**Nucleus**

A breathtaking sunset and deep orange skies above an ocean that is in a constant state of renewal borders a city that walks the line between the modern and the sustainable. From the curved frames of Tongva park, the Urchin appears in the distance, a translucent sphere in the ocean- like the setting sun in the horizon. As the sun sets, its rays filter through the structure and melt into the ocean. A deep orange sunset captures the eyes of spectators in brilliant hues.

The structure itself stands tall, but feels familiar. From afar, it seems to take the hexagonal structure of an urchin, a common animal in the waters around Santa Monica, transforming the organic commonplace animal into a modern reflection of nature. Upon closer inspection, the mouth of a whale opens up to shade visitors whilst also converting solar heat into hot water for use on the pier. Water rushes past through tubes that outline the Baleen waves of the walkway, pulling in a tide of visitors.

Upon entering the Nucleus, the air seems fresher; almost as if the bumps on the surface of the Nucleus act as a filter. The Sun begins to settle into the West and its rays illuminate the Nucleus. Visitors walk around a center which consists of a sphere and an opening above. A light sun-shower begins to fall and spectators stand in awe as the sunset frames the falling rain as it splashes onto the sphere below. As night falls, the middle sphere begins to glow a light blue, resembling a small earth covered in water.

Like its animal counterpart, the urchin, the importance of water is front and center within the structure. Rain falls through an opening at the top of the dome and is stored under the nucleus which filters and acts as a small reservoir for water. The opening at the top connects the sky and the sea; rain is a celebration as the walkway around the peripheral of the Urchin offers a 360 perspective.

The rounded surface of the Nucleus reflects not only a deeper connection with the earth, but relativity to the beauty of Santa Monica: the curved structures of Tongva park, the Ferris wheel, and the sun that joins it at the end of each day. The structure is large, but doesn’t overwhelm its surroundings and provides an ample view of the horizon.

Walking away from the Nucleus, the rest of the pier comes back into focus: the colors and bright lights of the Ferris wheel and the skyline of Santa Monica. The Nucleus is a reprieve from the city, celebrating a union of water, air, and the Earth’s source of energy: The Sun.

During nighttime the nucleus glows unobtrusively using minimal amounts of stored energy from its infrared panels.

The Nucleus parallels the urchin’s habitat, favoring shallow waters and a temperate climate. As a cleaner of the sea, the urchin combats eutrophication by eating algae. The structure parallels this by cleaning the air of Co2 using a lightweight photocatalytic cement from innovative company Italcementi which turns CO2 into inert salts.

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| **Technology Used**  Thin-film dye-sensitized solar panels  Infrared solar concentrator panels  Solar Thermal Evacuated Tubing  i.active biodynamic cement: recycled cement material with a Titanium Dioxide coating |
| **Annual kWh generated**  10,197,594.6 kWh per year (10197.594 mWh per year) |
| **Water Retention**  509756 m3 per year (134,663,393 gallons per year) |
| **Dimensions**  Diameter of Structure: 50m  Height above sea level: 33m  Height of Structure: 48m  Length of Walkway: 93m |
| **Materials**  Recycled Steel  Recycled ETFE paneling |

**Environmental Impact**

The bumps on the exterior of the Nucleus are made of i.active Biodynamic Cement by Italcementi, a lightweight, decorative, photocatalytic cement, which absorbs Co2 and produces inert salts via titanium dioxide. An alternative is a resin which absorbs CO2 and redistributes it.

At a 12% efficiency rate, the hexagon thin-film solar panels on the side of direct sunlight will be able to convert 5098 MWh annually, feeding back into electricity for the pier. By staying on the cusp of technology, the panels hold a layer of graphene, whose atomic shape also happens to be hexagon. The underlying structure is made of lightweight ETFE paneling which is 1% the weight of glass and can withstand strong winds and salt water.

Tinted panels throughout the rest of the urchin harnesses indirect infrared light and are constructed to be siding instead of just an added layer of material. In total, the Nucleus’s Solar Panels will be able to convert 10,200 MWh of electricity annually.

The solar heating tubes on the Baleen inspired walkway will have a 50% efficiency rate and will heat water for the pier.

The 25 meter diameter opening at the top of the structure lets in rainfall and collects it in a basin below the walkway. With 13 inches of rain per year, the Nucleus will be able to retain 134663400 gallons annually, filtering with a graphite enhanced sand. With ~119 gallons of water used per capita daily, this amount can support ~1,131,000 people.

The frame will be made from recycled, bio-coated steel and is positioned to withstand wave surges of up to 15 meters (50 feet).