*THE FLYING STEELHEAD OF SANTA MONICA*

*A school of enormous steelhead swimming through the sky,*

*powering our world by dancing with the wind.*

As you approach the Santa Monica Pier, you are immediately struck by the sight. Dozens of gleaming fish the size of school buses swimming low in the sky, just above and beyond the pier. They slowly swim, even in a soft breeze. At sunset they dance in unison, reflecting the sky and sea. At night, out on the pier, they are surreal ghostly giants swaying to the sound of the surf. The fish reflect the weather, the time of day and the time of year, in their mood and color. They follow the wind, in direction and in speed. In a breeze the movement is a hypnotic serpentine meander. As the wind picks up, the bodies of the fish start to straighten and the tails move faster. These fish have become as iconic as the Golden Gate bridge and the Eiffel tower. Attracting photographers from around the world who come to wait for the perfect light.

On cloudy days the fish look flat and steely. Often on days like this they swim faster into an oncoming storm and we are reminded that these fish are steelhead. We are reminded these incredible animals are born in mountain creeks and are identical to rainbow trout. Except that they then inexplicably head down river to the ocean to live in the biggest body of water in the world. After spending time in the Pacific, steelhead go back up the rivers and creeks to spawn. But unlike salmon, who at this point die, steelhead go back to the ocean and do it all over again.

On their journeys, steelhead sew the land to the sea, reminding us how this is one fabric, one ecosystem, that we are all a part of. The Los Angeles river had steelhead spawning pools until 1938 when it was made into the concrete channel that it is today. The southern steelhead that swim the waters around Santa Monica are endangered. There are many people presently working to increase access for steelhead in the Santa Monica mountains and elsewhere in southern California. The steelhead are a powerful symbol on many levels. They range to the Mexican border and should be abundant in these waters.

We know that most of the challenges the steelhead face are ones we created for them. We have to believe that we have the power to move beyond the paradigm that would so carelessly destroy habitat for fish, while creating habitat for humans. This requires us to question our beliefs, as Einstein said, “We cannot solve our problems with the same kind of thinking we used when we created them.”

The Flying Steelhead of Santa Monica are this new type of thinking. Using ideas from nature is more powerful than furthering high tech solutions that are rooted in previous failures.

It turns out that the heroic journey the steelhead take upstream is helped by the fact that the fish have such a refined shape that evolved from the rivers themselves. This shape is highly efficient at energy transfer. In turbulent water, it has been shown that the river ‘swims the fish.’ The fish go limp and are able to swim upstream. This is how these giant fish swim into the breeze.

Each steelhead balances on a single pole, but the poles are not centered on the fish. The tail section of the fish is twice as long as the head section. This helps the fish follow the wind and allows the wind to swim the fish, (like a flag). It also heightens the surreal look. Not everyone knows why it seems mysterious, but something doesn’t feel right. This adds to the effect that these fish are swimming. The secret to this is how the tail is counterweight balanced. Each section of the tail has a counter weight stretching towards the head, maintaining a perfect equilibrium. This allows the tail to move with the slightest of breeze.

Because the breeze at the pier is almost always blowing, these immense creatures almost never stop moving. The fish have a light frame of aluminum, with anodized aluminum skin over the head and front of the fish. Much of the fish is covered with anodized aluminum scales that act as the outside surface, as well as hold together a matrix of light elastic cords that allow flexibility so the fish can swim. The tail and fins are made of a sail cloth with flexible stays for reinforcing, similar to an actual fish fin.

These fish that remind us of our roles as stewards of our environment help us in more ways than inspiration and beauty. This is actually a power plant. Each twenty meter fish is equipped with twin 400kW generators, that at peak capacity yield 800 kW for each fish.

Most wind generators require strong winds and lots of space for the wind to regroup after getting churned up. The fish thrive on turbulence and are optimized grouped close together. On the ocean side of the fish, at the edge of the site boundary, is an occasional triangular concrete column. This insures the wind has enough turbulence. In the winter, when the wind is often off shore, the land and buildings churn the wind enough for this system. The movement of the fish allows for pistons to drive generators. The resulting electricity goes down the towers and through underground cables back to land.

There are so few moving parts, it would also be efficient to generate power through mechanical means. As the fish swim, one side gets longer and the other side gets shorter. Then it goes back the other way. A cable or chain is attached to both sides of the tail, running up the insides of the fish to a gear near the front. As the gear spins one way then the other, that power is put into two flywheels that spin opposite directions. This evens out and gears up the energy, that then powers two generators spinning two different directions. This idea is also scaleable. It could be built by individuals on a much smaller scale with bicycle parts and car generators.

**Environmental Impact:**

The negative environmental impact of this project is kept to a minimum because the site is barely altered. The towers for support could be similarly built to other wind generators that sit in the ocean. The ones designed for this project are a little different. These precast concrete towers have a pre cast foot. The foot has six large, sphere--like toes that surround a space as big as the perimeter spheres. When compressed air is shot down the center of the tower at the time of placement, the sand underneath is driven from the spot and the toes are able to go below the surface of the sand. The sphere like toes are hollow for easier movement but then fill with sand when placed.

The ocean is notorious for destroying things set near it. If any of the towers are ever knocked out of skew by a storm, compressed air can be run back down the center as well as down into the spheres, blowing all the sand out from around the base and it can be reset. In this way the array of fish can be adjusted to optimize the relationship to each other as we lean more about being like nature.

After setting the towers, the site is allowed to go back to its state before they were set. Except that, like the pier, the towers themselves create some habitat for fish.

The array of fish is adjustable in number. There is room enough for over seventy. For this situation we imagine thirty six. This has an estimated annual out put of 1752 MWh’s.

The long term ramifications of this project, done well, could have a profound impact on how we perceive and live in the world.