plane of water

An undulating, shimmering translucent surface stretches across a segment of the park, not only fostering the garden below but also a much larger area of the land. The proposal’s aim is twofold, focussed both on energy producing structures and their link to vegetation growth and irrigation systems for a sustainable development.

The tensioned light hyperbolic surfaces woven with translucent organic photovoltaic film create a space of shade, shelter and gathering for the park’s visitors under the glimmering canopy, able to generate annually 40 MWh, while through its translucency allowing vegetation growth underneath. In a small part, this energy is used to pump water daily from a well into the elevated water tank that in turn supplies the drip irrigation system, able to function solely with gravity due to the height difference.

Watering daily in the morning, the proposal is able to provide sufficient water for 2.8 hectares in the park while supplying majority of the energy generated into the grid, thus not only providing green energy to the surrounding households, but also aiding the development of the green spaces in an integrated way.

REQUIRED WATER

* park watering requirement: 25mm/week
* monthly average precipitation in Mannheim in spring to autumn watering period: 63mm/month =63/4.34 (average weeks/month) = 14.51 mm/week gained from precipitation

🡪 10.48 mm/week to be supplemented by drip irrigation

DRIP IRRIGATION

* water tank volume: 42 m3
* area covered with daily drip irrigation in the morning: (42 m3/10.48mm) x 7 = 4,007m2 x 7 = 2.8 ha
* drip irrigation optimal pressure: 1.37 - 2.75 bar
* water pressure from tank: 1+0.42 bar (4.2m median water height in tank) = 1.42 bar

🡪 energy required only to refill water tank once a day

ENERGY REQUIRED FOR THE IRRIGATION SYSTEM

* while the exact depth of the groundwater well and suitable pump is to be determined, submersible pumps for a 10m well depth with adequate flow to fill the water tank range between 1000W and 1500W, sufficiently covered by the energy generated from the canopy

ENERGY GENERATED BY THE CANOPY

* canopy surface: 907 m2
* OPV film output: 50W/m2
* annual capacity: 40 MWh (calculated using specialised software for Mannheim weather conditions)
* daily average capacity: 34.32 - 226.77 kWh

🡪in majority surplus energy generated to be distributed in the grid

The smaller units, suitable for domestic use, consist of a fragment of the structure coupled with a smaller elevated water tank of 1m3 capacity. They function by the same principle, aiding the growth of decorative plants or vegetables next to renewable energy generation as either an open canopy or a small, enclosed spaces on all sides, becoming a greenhouse as often found in the Schrebergarten.

TYPE 1 - OPEN

* canopy surface: 19.8 m2
* annual capacity: 0.93 MWh

TYPE 2 – CLOSED

* canopy surface: 91.62 m2
* annual capacity: 4.31 MWh

DRIP IRRIGATION

* water tank volume: 1 m3
* area covered with daily drip irrigation in the morning: 200 to 500 m2 from 25 to 50 mm/ week water requirement dependent on type of vegetables and plants

Environmental impact

The canopy is constructed out of low-carbon organic photovoltaic film mounted on ETFE strips, that also has a lower carbon footprint than other transparent building materials, both recyclable. The lightweight structure supporting the canopy and water tank are made from recycled steel. While this has a significant carbon footprint, the durability and maintenance cost, low material use, and ease of assembly mitigates it. The light connections of the project to the ground, its translucency, and the porosity of the canopy through its multiple openings allows it to have a minimal impact on existing ecosystems.