

# ID39 - FEASIBILITY ANALYSIS OF ENERGY HARVESTING WITH PIEZOELECTRIC DEVICES IN OCEANOGRAPHIC BUOYS

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## Abstract

This document shows the study carried out to demonstrate the feasibility of using piezoelectric devices in oceanographic buoys, as generators of electric power for feeding the buoy system.

One of the basic problems in an application of this type is to supply electrical power to the systems of the buoy. But the realisation of prototypes and especially their test in real conditions, for their validation, are extremely expensive. Therefore, a good solution is to demonstrate, previously, the viability of the system. This requires real data on movements, accelerations, etc., but in this particular case, these data are available for carrying out previous R & D projects that have given rise to developments that are currently located on operational oceanographic buoys. . With all this we have been able to carry out a study that demonstrates the interest of this technology.

*Keywords - energy harvesting, wave sensor, piezoelectric, oceanographic buoy.*

## I. INTRODUCTION

There are more and more needs to measure variables in remote locations. In these cases the electrical power of the systems in those locations is difficult, since the only solution would be with batteries that periodically need to be replaced, which complicates the efficient use of the system. These types of needs are, among others, those related to the measurement of environmental variables in the seas and oceans, which are carried out by means of oceanographic buoys. In this particular case, the buoy must be selfsufficient to feed the measurement systems, information storage and transmission of the same, via wireless, to a remote station located on land.

In the case of buoys, one can think of the generation of electric energy from thermal energy (Peltier cells), in the generation from piezoelectric devices, which could generate energy from the movement of the buoy due to its time, the movement of sea water, etc.

In this work, a theoretical analysis of the possible system to be used is made, based on piezoelectric devices, which is a form of generation that in principle seems adequate for this case.

## Operation of the system

The buoy presents repetitive and oscillatory movements characterized by the amplitude and frequency of the waves to which the buoy is subjected. Specifically, these movements depend on the amplitude of the waves, the frequency of them and the combination of these movements. The result is a buoy that presents accelerations in the three axes, which means that in each of the three planes of the space appear different types of accelerations (Roll, Yaw and Pitch). By locating two piezoelectric devices in each of the planes, all the energy corresponding to all the movements of the buoy can be captured.

The movements of the buoy depend on the location of thesea in a specific location. In our case and due to previous work we know these movements for specific locations and based on this information we intend to make an assessment of the amount of energy that would be possible to obtain for a particular buoy located at a specific point.

## Objectives

The general objective of the study is to evaluate the technical and economic feasibility of harvesting energy in a buoy from the movement of the own buoy. For this, the use of piezoelectric devices has been considered. To do this, all possible real movements of a buoy are analyzed and characterized for possible use to generate energy through commercial piezoelectric devices. An additional objective is the selection of the most suitable commercial devices for the design of a prototype that can be located in a concrete buoy.

## Conclusions

The work done shows the interest of using this form of energy as a source of power for the electronic systems of an oceanographic buoy.

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