**Green Energy Emblem**

**Vision**

Imagine a spectacular art that generates renewable energy while celebrating the Spinelli Park and the city of Mannheim. A culturally inspired modular large-scale power generator artfully and equitably woven into the park to support its function and amplify the vision. Smaller versions of the art could be installed at private or neighborhood gardens to help generate renewable energy while serving as a feature. It will utilize a holistic design approach that showcases innovation, cutting-edge technologies, sustainable living and advance the future of green energy to improve human lives.

**Masterplan**

The planning of the art installation is echoing the undulating profile of the river of Rhine and Neckar. Four bold and multi-layered sustainable design strategy has been developed to guide the implementation that will serve as the organizing element of the park.

1. Amplify the vision of the current masterplan

Create a stronger connection of design elements and open spaces from the Feld Park at south to Citizen Park at northeast by strategically placing the main central open area as the front door next to the Panorama Park framed by art installations, urban agriculture and terrain characterized by sand dunes and dry grassland at both sides. Celebrate the natural heritage and freshwater system of the existing condition by bringing the water into the development by means of retention pond to influence orientation and serve as sustainable feature thereby enhancing the natural vegetation and flora of the district.

1. Arrival and Landmark

Capture areas of greatest visibility from the main road and integrate sculptural gateway integrated with renewable energy installation to create a sense of arrival and transition from surrounding. Landmarks that are iconic and visually appealing that will bring many opportunities to the district, attract residents, businesses and visitors to the area.

1. Connected Civic with a Family of Sculptural Elements with Green Energy.

Sculp a memorable and grand park profile using creative, modular and scalable family of renewable energy installation tied together through a comprehensive open space network, footpaths and bridges. The vitality loop will unify all these elements inside the park. In the near future, it will also be serviced by a smart unmanned mini-bus paved with starpath glow in the dark that will light the park at night. The grand concave and convex motion of the loop is an intentional result of optimizing views that embraces spaces in between. A systematic layout of urban farming with themes along these green energy corridors will serve as a natural feature on ground level while framing views and provide uniquely dynamic experience along the variety of spaces at the park.

1. Diversity and Nodes

Organize a hierarchy of flowing public realm with diversified layout of permanent and rotating art installation that stimulate interest and provide multiple offerings fitting to public’s constantly evolving and dynamic appeal. It will employ a unified design and character of art prototypes thereby creating a cohesive language.

**Design Concept**

The design concept and compositions of the art installations takes an inspiration from the profile of national flower of Germany, Centaurea cyanus commonly known as Cornflower. This flower of elegance and nobility will serve as the beacon in the city. A contextual symbolism of hope for a brighter future and love for the environment.

The following are three main parts of the floral emblem that were used to incorporate renewable energy technology:

1. Flower

The Bud incorporates concentrator photovoltaic thermal CPV+T similar to Rawlemon®. The weatherproof and transparent deep blue colored ovoid captures the shape of a bud ready to blossom. It will serve as the focal point of the park. This will give a sense of orientation to all visitors coming from any direction. As an option, this 60m height installation could have an observation deck and a small café at the top serviced by an elevator to provide a 360-degree view of the district and beyond.

Annual capacity = nameplate capacity x area x time x efficiency

Annual capacity = 220 W/m2 x 250 m2 x 2000 h/yr x .25

Annual capacity = 28Mw/yr

The Sepal incorporates Organic Solar Cell similar product by Opvius ® and installed at the German Pavilion at the Milan Expo. A modular design and composition inspired by the petals of the cornflower. During daytime, the sepal of the bud spreads fully generating energy from the sun and turns into a central lighting feature at night.

Annual capacity = nameplate capacity x area x time x efficiency

Annual capacity = 40 W/m2 x 800 m2 x 2000 h/yr x .2

Annual capacity = 13 Mw/yr

1. The Leaf incorporates Organic Solar Cell similar product by Opvius ® similar to the Sepal. The material is 50-100% translucent and could still provide sunlight underneath the art. The space underneath the artwork will aim to promote gathering and showcasing commissioned art and community activity at multiple scales. These 3 elevated sculptural artform covering a total area of 1 hectare with a total height of 15m will allow the ground level fresh air to flow unobstructed to the surrounding neighborhood.

Annual capacity = nameplate capacity x area x time x efficiency

Annual capacity = 40 W/m2 x 7000 m2 x 2000 h/yr x .2

Annual capacity = 112 Mw/yr

1. The Root is a network of highly flexible and scalable energy generator art installations that incorporates Organic Solar Cell similar product by Opvius ® similar to the leaf and Sepal. It is a contextual and re-configurable art installation that will collectively create a gateway element, provide a shade, frame a corridor or create a rhythmic spatial experience forming the unified grand sculpture. The transparent solar cell pattern is a simplified version of the cornflower which blends with the linear design language of park layout. They will be spaced at every 15m and can be adjusted dynamically at different height and angle at multiple options and varying needs with a column total height is 15m. It intends to form the root extending to the neighborhood and guide breezes to the green corridor.

