



Floating Wind Energy Technology Strategy of the Basque Country



XI Marine Energy Conference, May 2025

Basque floating wind value chain

DEVELOPERS

ENGINEERING

INSTALLATION, OPERATION & MAINTENANCE

R&D CENTRES

WIND TURBINE & COMPONENTS

TOWERS & TRANSITION PIECES

FLOATING FOUNDATIONS

MOORING SYSTEMS

ELECTRICAL CONNECTION

References in almost all FOW projects in the world

DemoSATH, 2 MW (2023)
 saitec offshore technologies

Kincardine, 50 MW (2020)
 Basque companies: EUSKAL FORGING, NERVION INDUSTRIES, SENER, VICINAY

Hywind Scotland, 30 MW (2017)
 Basque companies: EUSKAL FORGING, NAVACEL, NERVION INDUSTRIES, SIEMENS GAMESA, VICINAY

Hywind Tampen, 88 MW (2023)
 Basque companies: EUSKAL FORGING, HAIZEA WIND, SIEMENS GAMESA, VICINAY

Kitakyushu/Hibiki, 3 MW (2019)
 Basque companies: VICINAY

Windfloat, 25 MW (2020)
 Basque companies: EUSKAL FORGING, NAVACEL, NERVION INDUSTRIES, VICINAY

Provence Grand Large, 24MW (2023)
 Basque companies: SIEMENS GAMESA, VICINAY

Basque Companies Logo Grid:
 BiMEP, Bilbao PORT, ferrovial, VICINAYmarine, GRI, haizea WIND, AUXEMA stemmann, prosertek, ORMAZABAL VILLALBA, euskalforging, ENR, SOVERIN CENTRAL, GABOTEK, TAMOIN, SPARBER

Context

- Development of a specific technological strategy for floating wind power in the Basque Country
- July 2023 - February 2024
- Benefits:
 - Identification of common challenges of interest to companies
 - Development of a logical framework to facilitate the identification and implementation of collaborative projects both in the Basque Country and internationally
 - Visibility of the Basque Country's technological capabilities in this field
- Involvement:
 - General outline, global sections and coordination from Basque Energy Cluster
 - Supervision of areas by platform developers (Nautilus, Saitec and Sener)
 - Details of technological lines by interested entities

