SUSTAINABILITY AND ENVIRONMENTAL DESIGN

CONCEPT

The concept for the module is inspired from ‘a village tree’. This community tree offers the people sheltering as it needs to do, how much energy it needs to capture, how much water it needs to filtrate, and so on. The skin or the bubble on the top expands or contracts as a function of what it needs to, how much energy it needs to capture, how much water it needs to filtrate, how much shade it needs to provide to the people below, etc.

The module is made of key components: a base support structure and a changing outer skin made of recycle polycarbonate. A PV or solar thermal power collection system is integrated into the module, so that the module can be self-supporting.

SOLAR ENERGY HARVESTED

The module is oriented towards South and perpendicular to the sun's position, placing it inclined to the ground plane. The solar position shifts 23.5° away from the equator. This position ensures maximum annual solar gains to the outer shell. 90% of the incident solar radiation passes through the shell (made of recycle poly carbonate) to reach the inclined photovoltaic surfaces, almost perpendicular to the direction of solar rays. This ensures maximum energy production from the solar panels, perpendicularly oriented. Inclined temperatures within the shell could result in maximum efficiency throughout the year.

WATER CIRCUIT

To avoid overheating of the PV, an underlying fabric is introduced that remains wet as it draws water from a small water puddle within the shell. An evaporative cooling system is used, which extracts water from a small water puddle within the module. The heated internal air in the module results in condensation from underneath the solar panels, and this condensed water drips collecting on the module's top skin. These condensates find their way to collection gutters and become source of pure drinking water. It is a similar process followed by small boats at sea to create fresh potable water from sea water. The condensate drips from the shell as condensate tubes to draw underground or surface water as it maintains the puddle in the module, sometimes with our without assistance from a pump. The extracted water is considered potable as it has been heated and pasteurized (when it exceeds 60°C). The distilled water is used for drinking and could also be diverted to summer evaporative cooling installations (the micro-evaporative cooling unit). The following table indicates typical daily water consumption.

REFERENCES SIMILAR SYSTEMS

ENERGY PRODUCTION

The daily average solar radiation is 586 W/m². A single 1.25kW PV panel is used. Photovoltaic energy production: 0.877 kWh/m² / day

ENERGY DEMAND

A cluster offers significant weather protection and creates microclimate.