III Jornadas sobre el Estado Actual y Perspectivas de las Energías Renovables Marinas en España
Madrid, 22 y 23 de noviembre de 2017

LA GESTIÓN AMBIENTAL EN EL DESARROLLO DE LAS ENERGÍAS RENOVABLES MARINAS

azti tecnalia Transforming Science into Business

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FLOTTEK, OM-EOLO, ZARATA

EUSKO JAURLARITZA GOBIERNO VASCO

Gamesa

RiCORE

RISK BASED CONSENTING FOR OFFSHORE RENEWABLES

PSE MAR

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

Estación undimotriz Mutriku

OCEANLIDER

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

IBERDROLA

acciona Energy

PROES INGENIERÍA Y ARQUITECTURA

EOLIA

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

General Cable

ICERMAR I y II (Elkartek)

EUSKO JAURLARITZA GOBIERNO VASCO

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016

OCEANTEC

tecnalia Inspiring Business

IBERDROLA

EVE Ente Vasco de la Energía

bimep

PVA Bimep (Preoperacional y Construcción)
EsIA Aerogeneradores
Revisión impactos cable

WETSITE

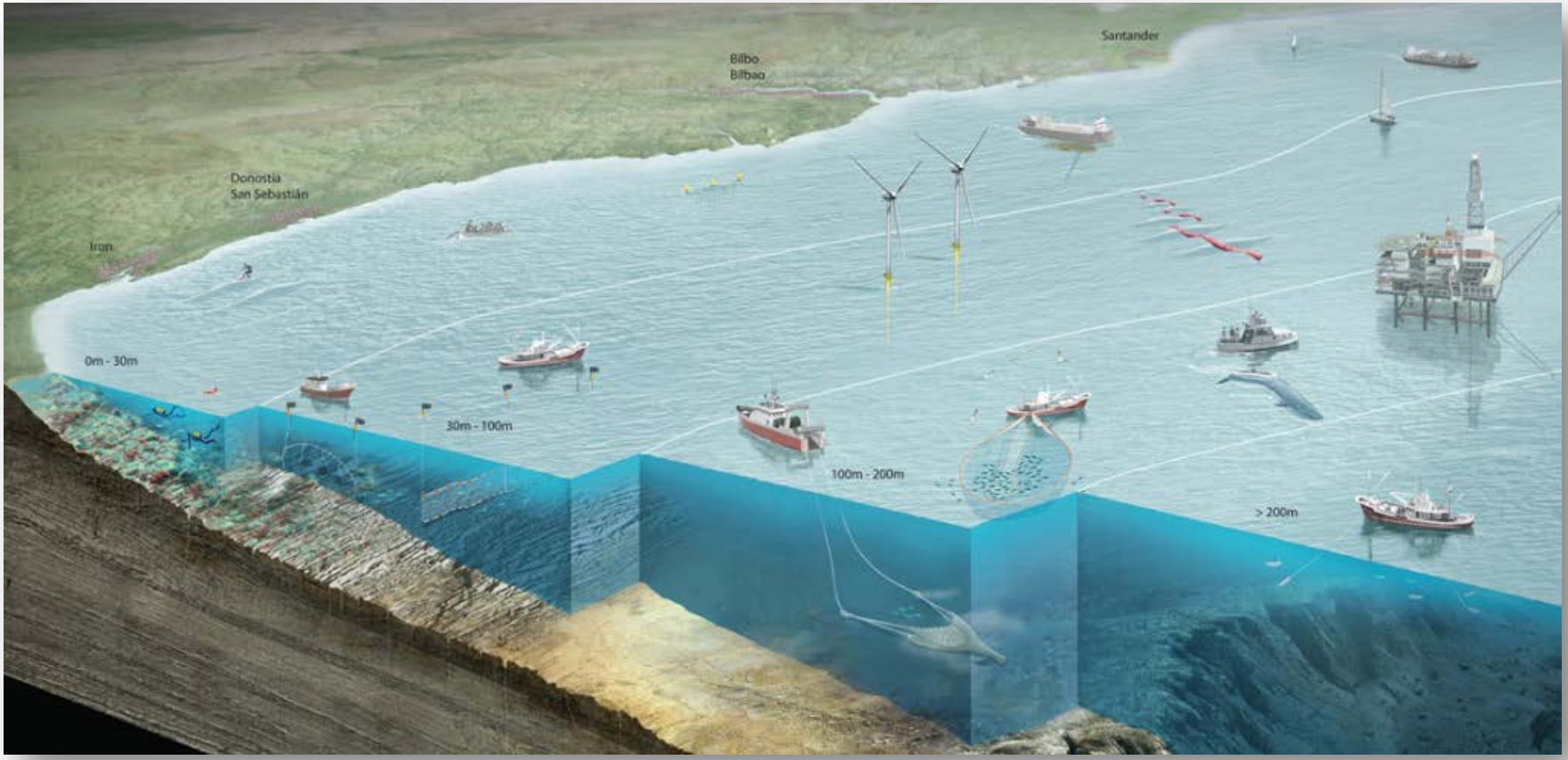
GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

El desarrollo de las Energías Renovables Marinas (ERM*) tiene que afrontar diferentes retos:

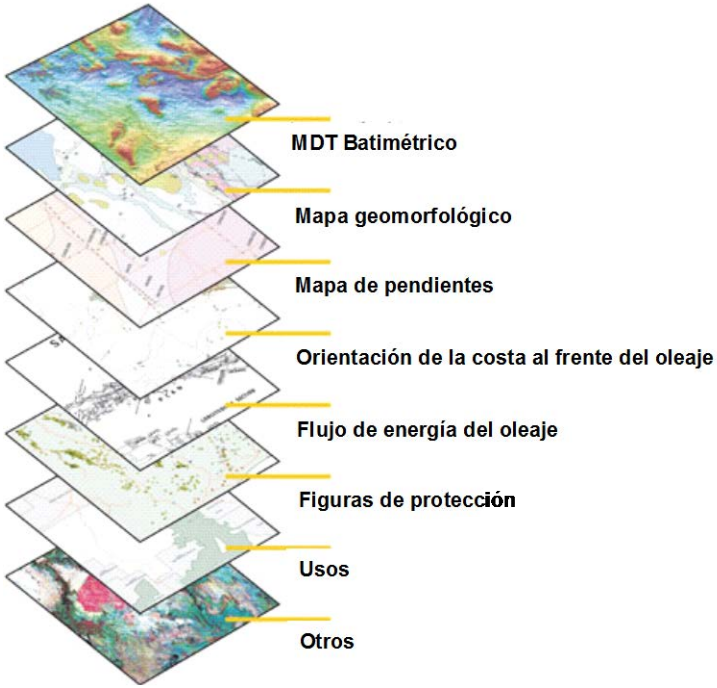
- Retos Tecnológicos
- Retos Económicos (coste de la energía, etc)
- **Retos no-tecnológicos**:
  - **Planificación Espacial Marina**
  - **Impactos Ambientales**
  - **Procedimientos Administrativos**

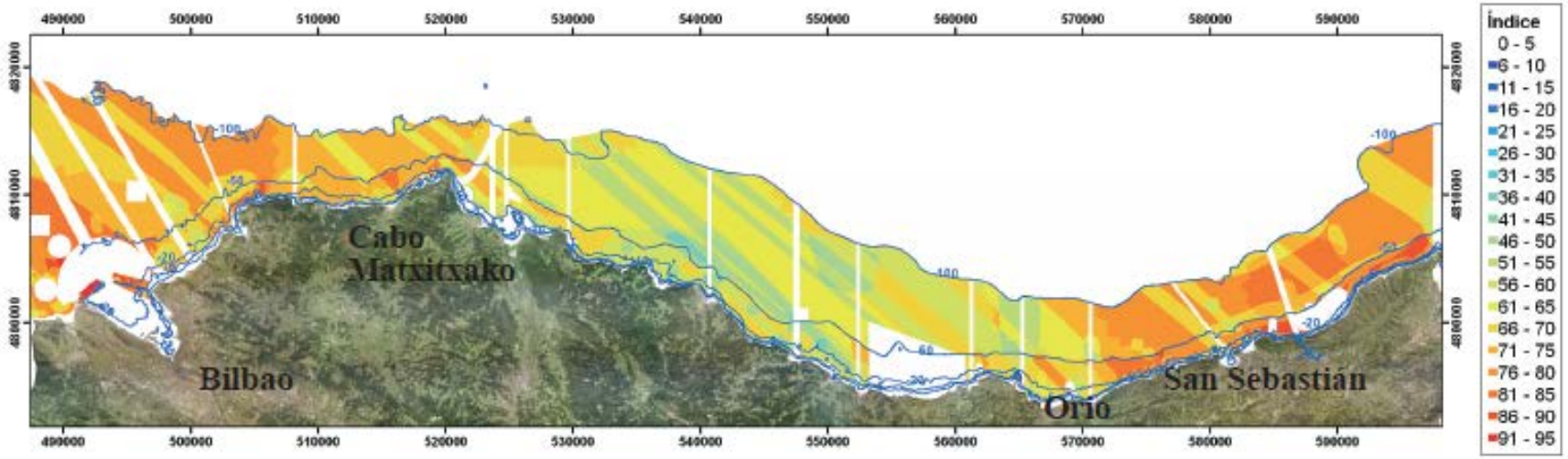
*olas, corrientes y viento

Los conflictos de las energías marinas con otros usos del litoral se deben a la competencia por un mismo espacio con otras actividades.



La selección de las zonas más adecuadas requiere la realización de una **Planificación Espacial Marina** que tenga en cuenta criterios de tipo técnico, medioambiental y socioeconómico.


MDT Batimétrico
Mapa geomorfológico
Mapa de pendientes
Orientación de la costa al frente del oleaje
Flujo de energía del oleaje
Figuras de protección
Usos
Otros


Cabo Matxitxako
Bilbao
Orio
San Sebastián
Índice
0 - 5
6 - 10
11 - 15
16 - 20
21 - 25
26 - 30
31 - 35
36 - 40
41 - 45
46 - 50
51 - 55
56 - 60
61 - 65
66 - 70
71 - 75
76 - 80
81 - 85
86 - 90
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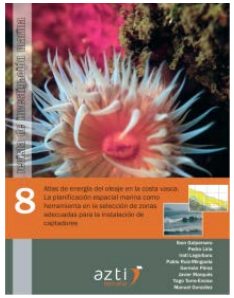
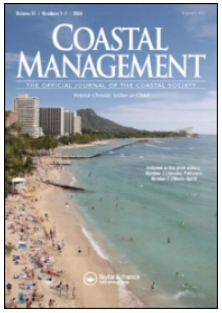
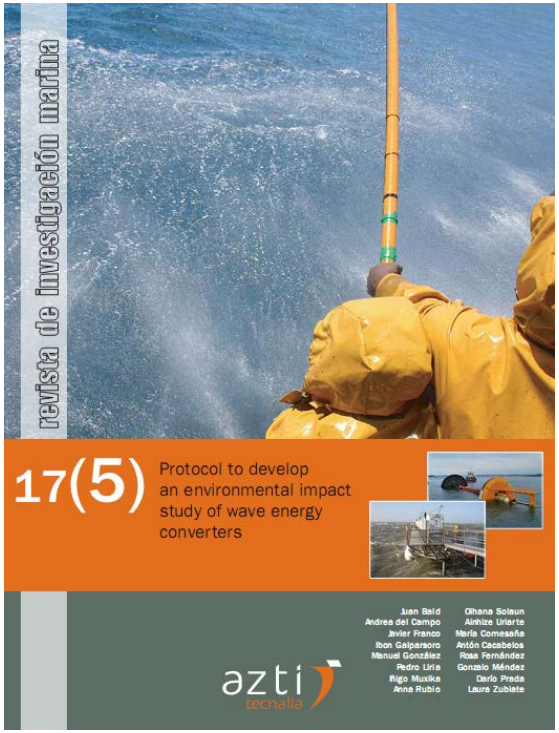


Galparsoro, I., P. Liria, I. Legorburu, Ruiz-Minguela, G. Pérez, J. Marqués, Y. Torre-Enciso y M. González, 2008. *Atlas de energía del oleaje en la costa vasca. **La planificación espacial marina** como herramienta en la selección de zonas adecuadas para la instalación de captadores*. *Revista de Investigación Marina,* **8**:9 pp. http://www.azti.es/rim/component/content/article/8.html



Galparsoro, I., P. Liria, I. Legorburu, J. Bald, G. Chust, P. Ruiz-Minguela, G. Pérez, J. Marqués, Y. Torre-Enciso, M. González, A. Borja, 2012. A **Marine Spatial Planning** approach to select suitable areas for installing wave energy converters on the Basque continental shelf (Bay of Biscay). *Coastal Management Journal*, 40: 1-19.