Participants

COORDINATORS OF STRATEGIC AREAS



OTHER PARTICIPATING COMPANIES



ORGANISATIONS OF THE BASQUE SCIENCE, TECHNOLOGY AND INNOVATION NETWORK



ACTIVITY FUNDED BY THE CLUSTER PROGRAM OF THE BASQUE GOVERNMENT

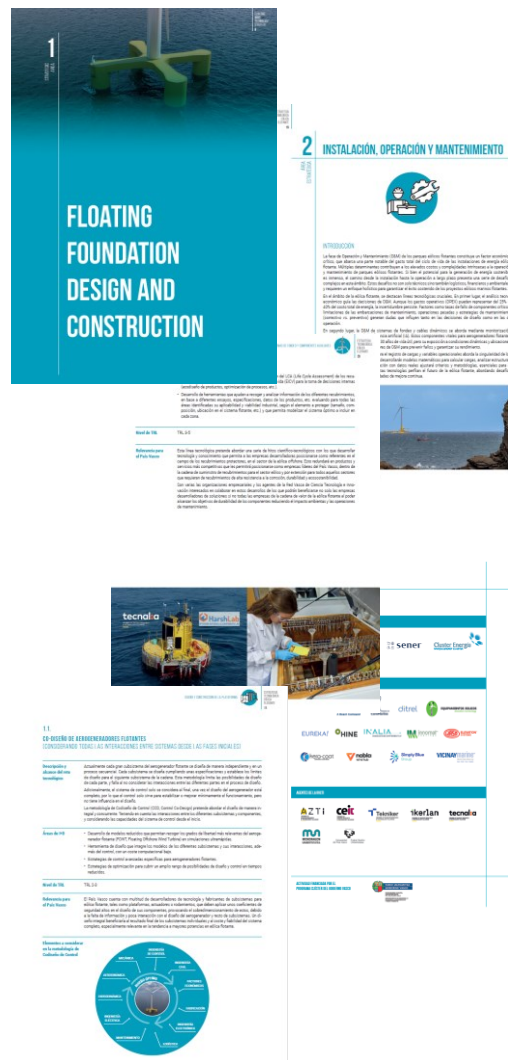
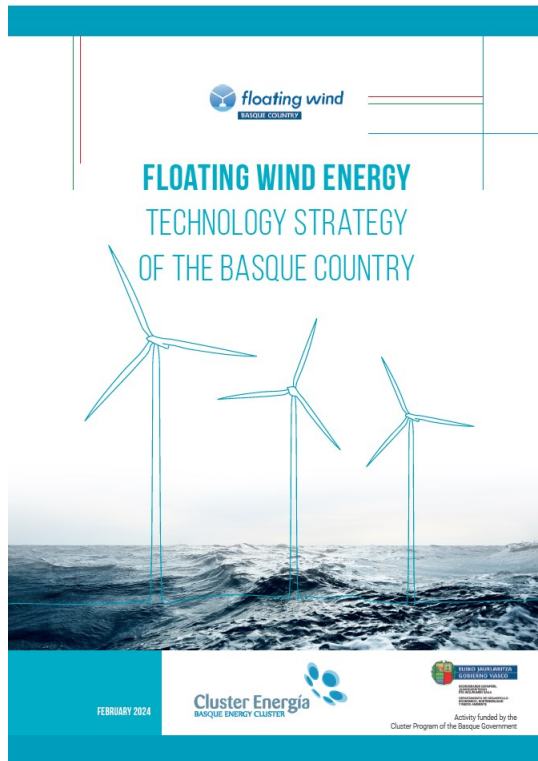


4 strategic areas & 20 technology lines

		Aeroblade	Bosch Rexroth	Core Marine	Ditrel	Equipamientos Eólicos	Eurekat	Hine	Inalia	Innomat Coatings	Jaso	Keracoat	Nabla Wind Hub	Nautilus FS	Saitec Offshore	Sener	Simply Blue	Vicinay Marine	Azti	Ceit	Ikerlan	MU	Tecnalia	Tekniker	UPV/EHU	TRL	
STRATEGIC AREA 1: FLOATING FOUNDATION DESIGN AND CONSTRUCTION																											
1.1	Co-design of floating wind turbines	x	x			x							x								x		x				2-3
1.2	Integral load analysis methodologies	x	x			x							x										x				3-5
1.3	Structural integrity calculation methodologies	x	x			x							x										x				3-5
1.4	Design for manufacturing and assembly		x										x										x				5-7
STRATEGIC AREA 2: INSTALLATION, OPERATION AND MAINTENANCE																											
2.1	O&M of mooring systems and dynamic cables		x	x		x		x					x	x						x	x	x	x				3-5
2.2	Techno-economic analysis for O&M decisions	x	x						x			x	x	x		x				x	x	x	x				3-5
2.3	Instrumentation for recording in-service loads and operational variables	x	x										x	x						x		x					5-7

STRATEGIC AREA 3: TURBINE, MOORING SYSTEMS AND AUXILIARY COMPONENTS																													
3.1	Subsea power cables and accessories		x	x																					x	x		4-5	
3.2	Development of optimised mooring lines for floating wind turbines		x										x	x	x										x	x	x	2-6	
3.3	Development of a lift specifically for floating wind turbines														x											x		3-4	
3.4	Development of new anti-corrosion coatings with reduced thickness and environmental impact						x																			x		3-5	
3.5	Multiphysics models of high-power turbines: mimicry and new developments													x	x											x	x	3	
3.6	Anchoring for adverse site conditions																									x	x	2-5	
3.7	Dismantling and recycling of floating wind turbine components														x	x										x		3-5	
3.8	Actuation systems for floating wind turbines and control strategies		x													x	x									x	x	2-4	
3.9	Development of thermal management systems for floating wind turbines																									x	x	2-4	
STRATEGIC AREA 4: RESOURCE AND IMPACT ANALYSIS AND STUDIES																													
4.1	Wave and wind resource characterisation and forecasting	x		x																						x		x	2-5
4.2	Maritime Spatial Planning: tools to identify suitable areas for offshore wind development																									x		x	2-6
4.3	Environmental impact of floating wind turbines in the marine environment																										x		1-7
4.4	Technical and economic analysis of offshore green hydrogen production plants																										x	x	2-5

