SOLAR TAPESTRY

The Solar Tapestry project is conceived from an initial question about use and being useful. In response to the recent acquisition of the site and the prospective plans for the future, it seems important to design a work of art that doesn't expire after a year of use and isn't limited to one site. The proposal for the Solar Tapestry revolves around the idea of creating a work of art that operates as a piece of infrastructure that is useful in generating power and providing shade for events and expositions, while also creating a system with adaptability, flexibility, mobility and scalability - able to meet varying demands on site and off.

The name of the proposal outlines two important principles in the project, first solar power and second the concept of a tapestry. The visual aesthetics of vast expanses of solar panels, or concentrated solar farms have always been appealing, however remain impenetrable to recreate due to their complex and very fixed arrangements. Their technologies are stable and work and the number of precedents that exist is high enough to trust that they continue to be an effective way of generating power.

The tapestry concept serves as a structure for describing the interrelation between construction elements and material elements. The construction elements describing both the physical, structural demands, while also describing the hosting elements that enable the materials, components and expression to take place. The material/expressive elements describe the solar shields themselves, their bays, rows, apertures, frequency and use.

Technology

The Solar Tapestry combines the principles of a parabolic concentrated solar shield with a venetian blind; making a retractable shading system, composed of parabolic solar blinds with a mirror along the concave surface of the parabola and thin film photovoltaic cells along the convex surface behind. When the tapestry is drawn open, sun light reflects from the concave mirror surface into the convex photovoltaic surface. Similar to a venetian blind, the angle and degree of openness between the blinds can be controlled either at the start of the system or locally.

Construction

For ease of installation and improved mobility, the parabolic solar blinds are designed to be as lightweight as possible, employing both thin super mirror film for the mirror surface and thin film photovoltaic cells for the solar/heat absorber. The sandwich core of the blind is made out of recycled bottle plastic - allowing for it to be lightweight and thin while also providing rigidity for the curved surface and durability for the harsh weather patterns.

Construction System

In order to maintain the scalability of the proposal, both for maintenance and replacement considerations, as well as installation and use; the tapestry is broken down into two perpendicular systems. The ROW, the steel cable that is drawn from the truss to the desired length of the canopy; and the BAY, the horizontal module that hosts 6x solar blinds, local control cables, intermediary support bars, local power systems, sensors and a power distribution line. The ROW provides adaptability, flexibility, mobility and scalability; customizable to demand - and can be rolled out from the truss to sit in the landscape. Inherent in the proposal is also the idea to reduce the footprint of the project as much as possible to avoid making unnecessary incisions in the landscape. The BAY provides further adaptability, flexibility and scalability; allowing for modules to be suspended either vertically or horizontally from the ROW cables and retracted or expanded as needed. When expanded the BAY module measures 3x3 metres; comprised of 6x solar blinds. The square module allows for optimal lateral support when placed parallel to other rows and intermediary support bars, while also allowing for easy solar blind replacement, should any problems arise. In addition to these attributes, the BAY module also functions as a power unit, and when connected to parallel support bars; it contributes to a wider power network. It is envisaged that each BAY module would also host sensors allowing remote maintenance teams to monitor performance.

Structural System

The main structural elements that make up the Solar Tapestry are sized from off-the-shelf standardized glasshouse /greenhouse building components. The main structural elements used comprise of a double truss, standard RHS columns at 9m centres and secondary mobile RHS columns at 3m centres; mobile due to the wheel which assists in pulling them out away from the truss for hosting the solar blind system. The trusses rest on either side of the RHS columns and host the solar blind boxes and control mechanism, the steel cable box and winch mechanism, power storage boxes, a lateral/cross-truss power distribution conduit and a linear cylindrical tube lighting unit above. The primary RHS columns and diagonal braces have fixing options at their bases for either sitting being anchored into local concrete piles or for being anchored onto a wheeled base for mobility and being transported to another site. The secondary wheeled column that connects perpendicularly to the truss is made of a smaller RHS with welded bracing for additional support.

Use

The purpose fo the proposal is twofold, one to make a piece of infrastructure capable of supporting other events on the site and two, to host events or activities at the site(s) of the tapestry. At the infrastructural scale, it could be installed adjacent to another proposal to help generate power, support festival events and provide shading from the elements. At the local scale it could be used to host events such as performances or could be hired for experimentation, exhibitions, rehearsals, etc.

Installation

The proposal has been designed to be as scalable as possible without over engineering. The installation process has been designed to be carried out by two maintenance contractors, made possible to the lightweight nature of the material. The installation order is as follows:

1. Erect primary RHS columns
2. Set truss on primary columns
3. Mount ROW cable system, control box and power storage units to truss
4. Connect wheeled secondary column to ROW cable system
5. Hang BAY solar blind modules
6. Connect BAY solar blind control cables to main

Prototype

Due to the scalability of the project, the prototype could begin with 1-2 truss lengths (9m each), which would create 6 rows to begin experimenting with. Although the primary building components are standard, the solar blind sandwich construction itself will meed review, testing, experimenting with on site.

Materials

* 9m truss: 600mm depth formed by two 60x30x3mm RHS with 20mm diameter bracing
* 4m height primary columns made with 140x60x3mm RHS
* 3.5m height secondary columns made with 120x60x3 RHS
* Steel cable, winch mechanism + structural steel wiring for solar blind control
* IP rated rubber wiring
* Solar blinds: 10mm cast recycled bottle plastic substrate, super mirror film, thin film photovoltaic cells

Environmental Impact Statement

The proposal’s structure is made primarily of standard building elements, which helps minimize waste and improves efficiency on site. The solar blind construction is made upon recycled plastic and ultra thin mirror and photovoltaic technologies. The thinness of the films dramatically reduce material costs/wastage, while also being lightweight. Due to the flexible nature of the project and mobile structural elements; the proposal will have a minimum impact on the land.

The innovative approach to solar energy in the project helps to reduce the static footprint often present in other solar projects. The mirror surface helps to bring increased light/heat to the photovoltaic panels, improving efficiency, while making the most of the harsh sun.