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Marine Energy Sources: The Role of Thermal Conversion

At the present time six marine renewable resources benefit from technological research and plants, mostly experimental: thermal conversion, wave power, tidal power, salinity gradients, bioconversion and currents. On a world-wide scale, thermal conversion potential is estimated at 10 million megawatts, 20 times wave and 200 times current potentials. Tourists visiting Big Island in the Hawaii can look at the 52-kW, 328 acres Ocean Thermal Energy Conversion (OTEC) plant built in 1979 and regarded as capable of meeting the local energy demand in the near future to the point of being a significant element in the Hawaii Ocean Resources Management Plan.

According to the United Nations Department of International Economic and Social Affairs, the exploitation of the thermal ocean gradient could develop especially in the intertropical areas since these plants convert the temperature differences between the warmer surface waters and the colder waters at depths up to 500–1000 metres and are feasible only where this difference is more than 20 °C. These conditions being frequent in tropical and subtropical waters, the locations where the OTEC plants can be installed coincide with ocean regions of many developing countries. Hence their leading role in ocean management plans aimed at supporting national policies and international actions in less, under and least developed countries.

Four configurations of commercial-scale OTEC plants have been achieved by research and experimentation: land-based, shelf-mounted, moored and free-floating. The selection between them depends on the local physical conditions, such as the surface and deep marine current layout and speed and climate features. First research achieved commercial-scale configurations of land-based and shelf-mounted plants. More recently moored and floating plants have benefitted from advancements and they are expected to be available during the nineties. The OTEC plant must be wide enough to be economic: its optimum size is from 100 to 400 MW.

Since energy from OTEC plants can be converted into electrical, chemical or protein forms, developing coastal, inland and archipelagic countries can exploit the thermal gradient of ocean waters where national jurisdiction is extended not only to produce electric energy but also for aquaculture, fertilizer, biomass, methanol, alumina, ammonia production, as well as desalination and other purposes. The range of by-products depends both on the configuration of plants and local economic and social conditions.

Although OTEC technology for the production of electricity is regarded as relatively clean, a range of important environmental implications must be tackled. At the present time attention from ecologists is drawn to three major environmental concerns: i) the implications in the ecosystem due to the water mass displacement and mixing; ii) chemical pollution; iii) the physical impacts due to the size of plants.

As can be seen, like other technologies set up to convert renewable energy sources into electric power, the exploitation of the thermal gradient of water mass is far from avoiding environmental impacts. Because of this circumstance, OTEC prospects can be regarded as a significant case of how difficult its to apply *environmental enhancement and use development principle* in sea management. In this respect, general principles and guide-lines which will be formulated in the United Nations Conference on Environment and Development (Rio de Janeiro, June, 1–12, 1992) are expected to play a leading role in influencing international co-operation, national policies and technological orientations in the nineties and afterwards. The International Conference on *Ocean Management in Global Change,* which will be held in Genoa soon afterwards (June, 22–26, 1992) will specifically refer the UNCED statements to coastal and ocean management.

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