Example of a technology line



1.2. INTEGRATED LOAD ANALYSIS METHODOLOGIES

Description and scope of the technological challenge

Integrated load analysis is a critical point in the design of floating wind turbines and all their components. It consists of coupling, in a single dynamic analysis, all the loads that affect the system, and on the basis of which the designs are made and optimised. Therefore, the maturity and robustness of the designs are directly linked to the loads obtained in the integrated analysis.

In the design of fixed offshore wind turbines, analysis focuses on the aeroelastic loads of the turbine. However, in floating wind, and due to the floating nature of the platforms, it is also necessary to integrate the hydroelastic loads affecting the float, which in turn depend on the environmental conditions and the design of the substructure (float and anchoring system). To this must be added the need to include an optimised control of the turbine under these more complex load conditions, and to introduce the structural flexibility of the floating platform to obtain results that are closer to reality.

R&D areas

- Development of new open-source simulation methodologies and co-simulation.
- Validation of integrated load analysis using real data.
- Design of data-driven models for integrated load analysis.
- Definition of strategies to validate and correlate numerical models with channel tests.
- Investigation of methodology for the extrapolation of coefficients obtained in laboratory tests to real scale, taking into account the limitations of similarity laws.
- Development of methodology to identify critical load cases according to the type of floating substructure (float and anchoring system).
- Definition of new strategies for grouping environmental conditions to reduce the number of load cases to be simulated.
- Generation of methodology for the integration of the structural flexibility of the float in the numerical model used for the coupled analysis.
- Definition of criteria for modelling failures and their control strategies in accidental loading cases.

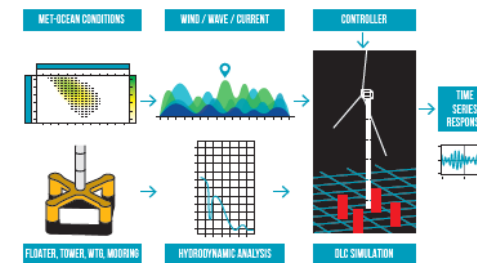
TRL

TRL 3-5

Relevance for the Basque Country

The business fabric of the Basque Country has many technology developers and component manufacturers for the floating offshore wind sector who need to ensure robust designs and/or optimise them. To do this, it is critical to obtain reliable loads, which offer the degree of accuracy required for a detailed and in-depth analysis, but which also allow for rapid prototyping of the system and adequate knowledge of its behaviour. Establishing methodologies and strategies that enable integrated load analysis, with numerical models that reliably represent their systems and at a lower computational cost, will benefit the design of all the systems that make up the floating wind turbine.

Key elements of the integrated load analysis methodology



Visibility actions

Floating wind value chain in Spain: the key to the Iberian market

March 21st, 2024
BECI - Level 5 Room 1B

Spain has a goal of reaching 3 GW of floating wind power in 2030. Key to achieving this milestone will be the involvement of the local value chain. With significant experience in the international development of offshore wind energy, this workshop will provide a quick overview of the market status in Spain, as well as of its main industrial regions and key players, both in floating foundation technologies and in manufacturing capabilities.

15:00 - Status of the Spanish market and new regulatory framework for offshore wind (AEE)

15:20 - Three strategic industrial regions in Spain for floating wind development:

- Floating Wind Basque Country
- Supercluster Atlantic Wind (regions of Cantabria, Asturias and Galicia)
- Cluster Marítimo de Canarias

