The Santa Monica Catchwaters

Santa Monica is a historic town known for its piers, beaches, and its progressive approach to transportation, water technology, and, now, to modern art and energy. Tourists will gravitate to Santa Monica to witness the mesmerizing movement of the Catchwaters, a dynamic landmark that cannot be captured in pictures and will be a must-see on the west coast. These Catchwaters are a monument to renewal: a metaphorical renewal of history, a literal renewal of energy, and a revitalization of public interest in the Santa Monica beach.

The Catchwaters celebrate the rich history of the pier and beach by reinstalling functional â€œbreakwatersâ€ in the Santa Monica harbor. The original breakwaters were completed in 1934 to create a yacht harbor that would befit the pierâ€™s ambitions. The pier itself underwent a much-needed restoration in the 1970s, but the breakwaters that accompanied it have been neglected. Today, they are barely visible as they continue to sink beneath the tide. The Catchwaters project represents the belated renewal of the breakwaters, attracting public interest and boasting increased utility for the harbor[1]. Once the Catchwaters are installed, boats will once more moor safely in the Santa Monica Yacht Harbor. The influx of recreational boating will win revenue for the area by increasing traffic and fomenting an atmosphere of vitality and promise.

The Catchwaters build on the pierâ€™s long history by incorporating the latest and greatest in renewable energy technology. The two energy models utilized in the new structure, â€œWaveriders" and â€œTidecatchers,â€ continuously convert the oceanâ€™s kinetic energy into useable electric energy. Spanning the full contest boundary, 600m x 150m and up to 30m tall, the faÃ§ades are designed to be aesthetically delightful, but are also the main source of buoyancy. The materials are carefully chosen, built out of an anodized marine-grade aluminum that prevents rust and is lighter and easier to install than steel but which is more resilient and monumental than plastic.

The three central rowsâ€”the Tidecatchersâ€”are the stable backbone of energy production, capable of generating over 4.3MWhr combined from the movements of the tide. Contained within the Tidecatcher shell are hydraulic arms that spin a turbine as the buoyant exterior is pushed up by rising water and as it relaxes with low tide. The tide is dependable, and it will slowly and steadily generate energy on which the city can rely.

The two outer rows on each side of the Catchwaters are comprised of Waveriders, which can capture an estimated combined total of 1.3 MWhr each day from the more unpredictable movements of the waves. The Waveriders generate electric current via a simple setup: magnets are attached to the ocean floor with a tether, and copper coils are attached to the Waveridersâ€™ metal case. The ridersâ€™ buoyant shell pulls the coils from the magnets when waves pass by, directly creating relative motion that generates energy. The currents and tides that pull the smaller Waveriders around can be read from above, or from the shore, as indicators for water strength and direction, telling the story of where the most energy is being generated.

The viewing walkway that runs parallel to the peer is also built on Tidecatchers. These exteriors,which visitors will walk down for a better view of the Catchwaters and of the open ocean, are constructed out of local oak and recycled woods rather than aluminum so as to complement the aesthetic of the main pier. The walkway is 420m long by 20m wide, at a typical height of 10m. Waves progress down the walkway, gently lifting and dipping visitors with the movement of the water. By traveling down the walkway, visitors participate in producing energy: their weight as they travel down the walkway adds kinetic energy to the generators. The small amount visitors literally contribute to the Catchwatersâ€™ energy output represents the small steps we all can make toward making the future renewable.

As guests look closer at the walkway and consider the role their weight plays in the project, they notice that the generators closest to shore are sometimes or always beached, and therefore are not actively producing energy. Marked on these units are future dates: â€œ2050,â€ â€œ2075,â€ â€œ2100.â€ These numbers represent the year that sea level is predicted to rise enough to lift the static Tidecatchers into continuous generation[2]. This positive twist on sea level rise will catch many off guard, opening up conversations about the mostly negative effects of rising oceans and our future in a world affected by climate change.

The project will have many straightforward benefits for visitors in addition to engaging the public with surprising and provocative approaches to renewable energy. The additional 422 meters of water-access walkway will be a boon for runners, bikers, and fishermen. Whatâ€™s more, the new moorings will be a source of income for the city and will revitalize local hospitality industries.

The Catchwaters mark the next chapter for the city of Santa Monica. The innovative combination of hydroelectric power sources works with environmental changes on both small and large scales (with waves, with the tide, and even with global warming) to invite visitors to reflect on their role in Santa Monicaâ€™s future.

Flexibility Note

The Catchwaters are shown at an ideal size and span. They can be reduced in size without significant changes to the overall design to cut down on investment.Â Similarly, if a favorable new technology becomes available, caretakers and designers will have the opportunity to integrate that technology into the installation by re-outfitting the pertinent aspects within the white faÃ§ade. For example, the Waveriders could consist of Corpower[3] technology outfitted with white rectilinear faÃ§ades rather than red buoy shapes. This will help with costs and maintenance support.

Environmental Summary

The harbor area will experience increased activity during the installation of the Catchwaters as motor boats, cranes, and other construction equipment move into in the area. This may create waste and debris and disturb the natural habitat through increased noise and wakes. To mitigate this intrusion, the inherent modularity of the design dictates that the Catchwaters should be assembled off-site and brought to Santa Monica before installation. Each generator can then be placed into the water, equipped with a motor, and driven into place, making use of its intrinsic buoyancy. When the Catchwaters are ready for installation, the support piers or concrete columns can be installed. If any of the modules malfunction or are in need of attention, they can be individually removed and replaced with minimum impact to other modules, reducing the consequences for the surrounding habitat.

The Catchwaters will introduce an increased number of hard-bottom features to the coastline, and will also require buried power cables. All of the generators are passive, requiring no input energy. Hopefully, the hard features and the moving Catchwaters themselves will be inhabited by marine life and incorporated into the environment as new dwelling places. The buried and heavily insulated electric cables should pose no threat to marine life.

To mitigate the risks of environmental impacts, all construction crews should be trained in Clean Boating Practices[4] using the Bay Foundationâ€™s guidelines. All waste should be captured and removed from the area as soon as possible, and best efforts should be made to use state-of-the-art practices for clean construction and assembly. Local materials should be sourced as a matter of course, and recycled materials should be used wherever possible.Â

[1] California Beach Restoration Study. http://www.dbw.ca.gov/PDF/Reports/BeachReport/Ch6\_Effectiveness.pdf. 2002

[2] â€œThe Impacts of Sea-Level Rise on the California Coast.â€™http://pacinst.org/wp-content/uploads/sites/21/2014/04/sea-level-rise.pdf. 2009.

[3] http://www.corpowerocean.com

[4] http://www.santamonicabay.org/learn/our-work/clean-boating/