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GEOTEC—A Promising Energy Alternative

The Pacific basin borders are characterized by active plate boundaries in which geothermal energy, associated with volcanic arcs, is prevalent. High-quality (270°–306°C) geothermal resources have been developed in areas such as New Zealand and Japan, but lower quality (less than 200°C) resources have not been tapped for electrical power generation.

If these lower quality geothermal heat sources were used in conjunction with cold ocean-water heat sinks, the resulting increased temperature differences would improve energy conversion efficiencies so as to be economically attractive. The technology of solar-driven ocean thermal energy conversion (OTEC) may be combined with geothermal power system technology to produce a geothermal/ocean thermal energy conversion (GEOTEC) system.

Geothermal reconnaissance has shown a promising resource at the base of three clustered volcanoes on Adak Island, located along the Aleutian arc of Alaska. Geophysical surveys revealed areas of abrupt and steep gravitational gradients and high electrical conductivity over the volcanoes, indicating possible subsurface magma. Geochemical analyses indicated a potential reservoir temperature of 180°C. The nearby Bering Sea has a surface temperature ranging between 3° and 8°C year-round and would provide for high heat reinjection.

The combination of geothermal and ocean sink resources could result in a GEOTEC plant having an overall thermal efficiency approaching one-third that of the present diesel-electric generating system at the Naval Air Station on Adak. The more than 5,000 permanently stationed personnel at the station consume over 8 million gal of JP-5 fuel for space heating and electrical power. Presently, electric energy on Adak costs 250-350 mils/kilowatt-hour. Preliminary estimates of the cost of electric power from a GEOTEC plant are about 200 mils/kilowatt-hour. A GEOTEC plant would also be a secure alternative energy source for the U.S. Navy.