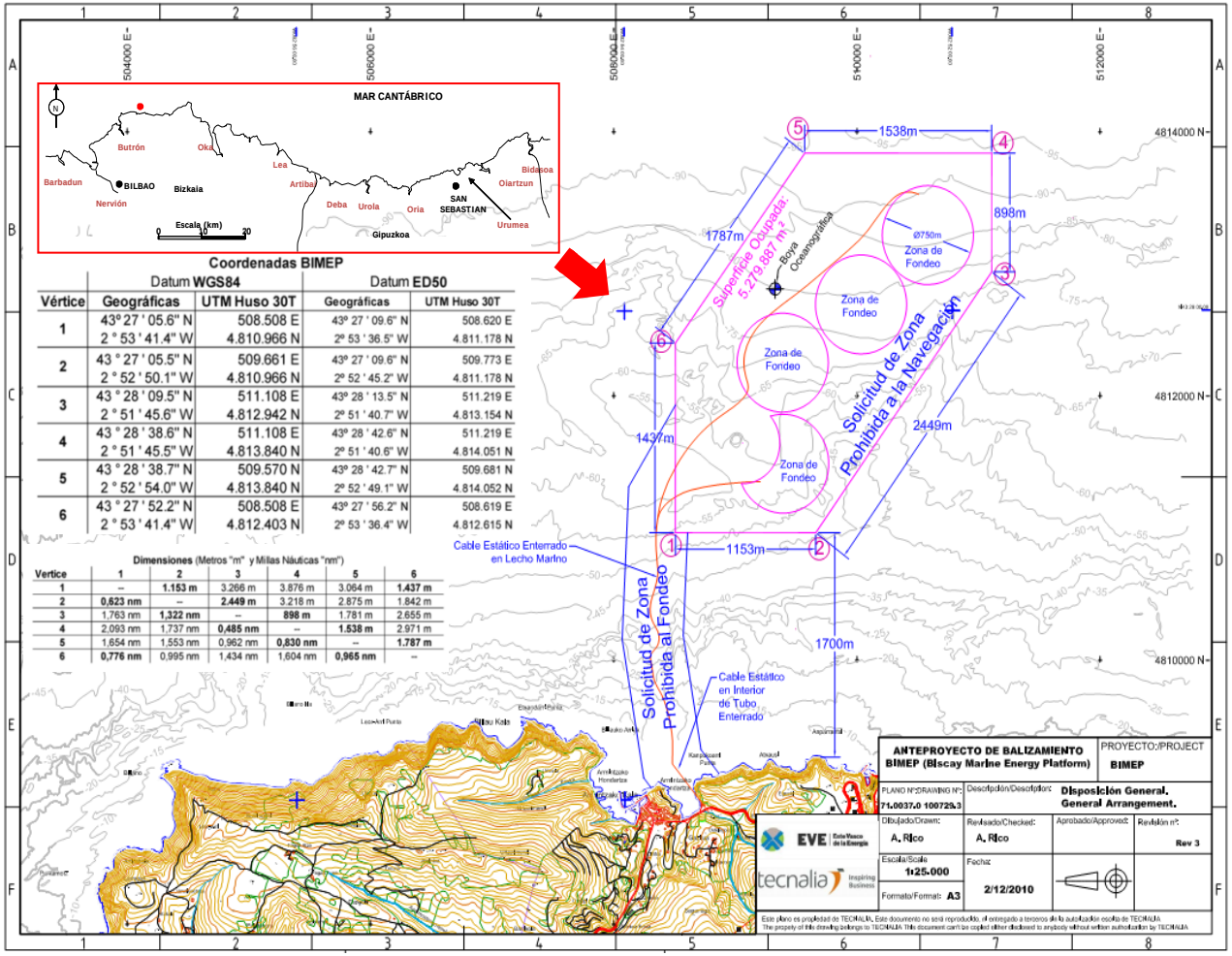
Bald, J., del Campo, A., Franco, J., Galparsoro, I., González, M., Liria, P., Muxika, I., Rubio, A., Solaun, O., Uriarte, A., Comesaña, M., Cacabelos, A., Fernández, R., Méndez, G., Prada, D., Zubiate, L., 2010. ***Protocol to develop an environmental impact study of wave energy converters***. Revista de Investigación Marina 17(5): 62-138
http://www.azti.es/rim/component/content/article/28.html



Bald, J., Curtin, R., Díaz, E., Fontán, A., Franco, J., Garmendia, J.M., González, M., Iriondo, A., Liria, P., Menchaca, I., Murillas, A., Muxika, I., Prellezo, R., Rodríguez, J.G., Solaun, O., Uriarte, A., Uyarra., M.C., Zorita, I. y C. Camba, 2013. **Guía para la elaboración de los Estudios de Impacto Ambiental de Proyectos de Energías Renovables Marinas.** Informe técnico realizado en el marco del proyecto nacional de I+D CENIT-E OCEAN LIDER, Líderes en Energías Renovables Oceánicas. 75 pp.

http://www.azti.es/es/acciona-energia-y-azti-tecnalia-elaboran-una-guia-que-facilita-el-estudio-de-los-potenciales-impactos-ambientales-de-las-energias-renovables-marinas/#.U4yRs3Kqmy4.

The Biscay Marine Energy Platform (bimep) is an offshore infrastructure for the demonstration and testing of wave energy harnessing devices promoted by the Basque Entity of Energy (Ente Vasco de la Energía - EVE). .



Características:

Flujo de energía: 21 kW/m^2

Superficie: 5,2 km^2

Profundidad: 50-90 m

Distancia a la costa: 1,7 km

Potencia total: 20 MW

7 boyas de balizamiento

1 boya oceanográfica (feb. 2009)

4 zonas de amarre y cables submarinos (13,2kV / 5MW)

1 subestación en tierra

Sistema de monitorización y control (SCADA)

Centro de datos e investigación

EVE | Ente Vasco de la Energía

La planta undimotriz de Mutriku

Estudio de Impacto Ambiental

The Environmental Impact Study of the Biscay Marine Energy Platform (bimep) project

BILBAO MARINE ENERGY WEEK

Bilbao, 20-24 April 2015

Juan Bald[1], Andrea del Campo[1], Javier Franco[1], Ibon Galparsoro[1], Manuel González[1], Carlos Hernández[1], Pedro Liria[1], Iratxe Menchaca[1], Iñigo Muxika[1], Oihana Solaun[1], Ainhize Uriarte[1], Yago Torre Enciso[2], Dorleta Marina[2]

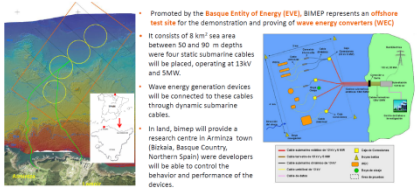
[1]AZTI-Tecnalia. Marine Research Division. Pasaia (Gipuzkoa), Spain. *Corresponding author: jbald@azti.es

[2]Ente Vasco de la Energía (EVE). Alameda de Urquijo, 36 - 1º. Edificio Plaza Bizkaia. 48011 Bilbao (Bizkaia), Spain.

1. INTRODUCTION

1. According to the Basque Country's Energy Strategy, wave energy is the one of the forms of marine energy for which a significant production is expected in the midterm. The particular geographical characteristics of the Basque Country provide suitable conditions for the production of such energy.
2. In this context, the Basque Energy Agency (Ente Vasco de la Energía-EVE) launched in 2008 the initiative to build the bimep (Biscay Marine Energy Project).
3. In 2008, according to Article 16 of Royal Decree 1/2008 of EIA, the Promoter (EVE) initiated the administrative procedure in order to achieve the environmental approval of the project.
4. For this purpose, in 2008, AZTI developed the Environmental Impact Study (EIS) of the BIMEP project.

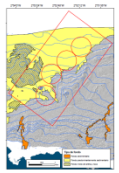
2. THE BIMEP PROJECT



- Promoted by the Basque Entity of Energy (EVE), BIMEP represents an offshore test site for the demonstration and proving of wave energy converters (WEC)
- It consists of 8 km² sea area between 50 and 90 m depths were four static submarine cables will be placed, operating at 13kV and 5MW.
- Wave energy generation devices will be connected to these cables through dynamic submarine cables.
- In land, bimep will provide a research centre in Arminza town (Bizkaia, Basque Country, Northern Spain) were developers will be able to control the behavior and performance of the devices.

3. PROJECT SITE ENVIRONMENTAL CHARACTERIZATION

3.1 Physical Environment



3.1.1 Geology, geomorphology and sedimentology

2/3 of the occupation area of bimep is over sedimentary sediments or mixed rock-sand sediments with low organic content and high grain size with a good selection degree (see figure on the left). 1/3 of the occupation area of bimep is over rocky bed. Nearshore, there are two paleochanels filled with sand-gravel sediments.

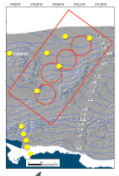
3.1.2 Tides: semidiurnal with a range between 4 and 1,5 m

3.1.3 Waves: the mean energy flux of waves is 21,4 kW/m coming from 50ºNW.

3.1.4 Currents: dominated by the wind, the mean speed of currents in water surface is about 10-20 cm·s⁻¹ with a NE-SW direction.

3.1.5 Hydrography: according to the Water Framework Directive requirements (Directive 2000/60/CEE), the physico-chemical status of the water bodies in the bimep area are in a very good status.

3.1.6 Landscape: all the shoreline near bimep is listed as an area of special interest from the point of view of marine landscape.



3.2 Biotic Environment

3.2.1 Benthos: according to the AZTI Biotic Index developed by AZTI, (http://ambi.azti.es/es/ambi/), the benthic communities in the samples taken in bimep (see figure on the left) are representatives of a community dominated by species sensible to the alteration.

3.2.1 Ichtyofauna: there are not specific data on the bimep area.

3.2.1 Marine birds: 3 are the main marine bird species in the bimep area: (a) European storm petrel (*Hydrobates pelagicus*); (b) European shag (*Phalacrocorax aristotelis*) and (c) Yellow-legged gull (*Larus michahellis*). Consequently, the bimep area has been proposed to be declared as an important Bird Area (IBA).

3.2.4 Marine mammals: the short-beaked common dolphin (*Delphinus delphis*) is a common specie in the bimep area.

3.2 Socioeconomic Environment

The main economic activity in the bimep area is the fishing activity of 11-14 small professional artisanal vessels which account for more than 14.000 kg of captures of more than 10 different species of small pelagic and bottom fishes.

Also, it´s significant the leisure fishing activity of more than 20 small vessels when meteorological conditions are suitable.

