**DER BIENENSTOCK (THE HIVE)**

*Over there, where butterflies and bees play, I walk.* In this verse, the german poet Hölderlin evokes a landscape that we decided to provide to the Bienenstock intervention. A beautiful place where people can interact harmoniously with local nature, small animals and plants, inside a symbiotic hive structure that generates and manages energy in a flexible way, in order to suit different site conditions. In this case the design responds as well to the traditional practice of community gardens: *schrebergarten.*

In our process for LAGI 2022 it was necessary to understand two aspects according to the design brief: modularity and scalable design. Also, the artistic and biomimetic approach must be present in the architectural solution. In this way, we analyzed some geometric formations in nature to ideally solve the design necessities: the honeycomb. Originally, honeycombs are constructions made by bees, this structure is optimal in material usage and can be adapted to a several variety of weather conditions and even on urban contexts.

Also, this structure is totally organic and non-harmful for the environment. It was clear that this principle in combination with the form of the honeycomb cell could work as a recipient for rainfall water and sun, generating an aesthetic, self-sufficient and adaptable structure.

The adaptability is one of the most important characteristics of this project, a global solution should be replicated successfully anywhere on earth. In general terms this module consists in a photovoltaic dish, a funnel that collects rainfall water, a translucid membrane that works as a greenhouse and shelter for insects and small animals; and a complementary eolic/kinetic module. For the Mannheim boundary site, the modular system presents a particular configuration according to specific conditions. The first one is the urban temperature control. The position of eolic modules enhances the wind flow direction (studied in the Green Corridor Master Plan) to produce energy, then the wind flow passes through many ponds under the hexagonal solar modules, that refreshes the air flow, before reaching the residential zone. For the second one, we would like to emphasize that solar modules create a second layer, designed for stocking the rain and avoid floods. And finally, water and sun are integrated into the city smart grid or used on site for urban agriculture.

The social aspect had a decisive impact for the project. Historical research showed us that since 19th century the southern german communities used to cultivate in collective lands: the schrebergarten. This practice transcended the time and keeps its popularity among the population, that is the reason to include farmable modular zones under the generated structures, agrivoltaics. The Bienenstock aspire to reinforce the cultural identity of the people. Naturally, the Bienenstock park provides a vast public space for many activities, like walking, running, outdoor training and even public events like concerts, urban galleries and shows.

During the design phase we considered the UN sustainable development goals (SDG), those who suit the best for our case. Because of this, the intervention offers affordable and clean energy as a logical result of implementation of sustainable strategies. Also, it improves the Mannheim’s quality of life, as a green city and community. Even the air conditioning is improved directly by modules that direct wind flows to refresh habitational zones, which has a positive impact on CO2 emissions by reducing the energy consumption of HVAC systems. Clean water and sanitation SDG is covered trough a system that collects the rainfall water, that could be used in further water management strategies. Other goal covered by the project is the shelter for life on land. Each solar modules disposes of many hollows ready to be used by birds, bees, squirrels, and other small urban fauna. Finally, the production of energy and food encourage Mannheim citizen to practice more responsible consumption and production.

In terms of technology applied, the design proposal can be structured by types of energy, each one has a particular technology and system. In our case, we exploit three sources of energy: solar, eolic and geothermal. The first one is generated by a CPV system (Concentrator photovoltaics) with heliostats. The second one consists of a system feed from eolic and kinetic energy transforming it into electric energy by filaments that can be moved from wind and people intervention, the filaments are made of composite carbon fiber and foam sheets and a piezoelectric system. And the last one type of technology is the geothermal closed loop, which basically produces electricity and heath. All these systems are integrated into the city’s smart grid and reach a total amount of 144.4 MWh per year.

Environmental impact summary

The best way to define the Bienenstock’s environmental impact is climate adaptability. This project offers an extraordinary performance regarding the reduction of an artificial climatization system through the implementation of evaporative cooling. A set of ponds cools the wind flow before it reaches the buildings, and the geothermal systems provide heath in the cold during the winter. One issue detected are floods, a problematic phenomenon in Mannheim. This situation is solved through the implementation of infiltration wells that return water to subsoil, or geothermal systems.

Finally, another positive impact is the protection of life on land. Urban animals could find a shelter in a huge zone of artificial trees. This solution helps to concentrate animals into a specific area, where they can live and contribute to the ecosystem, for example bees and other pollination insects. Life on earth depends on these reciprocal relations, and this is exactly what Bienenstock is, a symbiotic structure between plants, animals, humans and environment.