ELBE

EUROPE LEADING BLUE ENERGY

Cluster Energía BASQUE ENERGY CLUSTER

areg Aberdeen Renewable Energy Group

Flanders' Maritime Cluster

OFFSHORE ENERGY.DK

OFFSHORE VÄST

EU-KOREA Cluster cooperation seminar and matchmaking event

Vienna, 7 November 2018

Co-funded by the COSME programme of the European Union

This DELIVERABLE is part of the project ELBE which has received funding from the European Union's COSME Programme (2014-2020)

What is ELBE?

ELBE is an EU-funded project that aims to contribute positioning Europe as the world technological and industrial leader in Blue Energy, with a special focus on floating offshore wind, wave and tidal energy

ELBE gathers five European clusters with top expert companies and R&D organizations in Blue Energy to tackle the expansion of this sector beyond Europe

ELBE offers new opportunities to SMEs in offshore energy to share technology, establish alliances and create new business models across different sectors

Initially, ELBE will focus on consolidating the European alliance with the aim to develop strategic collaborations with companies and R&D entities in other leading countries throughout the world

Consortium

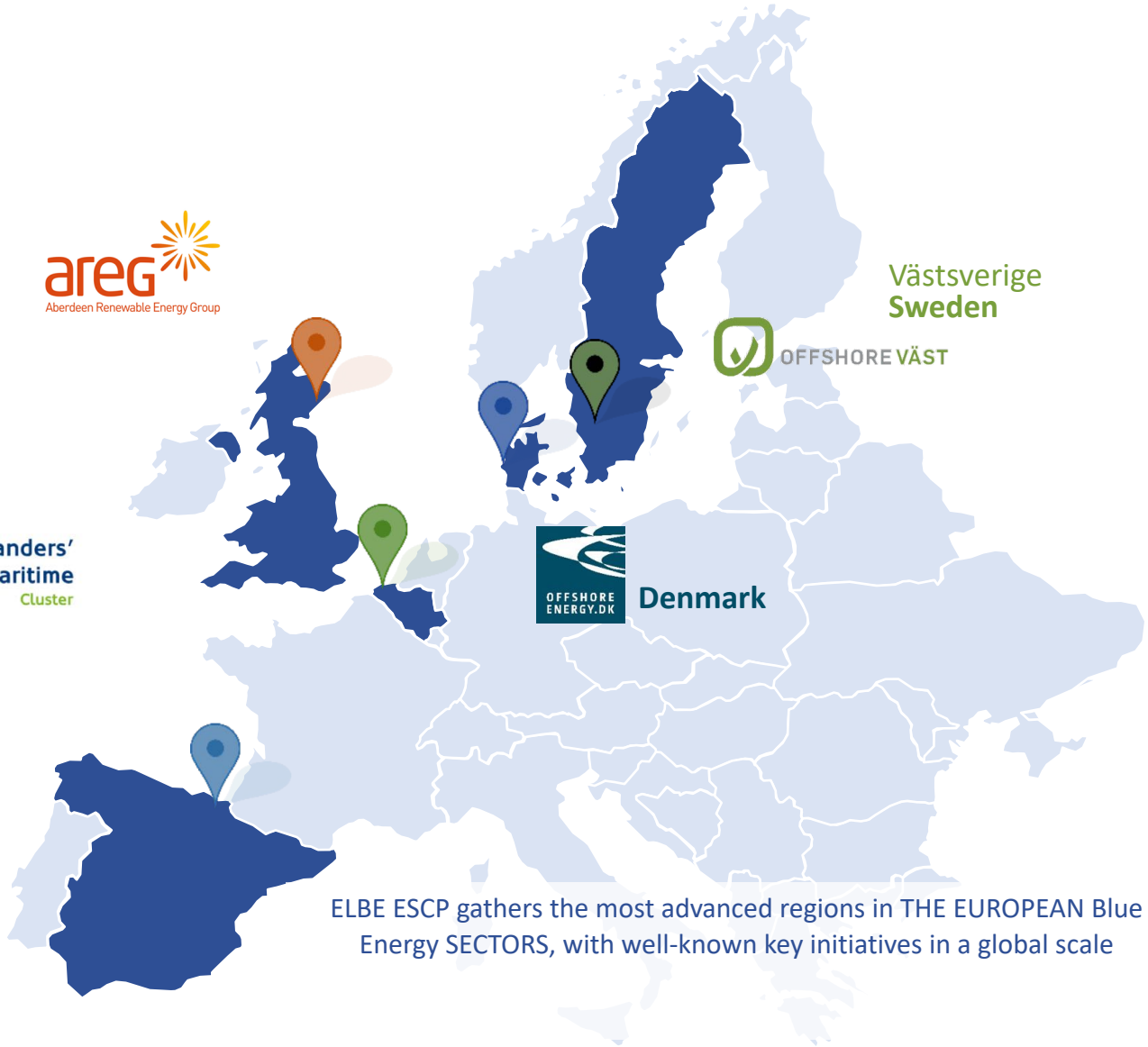
Aberdeen
Scotland

Flanders
Belgium

Basque Country
Spain

Västsverige
Sweden

Denmark



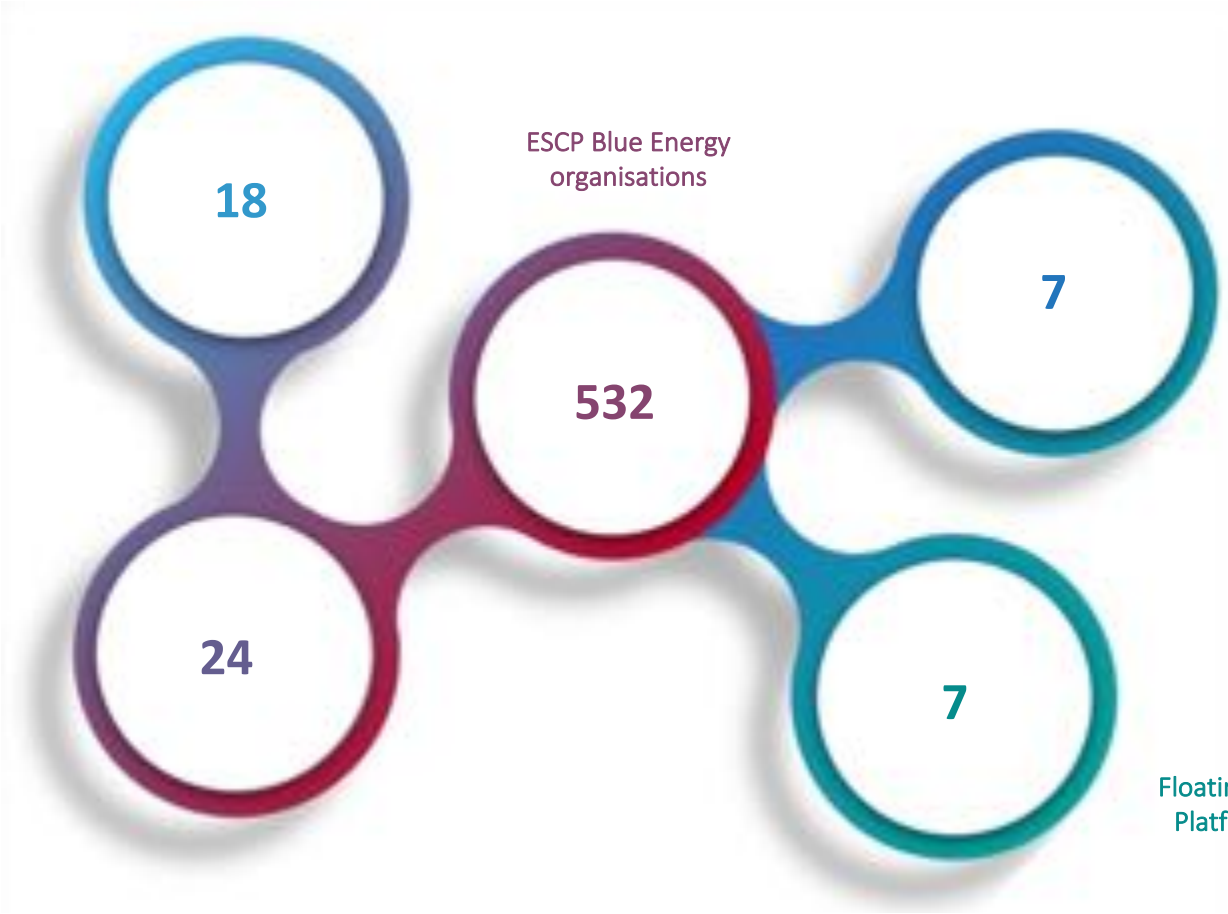
ELBE ESCP gathers the most advanced regions in THE EUROPEAN Blue Energy SECTORS, with well-known key initiatives in a global scale

