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Model-based global assessment of ocean thermal energy conversion (OTEC) power potential

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Ocean thermal energy conversion (OTEC) is a method of collecting solar energy stored as sensible heat in the upper mixed layer of tropical and subtropical oceans. Deep, cold water originally formed at the polar margins provides the low temperature needed for a working fluid (e.g. ammonia) to recondense in a closed Rankine power cycle. Though the thermal efficiency is relatively low, OTEC is capable of providing clean, renewable base-load power without being subject to output fluctuations caused by environmental variability. Conservative estimates put the global OTEC energy potential at a few TW, comparable to all of today's installed generating capacity. Useful power generation with OTEC begins around $\Delta T = 20°C$, where $\Delta T = T_{warm\ water} - T_{cold\ water}$. Marginal gains of 10-15% gross power are estimated with every 1°C increase in ΔT (Nihous, 2005, 2010), making slight variations in water temperature with depth and location worth pursuing.

In order to conduct a global-scale estimate of OTEC potential power generation, temperature and deep-water velocity data were acquired from the data-assimilative Hybrid Coordinate Ocean Model (HYCOM) using simulations conducted by the United States' Naval Research Laboratory. HYCOM global temperature and current velocity data were averaged on monthly and seasonal time scales beginning September 2008. Mapped estimates of ΔT, depth and velocity were used to identify sites of interest for concentrated direct OTEC resource assessment. Model predictions were verified against *in situ* temperature profiles monitored along the southeastern coast of Florida.