

111. The Ocean Resource

OTEC plants make use of the differential temperature between the surface and deep ocean water masses. Thus, potential energy resources are greatest in tropical regions of the ocean where surface temperatures remain warm (about 80°F) throughout the *year, and where cold water is* available at reasonable depths.

OTA's 1978 report noted that no one had undertaken total assessment of the ocean's thermal resources and their relationship to the amount and kind of energy needed in specific locations. It did not appear that a commercialization strategy for OTEC could be developed without, having more detailed information and analysis of the potential thermal energy resource. Since that report, it does not appear that DOE has completed even a preliminary assessment of this kind which could be used in their own planning and commercialization of OTEC power systems.⁹

It has been estimated that over 20 million square miles of suitable ocean area exists worldwide for OTEC sites¹⁰. The DOE estimates the upper extractable limit of this renewable resource as 200 quads (10^{15} Btu) per year. (One quad per year of electrical output is roughly equivalent to 11,000 megawatts operating 100% of the time) The magnitude of the thermal resource available to the United States for exploitation has been estimated by DOE to be tens of quads per year. These resource numbers have not been documented by DOE; it has not identified the sites for each estimate; and it has not stated the assumptions used in making these estimates.¹¹

Island and Gulf Coast Resources

Resource development strategy has also not been defined in existing DOE

planning documents. The DOE "island strategy" for electrical power generation has targeted the U.S. island market as ideal for OTEC development. OTA recommended in the 1978 report that it would be beneficial to emphasize such specific development of island sites in the Caribbean and Pacific Oceans.

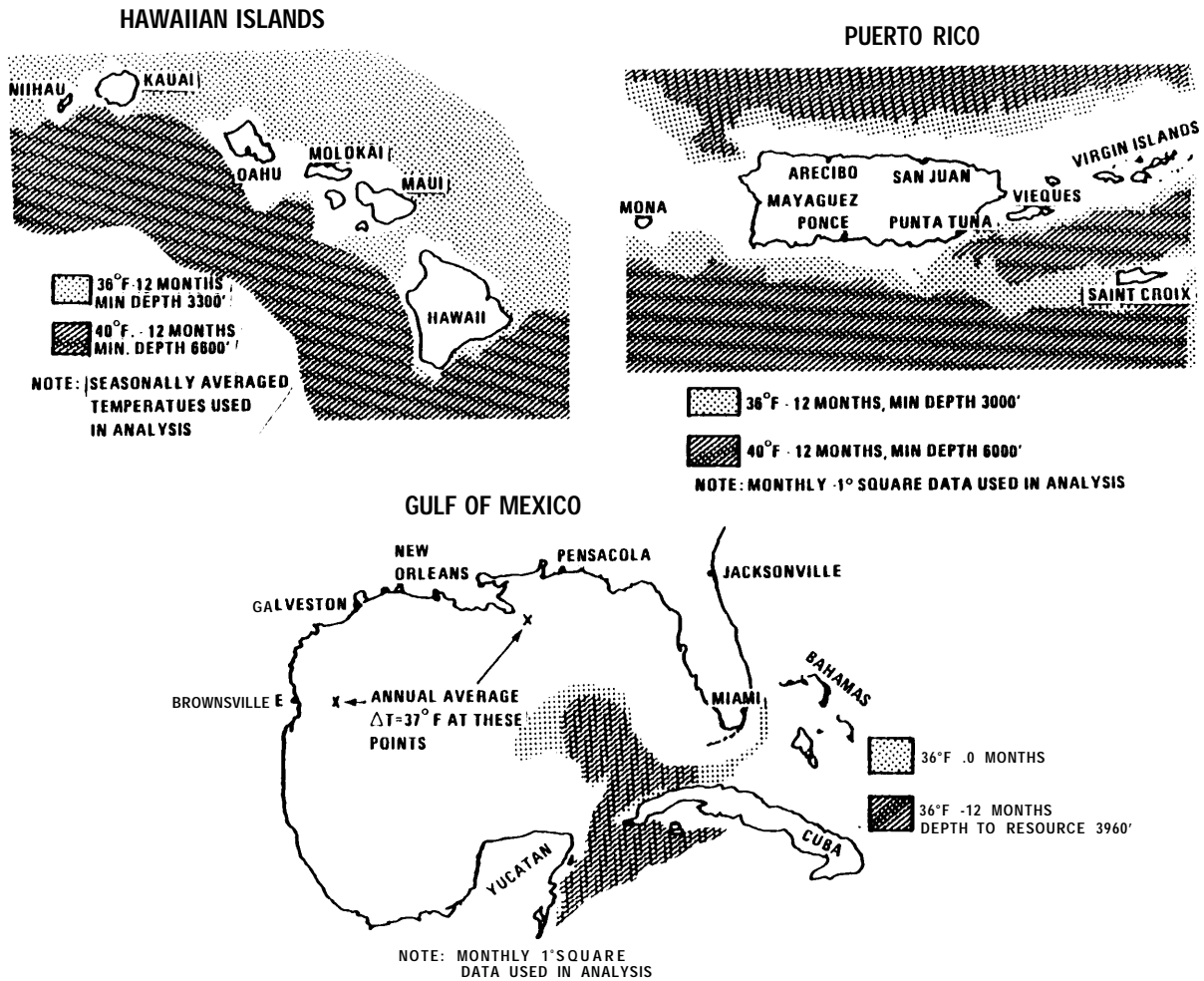
DOE has projected incremental baseload electricity needs of U.S. islands and the Gulf Coast. OTEC seems well-suited to the U.S. island market because the cost of alternative incremental generation capacity is so high for islands. The DOE strategy for commercialization also depends heavily on penetration into the much larger continental U.S. electricity demand in the Sunbelt region adjacent to the Gulf of Mexico. In this market, OTEC plants must compete with baseload fossil and nuclear generating plants.