FOCUS ON EMERGING AREAS

	Description	Implementation benefits
Floating Offshore Wind (FOW)	There are currently four substructure designs for floating offshore wind and all of them can be exploitable in different situations: - Barge - Semi-submersible - Spar buoy - Tension leg platform	FOW allows power generators to tap into areas with much higher wind speeds. At farther distances from the shore, the wind blows stronger and its flow is more consistent
Tidal Current	The movement of ocean water volumes, caused by the changing tides, creates energy from the tidal current. Kinetic energy can be used, usually near the coast and particularly where there are constrictions, such as straits, islands and passes.	- Never-failing source of energy (lunar gravitational pull) - Uniform and reliable power source - Cheap energy source - High energy density
Wave Energy	There is a wide variety of wave energy technologies, as a result of the different ways in which energy can be absorbed and depending on the depth of the water and the location (coast, near the coast, off the coast). • Oscillating water column (OWC) • Oscillating bodies (floating or submerged) • Overflow (Fixed or floating structures)	The development of wave energy benefits from: - Previous studies of hydrodynamics of ships in undulating seas - Abundant and highly available resources - Predictable, you can calculate how much you can produce

ALLIANCE KEY FIGURES

ELBE REGIONS HOST OVER 500 companies involved in blue energy development, with 18 TEST&DEMO SITES AND 38 technology developers in floating offshore wind, wave and tidal energy



HOME TO **18 BLUE ENERGY TEST&DEMO SITES**…

SOME EXAMPLES OF TEST-SITES IN ELBE REGIONS

Spain

Biscay Marine Energy Platform (BIMEP)

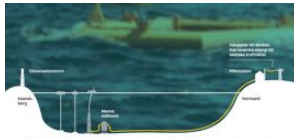
BIMEP is an open-sea facility to support research, technical testing and commercial demonstration of pre-commercial MRE prototypes. Key characteristics of the platform include: 20 MW of power, 4 connection points for WECs, Easy WEC installation, testing and operation, and an associated research centre.

Scotland

European Marine Energy Centre (EMEC)

EMEC, based in Orkney, is the first and only centre of its kind to provide developers of both wave and tidal energy converters with purpose-built, accredited open-sea testing facilities. It has 14 grid-connected test berths and it also operates 2 scale test sites, where smaller scale devices can gain real sea experience.

Sweden



Test Site Skagerrak

The marine research site has been up and running since 2004 with over 10 wave power plants, marine substations and grid connection installed between 2005 and today. The test facility is still expanding today with a total area of 0.5 km^2 at 25 meters depth and is located 200 km north of the Gothenburg area.

Belgium

Flanders Maritime Laboratory - Coastal and Ocean Wave Basin Ostend

The 30m by 30m wave basin and 175m long towing tank are used to study the impact of waves, tides and wind on ships and constructions at sea. These facilities provide the opportunity to develop innovative designs for coastal protection and offshore energy. The first experiments are planned in 2020.

Denmark

Danish Wave Energy Center (DanWEC)

DanWEC is the Danish site in the North Sea for testing WECs, located close to Hanstholm Habour. The site is marked and equipped with two buoys measuring wave heights as well as current. DanWEC plans to establish grid connections in order to facilitate the continued development and testing of WECs.

… 7 floating wind platform DEVELOPERS…

SOME EXAMPLES OF FLOATING PLATFORMS IN ELBE REGIONS

Scotland

Statoil - Hywind pilot park

Statoil has installed a 30 MW floating wind turbine farm on floating structures at Buchan Deep, 25 km offshore Peterhead, harnessing Scottish wind resources to provide renewable energy to the mainland. The wind farm will power around 20,000 households.

Denmark

Floating Power Plant A/S

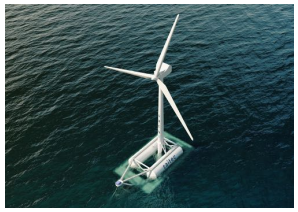
Floating Power Plant A/S (FPP) develops floating wind platforms that integrates wave power. FPP has successfully tested a grid connected ½ scale prototype over 2 years and is currently developing the technology for 3 commercial projects in Scotland, Wales and Ireland.

Spain

Nautilus Floating Solutions

Nautilus has developed a floating foundation for offshore wind energy that presents an optimized semi-submersible four-leg design, that will allow the reduction of the LCoE from current designs. Nautilus is working on installing its first full-scale prototype over the next two years in a suitable location.

Spain



Saitec Offshore Technologies

Saitec has developed SATH, a floating concrete platform that offers a competitive solution for the offshore wind power market. The manufacturing and assembly processes at the port, low material cost, easy plug&play installation and reduced maintenance costs, lead to a significant reduction in costs.

Sweden

Seatwirl

SeaTwirl's wind turbines use a vertical-axis wind turbine with a tower connected to the sub-sea structure. SeaTwirl's great advantages are its simple, robust and cost-effective design that also leads to lower service and maintenance costs compared with other traditional horizontal axis wind turbines.

… 24 WAVE ENERGY DEVELOPERS…

SOME EXAMPLES OF WEC DEVELOPERS IN ELBE REGIONS

Sweden

CorPower Ocean AB

An innovation based on the pumping principles of the human heart, CorPower Ocean AB has created a wave energy converter (WEC), a compact, highly-efficient product that offers five times the annual output of energy per tonne than any previously known technology.

Denmark

Wavepiston

Wavepiston have since 2015 been testing a ½ scale prototype in the North Sea at the DanWEC test site. The technology is based on a structure of a long steel wire rope, with a number of energy collectors mounted like pearls on a string, each of them converting the wave energy to electricity.

Belgium

Laminaria

The Laminaria wave energy buoy has an innovative load management mechanism and storm protection system. Development has been supported by the Flemish agency for innovation as well as through several European projects. After successful tests at Plymouth and Ostend, next phase is at EMEC in Scotland.

Spain

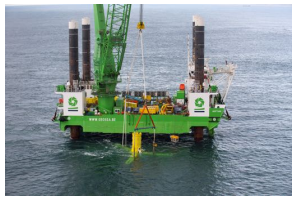
Oceantec

Oceantec's WEC follows the concept OWC and consists of a simple and robust buoy that moves by the action of the waves. Cylindrical buoys have proven their survival for many years. The WEC has only one moving part, the turbine, which is easily accessible for maintenance work.

… and **7 TIDAL ENERGY DEVELOPERS**

SOME EXAMPLES OF TEC DEVELOPERS IN ELBE REGIONS

Belgium



DEME Blue Energy

DEME Blue Energy is a specialized company that focuses on the development of energy generated from waves, tidal movements and tidal currents. DEME Blue Energy installed the four turbines of MeyGen's Phase 1A and is involved in the development of two additional tidal energy parks in Scotland and Northern Ireland.

