**Melbourne’s Heart**

Making the sun and the wind visible

The Challenge

One major difference between renewable energy and non-renewable energy is whether or not one is a cycle. Though termed “renewable”, most popular renewable energies in the market nowadays incline to don a “non-renewable” appearance – solar panels harvesting the down-beating sun, or wind blades harvesting the passing winds, etc. Occasionally, it can be hard to resist associating them with coal mining or oil digging.

Would it not be more interesting if we can give form to the cycle that is what we really harvest?

Design Concept

On a human scale, the heart acts like a powerhouse, pumping in and out energy to every cell of our body. On a natural scale, there are water cycle, nitrogen cycle, etc. However, the scale is too large that usually, we could hardly discern the changes and movements taking part in our daily lives. As a result, nature seems to stay constant and in turn, we incline to take harvesting, or not harvesting it for granted.

Similar occurrence applies to human energy production, in which energy seems to come out from nowhere, yet the supply seems so abundant that it feels infinite. On the other end of the spectrum, the sun’s energy is so widespread and readily available, but we have not a sense of its scale intuitively. In order to bridge this gap of scale, this design aims to create an art form that reflects natural cycle of energy, and reduce it to a scale that is comprehensible to the human eye.

The Design

The design of Melbourne’s Heart revolves around tapping into the kinetic energy of air as a result of its movement due to its density gap. For instance, air with higher temperature has lower density, thus rises or in fluid term “floats”.

The primary energy generating mechanism of this design relies on turbine-driving airflow as a result of solar heat. Air is trapped inside a big balloon and is heated directly by sunray and indirectly through thermal radiation of heat collectors. When target temperature is reached, the heated air is passed through a vent that directs the airflow through a turbine and thus generates electricity. During this process, when heat builds up the balloon expands; and when heated air is being drawn out, the balloon shrinks. The process repeats throughout the day, giving it the appearance of a heart. In harmony with the undulating ocean waves, this cyclical movement gives the renewable cycle a form that the human eyes are able to recognize, enhancing our recognition of the potential of natural energies.

The secondary energy generating mechanism relies on moving winds. Situated by a coast, the area experiences daily cyclical sea breeze and land breeze. The balloon, now acting as a sail, is designed to be airfoil to generate lift, which creates tension in the piezoelectric-inducing ceramic, thus generating electricity.

Electricity Generation

Calculating the solar updraft energy generation using a tower radius of 5.0m and a height of 100m, this translates to a power output of about 120kW, producing annually about 350MWh of electricity.

Material

This design is comprised of three main components: reinforced concrete foundation, steel tubes, and polymer-reinforced transparent membrane.

Environment Impact Summary

In tandem with the objective to maximize renewable energy generation while minimizing embodied energy in the process, it is no less important of this project to maintain or even improve the visual environment around the St. Kilda shorelines. Bringing the two objectives together, how the design reflects its role and position along with the master plan adopted by the Council needs to be considered.

In response to that, the primary energy generating mechanism of Melbourne’s Heart utilizes low temperature solar heat, which relies on convection and chimney effect which are natural occurrences. This translates to less impact on the ecosystem and water cycle in the region. Keeping in mind that St. Kilda is a popular tourist area, the use of low temperature heat also has the potential to reduce accidental risk, thus making it more approachable to a mass public.

Sandwiched between the beach and the suburb, the use of translucent material as its main body maintains good visibility of the landscape. As a wind catcher, the balloon acts like a slow-moving sail which, in addition to not imposing visual noises, poses no threat to the local sea birds.

Finally, the balloon sits atop an elevated structure, below which is the lawn area proposed as per the endorsed master plan. This allows for effective use of space without sacrificing green areas. Also, the columns that support the elevated lattice structure take the shape that drew inspiration from nearby vegetation. This has the effect of further blending the design into a coherent part of the master plan.