

A Key Parameter in Ocean Thermal Energy Conversion Plant Design and Operation

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Abstract : Ocean thermal energy is one of the ocean energy sources. It is a renewable, sustainable, and green energy source. Ocean thermal energy conversion (OTEC) applies the ocean temperature gradient between the warmer surface seawater and the cooler deep seawater to run a heat engine and produce a useful power output. Unfortunately, the ocean temperature gradient is not big. Even in the tropical and equatorial regions, the surface water temperature can only reach up to 28°C and the deep water temperature can be as low as 4°C. The thermal efficiency of the OTEC plants, therefore, is low. In order to improve the plant thermal efficiency by using the limited ocean temperature gradient, some OTEC plants use the method of adding more equipment for better heat recovery, such as heat exchangers, pumps, etc. Obviously, the method will increase the plant's complexity and cost. The more important impact of the method is the additional equipment needs to consume power too, which may have an adverse effect on the plant net power output, in turn, the plant thermal efficiency. In the paper, the author first describes varied OTEC plants and the practice of using the method of adding more equipment for improving the plant's thermal efficiency. Then the author proposes a parameter, plant back works ratio ϕ , for measuring if the added equipment is appropriate for the plant thermal efficiency improvement. Finally, in the paper, the author presents examples to illustrate the application of the back work ratio ϕ as a key parameter in the OTEC plant design and operation.

Keywords : ocean thermal energy, ocean thermal energy conversion (OTEC), OTEC plant, plant back work ratio ϕ

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