Algae-venture

Is algae energy the future for Australia?

This question came to mind at the start of this project. People often seek new methods of producing sustainable energy to resolve the issue of global warming. Where carbon dioxide contributes towards global warming, the project investigates opportunities of algae being a solution towards sustainable energy with architectural tectonics as the driver of this innovative idea.

The bio-reactive facade generates renewable energy from algal biomass and solar thermal heat than the waterfall with recycling the water to the facade. It can replace a traditional way of glazing system also can provide a good thermal and structural performance, also offer a good sun shading during the daytime.

Energy harvested through algae can be seen at various aspects of the project. The biomass facade creeps around the site from the horizontal to the vertical planes, allowing large surface areas for energy harvesting. A naturalistic environment is created within the St. Kilda Triangle, where the waterfall allows for the sounds of flowing water to be heard around the site. Ponds and skylights allow for natural light to flood the spaces and keep the place cool. Attracting the residents and visitors of the city who long for nature that is hard to find in the urban city. The vertical facades not only acts as an energy generator, the traditional glazing systems are reimagined through the biomass facade. It provides good thermal performance that allows for sun shading during the hot summer days and recycles the water on site. The bio-reactive facade generates renewable energy through algae biomass and solar thermal heat.

Algae-venture aims to create an environmental impact that offers environmental connection through various aspects of the project.

On ground, the plaza that allows the accommodation of over five thousand people is covered with lush greenery and various spaces. The algae pond and communal space gives back gathering spaces to St. Kilda while the waterfall on the facade that flows into the lake is the key production area of energy by biomass. A system on site circulates the water from the pond to the facade which absorbs the carbon dioxide from the surrounding atmosphere while recycling rainwater that falls on site. The system allows the release of oxygen to the site, providing better air quality for St. Kilda.

The second level though separated from ground provides a variety of spaces that connects to the ground. Several glass panels are installed on the floor plates that are integrated with an algae bioreactor are installed on the floor plate. The photosynthesis process removes carbon dioxide from the atmosphere which helps improve the surrounding climate. This helps create a low-carbon infrastructure in St. Kilda, generating sustainable energy and improving the environment of St. Kilda.

Biomass production from algae was chosen as the key driver for sustainable energy production due to its flexibility for power and heat generation. It can be stored with almost no energy loss and the production of biomass is more than three folds compared to normal crops. It is also easily harvested through service tubes buried beneath the ground.

Annual energetic estimation

Surface area of the algae panels :

Vertical facade panels: 9 pieces of algae glass panels = 838 square meter

Horizontal algae panels and algae pond = 2679 square meter

Total : 3517 square meter

According to the existing precedent in Munich (Germany) Algae facade can generate:

Heat: 220 kWh/m2a

Biomass: 50 kWh/m2a

Biogas: 40 kWh/m2a

Algae-venture Total (per year):

Heat = 220x 3517= 773740 kWh/m2a

Biomass: 50x3517 = 175850 kWh/m2a

Biogas: 40x3517= 140680 kWh/m2a

Microalgae can produce 0.02-0.20g/L/day of biomass and 11.2-40.0 mg/L/day of lipids, which is used in the production of biodiesel, in turn providing 550 to 800 kWh per day. The entire site can produce up to 6000 Kwh each day. 40% of which can be converted from Biogas to electricity.

The project is driven on the idea of photosynthesis of algae which helps bring a naturalistic scenery to the site through ponds and green facades. Different levels are introduced to provide different experiences for the pedestrians, where they can tunnel under the overhangs and walk up the ramps; spreading people around the site to avoid overcrowding of spaces. Retail shops line the ground floor, providing amenities to the visitors of the site. While the hotel and museum attracts people from around to St. Kilda. Glass panels on the first floor allows for light to flood into the space below while also acting as a sunshade that helps control the temperature below.

Algae-venture reimagines the idea of how an open space would provide a solution towards sustainable energy without the intrusion of public spaces and amenities. The system also improves the immediate surrounding by absorbing the surrounding carbon dioxide and producing oxygen to the surrounding. Through these ideas, the St. Kilda Triangle acts as a green node for the beach, providing sustainable energy that also improves the surrounding environment as well as open spaces for the residents and visitors.