15:50 - Pitch presentations of floating foundation developers



16:40 - Pitch presentations of floating wind key suppliers



17:00 - Networking and cocktail at the Wind Energy Basque Country pavilion

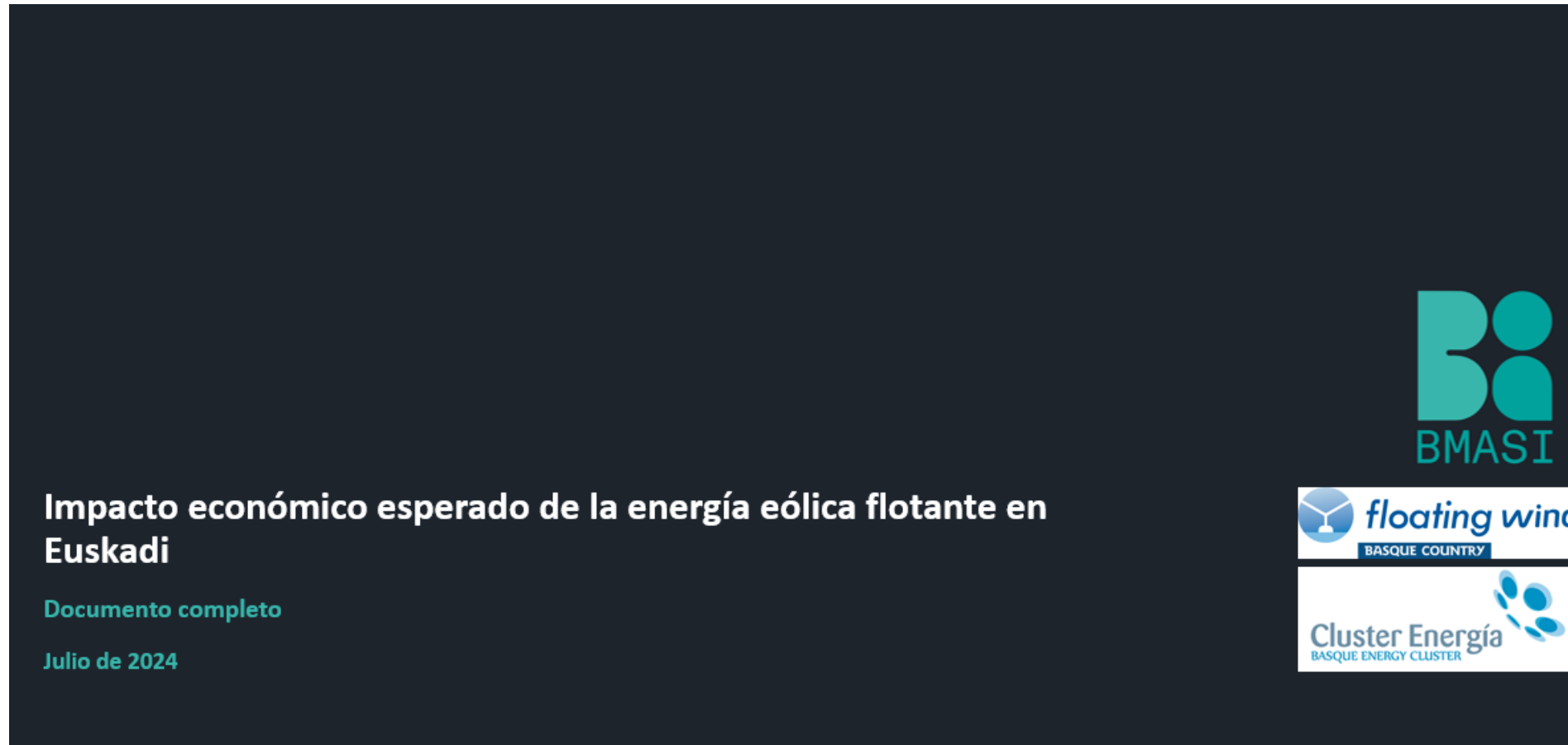




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Expected economic impact of FOW in the Basque Country



The image shows the cover of a report. The background is dark blue. On the right side, there are three logos: BMASI (a stylized 'B' and 'M' in teal), 'floating wind' (a blue wind turbine icon and the text 'floating wind' in blue, with 'BASQUE COUNTRY' in white on a dark blue bar below), and Cluster Energía (a blue cluster of dots and the text 'Cluster Energía' in white, with 'BASQUE ENERGY CLUSTER' in white on a dark blue bar below). On the left side, the title 'Impacto económico esperado de la energía eólica flotante en Euskadi' is written in white. Below the title, 'Documento completo' is written in teal, and 'Julio de 2024' is written in white.

