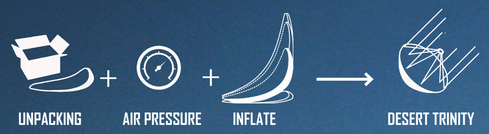
DESERT TRINITY

Renewable Oasis

Concentrated Solar Power (CSP) produces electricity using the heat of the sun, and is known to be a source of deployable power as it includes a Thermal Energy Storage System (TES). This system allows delivery of power regardless of the position of the sun and carries a zero-fuel cost risk, making it an alluring alternative energy option. Apart from the cost of materials, investment in thermal energy storage and solar field size requirements contribute to the high capital costs involving solar energy plants. .The concentrated solar elements harvest sunlight to make thermal energy from a strategically designed curved mirror surface onto a centrally focussed collector. The elements are tilted at an angle of 24° taking into consideration the optimum tilt angle in the summer and winter.



Materiality and Portability Concept

MIRROR FILM

A highly reflective, durable and flexible silver layered polymer mirror film reflects the light onto the thermal receiver.

ETFE MEMBRANE

A durable and lightweight ETFE membrane permits light to enter and reflect from the mirror film.

THERMAL RECEIVER

The Thermal receiver is the focal point of the paraboloid where the Heat Transfer Fluid (HTF) is passed.

FLUIDISED SAND (HTF)

Sand which is abundantly available and inexpensive in Masdar is used as the heat transfer fluid.

STEEL STRUCTURE

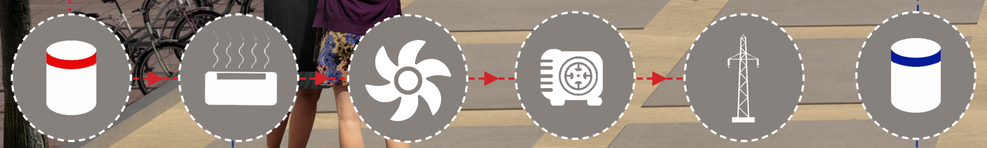
The steel structure is the structural framework that holds the paraboloid and the various membranes.

SUMMER SUN
June 21, 3 PM

WINTER SUN
September 21, 3 PM

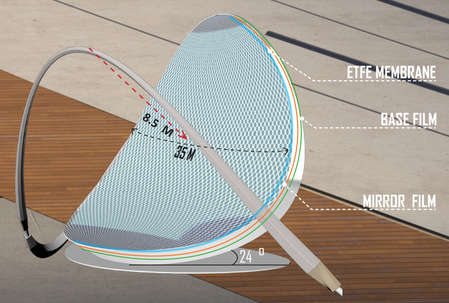
SUMMER SUN
June 21, 9 AM

WINTER SUN
September 21, 9 AM

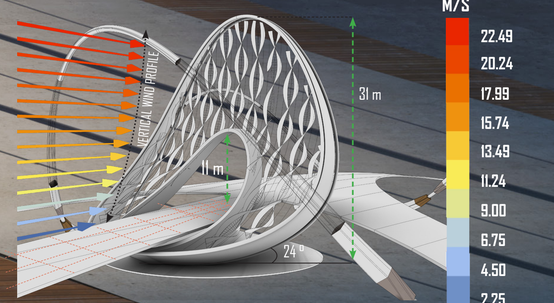


The mirror film has a reflectivity of 94% which ensures high optical efficiency. The elements are structurally strong due to the steel framework and pressurised air, but is lightweight permitting ease of installation and portability. The thermal receiver is situated on a parabolic steel outer ring containing the heat transfer fluid flowing in an absorber tube surrounded by vacuum within a glass tubular structure. Considering the availability of sand in the region we propose a fluidised sand as the Heat Transfer Fluid (HTF) which is pumped through the parabolic absorber tube from the cold storage tank to the thermal receiver which is placed at the focal point of the paraboloid at a distance of 8.5m from the vertex.

The HTF gets heated by reflecting sunlight from the mirror film onto the thermal receiver and once the sand attains a temperature of 550°C, it flows down to the hot storage tank through displacement and heat is transferred to the steam generator or stored for later use. The backend power block works similar to a thermal energy plant where steam runs the turbine generators which produces electricity. The HTF runs through a closed loop though the outer ring where it flows back to the elements and gets reheated. The thermal energy storage system ensures that heat is transferred to the steam generator after dusk, by storing energy for a period of 4-6 hours.



Membrane Based Concentrated Solar Paraboloid



Parabolic Configuration of Helical Wind Turbine