Sweden

Minesto

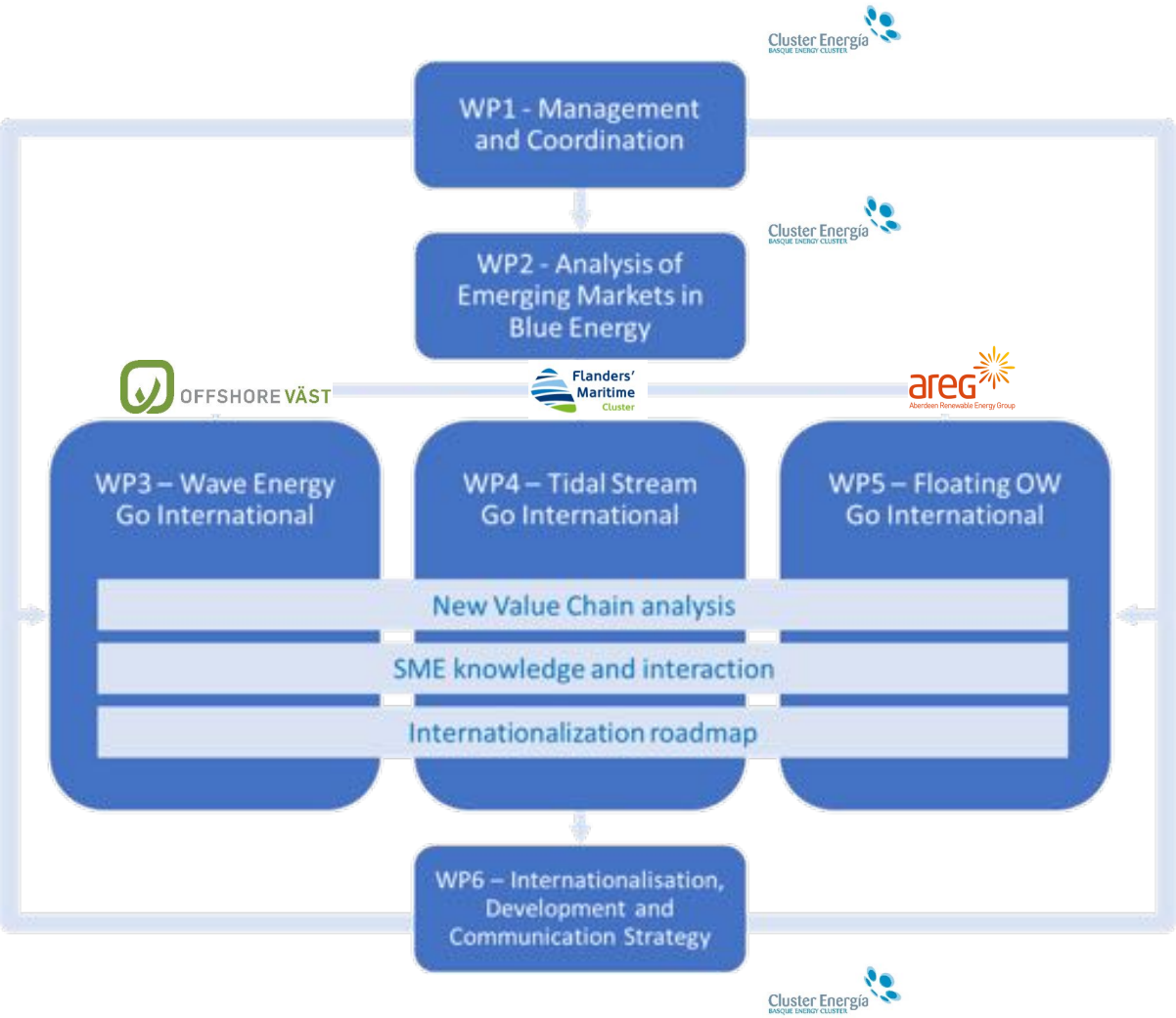
Deep Green is the technology developed by Minesto to harvest the energy of underwater currents. It is based in the concept of a kite with a turbine attached, where a water current flows instead of the wind blowing. This way, the wing pushes the turbine through the water, sweeping a large area at a high speed.

Scotland

Scotrenewables

This Floating Tidal Technology couples a streamlined, low cost design incorporating proven technologies with simple installation and maintenance strategies. This approach eliminates the need for the majority of high risk underwater operations. Scotrenewables launched the full commercial scale SR2000 2MW in 2016.

PROJECT structure

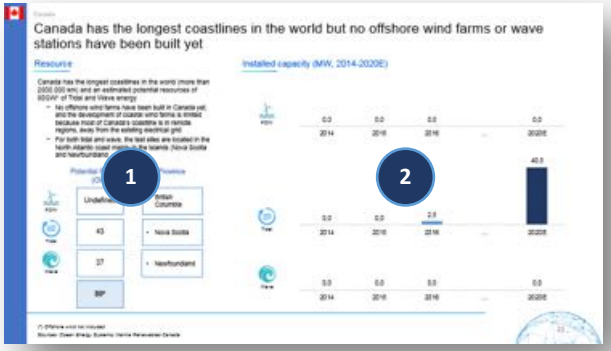


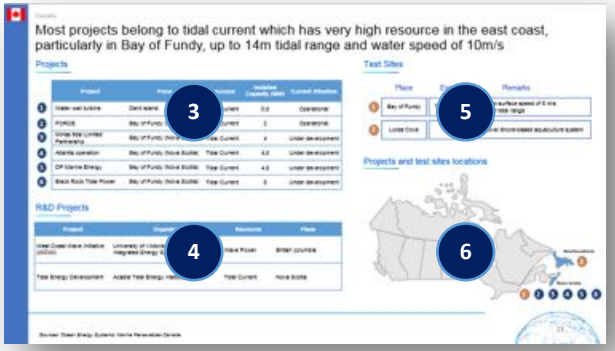
Markets analysis have been carried out on 20 countries in order to characterize them on variables such as installed and expected capacity, test sites, policy and support mechanisms, etc.

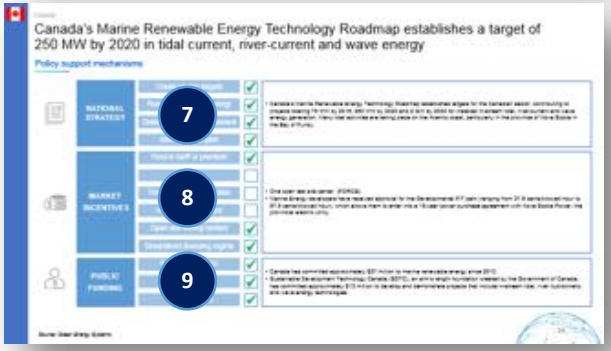
Variables taken into account

1. Potential resource and location
2. Installed capacity (2014-2020)
3. Operational projects
4. R&D projects
5. Test Sites
6. Projects and test sites locations
7. National Strategy for blue energy
8. Market Incentives for blue energy
9. Public Funding for blue energy
10. Key players for blue energy
11. Events of blue energy
12. Ease of doing business

Blue energy country profile*







(*) The contents could vary depending on the situation of each country and the availability of information

USA, China, Japan, Republic of Korea and Canada are the countries that have the best current and expected blue energy positioning, as well as a favorable regulatory framework

Country segmentation

Promising markets with favorable regulatory framework*	• Canada • China • Japan • Republic of Korea • United States
Emerging markets with high potential resource and uncertainty regulatory framework*	• Australia • Brazil • India • Taiwan • Indonesia
Medium resource with slight coordination of activities*	• Chile • Mexico • Philippines • Singapore
High potential resource with lack of incentives*	• Argentina • Barbados • Namibia • New Zealand • Puerto Rico • South Africa

