**Written Description**

**Construction**

SunGlass is grown from the desert, forged by concentrating the sun’s power to the melting point of sand. SunGlass’ forms are 3d printed using 10 foot (3 m) diameter Fresnel lenses mounted to a motorized gantry. Sand from the adjacent Arabian desert is fused at ~3,000 degrees Fahrenheit (1,650 degrees Celsius) to create 24 inch (60 cm) thick structural walls composed of concentric rings.

Each of SunGlass’ generators are powered by the same 10 foot Fresnel lenses that built them. Mounted via sun-tracking gimbal rings to the top of the generator cones, approximately 7kW of the sun’s heat, per generator, is concentrated on a tempered glass cylinder of seawater, causing the seawater to rapidly boil into steam energy.

**City Portal**

Large, polished cuts in the skin of desert glass create contrasting archways for visitors to enter the cool inner portions of SunGlass. Views of the city are framed by the tall conical forms of SunGlass from a distance, and by the large archways when approaching SunGlass either by (pod) car, public transportation or foot.

**The Source**

SunGlass is a celebration of the source of all energy and life on earth – the Sun. Built and powered by the Sun, SunGlass generates power by boiling seawater from the nearby Persian gulf with concentrated solar power (CSP). Steam, throttled through turbine generators, is recaptured as fresh water as it condenses along the insides of the generator cones (cooled by the seawater flowing through SunGlass’ skin enroute to the solar concentrator). This generated freshwater feeds the many cooling pools in the interior venue space of SunGlass, as it eventually trickles outwards to the provide nourishment to the surrounding planted landscape.

**Desert Transformation**

We conceptualize SunGlass as a catalyst for the desert. Born of sun and sand, it generates both electrical power and freshwater. SunGlass’ existence slowly transforms its site into a verdant garden space, offering a cooler microclimate for visitors with shade, pools and the evapotranspiration of the plants.

SunGlass is scalable along desert coastal regions. Entire coast lines of desert can become lined with green landscape as SunGlass cities are fused from the sand.

**Materiality**

SunGlass’ completed forms are reminiscent of desert dunes. The materiality of the fused desert glass is at once rough and striated like sandstone canyons, yet has a subtle translucency and gloss as if it were a glacier made of sand.

This materiality speaks to the dynamic abilities SunGlass has to use heat transfer to simultaneously heat large amounts of seawater to create steam power, as well as cool public areas with shade and breezes across water oases.

**Venue**

The large city portals open the interior of SunGlass to the public. 3d Printed desert glass cones, larger than the generators and open-topped create a continuous indoor/outdoor volume as venue area. The venue cones act like indigenous architectural wind towers by creating breezes through the chimney effect. These breezes bring air across cooling, reflection pools and eject hot air up and away from the public. Clear, insulated glass walls offer views from the venue into the generator cones to expose the story of the power and water generation happening all around SunGlass’ visitors.

**Technology used in your design**

Industrial Steam Turbines

Fresnel Lenses

Motorized 6 axes gantry for construction

“3D printing” with sand and sunlight

Heat transfer for desalination

**Nameplate capacity in kWp (peak output measured in kilowatts of power):**

20,000 kW

**Annual kWh (kilowatt-hours) of energy expected to be generated by your design under average site conditions:**

73,000,000 kWh

**Dimensions, list of the primary materials used in your design, and an order-of-magnitude**

**conceptual cost estimate**

Each generator unit is approximately 20 feet in diameter and 25 feet tall at highest point. The Venue area is significantly larger for placemaking/ city skyline landmark purposes.

Materials used are: Fused desert sand, large Fresnel lenses. High-heat tempered vision glass. Rough magnitude of costs are estimated at $450,000 usd per generator with an estimated overall price tag of $15,000,000 usd, not including the venue or plant material costs. This figure is assuming an economy of scale factor by re-using the same motorized gantry to build each generator unit.

**SunGlass Environmental Impact Study**

SunGlass embraces the sun as a tremendous provider of sustainable electricity without global warming emissions. Unlike photovoltaics, SunGlass’ solar concentrator does not contain hazardous materials such as heavy metals.

**Land Use**

SunGlass is unique as a mid-scale (but scalable) utility solar facility in that rather than create loss of habitat, biodiversity or land degredation, SunGlass provides a new source of freshwater as byproduct to its power generation. This freshwater is designed to irrigate the immediate site to create bio-diverse habitat to native species. The immediate site is cooled by the new vegetation, helping to lower ambient temperatures. Also, by creating large, immobile dune-like forms Sunglass could be an effective means of stopping desertification. Being sited in an urban area, SunGlass’ newly vegetated site will help aborb urban generated greenhouse gases. SunGlass could be also be sited in a brownfield in which the vegetation be selected for its bioremediative properties.

As a scalable system, SunGlass’ potentially positive effects on the land are perhaps more important than the energy it creates.

Unlike PV systems and large CSPs with arrayed, ground-level reflectors SunGlass’ elevated towers place their Fresnel lenses in less likely areas for soiling to happen (due to proximity to ground born particulates and higher winds speeds at elevation).

**Water Use**

Unlike typical Concentrating Solar Thermal Plants, which require external sources of water for cooling loads, SunGlass uses the water it generates onsite, providing more water to the area than it uses.

Concentrating solar thermal plants (CSP), like all thermal electric plants, require water for cooling. Water use depends on the plant design, plant location, and the type of cooling system. A dry-cooling CSP would not be feasible with the ambient temperatures of the Arabian Peninsula.

**Hazardous Materials**

Again, unlike the hazardous PV cell manufacturing process, SunGlass is created with sunlight and the local sand, a base/neutral material with zero off-gasing and high resilience to environmental and chemical processes. The steam turbine generators will need to be created off-site and will represent the only portion of the project with embodied energy not directly generated onsite through the sun’s direct power.

**Life-Cycle / Global Warming Emissions**

Similar to other means of generating electricity from the sun, there are no global warming emissions created during SunGlass’ power production period. What identifies SunGlass as a virtuous energy source beyond the other solar energy collectors is the onsite fabrication using direct solar power and local materials. This means embodied energy, carbon footprint and greenhouse gas emissions associated with manufacturing, material transportation, and installation are almost completely negligible.

**References:**

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Further References:

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