# Acoustic characterization of Mutriku OWC Plant


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## 1. Introduction

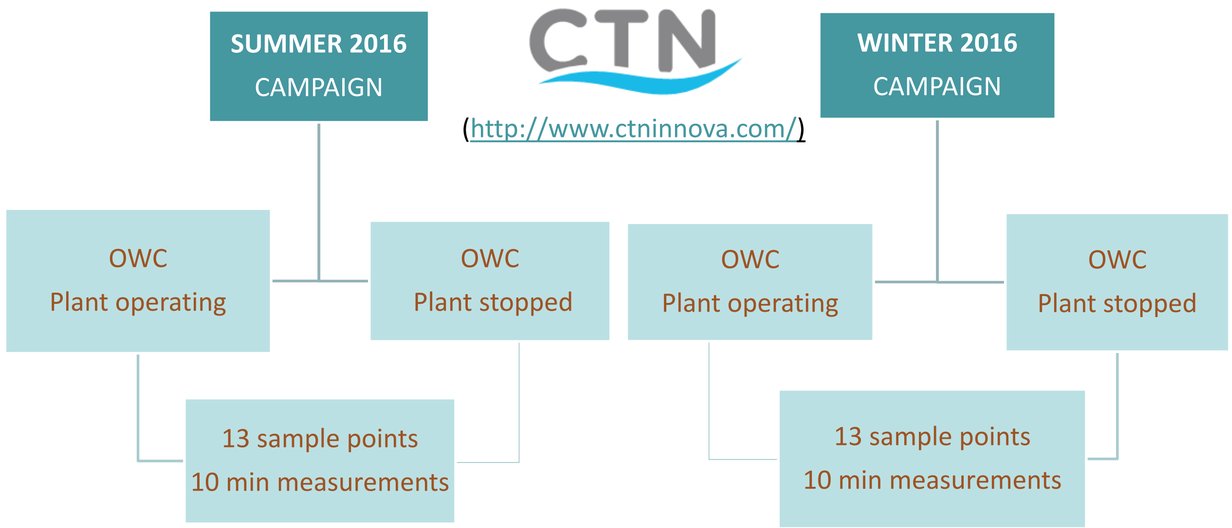
The **Mutriku Oscillating Water Column (OWC) Plant** is an onshore infrastructure for wave energy harnessing promoted by the Basque Entity of Energy (Ente Vasco de la Energía, EVE). The facility is housed within a breakwater at the port of Mutriku (Basque Country, Northern Spain) and opened in July 2011. The plant consists of **16 turbines** giving **a total installed capacity of 296 kW**. During winter 2015 it reached a major milestone; its first GWh of electricity supplied to the grid. This facility is now available as a **test site** providing developers with a unique opportunity to test new concepts in air turbines, generators, control strategies and auxiliary equipment.

Like other human activities in the marine environment, **some environmental impacts** over the marine environment **were expected** during the Mutriku OWC Plant exploitation phase. Among them, the **generation of underwater sound** during this phase was identified as one of the main expected environmental impact. In order to evaluate this impact, an **environmental monitoring Plan (EMP)** was developed for the **monitoring** of the **underwater sound** produced by the Mutriku OWC Plant.

## 2. Methodology

### Sampling campaign

**2** sampling **campaigns** where undertaken following the methodology developed by the Marine Technology Center (CTN):




The sampling campaign was done with an **icListen HF 200 kHz hydrophone** of Ocean Sonics.

Ocean Sonics
The Smart Hydrophone Company

(http://oceansonics.com/)

### Data processing

Data processing has been undertaken according to the requirements of the **Marine Strategy Framework Directive (MSFD) (Directive 2008/56/CE)** and the indicators established according to the Commission Decision 2010/477/UE for the Descriptor 11 of the Directive (Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment):

**Descriptor 11.1 Distribution in time and place of loud, low and mid frequency impulsive sounds**:

Proportion of days and their distribution within a calendar year over areas of a determined surface, as well as their spatial distribution, in which anthropogenic sound sources exceed levels that are likely to entail significant impact on marine animals measured as **Sound Exposure Level (SPL) (in dB re 1 µPa$^2$.s)** or as peak sound pressure level (in dBre 1µPa$_{peak}$) at one metre, measured over the frequency band 10 Hz to 10 kHz.

**Descriptor 11.2 Continuous low frequency sound**

Trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1 µPa RMS; average noise level in these octave bands over a year) measured by observation stations and/or with the use of models if appropriate.

## 3. Results

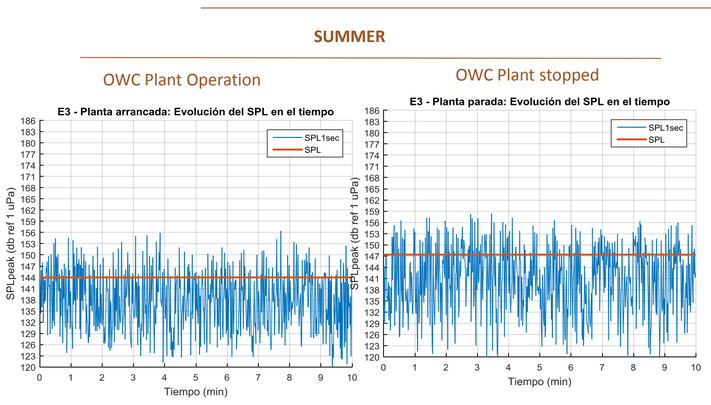
The results obtained with both indicators **didn't show any evidence of impulsive neither continuous sound emission coming form the OWC Plant of Mutriku**.