(*) Segment characteristics can be found in Annex 2

Development of ocean energy in Korea has been predominantly focused on promoting technology development and demonstrations

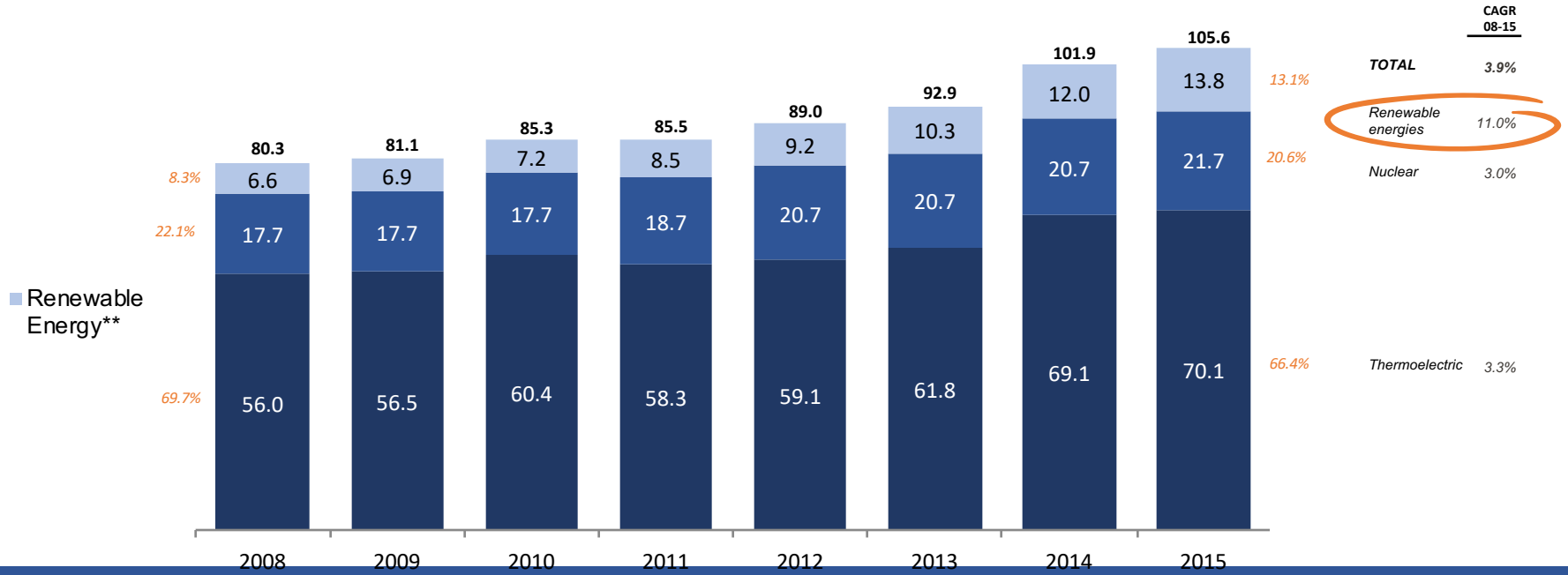
Policy support mechanisms

NATIONAL STRATEGY	Ocean energy targets ✓ Roadmap for ocean energy ✓ Detailed resource assessment ✓ Marine spatial plan ✓	• The national strategy for the development of ocean energy in Korea, approved by the National Science and Technology Council in 2015, was established based on the "Mid-term and Long-term Clean Ocean Energy Development plan 2015- 2025", which was written by both MOF (Ministry of Oceans and Fisheries) and MOTIE (Ministry of Trade, Industry and Energy). It emphasized the key action plan to stimulate R&D and to commercialize technologies related to the ocean energy.
MARKET INCENTIVES	Feed-in tariff or premium ✓ ROC ☐ Tradable green certificates ✓ RE portfolio standard ✓ Open sea testing centers ✓ Streamlined licensing regime ☐	• There is a market incentive plan, known as tradable Renewable Energy Certificate (REC). • The renewable portfolio standard was established in 2012 to enforce utility companies with the capacity of over 500 MW to provide an obligatory portion of the total electricity production with renewable energy, which was 4.0% in 2016.
PUBLIC FUNDING	Fundamental R&D ✓ Prototype testing ✓ Testing centers ✓	• MOF, Ministry of Oceans and Fisheries, and MOTIE, Ministry of Trade, Industry and Energy, provide public funding for ocean energy R&D, as well as demonstration projects. MOF funding focuses mainly on open sea demonstrations under the "Practical Ocean Energy Technology Development Programme," while the MOTIE primarily supports the fundamental R&D projects under the "New and Renewable Technology Development Programme".

Sources: Ocean Energy Systems, South Korea Government, "Outlook for Ocean Energy Development in Korea" EAS

The installed capacity is above 310 GW, of which renewable energy represents 13.1%, reaching 13.8 GW in 2015, replacing the drop in thermoelectric power

Korea energy installed capacity (GW, 2008-2014)



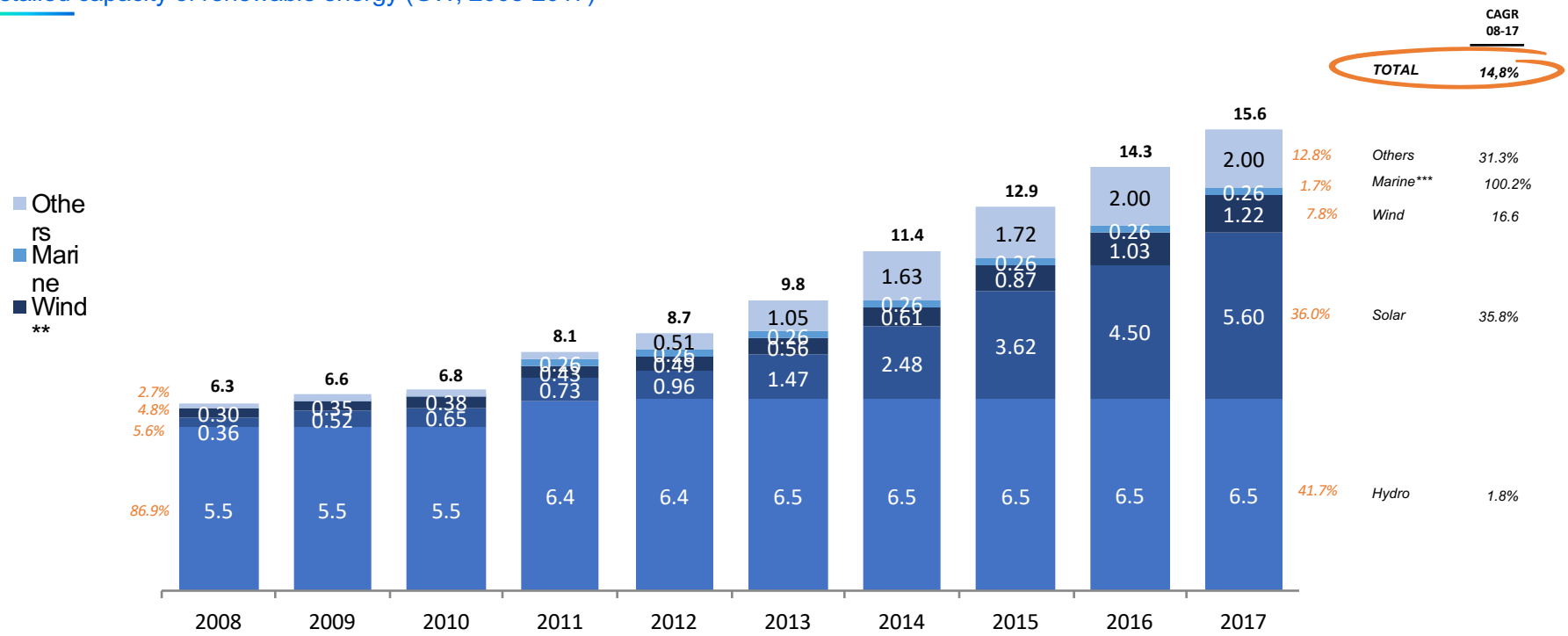
Renewable energy has the best installed capacity compound annual growth rate (+11.0%) between 2008-2015 of analyzed energy types

