**SYNTHESIS SPIRE**

Engaging Melbourne’s community with renewable energies, through a landmark that entices people, night and day.

St Kilda Triangle’s presence is a place where people go to unwind from the hustle and bustle of the city. The site’s relationship to the community of St Kilda fosters bars and restaurants along the calm water front, with open landscaped areas that terrace up against the main roads to block noise pollution. This creates gathering points for people to come together and socialise. Therefore, the context analysis revolved around gathering spaces for people, became the leverage for the scheme to help emphasise the importance of solar, algae and kinetic energy.

The notorious nightlife of the surrounding area highlights the need to emphasise that trend within the design. The site is situated beside Luna Park and The Palais Theatre which are spaces that partake in regular nighttime activities. The Synthesis Spire is a significantly prominent landmark, which becomes a point of reference within Melbourne’s urban fabric. It responds to the urbanisation of the city and the changing initiative of Melbourne’s community, to focus more on the goal to become a 100% renewable energy city.

The design of this interactive art installation is overlaid on Melbourne’s emerging master plan for urban regeneration. With the purpose to inspire, integrate, assemble and invite the public. The Synthesis Spire assists in creating a sense of identity and meaning for Melbourne’s sustainable movement. This coincides with the overall purpose of the design to reflect the shape of the triangle which reinforces the ‘St Kilda Triangle’ name and transforms it into a translucent spiral that is 68m in height.

The intent of the design is to work with the proposed planning scheme’s allocated pathways for easy access into the site. An operable photovoltaic roof provides cover for seating that has been set down into the ground plane to form two public spaces. The two open spaces on either side of the ground plane address the main entry points into the site. The two different areas capture the divide between the Esplanade and Jacka Blvd, the structure in the middle brings those two main pathways together.

In order to create a connection with the people using the spire, it was important to place eye capturing pavilions that lead down from the nightlife area of Fitzroy St. The pavilions will appear as illuminated bright green vertical tubing that are placed on either side of the pathway. This defines the path to guide crowds along the Esplanade and which takes them on a journey that creates connections with the local market stalls for the public, all while leading into the synthesis spire.

**TECHNOLOGY DESIGN**

Multiple energy system types have been integrated into the scheme. The intent of the design was not to create an ‘energy farm’ that focused on producing as much energy as possible, but to create an interactive form of public art that encourages the public to become intrigued to learn more about renewable energy.

The triangular shaped panels on the spire and the pavilions, contain LED lamps which connect St Kilda’s existing nightlife. Perovskite solar units wrap around the sculpture as a secondary skin to allow the abnormal form to remain whilst generating energy. Estimates indicate that the solar units in this scheme could potentially produce around 513mWh/y. This is equaled to powering around 74 homes at any one time, or alternatively feed energy back into the larger public dwellings around the site such as Luna Park, Palais Theatre, Sea Baths, bars & restaurants. The solar units are positioned in a circular form around the main steel structure, which provides a roof for the people using the amphitheatre below.

Pavegen tiles generate electricity through kinetic energy, this will be used in the amphitheatre underneath the spire and the surrounding pavilions. The triangular tiles can produce enough electricity to immediately illuminate the outline of the spire above. This forms a connection between how people can generate electricity with their movement while being able to see power being created and integrated. This enhances the public’s connection with the amphitheatre to subconsciously learn about how kinetic energy can be used. The intention is to showcase this system rather than generating great amounts of energy.

Algae Biomass tubes are used to frame the entry points of the site that lead to into the centre of the amphitheatre. The pavilions along the Esplanade have been incorporated with Algae tubes to help guide pedestrians who are travelling from Fitzroy street. The micro algae can be used to consume the C02 emissions from the heavy motorised traffic along the streets of St Kilda. This is a major issue that Melbourne currently faces because nearly 25% of total C02 emissions are created from vehicle exhaust fumes. Another benefit that Algae Biomass brings to the design is the waste, this organism can be used to create renewable fuels for existing motorised vehicles. Also, by adapting to the current pop-up food market culture along the Esplanade, algae can be used as a nutritious food item which can be transformed into algae chips or spirulina etc. The C02 absorbing pipes that have been incorporated into the design have been created by a company in France called Fremantalg. The statistics of this product are: 1.17m3 of algae = 1 ton of C02 that can been captured per year. The total volume of algae that the proposed design holds is roughly 49.63m3 which is equivalent to capturing 42.5 tonnes of C02 over the course of an entire year. Exhaust systems from the under ground carpark underneath the site is mechanically ventilated which directs the air flow through the columns at the front of the entry points of the site. Therefore, the higher concentrated amount of C02 air will get filtered through the algae pipes before exiting into the atmosphere as oxygen.

**ENVIRONMENTAL IMPACT STATEMENT**

Steel wires are connected down to the roof of the spire from the 68m tall spire. Steel has been chosen due to the strength capabilities of holding the thin PV roof structure. It was an important factor to make the spire visually permeable, as the local residents along the Esplanade didn’t want their ocean views blocked by the proposed design. Therefore, steel was the preferred material choice as it can be extremely thin and strong.

The proposed master plan contains commercial developments behind the Palais theatre which can relate to the materiality of the synthesis spire. By unifying the whole area, the material used will link multiple developments. The electricity generated from the spire will help power the proposed dwellings around the site which is emphasised through the chosen materials.

The construction process for the spire will tie in with the new developments on the master plan, this means only 1 phase of construction is potentially achievable due to the design layout. This includes the proposed underground carpark location which will sit directly underneath the spire. However, fire staircase access points must be integrated due to access and egress requirements.

The impact that fire could potentially have against the design is quite confined. The carpark will act as a bowl that will capture the fire, this prevents the spread to the shore area and the roads surrounding the site. Fire suppressant systems will also be integrated into the underground area as well, this is needed as the ceiling is supporting the auditorium which will be a suspended slab.

The entry and exit distances for all vehicles entering into the carpark is 38325km per year. This is equivalent to 7 tonnes of C02 that is being created on site. The Algae biomass tubes are designed to capture 42.5 tonnes of C02 on a yearly basis. There are 350 proposed car parks according to the master plan. As per the calculations, the site has excess capacity to capture more C02. In fact, the site can handle 2100 cars to enter into the carpark on a daily basis and would still make the site carbon neutral. As Melbourne’s carbon free proposal by 2050, this showcases the type of design that is needed to achieve this goal.