Impacto económico esperado de la energía eólica flotante en Euskadi

Documento completo

Julio de 2024

BMASI

floating wind
BASQUE COUNTRY

Cluster Energía
BASQUE ENERGY CLUSTER

Four major areas of opportunity

Areas	Detail
1. Development & Engineering	<ul style="list-style-type: none"> • Desarrollo de parques eólicos flotantes • Ingeniería de parques eólicos flotantes • Digitalización y sistemas de control
2. Wind turbine and electrical connection	<ul style="list-style-type: none"> • Fabricación del aerogenerador y sus componentes • Fabricación de componentes eléctricos de subestaciones
3. Substructures & Mooring System	<ul style="list-style-type: none"> • Ingeniería vinculada al diseño y desarrollo de subestructuras flotantes • Fabricación de componentes y elementos auxiliares para subestructuras flotantes • Fabricación de sistemas de fondeo de las plataformas flotantes y subestaciones offshore, y elementos accesorios
4. Installation, O&M	<ul style="list-style-type: none"> • Construcción de SOV - Service Operation Vessels • Fabricación de equipos de elevación y transporte • Mantenimiento de componentes y sistemas fabricados por empresas vascas

Methodological approach

1. Estimación GW de capacidad instalada acumulada en el Mundo, Europa y España a 2040

Capacidad total instalada en el Mundo 2023-2040E



2. Estimación de la evolución de costes por actividad (a partir de fuentes oficiales: estructura de costes BVGA y supuestos de reducción de costes establecidos por NREL)

Actividad	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
...

3. Estimación de cuotas de mercado para las actividades con potencial de desarrollo en Euskadi (en contraste con empresas del sector)

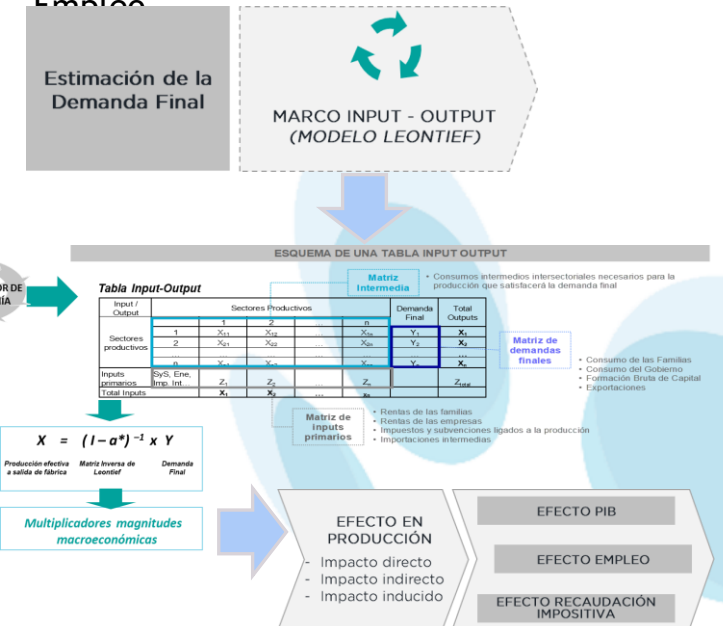
Actividad	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
...

4. Estimación de la facturación (€) por ámbito de oportunidad y actividad

Actividad	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
...

5. Construcción del modelo de impacto económico a partir de las Tablas Input-Output

- Cuantificación del impacto de la demanda en agregados macroeconómicos: PIB y Empleo

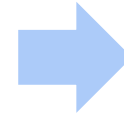


According to estimates, it is expected that the sector:



Genere **6.783 empleos**
directos en Euskadi a 2040

+ 6.161 empleos indirectos

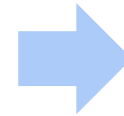


*Equivalente al 0,7% de la población
ocupada en Euskadi en 2022*



Incremente su facturación hasta
alcanzar los **1.424 M€** a 2040

*con un impacto de 858 M€ de PIB en
Euskadi*



*Equivalente al 1,0% del PIB
de Euskadi en 2022*



THANK YOU

