

PROGRESS OF WAVE ENERGY TECHNOLOGY

The presentation introduced the research of GIEC in wave energy utilization since 1980. Before 2002, all the researches were focused on development of Oscillating Water Column (OWC) wave energy converter (WEC). After having developed 3kW, 20kW, and 100kW OWCs and fulfilled a series of sea-tests, the study, however, encountered a setback. The conversion system consumed electrical energy of a constant power about 400W in operation, which was even greater than the output of the WEC in calm sea. While in rough sea, the output of the WEC usually exceeded its capacity. In these two cases, the WEC must be switched off. During the rest time, the WEC was normal in operation, but the efficiency of its conversion system was disappointingly low. The main reason of the low efficiency was caused by the much more quick variation of the air flow rate than that of rotation rate of the air turbine, which makes the turbine work in improper attack angle. Researchers realized that it is difficult to change the characteristic and to improve the performance of OWC in short period waves in China Sea. The easier way is to develop a new WEC, which has small oscillating period matching the short period of waves, has a power take-off (PTO) to be a pure generating system without consuming electricity in operation, and outputting smoothly in irregular waves. According to this idea, GIEC spent 5 years to develop an onshore Oscillating Body (OB) WEC in the first step, and spent another 10 years in the design of a floating OB WEC in the second step. The research followed 3 aims: improving the performance of wave-to-wire, decreasing the cost of the system and increasing the reliability. After the 15 years of hard work, GIEC has successfully developed a novel wave energy technology and the corresponding WEC - Eagle. The wave-to-wire efficiency in a 10-day average is 24%. The WEC is unmanned - all the necessary controls for energy conversion are driven by the hydraulic pressure in an autonomic way. The output of power can be AC or DC depending on the demand of the user. Fault-free time exceeds one year. After the development of half-scale (10kW) and full-scale (100kW) equipment, GIEC is now developing a commercial WEC - 1 MW Eagle.

Biography

Mr. Yage YOU, senior professor of Guangzhou Institute of Energy Conversion (GIEC), Chinese Academy of Sciences, has engaged in research of wave energy utilization since 1988. His research is involved in hydrodynamics analysis, optimization of geometry and load, autonomous control technology, and corresponding engineering problems. In practice, he tried to making use of the theorems to the design of wave energy converters (WECs), to improve their wave-to-wire efficiencies. After optimizing 3 Oscillating Water Columns (OWCs) and 5 Ducks, he and his group had a evident progress in hydrodynamic performance and maintainability, and invented the Eagle WEC that has been patented in China, US, UK and Australia.