**Wind Blossom**

**Landscape as a New Typology of Energy Infrastructure**

St. Kilda Triangle is the vertex of diverse urban and natural contexts integrating rich history, nature and culture into a lively and beautiful urban setting. The region contains immeasurable potential in its abundant source of renewable energy while the urban contexts encompass plentiful green space and public areas for inclusive and creative activities that would interweave various urban networks with the people. Utilizing these abundant resources and integrating them into the urban context of St. Kilda, ‘Wind Blossom’ starts with redefining the way renewable energies inspire people.

So far, studies and research on renewable energies have focused on efficiency and productivity. Through this process, renewable energy has become something distant from our everyday lives. In this respect, the next step for renewable energy production is rediscovering the connection between renewable energy and humans, inducing them to engage and participate in generating the energy in a livelier and more interactive manner.

The ‘Wind Blossom,’ hence, proposes the integration of the wind energy and the energy generated from the human movements which involves more active participation from the people.

The first step for the design was to carve a man-made landscape that would interlace diverse urban fabrics and outdoor programs. This landscape expands and connects green areas around the site and attracts human traffic into the site creating energy through energy generating tiles.

The next step was to create a series of wind tunnels into the major pedestrian entrance points of the landscape, which were optimized in shape and direction according to the wind conditions of the site. The wind tunnels would contain small flower-shaped wind propellers which would provide a unique and inspiring pedestrian space. This ‘Energy Generating Tunnels’ are more than just an energy infrastructure as they interact and inspire humans through visual and perceptual experience.

Consequently, the landscape becomes a new typology of energy infrastructure through artistic, technological, and active design. Here, humans themselves become participants of creating and interacting with the energy, and are interwoven into the nature, the art, and the city.

**Energy Production**

Basically, there are two major axis wind flows through the site; strong northerly winds at about 13 m/s approaching along The Esplanade and Jacka Boulevard, and the other approaching over rising ground from St. Kilda Beach at about 16 m/s.

Therefore, the directions of tunnels are aligned to the direction that maximizes the efficiency of the propellers inside. Each entrance points are open to the axis where wind is strong and gets narrower at the end of the tunnel to increase the wind speed. With this design, propellers create turbulence themselves which would help them to rotate without sufficient wind.

Thousands of flower-wheel propellers (diameter of 28cm) cover the ceilings. One propeller generates energy ranges from 15.5 Watts to 33.3 Watts dependent on the wind speed and direction.

With the given wind speed at the site,

Annual wind velocity

North: 13 m/s

West: 16 m/s

South West: 10 m/s

(Calm: 18.73% 1641 hours/year)

(Operation: 81.27% 7119 hours/year)

Mean value of the wind speed from the North: 9.19 m/s

Mean value of the wind speed from the West: 11.31 m/s

Mean value of the wind speed from the South-West: 7.07 m/s

(Mean value vmax / √2)

Area of one propeller: approximately 0.07 sqm

Wind generator efficiency: 30% (We calculated 25% as efficiency due to varying factors)

E = 1/2 x I x w2 = 1/2(Iaxis + Irotating propeller) x w2

At the primary and secondary boundaries, there are 15 tunnels and 8 tunnels respectively.

Tunnels facing the North: 5

Tunnels facing the West: 16

Tunnels facing the South-West: 3

North: 33.277 x 25% x Nn = 25.8 kW

West: 62.029 x 25% x Nw = 219.5 kW

South West: 15.5 x 25% x Nsw = 11 kW

Total generating value = 1182 Mwh

1182 x 81.72% (rate of propeller operation) = 960 Mwh approximately.

Along with the wind tunnels, energy generating tiles cover the new landscape which have been developed by ‘Pavegen’.

Approximately 18,325 and 14,831 tiles can be installed at the primary and secondary sites respectively. They can create light or store energy with batteries. Each tile utilizes kinetic energy from the footsteps of people. Each step generates 7 watts.

7 watts x (18,325 + 14,831) = 232 kW approximately

(Energy Engineering consulted by Mechanical Engineer Mr. Im)

**Environment Impact Statement**

‘Wind Blossom’ affects essentially two parts of the environment; physical and psychological.

The new undulated landscape expands and connects different green public space as it defines different programs such as gardening, urban farming and green terraces. These various public outdoor programs provide inclusive, breathing and social space for people. In the urban perspective, the large three-dimensional park supports stronger social connection and interaction between people. Also, wind and kinetic energy is integrated into artistic and lively space which would educate, inspire and interact with humans.

Furthermore, the new landscape recovers the separation of natural contexts and supports habitats to flora and fauna. Consequently, rather than constructing large infrastructure which may disrupt the natural conditions, the new landscape minimizes the artificial and mechanical approaches open to the natural environment.