(*) Thermoelectric: Includes coal, petroleum and natural gas
(**) Renewable Energy: Includes wind, solar, biogas, biomass, waste and hydropower

Sources: IRENA, UNDATA

Renewable energy is driven primarily by the extraordinary growth experienced in solar PV, increasing its weight from the 5,6% in 2008 to the current 36%

Installed capacity of renewable energy (GW, 2008-2017)



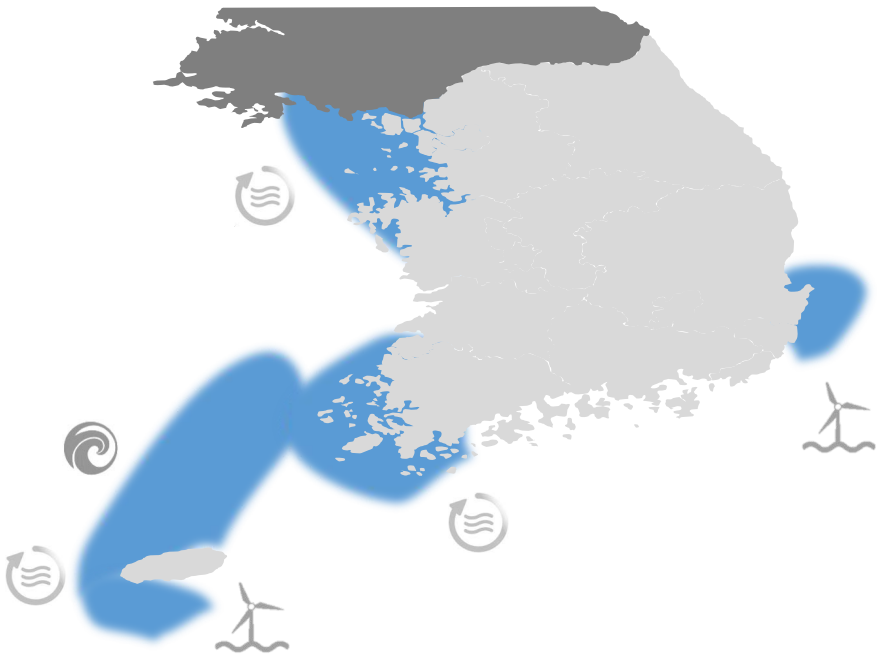
Solar energy is the energy type with highest compound annual growth rate since 2008 (+35.8%) followed by wind energy (+16.6%)

(*) Solar includes Solar PV (photovoltaic) and Solar CSP (thermal)
(**) Offshore wind represents the 4%
(***) Marine CAGR from 2009 to 2017
Sources: IRENA

South Korean blue energy potential is relatively relevant and its development is still in early stages, investors have favored tidal current power despite it's environmental issues

Blue energy potential resource

Floating Offshore Wind	• With 7.9GW, South Korea has relatively low floating offshore wind power potential • The south-east area of the peninsula and Jeju Island, provide the best locations for floating offshore wind power due to their high wind speed
Tidal Current	• The eastern coastal area of South Korea and Jeju Island have a potential resource for tidal range and tidal current energy totaling near 7.5GW • Tidal energy and tidal current energy are likely to play an important role in meeting the future energy needs of South Korea, but there are currently a number of projects halted following environmental concerns
Wave power	• Wave power energy resources in South Korea are located down the west coast of the country and around Jeju Island and accounts for a potential of 6.5GW • The potential of wave energy is relatively low and it´s strong dependence on the season of the year makes it even less likely to provide a solid base for energy consumption

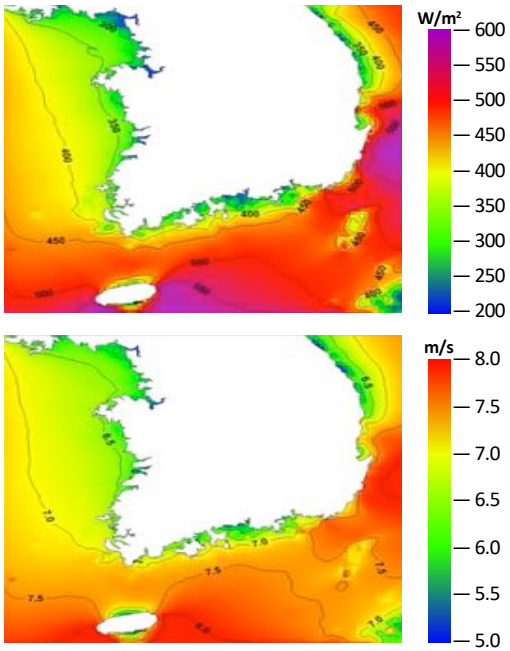


Sources: An overview of ocean renewable energy resources in Korea, Introduction to ocean policy, analysis by Minsait

Potential Resource

For floating offshore wind, the Jeju Island and the South-East area of the peninsula, are the best locations due to its high wind speed

Wind power resource



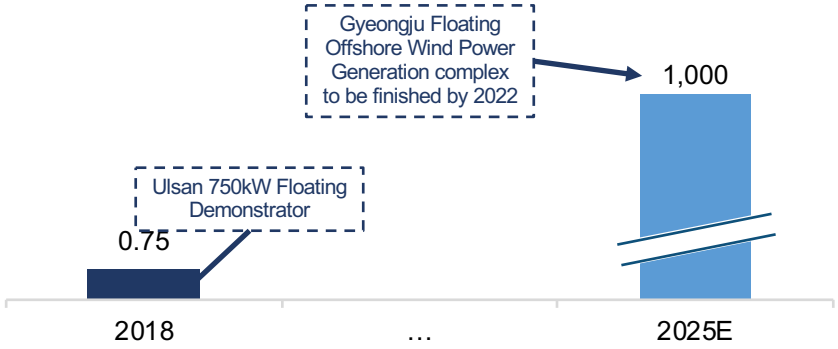
Category	Capacity (GW)	Area (km²)
Theoretical Potential	309.8	79,549
Geographical Potential	62.8	15,910
Technical Potential	31.4	7,995
Implementation Potential	7.9	1,989

Sources: Korea Wind Energy Industry Association

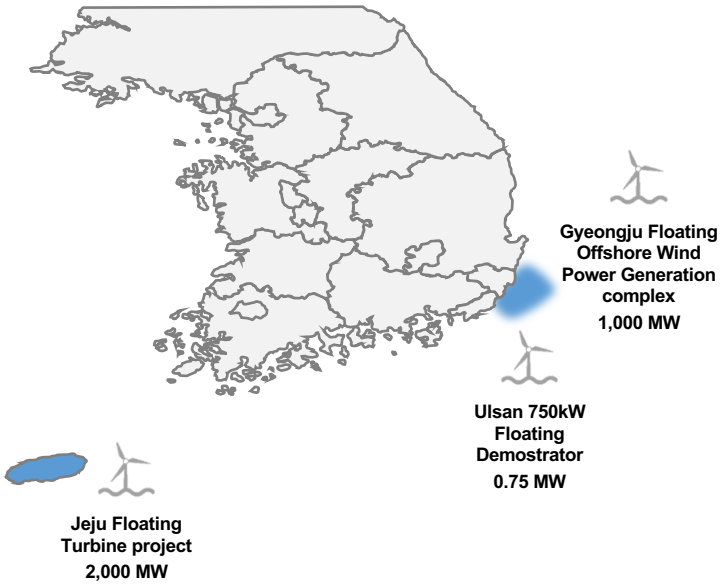
The development of floating offshore wind energy in South Korea is still in early stages, with the city of Ulsan as the main hub for new projects