4. ENVIRONMENTAL IMPACTS

- Very significant impact;
- Significant impact;
- O Not significant impact;
- --- no relation

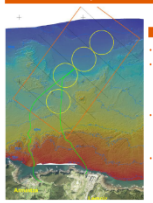
		Hydrodynamic	Water Quality	Sediments	Benthos	Ichthyofauna	Marine birds	Marine mammals	Fisheries	Cultural and archaeological values	Protected species and areas	Landscape	Socioeconomy
Installation	Consequence of energy extraction and physical presence of devices. Underwater sound, light, vibration and electromagnetic fields generated by the WECs and submarine cable during operation. Wildlife entanglement, entrapment and collision. Visual and landscape impacts. The presence of devices and their mooring system has the potential to interfere with vessels and other sea uses, e.g. fisheries, and also can lead to disturbance/destruction of seabed habitats. interference with designated conservation areas and protected species, of international, national and local significance.	---	O	●	●	●	O	●	●	O	O	O	●
Exploitation		●	O	●	●	●	O	●	●	O	O	●	●
Dismantling		---	O	●	●	●	O	●	●	O	O	O	●

5. IMPACT HYERARCHY

	Estructures			Submarine cables			Beach Man Hole			Power lines			Impact (%)	
	a	b	c	a	b	c	a	b	c	a	b	c		
PHYSIC ENVIRONMENT														
Sediments	1	3	1	1	1	1							33,30	
Water quality	1	1	1	1	1	1							25,00	29,17
Hydrodinamics	1	1	1	1	1	1							25,00	
Landscape	1	1	1	1		1	1	1	1	1	1	1	25,00	
BIOTIC ENVIRONMENT														
Benthos	2	3	2	2	2	2							54,10	
Ichthyofauna	2	2	2	2	2	2							50,00	54,30
Marine birds	2	2	2	2		2							50,00	
Marine mammals	3	2	2	3	2	3							62,50	
SOCIOECONOMIC ENVIRONMENT														
Fishing	3	3	3	1		1							50,00	
Socioeconomy	+	+	+	+	+	+	+	+	+	3	3	2	66,60	43,50
Archaeological underwater resources						1	1						25	
Protected areas and species	2	2	1	3									62,50	
IMPACT (%)	45,00	50,00	42,50	45,40	44,40	43,7	25	25	25	50	50	37,50		
	45,80			44,50			25			45,80				

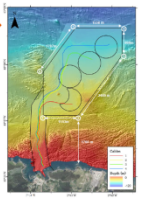
- The structures (WECs, moorings and mooring lines) produce a 45,8% of impact, specially during the operation phase.
- The submarine cable produce a 44,5% of impact, specially during installation and decommissioning.
- The biotic environment receive a 54,3% of impact, specially over marine mammals and benthic communities.
- The socioeconomic environment receive a 43,5% of impact, specially over the fishing activity.

6. PROTECTION, AMENDMENT AND COMPENSATING MEASURES



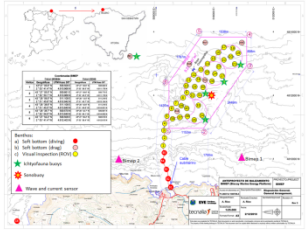
PROJECT MODIFICATION

- Project area: 8 km² → 5,3 km²
- Submarine cables route:
  - Avoid rocky bottom.
  - 100 m distance from some geologic structures.
- WEC moorage areas: one of the moorage area has been reshaped in order to avoid the impact over some geologic structures.
- Economic compensation to the fishing sector due to the competence of bimep with the same space of activity.



7. ENVIRONMENTAL MONITORING PLAN (EMP)

The Environmental Monitoring Plan focus on the monitoring of benthic communities (drag samples and visual inspections with ROV), ichtyofauna (active acoustics buoys), underwater sound and marine mammals (passive acoustic), hydrodinamics (wave and current profiler installation), archaeological resources (visual inspections with ROV), electromagnetic fields, marine birds (following of the results of the annual census made in the nesting colonies near bimep) and coastline landscape characterization.



8. CONCLUSIONS

- On the first of June 2009, the General Council on Environmental Quality Assessment of the Ministry of Rural, Marine and Natural Environment of the Spanish Government, on the light of the Environmental Impact Assessment (EIS) of the BIMEP project undertaken by AZTI-Tecnalia, decided to not submit the project to the whole Environmental Impact Assessment (EIA) process.
- In any case, the Environmental Impact Statement (EISt) of the Ministry, taking into account the great uncertainties about some predicted environmental impacts, underlined the need to implement the proposed Environmental Monitoring Program (EMP) of the EIS.

Acknowledgements

This work has been funded by the Basque Entity of Energy.

BILBAO MARINE ENERGY WEEK

The **Environmental Impact Study** of the Biscay Marine Energy Platform (BIMEP) project: http://www.bilbaomarinenergy.com/CMSPages/GetFile.aspx?guid=14c1f84c-b7a7-4dfc-9cb3-a356bd8647c6

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Exploitation		●	O	●	●	●	O	●	●	O	O	●	●
Dismantling		---	O	●	●	●	O	●	●	O	O	O	●

- Estudio de Impacto Ambiental
- PVA Preoperacional

The Biscay Marine Energy Platform (*BIMEP*) Preoperational Environmental Monitoring Plan

BILBAO MARINE ENERGY WEEK
Bilbao, 20-24 April 2015

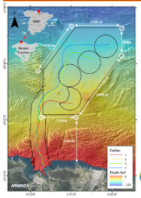
Juan Bald[1], Ibon Galparsoro[1], Manuel González[1], Carlos Hernández[1], Pedro Liria[1], Julien Mader[1], Iñigo Muxika[1], Idoia Adarraga[1], Igor Cruz[2], Mikel Markiegui[2], Julián Martínez[2], José María Ruiz[2], Yago Torre Enciso[3], Dorleta Marina[3]

[1]AZTI-Tecnalia. Marine Research Division. Pasaia (Gipuzkoa), Spain. *Corresponding author: jbald@azti.es
[2]Sociedad Cultural de Investigación Submarina (INSUB). Av. de Navarra, 0. 20013 Donostia (Gipuzkoa), Spain
[3]Ente Vasco de la Energía (EVE). Alameda de Urquijo, 36 - 1º. Edificio Plaza Bizkaia. 48011 Bilbao (Bizkaia), Spain.

1. INTRODUCTION

- On the first of june 2009, the General Council on Environmental Quality Assessment of **the Ministry of Rural, Marine and Natural Environment of the Spanish Government**, on the light of the **Environmental Impact Study (EIS)** of the **BIMEP project** (www.bimep.com) undertaken by **AZTI**, decided to **not submit** the project to the whole Environmental Impact Assessment (EIA) process.
- Anyway, the **Environmental Impact Statement (EIST)** of the Ministry, taking into account the great uncertainties about some predicted environmental impacts, underlined the **need to implement** the proposed **Environmental Monitoring Program (EMP)** of the EIS.
- Consequently, on August 29th of 2011, the **Basque Entity of Energy** (promotor of the BIMEP project) entrusted to **AZTI** the **development** of the **PREOPERATIONAL phase** of the EMP. This work present the methodology of this preoperational phase on some environmental factors such as, ichtiofauna, benthic communities, marine acoustics, mammals, and hydrodynamics.
- The objective is to establish the "zero state" of the environment in order to be able to compare this status during the construction and operational phase of BIMEP and then to see if real impacts match with the predicted ones

2. THE BIMEP PROJECT

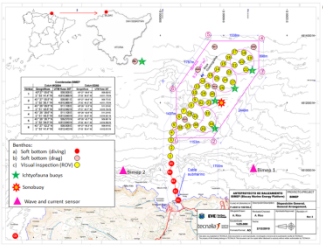


- Promoted by the **Basque Entity of Energy (EVE)**, BIMEP represents an **offshore test site** for the demonstration and proving of **wave energy converters (WEC)**
- It consists of 5,3 km² sea area between 50 and 90 m depths where four static submarine cables will be placed, operating at 13kV and 5MW.
- Wave energy generation devices will be connected to these cables through dynamic submarine cables.
- In land, BIMEP will provide a research centre in Arminza (Bizkaia, Basque Country, Northern Spain) where developers will be able to control the behavior and performance of the devices.

bimep

For this purpose a public society named **bimep S.A.** was created between the Basque Government and the Spanish Ministry of Industry

3. METHODOLOGY

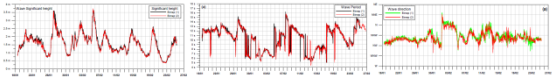


On the light of the expected impacts identified by the EIS of bimep, the EMP focus on the monitoring of:

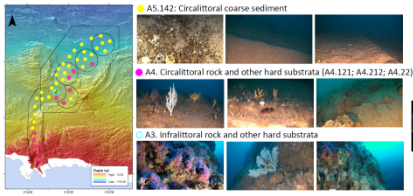
1. **Benthic communities:** (i) in situ sampling with a Shipeck grab sampler soft bottom sediments in five locations (4 samples inside the BIMEP area and one far beyond in order to act as control area) and by divers in five locations near the landing point of the submarine cable and (ii) visual inspection with a submarine camera in 36 points distributed all along the submarine cable route and the mooring areas.
2. **Ichtyofauna: Visual census**: (i) Line transects: five 200 m (surveyed 2.5 m each sided of the transect line) transect lines were placed along the tip of a "Isla de las lubinas" submarine mountain; (ii) Stationary methods: four sampling points at a 15 m depth were selected for visual inspection, one in the center of each of the four mooring areas of BIMEP. **Active acoustic methods**: five M3i buoys, developed by Marine Instruments (www.marineinstruments.es), were placed on the 6 of June 2012 in the area, one in each of the four mooring areas and one far enough from BIMEP area to act as control site.
3. **Underwater noise and marine mammals:** a sonobuoy was moored at 40 m depth. The sonobuoy is able to detect and classify automatically all the acoustic events above the ambient noise (presence of cetaceans and noise) and store the information. It was moored on the 6 of June 2012 and during 5 months the presence of marine mammals and underwater ambient noise was monitored.
4. **Hydrodinamics:** two Nortek profilers were installed, one in the shadow area of BIMEP, and the other one in a place far beyond from BIMEP in order to act as control area. Additionally, ADCP transects along all the BIMEP area were undertaken.
5. **Landscape:** The characterisation process of marine landscape was carried out in 4 stages: (i) defining each Landscape unit's area; (ii) defining each landscape unit's characteristics; (iii) defining activities, visibility and views and; (iv) presentation of landscape characterisation and base visual analysis

4. RESULTS

1. Hydrodinamics



2. Benthic communities: EUNIS Habitat Classification 2012



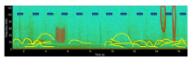
A5.142: Circalittoral coarse sediment
A4. Circalittoral rock and other hard substrata (A4.121; A4.212; A4.22)
A3. Infralittoral rock and other hard substrata

3. Archaeological resources: visual inspection with ROV and divers didn't detect any archaeological element in the bimep area. Most of the submarine archaeological elements in the Basque Country are restricted to the ports and estuaries.

