

The Helical Turbine and its Applications for Tidal and Wave Power

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Abstract: The objective of this presentation is to introduce an environmentally friendly Helical Turbine that has been developed to operate in free or ultra low-head water currents without dams. The turbine is a cross flow unidirectional rotation machine that makes it particularly valuable for ocean applications, such as reversible tidal streams in ocean bays, estuaries, streams in open ocean, underwater currents generated by wave fluctuations. It can also be used for hydropower in rivers without dams, canals, hydraulic tunnels, etc.

Hydropower is one of the best sources of renewable energy because of its abundance and economic and technical advantages over other known sustainable energy sources. Compared with the wind energy, the water flow has about one thousand times higher density than a comparable airflow, bringing a much greater energy per unit area. At the same time, hydropower technology has gained a poor reputation because it is always associated with massive dams in rivers. These dams block fish

migration, destroy their populations, and often damage the ecology by flooding and swamping agricultural lands.

In contrast to conventional hydraulic turbines used in river dams, the helical turbine is a reaction cross flow machine designed for extracting power from unconstrained water currents. It was invented in 1993-1995 and further developed at Northeastern University mostly under R&D contracts from the DOE, NSF and ONR. The turbine has been tested both in laboratories at Northeastern and Michigan Universities and in the tidal current of the Cape Cod Canal, Massachusetts. During these tests the triple-helix turbine demonstrated its reliability and up to 35% efficiency in the free streams, which makes it one of the best hydraulic machines for such applications. Triple-Helix turbines are presently under testing in the powerful tidal current in the Uldolmok Strait at Korean Peninsula and at some other tidal sites around the Globe.