Floating offshore wind projects and wind installed capacity (MW, 2018-2030E)

Projects	Companies	Place	Installed Capacity (MW)	Current Situation
Jeju Floating Turbine project	Gusto MSC, POSCO, Halla Wind Power, Hyundai Heavy Industries, Jeju Energy Corp.	Jeju Island	2,000	Cancelled
Ulsan 750kW Floating Demonstrator	Un. of Ulsan, Mastek Heavy Industries, Unison, Seho Engineering	Ulsan	0.75	In operation
Gyeongju Floating Offshore Wind Power Generation complex	Gyeongbuk FOW Power, Macquarie Capital Korea	Gyeongbuk	1,000	Early planning



Floating offshore wind projects location

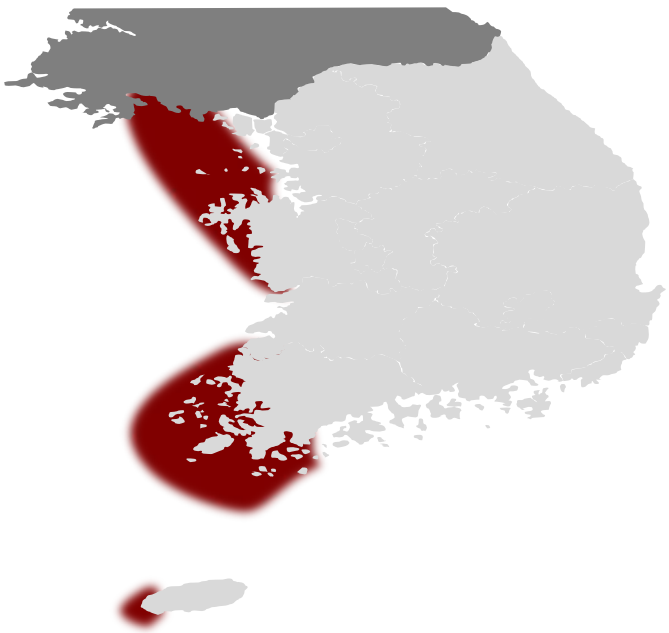


The biggest FOW planned project has been cancelled after one of the companies involved decided not to invest in the technology cause it has not been verified in Korea or abroad, but it could be developed in the future

Sources: 4COffshore, University of Ulsan

The eastern coastal area of South Korea and Jeju Island have a potential resource for tidal range and tidal current energy totaling near 7.5GW

Tidal power resource



	Tidal range potential		Tidal current potential		Total tidal potential
Resource potential	6.5 GW	+	1 GW	=	**7.5 GW**

- **Tidal energy and tidal current energy are likely to play an important role** in meeting the future energy needs of South Korea
- The advantages tidal current power over tidal range power include:
  - Tidal current power doesn´t require dams to operate
  - Tidal current power can be operated 24 hours a day
  - Tidal current power has lesser impact on marine ecosystems
- The are a number of tidal current projects in feasibility phase along the west coast of South Korea, but for the most part, **they have been halted following environmental concerns**
- **2 development guidelines** for tidal energy can be extracted from the Mid- and Long-term Offshore Energy Development Plan (2015-2025)
  - To develop and operate an active control-type generating system for early commercialization by participation of the private sector and to expedite commercialization through transfer of the technologies
  - To establish five sites of real-ocean test beds through expansion of the Uldolmok Tidal Current Power Plant and to expedite the commercialization

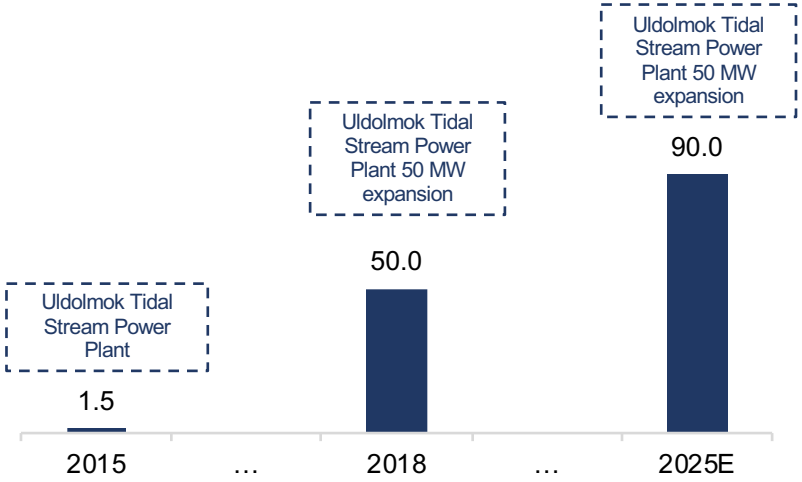
Tidal energy and tidal current energy are likely to play an important role in meeting the future energy needs of South Korea

Sources: An overview of ocean renewable energy resources in Korea, Introduction to ocean policy, analysis by Minsait

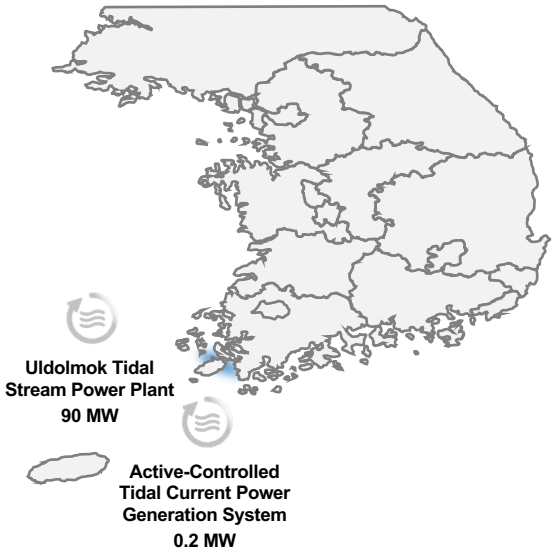
Installed capacity of ocean energy is mainly driven by tidal technologies and most of these projects are being developed on the West and South coasts

Tidal current projects and installed capacity (MW, 2009-2020E)

Projects	Companies	Place	Installed Capacity (MW)	Current Situation
Uldolmok Tidal Stream Power Plant	Korea East West Power Co, Hyundai, Iljin Electric	Uldolmok, Jindo County	1.5	In operation
Active-Controlled Tidal Current Power Generation System	Korea Institute of Ocean Science and Technology and Hyundai	Uldolmok Test Site	0,2	Early Planning