4. Underwater sound

	Mean	Mode	Mediane	Max	Min
RMS 1/3 octave 63 kHz	90	88	89	147	77
RMS 1/3 octave 125 kHz	86	84	85	140	78
RMS in all the registered bandwith	112	110	111	159	99
SPL	137	137	136	178	120
RMS 5-20 kHz	84	94	94	130	84
RMS 20-80 kHz	93	91	92	142	86

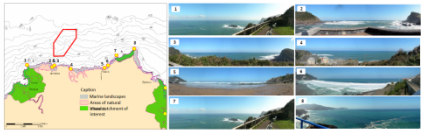
5. Marine mammals



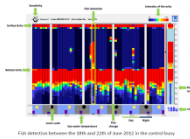
Documented presence of dolphins (*Delphinus delphis, Tursiops truncatus*) between june and october and misticetes between september and october

6. Landscape:

All the coastal landscape units have a high value. 8 view point have been identified and different photographic documents have been acquired in order to be able to undertake the visual simulations in the case that a prototype should be installed in bimep



3. Ichtyofauna:



Fish detection between the 10th and 22th of June 2012 in the control buoy

Number of fish detections 2012

	J	J	A	S	O	N	D
Buoy 1	46	94	102	93	72	45	21
Buoy 2	267	237	235	126	---	---	---
Buoy 3	170	121	---	---	35	---	---
Buoy 4	183	129	181	94	71	37	22
Control	113	93	95	---	---	---	---

Fish detections more abundant in summer and in the first 30 m of the water column.

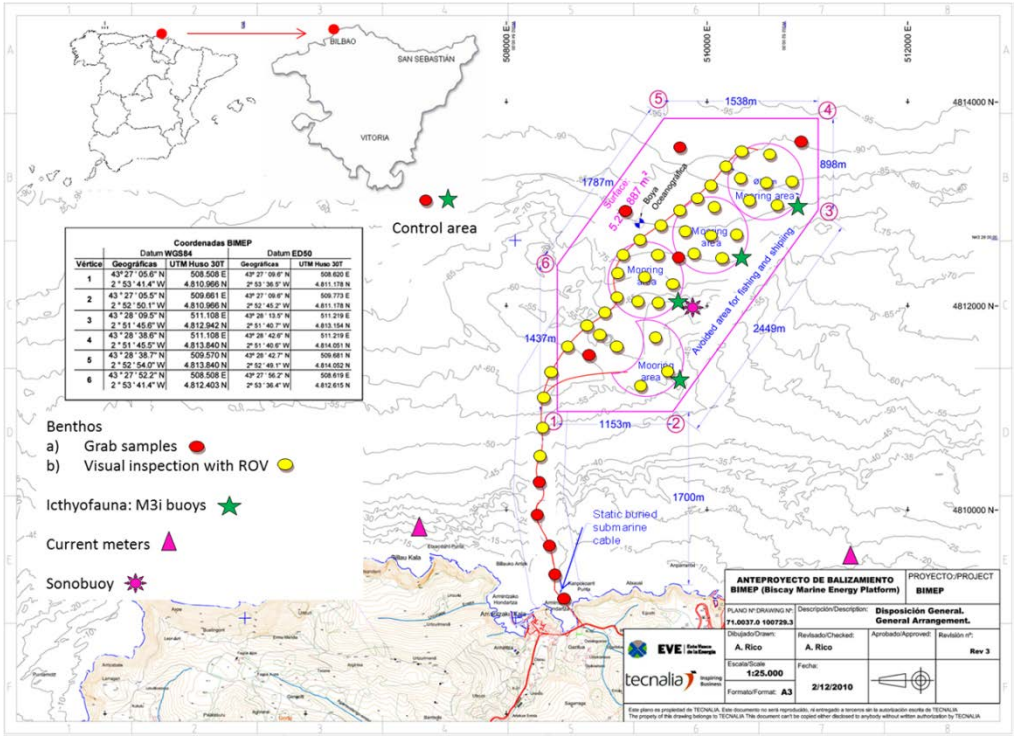
5. CONCLUSION

The characterization undertaken in the present work has allowed to collect sufficient and relevant information. This information will allow us to perform at further stages of the environmental monitoring plan (construction phase and operational) the identification, monitoring and evaluation of impacts predicted by the EIS of bimep.

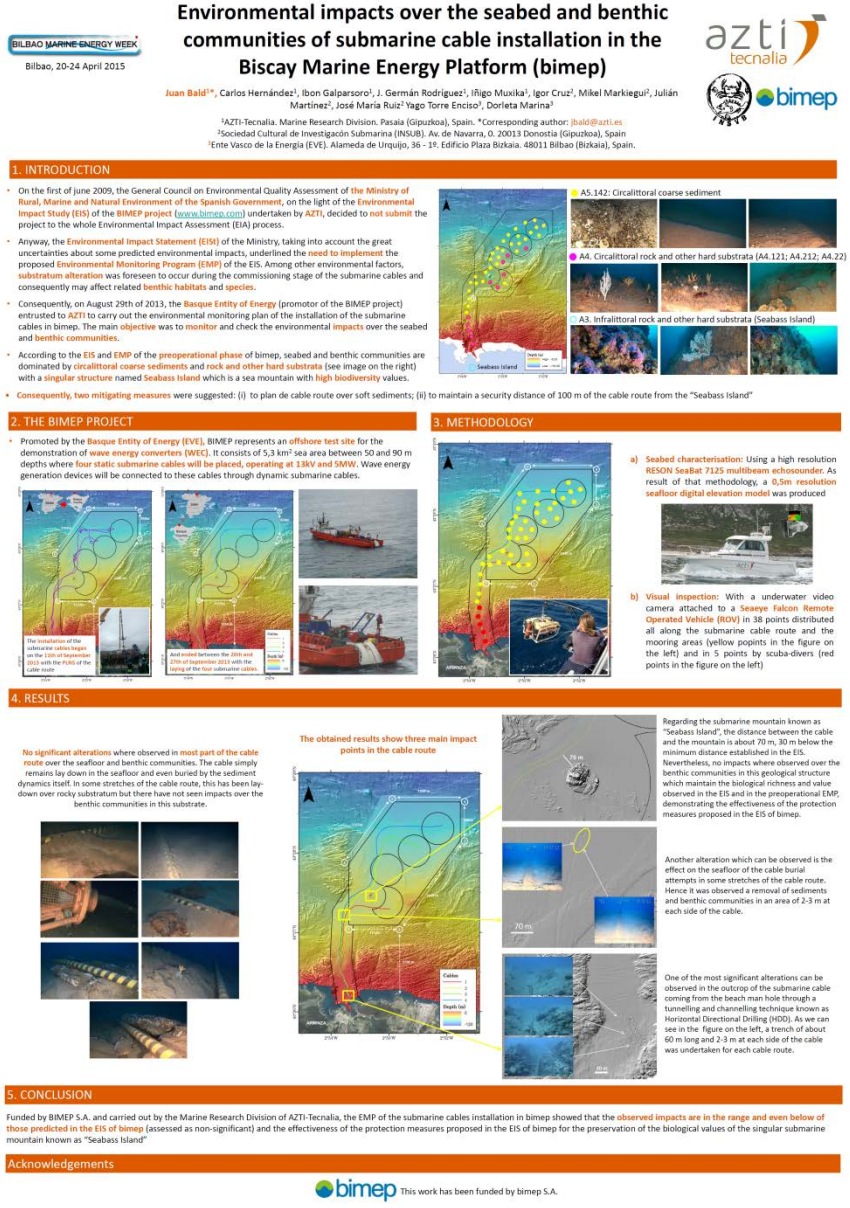
Acknowledgements

EVE Ente Vasco de la Energía
This work has been funded by the Basque Entity of Energy.

Environmental **Monitoring** Plan of the **pre-operational phase** of the BIMEP project: http://www.bilbaomarinenergy.com/CMSPages/GetFile.aspx?guid=07512b03-0214-4a38-94c0-be77e8183f51



- Estudio de Impacto Ambiental
- PVA Preoperacional
- PVA Fase Construcción
  - Bentos



Environmental impacts over the seabed and benthic communities of submarine cable installation in the Biscay Marine Energy Platform (bimep)

BILBAO MARINE ENERGY WEEK
Bilbao, 20-24 April 2015

Juan Bald[1*], Carlos Hernández[1], Ibon Galparsoro[1], J. Germán Rodríguez[1], Iñigo Muxika[1], Igor Cruz[2], Mikel Markiegui[2], Julián Martínez[2], José María Ruiz[2] Yago Torre Enciso[3], Dorleta Marina[3]

[1]AZTI-Tecnalia. Marine Research Division. Pasaia (Gipuzkoa), Spain. *Corresponding author: jbald@azti.es
[2]Sociedad Cultural de Investigación Submarina (INSUB). Av. de Navarra, 0. 20013 Donostia (Gipuzkoa), Spain
[3]Ente Vasco de la Energía (EVE). Alameda de Urquijo, 36 - 1º. Edificio Plaza Bizkaia. 48011 Bilbao (Bizkaia), Spain.

1. INTRODUCTION

- On the first of june 2009, the General Council on Environmental Quality Assessment of the Ministry of Rural, Marine and Natural Environment of the Spanish Government, on the light of the Environmental Impact Study (EIS) of the BIMEP project (www.bimep.com) undertaken by AZTI, decided to not submit the project to the whole Environmental Impact Assessment (EIA) process.
- Anyway, the Environmental Impact Statement (EIST) of the Ministry, taking into account the great uncertainties about some predicted environmental impacts, underlined the need to implement the proposed Environmental Monitoring Program (EMP) of the EIS. Among other environmental factors, substratum alteration was foreseen to occur during the commissioning stage of the submarine cables and consequently may affect related benthic habitats and species.
- Consequently, on August 29th of 2013, the Basque Entity of Energy (promotor of the BIMEP project) entrusted to AZTI to carry out the environmental monitoring plan of the installation of the submarine cables in bimep. The main objective was to monitor and check the environmental impacts over the seabed and benthic communities.
- According to the EIS and EMP of the preoperational phase of bimep, seabed and benthic communities are dominated by circalittoral coarse sediments and rock and other hard substrata (see image on the right) with a singular structure named Seabass Island which is a sea mountain with high biodiversity values.
- Consequently, two mitigating measures were suggested: (i) to plan de cable route over soft sediments; (ii) to maintain a security distance of 100 m of the cable route from the "Seabass Island"

A5.142: Circalittoral coarse sediment
A4. Circalittoral rock and other hard substrata (A4.121; A4.212; A4.22)
A3. Infralittoral rock and other hard substrata (Seabass Island)

2. THE BIMEP PROJECT

- Promoted by the Basque Entity of Energy (EVE), BIMEP represents an offshore test site for the demonstration of wave energy converters (WEC). It consists of 5,3 km² sea area between 50 and 90 m depths where four static submarine cables will be placed, operating at 13kV and 5MW. Wave energy generation devices will be connected to these cables through dynamic submarine cables.

3. METHODOLOGY

a) Seabed characterisation: Using a high resolution RESON SeaBat 7125 multibeam echosounder. As result of that methodology, a 0,5m resolution seafloor digital elevation model was produced

b) Visual inspection: With a underwater video camera attached to a Seaeye Falcon Remote Operated Vehicle (ROV) in 38 points distributed all along the submarine cable route and the mooring areas (yellow popints in the figure on the left) and in 5 points by scuba-divers (red points in the figure on the left)

4. RESULTS

No significant alterations where observed in most part of the cable route over the seafloor and benthic communities. The cable simply remains lay down in the seafloor and even buried by the sediment dynamics itself. In some stretches of the cable route, this has been lay-down over rocky substratum but there have not seen impacts over the benthic communities in this substrate.

The obtained results show three main impact points in the cable route

Regarding the submarine mountain known as "Seabass Island", the distance between the cable and the mountain is about 70 m, 30 m below the minimum distance established in the EIS. Nevertheless, no impacts where observed over the benthic communities in this geological structure which maintain the biological richness and value observed in the EIS and in the preoperational EMP, demonstrating the effectiveness of the protection measures proposed in the EIS of bimep.