Even though DOE future projections appear to rely heavily on developing OTEC sites in the Gulf of Mexico, this has not been based on a detailed analysis of the total resource that would be available to the U.S. Some researchers have developed dynamic models of the ocean temperature in the Gulf but these have yet to be verified. OTA made a very rough estimate of total potential OTEC electrical production from the Gulf of Mexico in its 1978 report and concluded that about 15,000 megawatts may be available for U.S. markets. While this estimate has also not been verified, it does indicate that there may be some limits on resources in this particular region. 12, 13

Another question to be addressed in analyzing the Gulf of Mexico resource is that of U.S. jurisdiction. Most of the resource now identified is outside of 200 miles from U.S. shores and inside 200 miles from Cuban and

Figure 1

THERMAL RESOURCES



THERMAL RESOURCE AVAILABILITY FOR THE HAWAIIAN ISLANDS, PUERTO RICO, AND THE GULF OF MEXICO

Source : U.S. Department of Energy, Draft Multiyear Program Plan, Ocean Systems, Oct., 1979.

Mexican coastlines. This is now considered international waters but it is by no means easily accessible to large U.S. electrical markets.

Plant Ship Resources

The OTEC plant ship concept uses the electricity generated from the thermal temperature differences to produce an energy intensive product such as ammonia. This concept avoids the requirement of the electric cable from the OTEC plant site to the user. Instead, a product will be shipped by barge or by pipeline to the end user.

To gain maximum OTEC efficiency, there is an incentive for the plant ship to be located where maximum temperature differences exist between the surface and deep ocean water. These locations may be in the tropical Atlantic or Pacific or even in the large ocean regions near the long Hawaiian Island chain, all of these both regions having very large resource potential. Thus, the plant ship may be located in international waters, a considerable distance from the product markets of the continental United States.

Summary

The Department of Energy has projected that OTEC will be able to serve major U.S. markets through the use of Gulf of Mexico sited electrical generating systems and plant ships in the tropical oceans. They have projected 50,000 megawatts for the Gulf of Mexico and Plant ships by the year 2010. It is not stated, however, what portion of this number would be electrical generation or plant ships. Since the types of systems are very different and since there is a huge difference in possible resources between Gulf of Mexico and the tropical oceans, a strategy for resource evaluation is urgently needed. More attention should also be given to careful analysis of all feasible ocean thermal resources that will have an effect on OTEC development.