Tidal current projects location



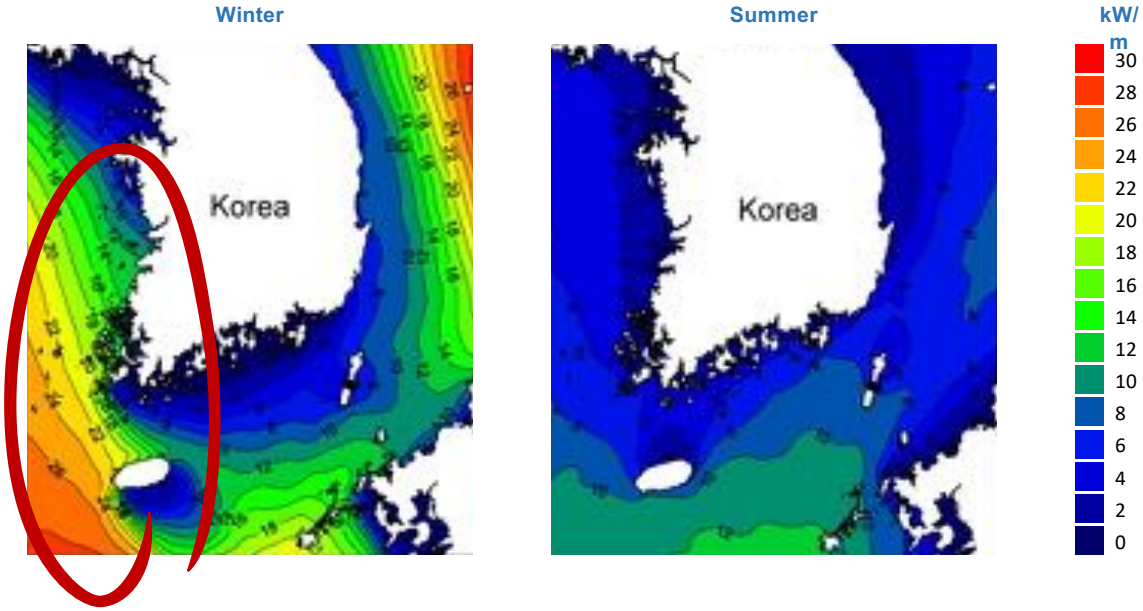
The are a number of tidal current projects in feasibility phase along the west coast of South Korea, but for the most part, they have been halted following environmental concerns

Sources: Ocean energies, moving towards competitiveness: a market overview & OES annual report 2017

Potential Resource

Wave power energy resources in South Korea are located down the west coast of the country and around Jeju Island and accounts for a potential of 6.5GW

Wave power resource



- The **potential of wave energy is relatively low** when compared to the potential of tidal energy in South Korea
- Wave power is **deeply dependent on the season of the year**, the winter season provides a better potential for energy harvesting
- This strong dependence on the season of the year makes it even **less likely to provide a solid base** for energy consumption
- **3 development guidelines** for wave energy can be extracted from the Mid- and Long-term Offshore Energy Development Plan (2015-2025)
  - To accelerate a floating-type wave energy generating system, which is using the deep sea wave energy
  - To develop a small-size wave energy generating system to supply electricity to small islands
  - To expedite commercialization through establishment of a real-ocean test bed, connected with the Jeju Pilot Wave Energy Plant, and through construction of a private-oriented test bed

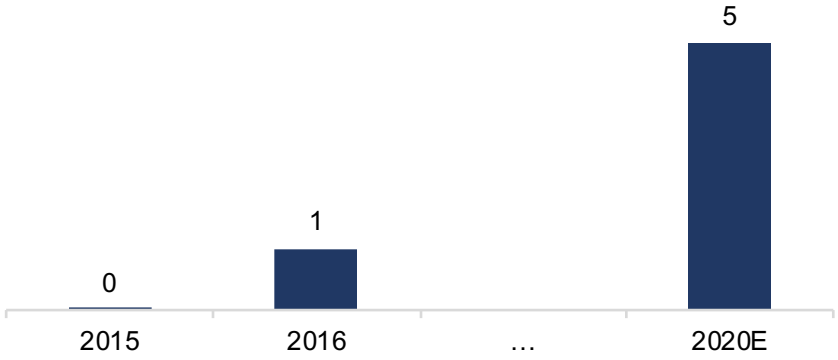
The potential of wave energy is relatively low and it´s strong dependence on the season of the year makes it even less likely to provide a solid base for energy consumption

Sources: An overview of ocean renewable energy resources in Korea, Introduction to ocean policy, analysis by Minsait

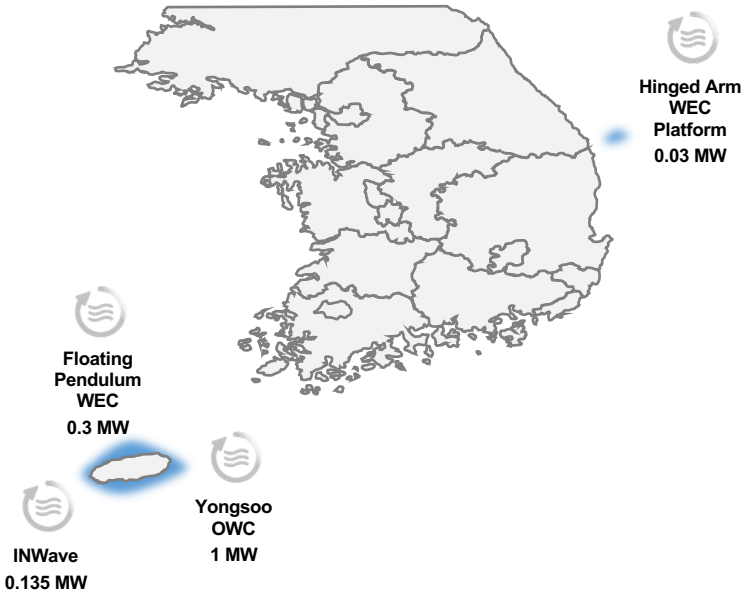
There is only one wave power project under development, however there are a few more in R&D stage

Wave power projects and installed capacity (MW, 2015-2020E)

Projects	Companies	Place	Installed Capacity (MW)	Current Situation
INWave	INGINE Inc	Jeju Island	0,135	Operational
Floating Pendulum Wave Energy Converter	KRISO	Jeju Island	0,3	Under development
Yongsoo OWC Pilot Plant	KRISO	Jeju Island	1	Operational
Heaving Semi-Spheres with Hinged Arm WEC Platform	Hwa Jin Co	Hupo-Hang	0.03	Concluded

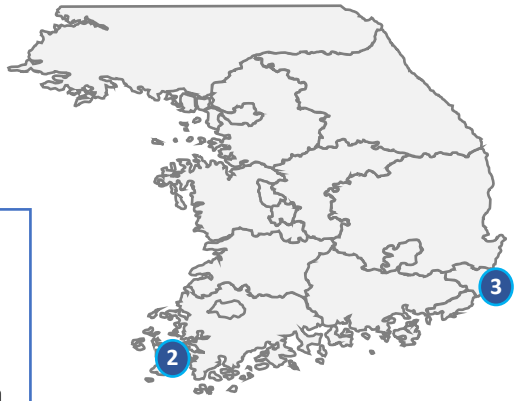


Wave power projects location



Sources: Ocean energies, moving towards competitiveness: a market overview & OES annual report 2017

The Ministry of Oceans and Fisheries has been supporting open sea test sites for wave energy converters and tidal energy converters, still under development.



Test sites description

Under development

KRISO – Jeju Island

- KRISO started the construction project of the test center for the wave energy converter in May 2016 and the project is expected to be finished by December 2019
- The western shore of Jeju Island was selected as the test site, where the Yongsoo OWC wave energy plant is installed, to be utilized as the offshore substation for the open sea test site
- A number of cables from five different berths will be connected to the offshore substation and the grid system with the allowance capacity of 5 MW. KRISO surveyed and designed the cable routes from the offshore substation to each berth in 2016. The consenting process for ocean space occupation and electrical connection started in 2017. The cables and offshore substation will be constructed in 2018
- The Floating Pendulum Wave Energy Converter (FPWEC), with the capacity of 300 KW, is expected to be tested in the fourth berth, with the water depth of 40 m, in 2018

Under development

KIOST – Uldolmok

- KIOST started the construction project of an open sea test bed for tidal energy converters in May 2017 and is expected to finish it in December 2021
- The test site will consist in a grid of 5 berths of 4.5 MW, to serve as a performance test facility for components of tidal energy converters, such as blade and drive train, which will also be constructed in this project.
- The southwestern waters of Korean peninsula are primarily considered as the tidal energy test site, where the Uldolmok tidal current pilot plant is installed

