal No.1 and No.2)**

Due to the high value of agricultural land and the lack of land for agriculture caused by the daily increase in population, the need for agriculture (agricultural towers) is quite evident. Therefore, these leaves give us a suitable opportunity for vertical agriculture with proper absorption of sunlight and the possibility of irrigation by rainwater stored in the storage.

Also, the robotic system in industrial agriculture and the use of ladders in traditional agriculture provide farmers the proper access to these leaves; This type of using the leaves helps greatly in increasing the amount of food production to reduce the level of world poverty

**3- children's playing equipment and people’s gathering place**

These leaves in the lower parts of the stem are intended to create a pleasant and lovely atmosphere for children and their families, which makes people more connected with this design and causes more acceptability of this system in their daily life. It also makes children interested in clean energy from an early age.

**Scalability (urban and residential):** Due to the changeability of the number, size, and height of leaves and stems, this design can be resized in different urban dimensions from 8 to 16 meters high and in residential dimensions from 3 to 8 meters high; Also, the number and scale of the leaves can be changed according to the needs of the users.

**Environmental impact summary:**

In this design, by using the benefits of vertical agriculture, less land is occupied with higher productivity, and far more products can be harvested than the same occupied area.

At a time when there is a problem of water shortage all over the planet, according to the type of operation of the rainwater collection and storage system designed by preventing water wastage, a lot of water consumption is saved. Because the most waste of usable water occurs in the agricultural process and especially in traditional agriculture, therefore, by not using the available water reserves for agricultural irrigation and the targeted use of rainwater stored by the designed leaves, a lot of environmental damage can be prevented.

Due to the adjustability of all the angles of the leaves and photovoltaic cells, by producing electrical energy from most of the available solar and wind energy, according to the specific characteristics of the region and context, all of the natural capacities are used in the best way.

**United Nations Sustainable Development Goals achieved:**

**Goal 1.** End poverty in all its forms everywhere

**Goal 2.** End hunger, achieve food security, improved nutrition, and promote sustainable agriculture

**Goal 6.** Ensure availability and sustainable management of water and sanitation for all

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

**Goal 9.** Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

**Goal 11.** Make cities and human settlement inclusive, safe, resilient, and sustainable

**Goal 12.** Ensure sustainable consumption and production patterns

**Goal 17.** Strengthen the means of implementation and revitalize the global partnership for sustainable development