**Flower Power - Forever in Bloom**

**STORY BEHIND THE DESIGN AND environmental impact**

As a collective of practicing landscape architects this year’s LAGI design challenge is particularly enticing given its strong link to the BUGA 23 German Federal Garden Show. Whilst researching Mannheim and its deeply rooted history of innovation we wanted to create a proposal which brings all of these aspects together to provide an exciting installation for all future users to enjoy if selected.

To create beautiful forms of energy we first explored the various forms of renewable energy such as solar, wind, and wave and played with the various ways in which these elements could be creatively incorporated into a beautiful installation whilst still providing a significant amount of energy.

It was also important to understand the **local climate and environment of Mannheim** to ensure the appropriate form of renewable energy to be incorporated within the land art was chosen. From our investigations it was determined that a considerable amount of energy could be generated from both solar and wind.

Located in the south west of Germany, Mannheim has a higher potential photovoltaic power in comparison to other parts of the country.

The urban fabric surrounding the site further provides a series of wind channels which run through the site and by utilising this we can also generate energy through an adaption of our sculptural elements.

We wanted our installation elements to be closely related to the theme associated with the garden and horticultural festival. We felt that this approach was appropriate and could present the opportunity to be developed in such a way that it could be a relevant and lasting landmark within the site for numerous years after the garden festival is completed and the site returns to its original function as a city park.

With any installation colour and material is always an important component to consider. Given the theme is energy and the project is so closely linked to the horticultural exhibition we decided on the colour blue as the dominant colour of choice.

Shades of blue are commonly associated with energy and with the national flower of Germany being the Cornflower with its striking blue flower we felt this was a very appropriate selection.

**SUPPORTING UNITED NATIONS sustainable development goals**

An important goal for the competition entry was to help advance one or more of the United Nations Sustainable Development Goals. Through our proposed design we have addressed the following:

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

Our proposal will generate energy at each of the installation pieces which can be used by the public to generate Wi-Fi coverage, mobile phone/ laptop charging points and other small electrical items. As these sculptures are located within a local park they are freely accessible to all members of the public and as the power is generated by the local environmental conditions there is no charge involved.

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

Our proposal will provide ambient light within the park after sunset which will provide sufficient lighting to ensure users feel safe in the environment. As these installations will be located within the park they will be free for all to visit and enjoy both during the day and at night. As these elements will help increase the footfall within the park by creating an iconic landmark, visitor numbers will likely increase which would hopefully lead to enhanced economic opportunities within the local community.

**The Design and Technology used**

Our installation comprises of two types of sculpture as outlined below:

**Piezoelectric Fabric Flower**

The first is an expression of the cornflower with a sleek aluminium frame which will house all of the electrical cabling and components. Within the flower stalk will contain charging points for devices such as mobile phones and laptops. The flower head will be constructed from piezoelectric fabric which will turn kinetic energy generated from the wind into electricity. Additional energy generation will come from the petals touching each other during windy conditions. This energy will be diverted down through the base of the flower stock into a storage unit and connected to a grid which links all of the flower sculptures through the park. A total quantity of 4000 piezoelectric flowers are distributed throughout the park with their main focus along the wind channels, and nodes to increase efficiency and energy production. The technology behind piezoelectric fabric is still in its infancy however researchers have developed this fabric through a combination of nanotechnology and a principal known as the piezoelectric effect, which is observed through generating energy through pressure and movement. Piezoelectric fibre has ultra-thin zinc oxide coated wires woven in one direction, while there are gold wires aligned in another direction. These wires are only 50 nanometres in diameter which is around 1,800 times thinner than a human hair. When the fabric is stretched, twisted, the two wires rub against each other and the resulting tension and pressure is converted into electricity. The total estimated yearly output for this installation is calculated at **75,886 MWH per annum**. Initial cost estimate of each item is EUR 5,500 and total quantity of the items is 4000 with EUR 22,000,000.

**Photovoltaic Solar Flowers**

As per the piezoelectric fabric flower the inspiration for the photovoltaic flowers is also the Cornflower. The flower stalk will contain charging points for devices such as mobile phones and laptops and will be connected to a network underground to harvest the collected energy for use across the park. Photovoltaic panels are available in all ranges of colours therefore we have selected a range of blue shades to replicate the cornflower beauty. Photovoltaic (PV) panels are used to produce electricity directly from sunlight. PV panels consist of a number of individual cells connected together to produce electricity of a desired voltage. Photovoltaic panels are inherently DC devices. To produce AC, they must be used together with an inverter. A total of 150 of these flowers are proposed across the site and aim to provide an alternative energy provider. As previously mentioned based on the local climate within Mannheim it is expected that a higher yield can be collected in comparison together parts of the country. As the quantity of these installations is much lower than the piezoelectric sculptures the total estimated yearly output for this installation is calculated at **316 MWH per annum**. Initial cost estimate of each item is EUR 7500 and total quantity of the items is 150 with EUR 1,125,000.

**Synthetic Bioluminescence**

To add an additional exciting feature we are proposing to incorporate artificial bioluminescence to each of the flower sculpture typologies. The most well-known instance of bioluminescence is the light produced by fireflies or plankton activated by the crashing waves along the shoreline at certain times of the year. A synthetic version of this has been developed which can be activated by movement in a controlled environment. Within our sculptures we propose to line the petals with tubes containing the synthetic bioluminescence material. This will produce an ambient blue light at night to create a magical setting amongst the meadow of sculptural cornflowers. Given the quantity this will provide a light source each night without any power provision and will ensure users feel safe in the environment due to its level of illumination along the pathways in which the sculptures are positioned.

**SUPPORTING public activities and social co-benefits**

With the generated power from the installations it will be possible to use these to generate additional activities within the park. Power generated from the sculptures can be used to power interactive play equipment pieces which require an electric connection. In additional seating pods can be introduced where users can come to work, socialise together. Power from the sculptures can again be used to provide power for their electronic devices and wifi connections. The intention is to fully harness the potentials of the park/open space and generate as much additional social interaction for the public. It is expected these sculptures will also become an ínstagrammable’ destination bringing many influencers and travel bloggers alike to Mannheim to capture this unique meadow art installation.