Possible oceanographic and biological effects due to the operation of an OTEC (Ocean Thermal Energy Conversion) plant in the area of Puerto Angel, Oaxaca, Mexico

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An OTEC plant uses the thermal gradient (oceanic thermal difference, which should preferably not be less than 20ºC) to transform heat into electrical energy and the best regions to implement it are those found in the inter-tropical and tropical areas of the planet. Among the countries currently experimenting with this cycle are France (experimental plant without generation in the Reunion Island Overseas Department), South Korea (20 kW in Goseong), Japan (100 kW in Okinawa and an experimental plant in the Saga University that generates 35 kW) and the United States (105 kW in Hawaii). Recently, Mexico began to be interested in this type of alternative energy technologies, since it presents the ideal geographic and oceanographic conditions for its use, and before the establishment of the Mexican Center for Ocean Energy Innovation (CeMIE-O), both theoretical and laboratory research is being carried out. to know if it is possible to use this technology in the country and one of the lines to work on is the part of the environmental assessment. For this reason, the objective was to analyze at a theoretical level the possible environmental effect that the operation of a high-power generation plant (100 MWe) could cause in the area of Puerto Angel, Oaxaca, Mexico due to the bio-feather that would discharge the installation.

Firstly, surface and bottom temperature data (up to 1000 m) were used from databases of the National Oceanographic Data Center (NODC) and the World Ocean Atlas Database (WOA) 2018 with the purpose of calculating the annual and seasonal thermal gradient of the Gulf of Tehuantepec area. Subsequently vertical profiles of temperature, salinity and nutrients were made in order to analyze their behavior

at different depths depending on seasonality. With this information, the velocity of the plant discharge water and its density were calculated to establish the maximum depth at which it would stabilize in the water column, as well as possible changes in the vertical profile of the parameters. Because the operation of the plant is very similar to that of an ocean upwelling (due to the pumping of cold bottom water and warm surface water), the bio feather data was compared with the upwelling data generated in the Gulf of Tehuantepec to review the type of possible environmental impact that could exist in Puerto Angel once the plant operates.

With the biofeather in the ocean and when establishing its maximum depth, the possible biological effect was analyzed by means of a numerical simulation to describe the progress of the biofeather, the dilution rate of the nutrients, the initial and final concentrations of the same from of the operation of the plant and with this analyze the effect on marine phytoplankton to define those organisms that could benefit from their biological parameters, especially emphasizing those that can cause FAN (harmful algal blooms) or red tides.

The results describe that the plant's feather would stabilize at 64 m depth, so it is within the photic zone of the area, which could generate positive or negative environmental effects. Regarding the parameters of temperature, salinity and density, it is observed that there would be no thermal and hyaline contamination, which is why the plant is beneficial to the marine environment. Lastly, since the discharge water presents nutrient concentrations that are important for the development of phytoplankton, it is observed that due to the dilution rates and the path of the bio-feather there will be no risk regarding the generation of a "bloom" algal, whether they are FAN generating organisms or not.

From the results, it is concluded that the discharge water can be used for different secondary by-products that the OTEC plant can offer, such as drinking water, air conditioning, aquaculture of macroalgae and fish in the area, cold water agriculture, among others with In order that there are no possible environmental effects in the area, as well as frequently monitoring what can happen with the bioplume in the water column in order to have security, prevention and mitigation measures with which the implementation of this technology in the country.

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