**THE WAVE**

**Technologies:**

1. UV sequestration with luminescent solar concentrators (LSCs)
2. Color-stimulated photosynthetic induction
3. Carbon capturing coating

The Wave is an interactive installation, a modular energy-generator and art piece designed to complete the net-zero vision of the **2023 German Federal Horticulture Show (BUGA 23)**. The Wave aims to allow visitors and residents to explore the fair, the park and the city of Mannheim from another perspective. Installed on top of the historical U-Hall building, the installation will create a new accessible level for users to walk over a double-layered energy generating mesh. A dynamic art installation of minimum environmental impact, in which energy generation is the protagonist.

The system uses luminescent solar concentrators (LSCs) and is capable of absorbing up to 50% of direct light emissions and albedo (reflected light), producing electricity even in low-light conditions, since it does not require direct exposure to sun-light. With LSCs, high energy particles are absorbed by the luminescent structure of the material, and then re-emitted as visible light of a certain wavelength.

The Wave is capable of generating up to **3.040mWh** per year, and each module of 900m2 of LSC mesh is capable of producing **190mWh** per year. The current layout allows a minimum of 6 modules and a maximum of 16 modules installed on top of the U-Hall building depending on the desired experience and energy generating goals. - *For the minimum intervention of 6 modules, footprint area is reduced to 5.400m2 - with estimated annual production of 1.140*mWh per year.

**The mesh:**

The “floating” mesh is the main feature of the installation, a tensioned network that is constantly reshaped by the encounters happening on its top, with two layers that synchronize themselves with the visitors movements, resulting in unique reflections on its lower level, without disrupting the energy production.

Even though independent systems, both layers will be interconnected in a way that when one moves the other mimics its movement, maintaining an always constant distance of 200mm between the two, enough to avoid any obstructions in luminosity to the LSC panels, but still close enough so the upper mesh looks almost invisible to the visitors when seen from underneath. Each one of the meshes has a different purpose, one for allowing visitors to access the new level and the other focused exclusively on generating energy from visible luminance with organic LSC technology.

The top - and walkable - layer is made out of highly-resistant and nearly-transparent steel mesh which is designed to outstand the weight of visitors and allow walking on this new and yet unexplored rooftop level. Its system is inspired by the work of Berlin-based artist Tomas Saraceno, and is provenly efficient, reliable and replicable.

The bottom layer is composed of a network of Luminescent Solar Concentrators (LSCs) panels. Each module is produced out of an organic-based coloured bioplastic tile synthesized from crop / vegetables waste, resulting in a 99% recycled and carbon-efficient material.

These panels have luminescent particles in their microstructure, so non-visible UV light bounces internally and is re-emitted along the panel edges as visible light (coloured) due to its internal reflectance; the outcome of this process can then be transformed into electricity in a more efficient way after being intercepted by linear photovoltaic cells placed on the edges to convert the captured light energy into usable DC electricity.

The low tension produced by each module allows thin cables to safely connect the generator cells to the central energy alternator of each panel module, alternator circuits will process the output voltage and redirect it to the local grid or specified energy storage.

**Color-stimulated photosynthetic induction:**

The LSCs system also works as a light filter, that allows only a small parcel of the visible light spectrum to pass through, this can be used in many ways to stimulate photosynthesis by the use of specific wavelengths since different plants react differently to extended exposure to certain hues, which can enhance the color, the fruiting, and the aroma of the plants (violet, per example - 380nm to 430nm) and increase flavor and total amount of antioxidants in the plant stems and even help plants to reach its maturation flowering stage (red - 625-740nm).

**A carbon-capturer structure:**

The lightweight metallic structure will be modular and ultra-slim, sustained mainly by its contrary bracing forces and tensioned tie-rods; by this way reducing the amount of material needed for construction, and its overall carbon footprint and energetic impact. In those terms, the structure aims to be net-zero, since its organic coating will also passively capture carbon dioxide (CO2) from the atmosphere and purify the city air. A coating that will compensate for its own footprint by filtering and providing fresher air flows in the Mannheim green-corridor.

**Circularity and long-term small and medium sized applications:**

The Wave is the result of loops of energy, art and biology. Its simple structure and modular system allows a relatively low time for implantation and flexibility for future expansions; being designed to be scaled up and down.

LSC panels are not a new technology, but its commercial use has been halted by a simple factor, its coloured hue. Since coloured panels are not very well accepted in urban building facades and private residences its use became very limited in the present days. The Wave aims to reimagine this system into a mainstream energy source, to apply its highly efficient properties into places that seek colors and are not permanently occupied, schrebergarten - urban gardens are perfect for it. Not only this system will bring color and joy to the schrebergarten greenhouses, but also generate usable electricity, and possibly also increase plant growth and quality by filtering the light into specific colors.

**Additional considerations:**

**The Wave aims to inspire.** Our goal is to bring visitors and residents closer to alternative sources of clean energy, not only as observers but also actively as protagonists. During the BUGA23 visitors of the Spinelli Park will be able to gather together and walk “on top” of the bio-panels, nonetheless its long term impact is on the hands of each person, that will have the opportunity to learn about the applied technologies and bring back home a piece of what could possibly be a more energetic and colorful future.

**Bonus feature:**

The Wave also aims to fulfill four of the UN Sustainable Development Goals and by this way, help to develop a better future:

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

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

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

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