The graphic representation of some of the results shown below:

**Indicator 11.1 (Impulsive sounds)**

**SUMMER**

OWC Plant Operation

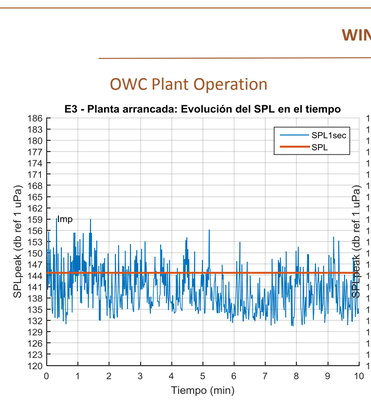



OWC Plant stopped

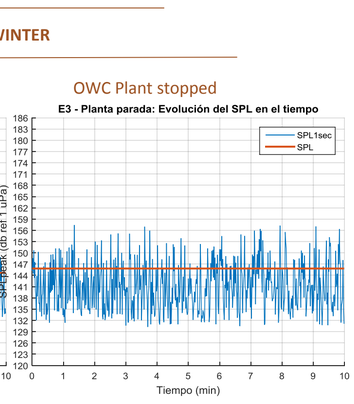



**WINTER**

OWC Plant Operation



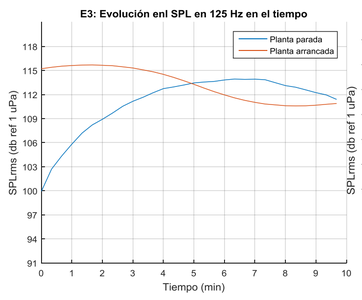

OWC Plant stopped



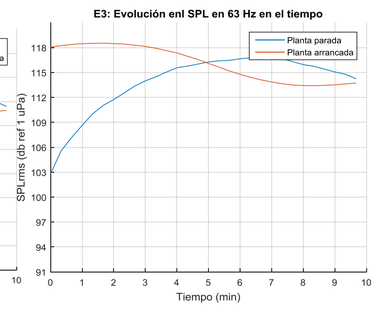

**Indicator 11.2 (Continuous sounds)**

**SUMMER**

SPLrms 63Hz

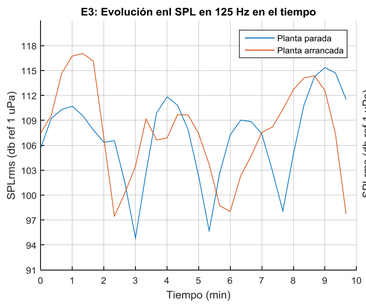



SPLrms 125Hz

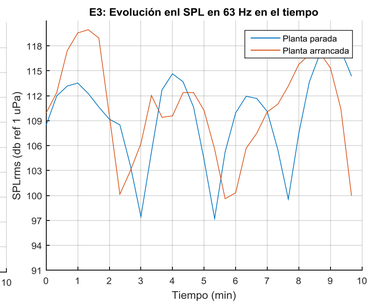



**WINTER**

SPLrms 63Hz

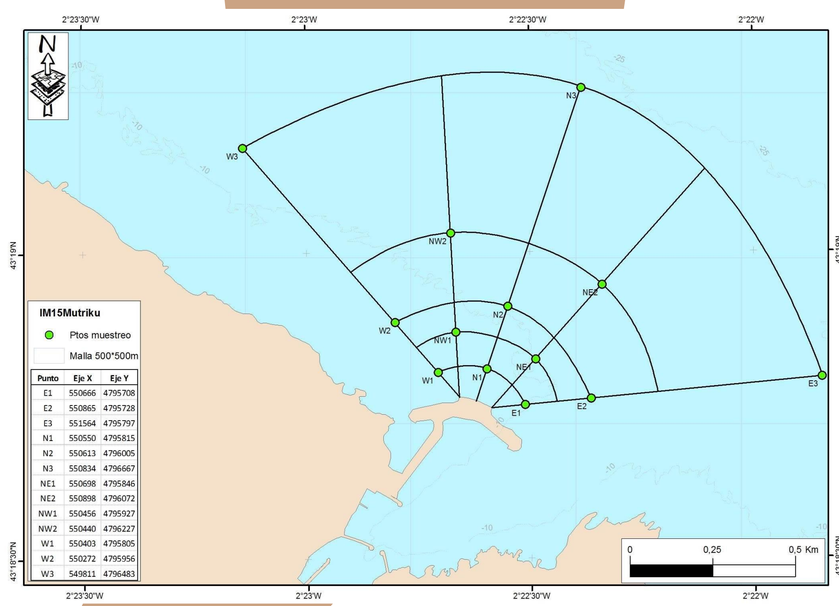



SPLrms 125Hz




However, it´s important to underline some limitations in the data:

- the time scale of the data series is too short;
- the difference in the time scale between samples and between OWC Plant operating and stopped makes difficult the comparison between measures.




| Punto | Eje X | Eje Y |
|---|---|---|
| E1 | 550666 | 4795708 |
| E2 | 550865 | 4795728 |
| E3 | 551564 | 4795797 |
| N1 | 550550 | 4795815 |
| N2 | 550613 | 4796005 |
| N3 | 550834 | 4796667 |
| NE1 | 550698 | 4795846 |
| NE2 | 550898 | 4796072 |
| NW1 | 550456 | 4795927 |
| NW2 | 550440 | 4796227 |
| W1 | 550403 | 4795805 |
| W2 | 550272 | 4795956 |
| W3 | 549811 | 4796483 |

## 4. Conclusions

No evidences of significant acoustic impact coming from the Mutriku OWC Plant were obtained.

Nevertheless, some important limitations related with the design of the EMP suggested the development in the future of a more advanced monitoring strategy based on the implementation of a permanent acoustic underwater monitoring station cabled to the Mutriku OWC Plant.


## Acknowledgements

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