## Solar Park

Focusing on Solar Power, ‘Solar Park’ presents a prototypical model for a distributed energy resource network which is interwoven within Spinelli-Park and presents wider opportunities for scalability within the urban fabric of Mannheim. The modular integration intentionally functions at an urban scale and offers both renewable energy generation and benefits to societal users such as recreation, exercise, waste management, public safety, device charging points, bike charging points and EV charging points. The renewable solar modules offer a sense of energy security for the city of Mannheim. Four prototypical ‘modules’ have been designed for the Spinelli-Park and arranged throughout the masterplan boundary with consideration to visitor flow, public safety, and convenience of access. The Modules present no obstruction to the Klimopass and support fresh air flow to the city.

The modules follow a consistent design language, creating a unique and recognisable distributed energy resource that become iconic Spinelli-Park and Mannheim, further location specific branding and wayfinding elements could be additionally implemented. All the modules are constructed from Engineered Timber, only using concrete where the modules meet the ground, providing resistance from rain and moisture at ground level. The use of Engineered Timber reduces the amount of embodied carbon within the construction, transportation and installation phases of the project and allows the modules to be prefabricated off site presenting efficiencies in construction, transportation, and installation. The use of Timber construction fits with the vision of the redevelopment of the Spinelli Barracks as an innovative and sustainable place of the future.

To address the limitations of solar power and the lack of generation of electricity at night, each module is connected to a battery, in a locked storage area to ensure public safety when using the module. The batteries are subsequently connected to the power grid, ensuring that they are functional 24 hours of the day. As the modules are designed to be self-sufficient regarding their energy consumption, any excess electricity can be contributed to the grid. It is envisaged that if the modules were applied over a wider urban area, a significant contribution to Mannheim’s power usage could be achieved.

The modular integration throughout the Spinelli-Park seeks to inspire the public about the beauty of renewable energy and bring a positive message about life in a post carbon future. With the above in mind, we are confident that the proposal advances the following three United Nations Sustainable Development Goals:

- Goal 3. Ensure healthy lives and promote well-being for all at all ages

- 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 settlements inclusive, safe, resilient and sustainable

The four modules, their functionalities and features are explained below:

1. **Electric Vehicle (EV) Charging Module**

Electric cars are gaining global popularity and are an integral means to creating a green city. The ability to charge conveniently within the urban realm is key to increasing their widespread use and marries with the aspiration of a new model of distributed energy resources. The solar powered car charging module addresses the issue of the origin of the power to charge the car is originating by utilising solar power. The module incorporates a battery to store power and is connected to the grid to exchange excess produced energy or draw from the grid should the module not produce enough electricity.

Estimated Annual Energy Production (per Module) 7361.43 MWh

1. **Electric Bike Charging Module**

Electric Bikes provide an effective means of localised city transportation for all generations and all fitness levels. With Mannheim developing its cycle network, this will provide a green solution for urban transport in the future. There are currently very limited or non-existent public charging facilities for electric bikes. We therefore propose a solar powered electric bike charging station which enables bikes to be charged whilst locked up. The module incorporates a battery to store power and is connected to the grid to exchange excess produced energy or draw from the grid if necessary.

Estimated Annual Energy Production (per Module) 7361.43 MWh

1. **Urban Experience Module**

The Urban Experience Module integrates human scale public amenities that self-sustain and contribute to Mannheim’s distributed energy infrastructure, whilst providing safety, recreation areas and public amenities. A solar lamp unique to Mannheim provides illumination, increasing public safety. A solar bench with integrated USB chargers provides a sheltered space for relaxation and mobile device charging. Two typologies of bin, a composting bin and recycling bin have been designed to provide a sustainable waste management solution for the area.

Estimated Annual Energy Production (Per Lamppost) 292 MWh

Estimated Annual Energy Production (Per Bin) 215 MWh

Estimated Annual Energy Production (Per Bench) 2627 MWh

1. **Solar Cooled Hydro Module**

The Solar Cooled Hydro Module seeks to capitalise on the existing water bodies proposed on the site, and the opportunity for additional ones to be placed. The terraced periphery of the lakes increases water capture and surface drainage for the surrounding areas whilst providing waterfront recreation and relaxation areas in warmer months. The solar panels on the surface of the water reduce evaporation whilst using the water body to retain a cooler temperature, thus increasing efficiency. Exercise bikes promote healthy living and vitality within Mannheim, whilst harnessing this energy to power lampposts or be fed into the grid.

Estimated Annual Energy Production (Per Solar Panel (1.2m2)) 584 MWh

Estimated Annual Energy Production (Per Lamppost) 292 MWh

Estimated Annual Energy Production (Per 4 Bikes) 105 MWh

## Total Energy Genesis Calculation:

|  |  |  |  |
| --- | --- | --- | --- |
| Module | **MWh Per Module per Annum** | **Quantity of Modules** | **Annual MWh** |
| **Electric Vehicle Charger** | 7361.43 | 29 | 213481 |
| **Electric Bicycle Charger** | 7361.43 | 35 | 257650 |
| **Urban Experience- Lamppost** | 292 | 391 | 114143 |
| **Urban Experience- Waste Disposal** | 215 | 200 | 42816 |
| **Urban Experience – USB Bench** | 2627 | 100 | 262734 |
| **Solar Cooled Hydro Module** | 584 | 200m2 | 19461800 |
| **Exercise Bike** | 26.25 | 60 | 1576.8 |
|  |  |  |  |
|  |  | **TOTAL** | **20,362,086** |

Comparison:

Enough power is generated to power 5,000 homes for a year or to fully charge 407,250 Tesla’s.

## Environmental Impact Summary

The prototypical model for distributed energy resources is interwoven with the urban fabric, creating a synthesised network of solar power genesis that can both self-sustain and contribute to the urban grid and the hypothesis of a post-carbon city. The concept respects the limitations of solar power generation, utilising batteries to store power for times with less sunlight and integrating a direct exchange with the power grid enabling electricity to be contributed to the grid when the module has a surplus, or to draw from the grid should the module have a deficit, thus enabling a consistent functionality and reliability of the urban modules.

The modules are constructed from engineered timber, providing a minimal amount of embedded carbon in their construction and promote timber as a construction material for the future.

The individual modules are designed to create enough power to be self-sufficient, whilst any additional electricity generated can be contributed to the grid, providing a green power contribution to Mannheim. The modules present a prototypical model for distributed energy resourcing, with a vision that they can be applied to both the Spinelli-Park and wider urban fabric, offering tactile user engagements and functions within the urban fabric in synthesis with generating green electricity.