Another alteration which can be observed is the effect on the seafloor of the cable burial attempts in some stretches of the cable route. Hence it was observed a removal of sediments and benthic communities in an area of 2-3 m at each side of the cable.

One of the most significant alterations can be observed in the outcrop of the submarine cable coming from the beach man hole through a tunnelling and channelling technique known as Horizontal Directional Drilling (HDD). As we can see in the figure on the left, a trench of about 60 m long and 2-3 m at each side of the cable was undertaken for each cable route.

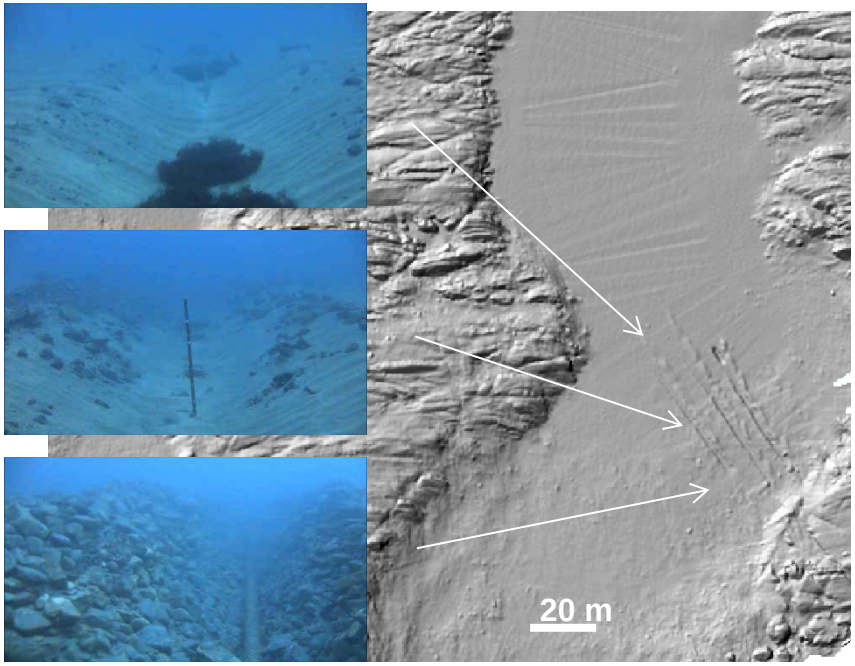
5. CONCLUSION

Funded by BIMEP S.A. and carried out by the Marine Research Division of AZTI-Tecnalia, the EMP of the submarine cables installation in bimep showed that the observed impacts are in the range and even below of those predicted in the EIS of bimep (assessed as non-significant) and the effectiveness of the protection measures proposed in the EIS of bimep for the preservation of the biological values of the singular submarine mountain known as "Seabass Island"

Acknowledgements

bimep This work has been funded by bimep S.A.

Environmental **impacts** over the **seabed** and **benthic communities** of submarine cable installation in the Biscay Marine Energy Platform (BIMEP): http://www.bilbaomarinenergy.com/CMSPages/GetFile.aspx?guid=812d5ab8-993b-4791-a088-d00f63eb7ac2



- Estudio de Impacto Ambiental
- PVA Preoperacional
- PVA Fase Construcción
  - Bentos
  - Ichtyofauna

Environmental **impacts** over **fish communities** of submarine **cable installation** in the Biscay Marine Energy Platform (BIMEP):

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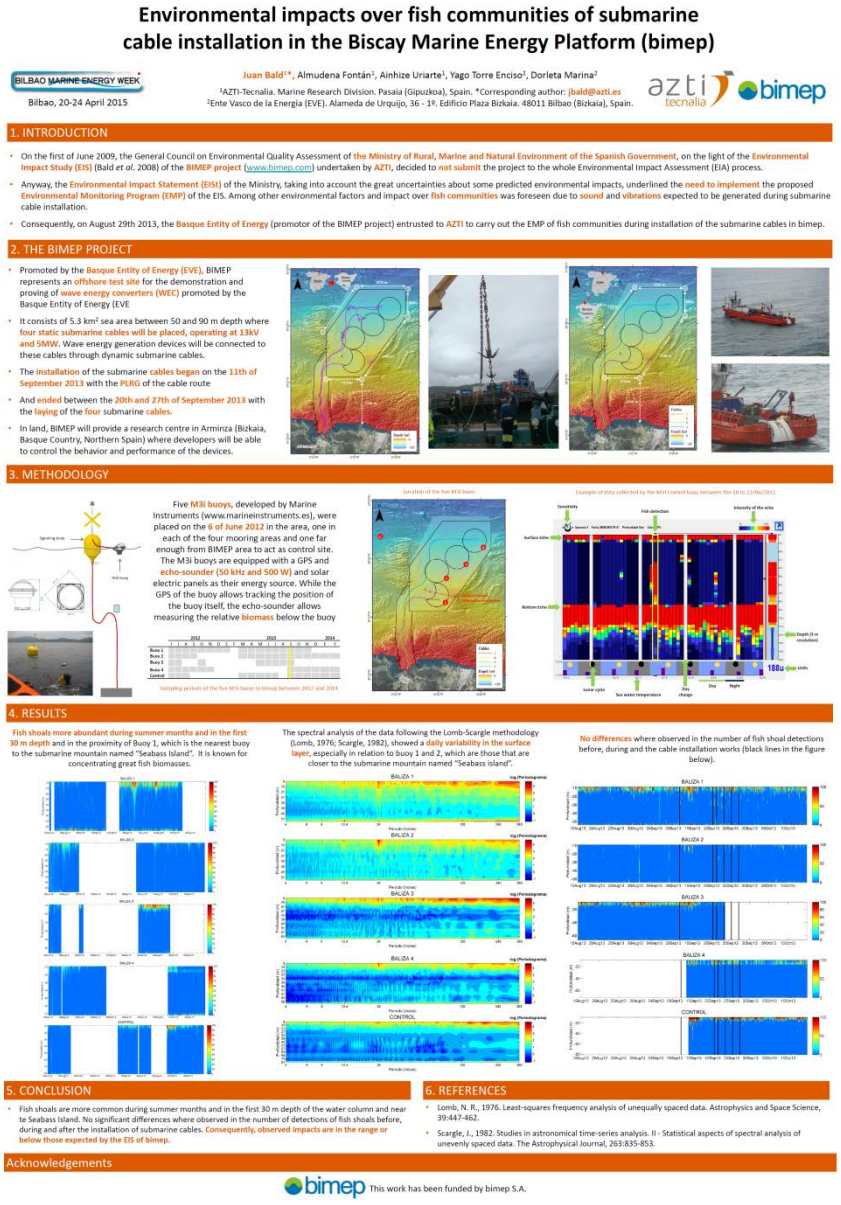

Environmental impacts over fish communities of submarine cable installation in the Biscay Marine Energy Platform (bimep)

BILBAO MARINE ENERGY WEEK
Bilbao, 20-24 April 2015

Juan Bald[1*], Almudena Fontán[1], Ainhize Uriarte[1], Yago Torre Enciso[2], Dorleta Marina[2]
[1]AZTI-Tecnalia. Marine Research Division. Pasaia (Gipuzkoa), Spain. *Corresponding author: jbald@azti.es
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azti tecnalia bimep

1. INTRODUCTION

- On the first of June 2009, the General Council on Environmental Quality Assessment of the Ministry of Rural, Marine and Natural Environment of the Spanish Government, on the light of the Environmental Impact Study (EIS) (Bald *et al.* 2008) of the BIMEP project (www.bimep.com) undertaken by AZTI, decided to not submit the project to the whole Environmental Impact Assessment (EIA) process.
- Anyway, the Environmental Impact Statement (EISt) of the Ministry, taking into account the great uncertainties about some predicted environmental impacts, underlined the need to implement the proposed Environmental Monitoring Program (EMP) of the EIS. Among other environmental factors and impact over fish communities was foreseen due to sound and vibrations expected to be generated during submarine cable installation.
- Consequently, on August 29th 2013, the Basque Entity of Energy (promotor of the BIMEP project) entrusted to AZTI to carry out the EMP of fish communities during installation of the submarine cables in bimep.

2. THE BIMEP PROJECT

- Promoted by the Basque Entity of Energy (EVE), BIMEP represents an offshore test site for the demonstration and proving of wave energy converters (WEC) promoted by the Basque Entity of Energy (EVE
- It consists of 5.3 km² sea area between 50 and 90 m depth where four static submarine cables will be placed, operating at 13kV and 5MW. Wave energy generation devices will be connected to these cables through dynamic submarine cables.
- The installation of the submarine cables began on the 11th of September 2013 with the PLRG of the cable route
- And ended between the 20th and 27th of September 2013 with the laying of the four submarine cables.
- In land, BIMEP will provide a research centre in Arminza (Bizkaia, Basque Country, Northern Spain) where developers will be able to control the behavior and performance of the devices.

3. METHODOLOGY

Five M3i buoys, developed by Marine Instruments (www.marineinstruments.es), were placed on the 6 of June 2012 in the area, one in each of the four mooring areas and one far enough from BIMEP area to act as control site. The M3i buoys are equipped with a GPS and echo-sounder (50 kHz and 500 W) and solar electric panels as their energy source. While the GPS of the buoy allows tracking the position of the buoy itself, the echo-sounder allows measuring the relative biomass below the buoy

4. RESULTS

Fish shoals more abundant during summer months and in the first 30 m depth and in the proximity of Buoy 1, which is the nearest buoy to the submarine mountain named "Seabass Island". It is known for concentrating great fish biomasses.

The spectral analysis of the data following the Lomb-Scargle methodology (Lomb, 1976; Scargle, 1982), showed a daily variability in the surface layer, especially in relation to buoy 1 and 2, which are those that are closer to the submarine mountain named "Seabass Island".

No differences where observed in the number of fish shoal detections before, during and the cable installation works (black lines in the figure below).

5. CONCLUSION

- Fish shoals are more common during summer months and in the first 30 m depth of the water column and near te Seabass Island. No significant differences where observed in the number of detections of fish shoals before, during and after the installation of submarine cables. Consequently, observed impacts are in the range or below those expected by the EIS of bimep.

6. REFERENCES

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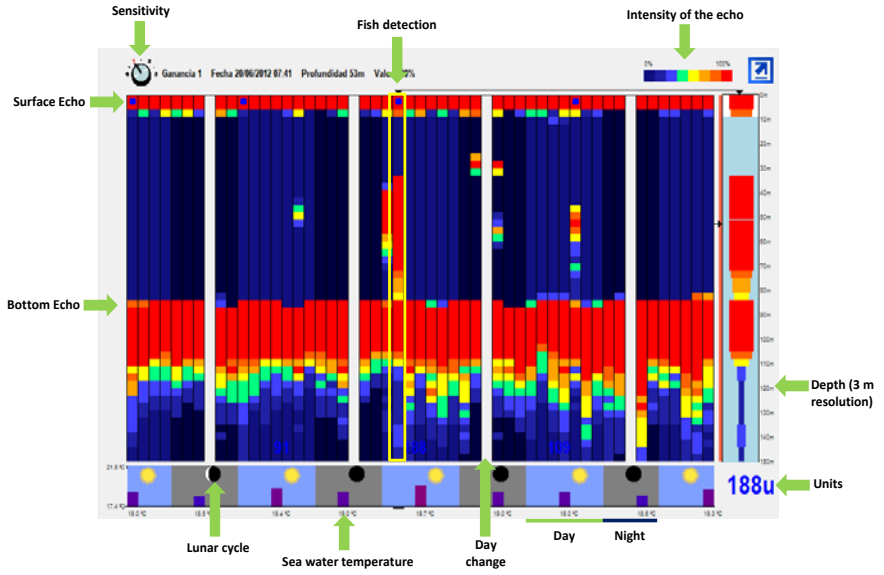
- Scargle, J., 1982. Studies in astronomical time-series analysis. II - Statistical aspects of spectral analysis of unevenly spaced data. The Astrophysical Journal, 263:835-853.

