

THE OTEC RESOURCES ASSESSMENT IN TAIWAN (I)¹

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ABSTRACT

The most potential ocean energy in Taiwan is the ocean thermal energy conversion (OTEC). Along east coast of Taiwan, Kuroshio flows near by and the 1000 meter depth contour is close to the shore. The former STD (salinity, temperature and depth) data collected by the R/V Chiu Lien in the vicinity of Hualien and Taitung are analyzed to get an average ΔT -depth graph. The result shows that the OTEC resources for the sea areas in the vicinity of Hualien and Taitung are approximately the same. For the sake of a complete understanding of the sea surface temperature, especially for the winter season, the seawater temperature at the surface are measured at Taitung and Lutau both by a person and by a self-contained recorder. The results show that the temperature at Taitung is lower and the lowest monthly average temperature is in January and equal to 22.4°C at Taitung and 24.1°C at Lutau. A detailed statistical analysis is done for the data of air temperature, surface seawater temperature and tide at Taitung. The diurnal peak is greater than the semi-diurnal peak in air temperature spectrum, and vice versa for the seawater temperature. The reason is that the daily fluctuation of the air temperature is dominated by the sunshine, however, the daily fluctuation of the seawater temperature is mainly influenced by the tidal current in which the semi-diurnal tidal current is dominant. For the variation of over daily period, the seawater temperature is strongly correlated to the air temperature. In winter the air temperature is colder than that of the seawater, the efficiency of the cooling effect by the atmosphere is a function of the variance of air temperature.

Besides temperature differences, the depth of mixing layer and thermocline are processed from the former and the present STD data. The mixing layer depths are generally very small. There are frequently no mixing layers. Only in winter season the mixing layer may extend to 60 m depth. The thermocline depth extends normally to 200 m depth.

Generally, the OTEC resources in Taiwan is quite well even better than that of the United States. We hope that in the future abundant electricity from the sea will be used by the people in Taiwan.

INTRODUCTION

Since the energy crises in 1973, scientists and engineers have paid more attention to exploiting the non-fossil energy—such as, solar, wind, geothermal, bio-mass and ocean. Taiwan is an island. Of course, ocean energy should be emphasized. Dr. John D. Isaacs of Scripps Institute of Oceanography estimated that the exploitable ocean energy capacities in the world are $4,000 \times 10^7$ MW for OTEC, 140×10^7 MW for salinity gradient, 0.5×10^7 MW for ocean current, 0.27×10^7 MW for tidal power and 0.25×10^7 MW for wave energy. The quantity of ocean energy is very large. However, till now there is only tidal power being commercially utilized. In Taiwan, there are neither favourable site for tidal power plant nor site for salinity gradient. Therefore, the candidates left are wave, current and OTEC. The problem now is: which one is the most potential candidate in Taiwan? One of the most important criterion of the natural conditions is the energy density which is defined by the energy (measured by water head) contained in unit water mass, and the unit is cm/gram. If one gram seawater decreases 1°C, it releases 1 calorie of heat. One calorie is equal to 4.18 Joule. It means that

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