Annual capacity = nameplate capacity x area x time x efficiency

Annual capacity = 40 W/m2 x 24000 m2 x 2000 h/yr x .2

Annual capacity = 384 Mw/yr

Hexagonal organic photovoltaic modules will be used reflecting the supermolecular assembly of the flower. Flat photovoltaic arrangement is recommended for modules that are directly facing the sun. Using the same modular plan, a more creative 3-dimensional arrangement of concave and convex for units that are not directly exposed to sunlight. A monumental work of art with soffit clad in mirror polished stainless steel providing a dynamic reflection of the surrounding vibrant activities and sky. Potentially, a thematic sustainable art installation could be explored for local gardens to provide green energy, shade and identity.

**Overall Annual capacity = 28 + 13 + 112 + 384 = 537 Mw/yr**

List of primary materials, quantity/ dimensions/area and conceptual cost estimates of the art installations:

1. Bud Concentrator Photovoltaic Thermal CPV+T (250 sqm x $300): $75,000
2. Sepal Organic Solar Cell (800 sqm x $100): $80,000
3. Leaf Organic Solar Cell (7000 sqm x $100): $700,000
4. Root Organic Solar Cell (24000 sqm x $100): $2,400,000
5. Soffit Mirror Polished Stainless Steel Cladding (31,800 sqm x $30): $ 954,000
6. HSS Column (15m height, .15 tons x 550 units x $300): $24,750
7. HSS Beam (30m length, .30 tons x 550 units x $300): $49,500
8. Tension Cables ( 508 units X $10): $5,080
9. LED Lights ( 600 units x $100): $60,000
10. Pile Foundation System ( 520 units x $1,500): $780,000
11. Starpath glow at Vitality Loop (18,000sqm x $100): $1,800,000
12. Labor Cost (10% X $6,928,330 material system cost): $692,833

**Total Estimated Construction Cost: $7,621,163**

**UN Sustainable Development Goals Support**

1. A zone for urban farming has been kept at the north-east side of the site extending its pattern into the central retention pond that collects rainwater then utilized for irrigation. Outdoor hydroponic systems could be used to help produce fresh local produce, thereby helping to end hunger, achieve food security and improved nutrition and promote sustainable agriculture. It could also sequester carbon, limit urban heat islands, create social ties and enrich the city's biodiversity. This type of urban agriculture is a timely strategy to ensure fresh vegetable and fruits during home quarantine in fighting covid.

Any waste from these plants is turned into compost to fertilize the crops for the next growth cycle. Year-round workshops on sustainable agriculture for the surrounding community will be held to connect urban dwellers to agricultural practices and aspires to pass on indigenous lessons to future generations to help mitigate food security challenges.

1. The provision of playground and exercise facilities along the jogging loop promote healthy lifestyle and well-being for all ages.
2. The solar renewable energy as the most abundant energy resource on earthwas used strategically in the masterplan to serve the community and ensure access to affordable, reliable and sustainable energy for all.

**Maximum Environmental Impact**

Energy demand is increasing daily in the city and the park’s sculptural media for the renewable energy technology will help end the reliance on energy generated from fossil fuels which is the main cause of climate change. The planning and design of the artwork will reinforce the parks’ ability to bring fresh air into the city and support the use of the site as part of the green corridor. It will also provide social co-benefits and advances some of UN Sustainable Development Goals.The material used are non-toxic and will not emit carbon dioxide through its operation. The excess energy and resources invested in the production and operation will be used by the people of Mannheim by connecting the system to the electricity grid. All the materials such as metal, steel cable, photovoltaic panels and light are manufactured or transported locally and assembled on site for clean construction.

As an option to fully maximize the potential of green energy, a room in the U-Halle could be allocated for a portable Bio-waste treatment plant and Green Hydrogen Plant similar to the ThyssenKrupp modules. An approach of a forward-looking city anticipating the future of green energy. The power to produce hydrogen could be taken from surrounding solar power incorporating more efficient and cost-effective electrolysers. Energy produced that is not required by the park will be fed back into the electrical grid.

In a nutshell, the creative integration of green energy to the park’s masterplan will deliver a range of benefits through a holistic approach of sustainability. A bold vision that will give an international visibility, leave a lasting environmental and cultural legacy that will serve as the key to a progressive and brighter future of the city of Mannheim.