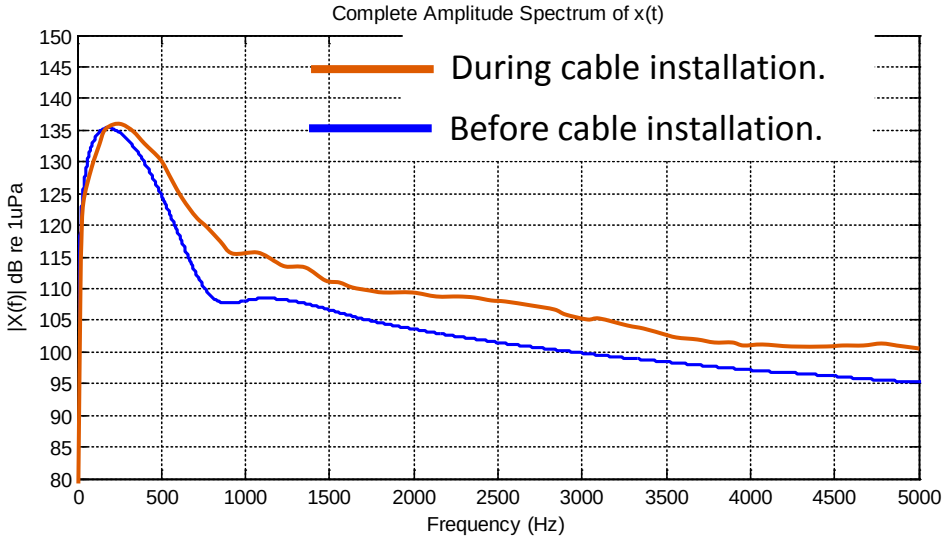
Acknowledgements

bimep This work has been funded by bimep S.A.



- Estudio de Impacto Ambiental
- PVA Preoperacional
- PVA Fase Construcción
  - Bentos
  - Ichtyofauna
  - Ruido submarino

Acoustic characterization of **submarine cable installation** in the Biscay Marine Energy Platform (BIMEP): http://www.bilbaomarinenergy.com/CMSPages/GetFile.aspx?guid=875321e6-e46b-4db3-ae25-42b84833f448



Acoustic characterization of submarine cable installation in the Biscay Marine Energy Platform (bimep)

Bilbao, 20-24 April 2015

Juan Bald[1]*, Carlos Hernández[1], Ainhize Uriarte[1], Juan Antonio Castillo[2], Pablo Ruiz[2], Noelia Ortega[2], Yago Torre Enciso[3], Dorleta Marina[3]

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1. INTRODUCTION

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- Anyway, the Environmental Impact Statement (EIST) of the Ministry, taking into account the great uncertainties about some predicted environmental impacts, underlined the need to implement the proposed Environmental Monitoring Program (EMP) of the EIS. Among other environmental factors, an increase in noise from shipping activity would be expected during installation of submarine cables and consequently may affect marine mammal communities.
- Consequently, on August 29th of 2013, the Basque Entity of Energy (promotor of the BIMEP project) entrusted to AZTI to carry out the acoustic EMP of the installation of the submarine cables, which consist on an acoustic characterization of: (i) sound background levels; (ii) cable installation operations; and (iii) a propagation of the measured cable installation sound.

2. THE BIMEP PROJECT

- Promoted by the Basque Entity of Energy (EVE), BIMEP represents an offshore test site for the demonstration and proving of wave energy converters (WEC) promoted by the Basque Entity of Energy (EVE
- It consists of 5,3 km² sea area between 50 and 90 m depths where four static submarine cables will be placed, operating at 13kV and 5MW. Wave energy generation devices will be connected to these cables through dynamic submarine cables.
- The installation of the submarine cables began on the 11th of September 2013 with the PLRG of the cable route
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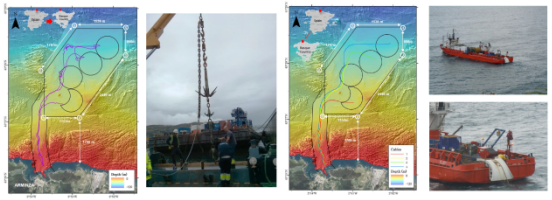
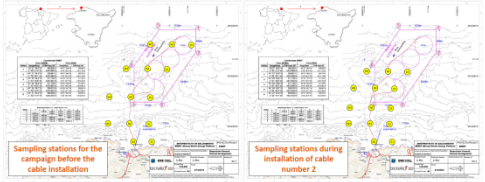


3. METHODOLOGY

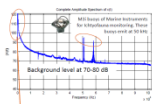
1. Sampling campaign: Two sampling campaigns where undertaken: (i) the first one was done prior to the installation of the cables. The objective of this campaign was the establishment of the baseline noise levels in bimep; (ii) the second one was done during the installation of cable number 2.

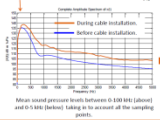
The sampling campaign was done with an icListen HF 200 kHz hydrophone of Ocean Sonics (http://oceansonics.com/). In each campaign 5 minutes measurements at 10 m depth where done in 15 sampling points all along the cable route.

2. Sound propagation: according to the obtained results a propagation of the sound in the bimep area was done by means of Bellhop and Ram models.



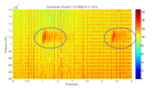
4. RESULTS: sound levels and propagation





Mean sound pressure levels between 0-100 kHz (above) and 0-5 kHz (below) taking in to account all the sampling points

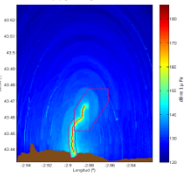
- Sound background levels between 70-80 dB
- During cable installation an increase of the average sound can be observed in low frequencies: 140 dB in 11 kHz, about 30 dB above the background level in this frequency.



Sound spectrogram between 0 – 15 kHz in N2 during cable installation.

Taking into account the characteristics of the sound measured in the sampling points (view precedent paragraph), and the transmission looses of the sound in the field, the intensity in the source (cable vessel) of the sound was modelled.

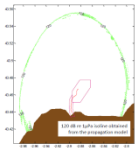
	Measured sound (dB re 1µPa)	Source Level (dB re 1µPa @ 1m)
N1	134.0	180.8
N2	142.0	192.0
N3	139.0	191.5
N4	133.0	185.0
N5	148.0	201.6
E4	128.0	184.3
E5	127.4	184.4



5. DISCUSSION

- During cable installation, an impulsive sound average of 188,5 dB re 1µPa at 11 kHz has been isolated.
- Taking into account the marine mammal noise exposure criteria stablished by Southall *et al.* (2007) (table below): (i) injury levels of 190 db where not achieved; (ii) levels between 174-180 dB where achieved 10-15 m from the source and (iii) levels of 120 dB have a widespread distribution from the source affecting an area of 400 km² (see figure on the right)

Exposure limit	Effect
190 dB re. 1µPa (RMS)	Auditory injury criteria – pinnipeds
180 dB re. 1µPa (RMS)	Auditory injury criteria – cetaceans
174 dB re. 1µPa (Peak)	Aversive behavioural reaction in harbour porpoise
120 re. 1µPa (RMS)	Level B - Harassment in cetaceans and pinnipeds exposed to continuous sounds



- Taking into account (i) the installation date (in december and far from the breeding season) and (ii) the temporality of the impact (7 days of intermitent installation works), it´s expected that the impacts over marine mammals have been below the impacts expected in the EIS of bimep (Bald *et al.* 2008).

6. CONCLUSION

- During cable installation, an impulsive sound average of 188,5 dB re 1µPa at 11 kHz has been isolated.
- Taking into account the source of the sound measured, the acoustic impact thresold for marine mammals in the bibliography, the installation date (in december and far from the breeding season) and the temporality of the impact (7 days of intermitent installation works), it´s expected that the impacts over marine mammals have been below the impacts expected in the EIS of bimep.

7. REFERENCES

- Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, G. R.L., J. C. R. Greene, D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas y P. L. Tyack, 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals, 33:411-521
- Bald, J., A. Borja, A. D. Campo, J. Franco, I. Muxika, J. G. Rodríguez, O. Solaun, A. Uriarte y L. Zubiate, 2008a. Estudio de Impacto Ambiental del Proyecto Biscay Marine Energy Platform (bimep). Informe para el Ente Vasco de la Energía (EVE). AZTI-Tecnalia. 364 pp.

Acknowledgements

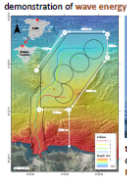
This work has been funded by bimep S.A.

Impact on seabirds of new offshore wind energy test and demonstration projects in the Biscay Marine Energy Platform (BiMEP, N. Spain)

Juan Bald[1], Javier Franco[1], Iratxe Menchaca[1], Yago Torre Enciso[2], Dorleta Marina[2]
[1]AZTI. Marine Research Division. Pasaia (Gipuzkoa), Spain. *Corresponding author: jbald@azti.es
[2]BiMEP, S.A. c/Atalaia, nº2, 48620 Armintza (Bizkaia), Spain.

1. Introduction and objectives

Promoted by the Basque Energy Board (EVE), BiMEP represents an offshore test site for the demonstration of wave energy converters (WEC) in Armintza (Bizkaia, Basque Country, Northern Spain).



Recent developments have promoted the interest of BiMEP facilities for the testing and demonstration of offshore wind developments as well, allowing the installation of a maximum of 2 offshore floating wind mills of 5 MW each (physical dimensions showed in the picture on the left). Consequently, new and different environmental impacts from the original projects are expected. Among others, an impact over seabirds was foreseen taking into account that BiMEP project is inside an Special Protection Area (SPA) for birds declared under the Birds Directive (Directive 2009/147/EC), the ES0000490 Mundaka-Cabo de Ogoño Special Bird Protection Area.

The ES0000490 Mundaka-Cabo de Ogoño SPA encompass an area of 175 km² all along 30 km of coastline. It was declared in 2014 for the protection of a total number of 27 seabird species. Five of them are considered as key species (due to their endangered conservation status and their representativeness) for the SPA. These species are the following:

The main objective of this work is to assess the impact on seabirds protected under the ES0000490 Mundaka-Cabo de Ogoño SPA of the new offshore wind energy demonstration projects in BiMEP

3. Methodology

As wide-ranging, long-lived birds with delayed sexual maturity and low annual productivity, many species of seabirds and coastal waters birds are potentially at risk to impacts from offshore wind. The main risks are from fatal collision with blades; displacement from the wind farm area due to disturbance; barrier effects; and habitat loss. Based on the methodology developed by Bradbury *et al.* (2014) a sensitivity index to collision and to displacement was calculated for each of the 27 species of the ES0000490 Mundaka-Cabo de Ogoño SPA.

Conservation index (CI) = a+b+c+d
Collision risk index (CRI)= (e*(f+g+h)/3)*CI)
Displacement risk Index (DRI)= ((i*j)*(CI))/10

Where:

a = a percentage of the biogeographic population that occurs in Basque country waters during any particular season (taking into account turnover of individual birds)
b = adult survival rate
c = threat status in Spanish protection laws
d = status in relation to the Birds Directive
e = estimated percentage at blade height
f = flight manoeuvrability
g = percentage of time spent flying
h = nocturnal activity
i = disturbance susceptibility
j = habitat specialization

Scores: 1 = low and 5 = high (% of the biogeographic population that occurs in Basque country; survival rate; threat status; manoeuvrability; % of time spent flying, etc)

The expected impacts over seabird communities were evaluated taking into account the values of these sensitivity indexes together with the specific characteristics of the project (number of devices, dimensions, distance to the main resting communities of seabirds in the shore, etc.) for the installation and operational stages of the project according to the requirements of the EIA Spanish law.

4. Impact assessment on seabirds

- Installation and decommissioning: during installation and decommissioning stage some disturbances can be expected due to noises produced during installation, vessel traffic, etc. Only the Shag (*Phalacrocorax aristotelis*) presents a moderate risk of being disturbed during this phase of the project (see table below). Taking into account that the number of windmills is only of 2 devices, it is expected that the installations works wont last more than 10-12 days and thus the impact associated to displacement-disturbance is expected to be Moderate.
- Operation: during the operation stage only the Northern gannet (*Morus bassanus*) present a high risk of collision (see table below) and the Shag a moderate risk of displacement. Taking into account the number of windmills (2 devices)and the distance to the main breeding birds colonies in the shore (more than 2 km), the impact of the project during the operation stage it is expected to be Moderate.

Displacement Risk index:

Especie	a	b	c	d	CI	e	f	g	h	i	j	DRI	Risk
Red-throated diver (Gavia stellata)	1	3	3	5	12	5	5	2	1	5	4	24	High
Great northern diver (Gavia immer)	1	4	4	5	14	5	5	2	1	5	3	21	High
Common scoter (Melanitta nigra)	2	2	1	3	7	3	3	2	1	5	4	14	Moderate
Common guillemot (Uria aalge)	1	5	3	5	14	1	4	1	1	3	3	13	Moderate
Storm petrel (Hydrobates pelagicus)	1	5	3	3	12	1	3	3	3	3	3	13	Moderate
Razorbill (Alca torda)	1	5	3	3	12	0,5	4	1	1	3	3	11	Moderate
Little tern (Sterna albifrons)	1	4	3	5	13	10	1	5	1	2	4	10	Moderate
Red-breasted Merganser (Mergus serrator)	1	3	1	3	8	5	4	2	2	3	4	10	Moderate
Black tern (Chlidonias niger)	1	4	3	5	13	10	1	5	1	2	3	9	Low
Sandwich tern (Sterna sandvicensis)	1	4	3	5	13	10	1	5	1	2	3	8	Low
Common tern (Sterna hirundo)	1	4	3	5	13	10	1	5	1	2	3	8	Low
Arctic tern (Sterna paradisaea)	1	4	3	5	13	5	1	5	1	2	3	8	Low
Mediterranean gull (Larus melanocephalus)	1	3	3	5	12	25	1	2	1	2	2	3	Very low
Black-legged kittiwake (Rissa tridactyla)	1	3	4	3	11	15	1	3	3	2	2	4	Very low
Great black-backed gull (Larus marinus)	1	5	1	3	10	35	2	2	3	2	2	4	Very low
Black-headed gull (Larus ridibundus)	1	3	1	3	8	20	1	1	2	2	2	3	Very low
Northern gannet (Morus bassanus)	1	3	3	3	10	10	5	1	4	1	1	2	Very low
Lesser black-backed gull (Larus fuscus)	1	5	3	3	12	30	1	2	3	2	1	2	Very low
Yellow-legged gull (Larus michahellis)	2	5	1	3	11	30	1	2	3	2	1	2	Very low
Great skua (Stercorarius skua)	2	4	1	3	10	10	1	4	1	1	2	2	Very low
Balearic shearwater (Puffinus mauretanicus)	4	4	5	5	18	0	3	3	3	3	1	2	Very low
Cory's shearwater (Calonectris diodemea)	1	5	5	5	16	0	3	3	3	1	1	2	Very low
Pomarine skua (Stercorarius pomarinus)	1	4	1	1	7	10	1	5	1	1	2	1	Very low
European Storm-petrel (Hydrobates pelagicus)	1	5	3	3	12	1	3	3	3	3	1	1	Very low
Manx shearwater (Puffinus puffinus)	1	5	5	3	14	0	3	3	3	1	1	1	Very low
Arctic skua (Stercorarius parasiticus)	1	5	1	1	8	10	1	5	1	1	2	1	Very low
Scotty shearwater (Puffinus griseus)	1	5	3	3	12	0	3	3	3	1	1	1	Very low
Great shearwater (Puffinus gravis)	1	5	3	1	10	0	3	3	1	1	1	1	Very low

Collision risk index:

Especie	a	b	c	d	CI	e	f	g	h	i	j	CRI	Risk
Great black-backed gull (Larus marinus)	1	5	1	3	10	35	2	2	3	2	2	817	High
Lesser black-backed gull (Larus fuscus)	1	5	3	3	12	30	1	2	3	2	1	720	High
Yellow-legged gull (Larus michahellis)	2	5	1	3	11	30	1	2	3	2	1	660	High
Mediterranean gull (Larus melanocephalus)	1	3	3	5	12	25	1	2	1	2	2	500	High
Northern gannet (Morus bassanus)	1	3	3	3	10	10	5	1	4	1	1	200	Moderate
Black-legged kittiwake (Rissa tridactyla)	1	3	4	3	11	15	1	3	3	2	2	165	Moderate
Sandwich tern (Sterna sandvicensis)	1	4	3	5	13	10	1	5	1	2	3	305	Moderate
Little tern (Sterna albifrons)	1	4	3	5	13	10	1	5	1	2	4	303	Moderate
Common tern (Sterna hirundo)	1	4	3	5	13	10	1	5	1	2	3	303	Moderate
Black tern (Chlidonias niger)	1	4	3	5	13	10	1	4	1	2	3	300	Moderate
Black-headed gull (Larus ridibundus)	1	3	1	3	8	20	1	1	2	2	2	213	Moderate
Great skua (Stercorarius skua)	2	4	1	3	10	10	1	4	1	1	2	200	Moderate
Storm petrel (Hydrobates pelagicus)	1	5	3	3	12	1	3	3	3	3	3	13	Low
Great northern diver (Gavia immer)	1	4	4	5	14	5	5	2	1	5	3	167	Low
Pomarine skua (Stercorarius pomarinus)	1	4	1	1	7	10	1	5	1	1	2	163	Low
Red-throated diver (Gavia stellata)	1	3	3	5	12	5	5	2	1	5	4	160	Low
Arctic tern (Sterna paradisaea)	1	4	3	5	13	5	1	5	1	2	3	152	Low
Arctic skua (Stercorarius parasiticus)	1	5	1	1	8	10	1	5	1	1	2	140	Low
Red-breasted merganser(Mergus serrator)	1	3	1	3	8	5	4	2	2	3	4	107	Low
European Storm-petrel (Hydrobates pelagicus)	1	5	3	3	12	1	3	3	3	3	3	13	Low
Common scoter (Melanitta nigra)	1	2	1	3	7	3	3	2	3	5	4	56	Low
Common guillemot (Uria aalge)	1	5	3	5	14	1	4	1	2	3	3	33	Very low
Razorbill (Alca torda)	1	5	3	3	12	0,5	4	1	1	3	3	12	Very low
Balearic shearwater (Puffinus mauretanicus)	4	4	5	5	18	0	3	3	3	3	3	2	Very low
Great shearwater (Puffinus gravis)	1	5	3	1	10	0	3	3	1	1	1	1	Very low
Manx shearwater (Puffinus puffinus)	1	5	5	3	14	0	3	3	3	1	1	1	Very low
Scotty shearwater (Puffinus griseus)	1	5	3	3	12	0	3	3	3	1	1	1	Very low
Cory's shearwater(Calonectris diodemea)	1	5	5	5	16	0	3	3	3	1	1	0	Very low

5. Prevention measures and Environmental Monitoring Plan (EMP)

Even if no significant impacts were foreseen and consequently, according to the EIA Spanish law no protection or amendment measures are required and the implementation of a EMP is not mandatory, taking into account the values of the ES0000490 Mundaka-Cabo de Ogoño SPA, five monitoring tasks were suggested:

1) Compile and assess the data of breeding seabirds monitored by the regional government every year.

2) Biweekly monitoring of seabirds in BiMEP in the three stages of the project (preoperational, operational and decommisioning).

3) Installation of nanotransmitters during ringing campaigns of the European storm-petrel in the Basque Country

3) 4) Monitoring of dead birds in the surrounding of wind mills in the operational stage

5) Installation of a DTBird ® System for Bird Monitoring and/or Mortality Mitigation at On&Offshore Wind Turbines (www.dtbird.com). In operating Wind Farms, DTBird® System includes specific modules that take automatic actions to reduce the collision risk of birds with the WTGs: DTBird® Collision Avoidance Module, and DTBird® Stop Control Module. In addition, DTBird® Collision Control registers bird collisions.

a) DTBird® Collision Avoidance Module: This module automatically emits warning sounds at birds flying in potential collision risk and discouraging sounds for birds flying in the high collision risk area. Adjustable to target species, wind turbine dimensions and local sound regulations. No energy production loss and useful for all bird species.

b) DTBird® Stop Control Module: automatic wind turbine stop and restart according to real-time bird collision risk evaluation. Adjustable to target species/groups.

c) DTBird® Collision Control Module: HD cameras survey 360º around the Wind Turbine, detecting birds in real-time while storing videos and data. Potential and accidental bird collisions can be recorded and checked in videos with sound through Online access

6. Conclusions

1. No significant environmental impacts over seabirds protected under the ES0000490 Mundaka-Cabo de Ogoño SPA are expected in relation with the new offshore wind developments in BiMEP.
2. However, a strict and ambitious environmental monitoring plan has been suggested in order to detect any potential unexpected impact and, consequently, to implement the corresponding management measures.

Acknowledgements

This work has been funded by BiMEP, S.A.

- Estudio de Impacto Ambiental
- PVA Preoperacional
- PVA Fase Construcción
- Estudio de Impacto Ambiental Eólica Offshore

Impact of BIMEP on seabirds:

http://www.bilbaomarinenergy.com/CMSPages/GetFile.aspx?guid=875321e6-e46b-4db3-ae25-42b84833f448

The ES0000490 Mundaka-Cabo de Ogoño SPA encompass an area of 175 km² all along 30 km of coastline. It was declared in 2014 for the protection of a total number of 27 seabird species. Five of them are considered as key species (due to their endangered conservation status and their representativeness) for the SPA. These species are the following:

Acoustic characterization of Mutriku OWC Plant

Juan Bald[1], Ainhize Uriarte[1], Pablo Ruiz[1],Pablo Cervantes[2], Noelia Ortega[2]
[1]AZTI. Marine Research Division. Pasaia (Gipuzkoa), Spain. *Corresponding author: jbald@azti.es
[2]Centro Tecnológico Naval y del Mar (CTN). Ctra. El Estrecho-Lobosillo, km. 2. CP: 30320 Fuente Álamo (Murcia)

1. Introduction

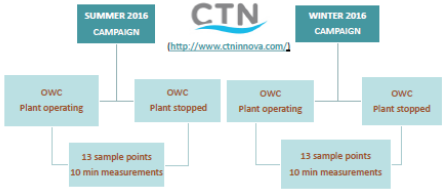
The Mutriku Oscillating Water Column (OWC) Plant is an onshore infrastructure for wave energy harnessing promoted by the Basque Entity of Energy (Ente Vasco de la Energía, EVE). The facility is housed within a breakwater at the port of Mutriku (Basque Country, Northern Spain) and opened in July 2011. 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 (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 $\mu Pa^2.s$) or as peak sound pressure level (in dBre 1μPa_{peak}) at one metre, measured over the frequency band 10 Hz to 10 kHz.

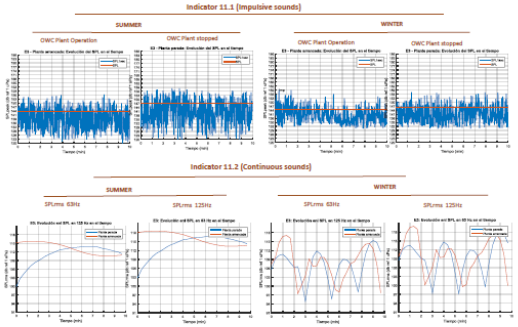
Descriptor 11.2 Continuous low frequency sound

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

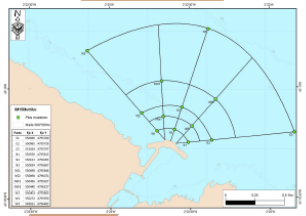
The results obtained with both indicators didn't show any evidence of impulsive neither continuous sound emission coming form the OWC Plant of Mutriku.

The graphic representation of some of the results shown below:



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.



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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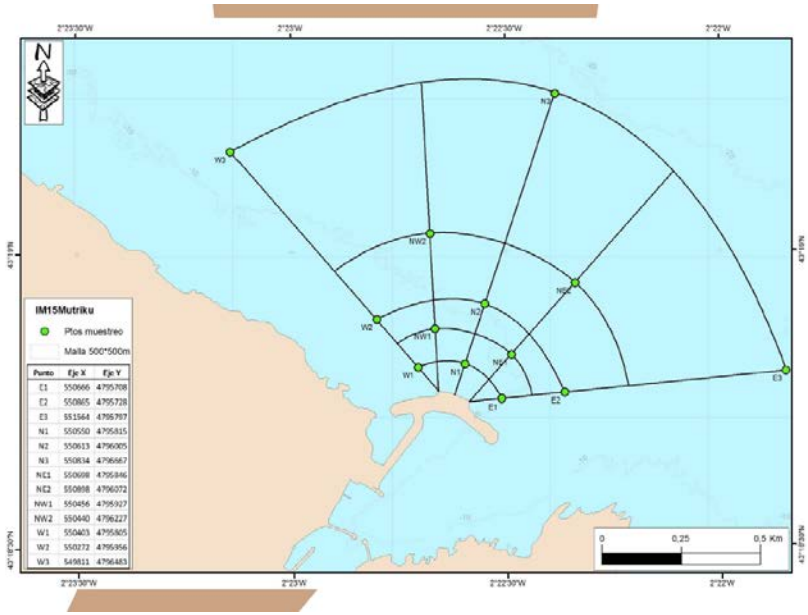
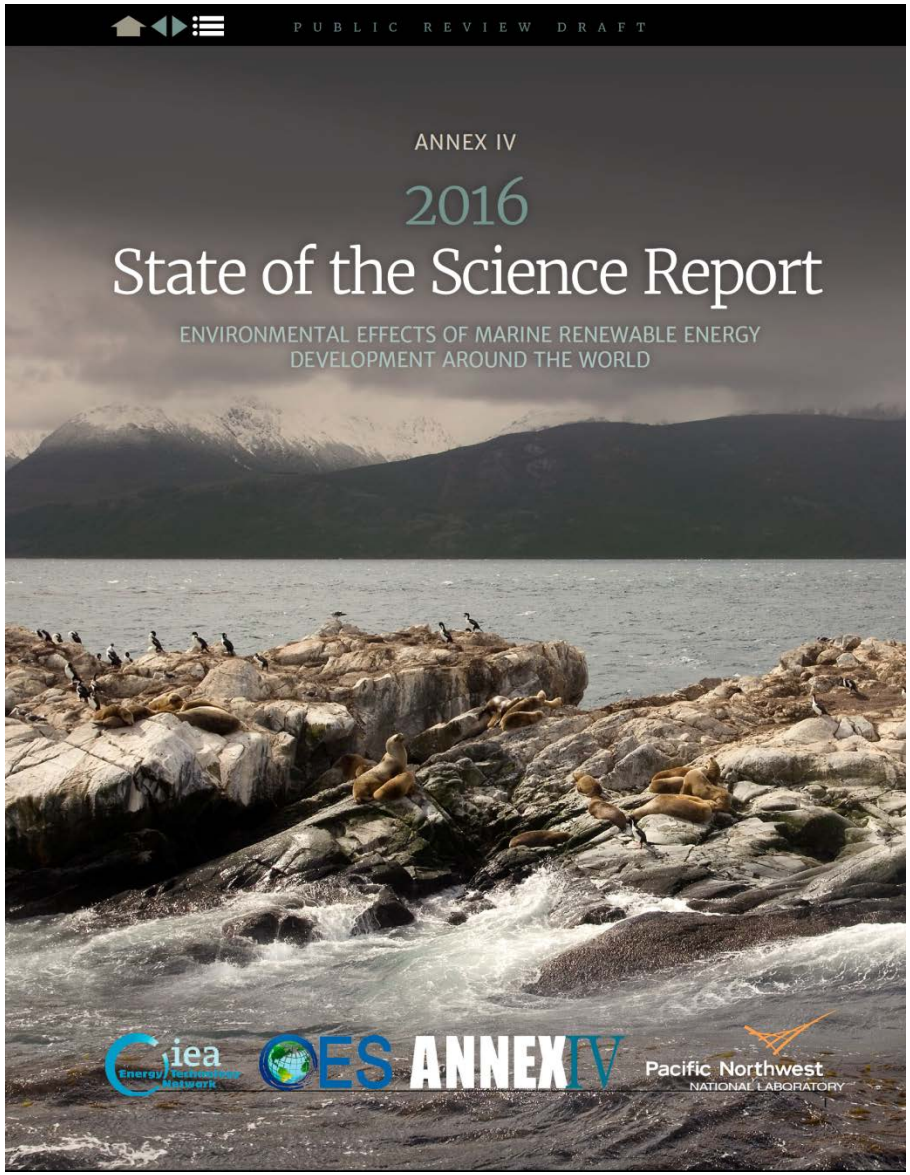
- Estudio de Impacto Ambiental
- PVA Preoperacional
- PVA Fase Construcción
- Estudio de Impacto Ambiental Eólica Offshore
- Caracterización acústica Mutriku

Acoustic characterization of Mutriku OWC Plant: http://www.bilbaomarinenergy.com/BilbaoMarineEnergyWeek/media/BilbaoMarineEnergy/PDF/posters/MEW17-Poster-10.pdf





https://tethys.pnnl.gov/publications/state-of-the-science-2016

ICES WGMRE REPORT 2017

SCICOM Steering Group on Ecosystem Pressures and Impacts

ICES CM 2017/SSGEPI:02

Ref. SCICOM

Interim Report of the Working Group on Marine Renewable Energy (WGMRE)

4–6 April 2017

Lisbon, Portugal

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CIEM Conseil International pour l'Exploration de la Mer

http://www.ices.dk/community/groups/Pages/WGMRE.aspx

Debido a su **incipiente estado de desarrollo** y la **ausencia de datos** asociados a una vigilancia ambiental de proyectos concretos, existen **grandes incertidumbres** en relación con el posible **impacto ambiental** de las tecnologías para el aprovechamiento de la energía del mar

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- Campos electromagnéticos
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- Afección a la integridad del fondo marino
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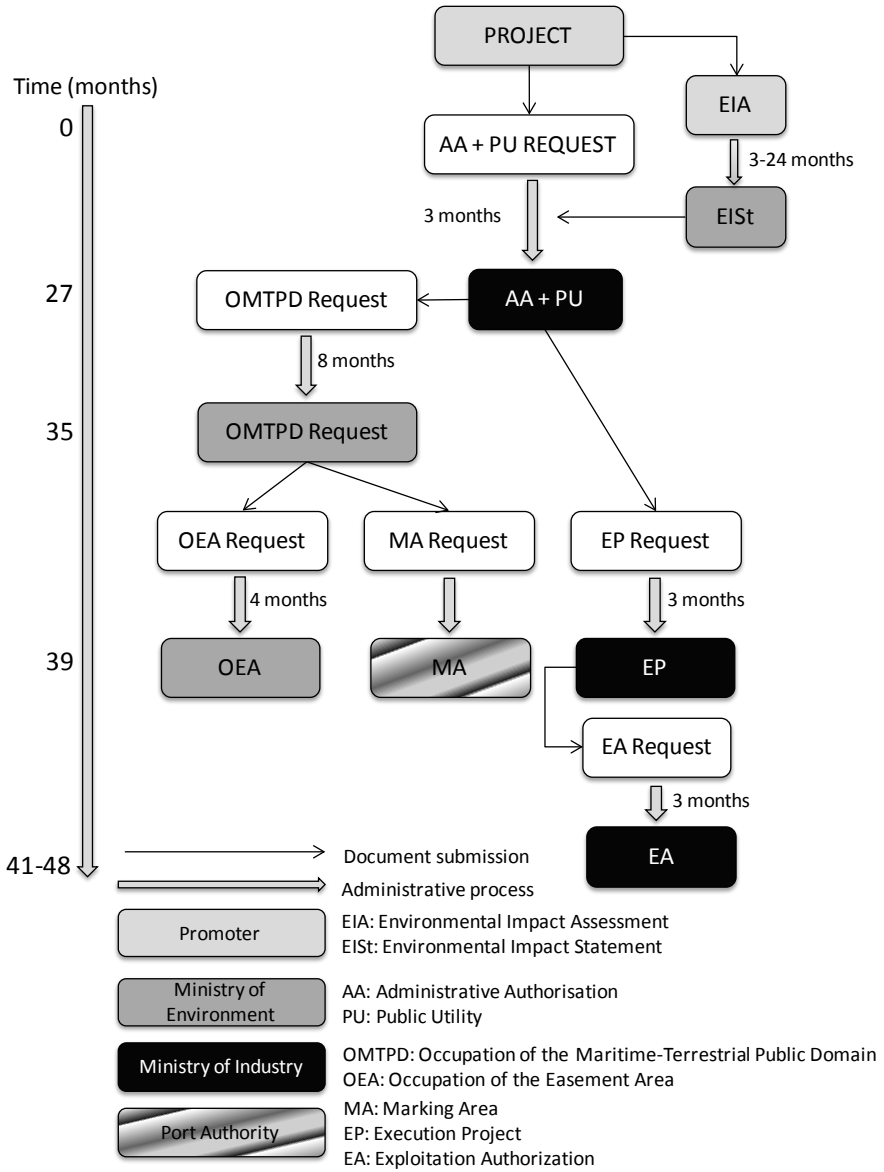

RiCORE
RISK BASED CONSENTING FOR OFFSHORE RENEWABLES

http://ricore-project.eu/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646436.

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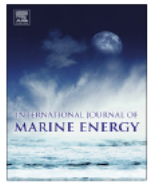

Review of consenting processes for ocean energy in selected European Union Member States

Teresa Simas [a,*], Anne Marie O'Hagan [b], John O'Callaghan [b], Soraya Hamawi [a], Davide Magagna [c,1], Ian Bailey [c], Deborah Greaves [c], Jean-Baptiste Saulnier [d,2], Dorleta Marina [e], Juan Bald [f], Cristina Huertas [g], Jan Sundberg [h]

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Call for Proposals EASME/EMFF/2017/1.2.1.1

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III Jornadas sobre el Estado Actual y Perspectivas de las
Energías Renovables Marinas en España
Madrid, 22 y 23 de noviembre de 2017

LA GESTIÓN AMBIENTAL EN EL DESARROLLO DE LAS ENERGÍAS RENOVABLES MARINAS

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