Under development

Ulsan Metropolitan City – Ulsan floating demonstration site

- The city of Ulsan is promoting the development of floating offshore wind power in the area and building a test site for the development and demonstration of prototypes
- Ulsan Metropolitan City has stablished partnership agreements with different companies and associations like Korea East-West Power Co. Hyundai Heavy Industries or Ulsan Technopark
- It will consist in a demonstration site with 50 4MW floating turbines totaling 200MW to be finished by 2022 with an investment of 1,147.5€ million

Sources: Ocean energies, moving towards competitiveness: a market overview & OES annual report 2017

The floating offshore wind value chain is strongly covered with the main South Korean conglomerates, such as Hyundai, Hyosung, Doosan, Unison or Hanjin

Offshore wind value Chain in South Korea

R&D agents

- 울산대학교 UNIVERSITY OF ULSAN
- 경남테크노파크 Gyeongnam Technopark
- KIOST
- KRISO
- KERI KOREA ELECTROTECHNOLOGY RESEARCH INSTITUTE
- KOMERI
- KETEP

Design, services and component manufacturers

Rotor

- DACC CARBON
- KM 주식회사 케이엠
- HYOSUNG
- DAEWOO E&C
- DOOSAN
- PLASPO
- HYUNDAI SAMHO HEAVY INDUSTRIES CO.,LTD.

Nacelle

- ILJIN Electric
- HYUNDAI SAMHO HEAVY INDUSTRIES CO.,LTD.
- HYOSUNG
- LS전선
- SHILLA CORPORATION
- SINCE 1961 Bokuk

Wind turbine

- DOOSAN
- HYUNDAI SAMHO HEAVY INDUSTRIES CO.,LTD.
- UNISON
- HANJIN
- HYOSUNG

Structure and mooring

- TAEWOONG
- UNISON
- CS WIND
- DONGKUK STEEL
- MASTEK 重工業株式會社 HEAVY INDUSTRIES CO.,LTD
- Pyungsan

Logistics and Wind Farm

- UNISON
- DSME
- stx
- KOEN KOREA SOUTH-EAST POWER CO.
- SAMSUNG SAMSUNG RENEWABLE ENERGY
- HYUNDAI SAMHO HEAVY INDUSTRIES CO.,LTD.
- wp 한국서부발전(주) KOREA WESTERN POWER CO., Ltd.
- KOREA EAST-WEST POWER CO.,LTD.
- KOSPO KOREA SOUTHERN POWER CO.,LTD.

Wind Farm Managers

- KOREA EAST-WEST POWER CO.,LTD.
- wp 한국서부발전(주) KOREA WESTERN POWER CO., Ltd.
- KOSPO KOREA SOUTHERN POWER CO.,LTD.
- KOMIPO KOREA MIDLAND POWER CO.,LTD.
- KOEN KOREA SOUTH-EAST POWER CO.
- kepco kps
- HANSHIN ENERGY
- HYUNDAI SAMHO HEAVY INDUSTRIES CO.,LTD.

Source: Minsait analysis, KWEIA

Wave and tidal current energy are mainly led by engineering conglomerates such as POSCO, Hyundai Heavy Industry, Daewoo E&C and GS E&C

Wave energy and ocean current value chain

R&D agents

KIOST
경남테크노파크 Gyeongnam Technopark
KRISO
KOMERI
KERI KOREA ELECTROTECHNOLOGY RESEARCH INSTITUTE
KETEP

Design of wave power and tidal current devices

posco
HYUNDAI SAMHO HEAVY INDUSTRIES CO.,LTD.
ATLANTIS RESOURCES
DAEWOO E&C
GS E&C

Equipment manufacturers

Converters

VOITH
HYOSUNG
ANDRITZ
SINCE 1961 Bokuk

Other equipment

HYOSUNG
RENETEC
ANDRITZ
HYUNDAI SAMHO HEAVY INDUSTRIES CO.,LTD.

Energy evacuation infrastructure

K water
KHNP KOREA HYDRO & NUCLEAR POWER CO.,LTD
KOSPO KOREA SOUTHERN POWER CO.,LTD.
wp 한국서부발전(주) KOREA WESTERN POWER CO., Ltd.

Installation, operation and maintenance

K water
KHNP KOREA HYDRO & NUCLEAR POWER CO.,LTD
wp 한국서부발전(주) KOREA WESTERN POWER CO., Ltd.
KEPCO KPS
ATLANTIS RESOURCES

Source: Minsait analysis

NEXT STEPS: EUROPEAN NETWORKING EVENTS

Three workshops will be organised to establish new collaboration opportunities among companies in Blue Energy sector. Participation is open to other clusters and Blue Energy organizations from other European and international regions

Locations and expected dates

- **Scotland**
- October 2018

- **Belgium**
- February 2019

- **Sweden**
- May 2019

Events main contents

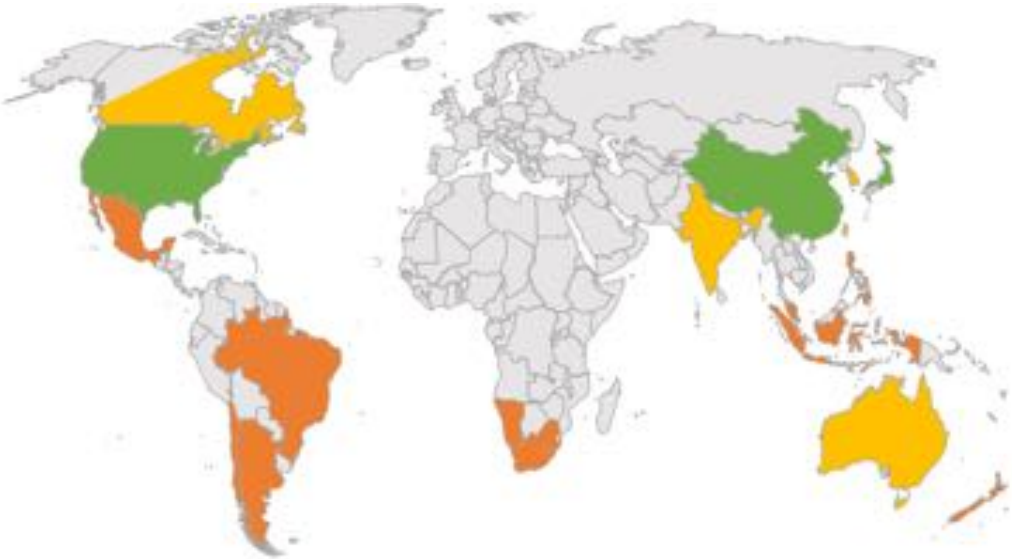
- **Presentations of local leading companies and organizations**
- **B2B Meetings**
- **Visit to singular infrastructures or organisations**
- **International markets analysis**
- **Contribution to ELBE internationalisation strategy definition**
- **Identification of synergies among different Blue Energy value chains**
- **Information about Blue Energy collaboration support programs**

NEXT STEPS: EXPLORATORY TRIPS AND BUSINESS MISSIONS TO THE 5 SELECTED COUNTRIES

- Contact with key stakeholders: associations, clusters, public entities, companies
- Exploratory trips of ELBE consortium to the target country, in order to identify collaboration potential and key partners
- Joint internationalization strategy and roadmap of activities
- Business missions with European companies: meetings, technical visits, conferences, matchmaking events, (strand 2)

Ranking based on assessment criteria

High interest	1º	USA
	2º	China
	3º	Japan
Medium interest	4º	Republic of Korea
	5º	Canada
	6º	Taiwan
	7º	Australia
	8º	India
Low interest	9º	Indonesia
	10º	Singapore
	11º	Chile
	12º	Mexico
	13º	South Africa
	14º	New Zealand
	15º	Brazil
	16º	Philippines
	17º	Puerto Rico
	18º	Namibia
	19º	Argentina
	20º	Barbados



ELBE

EUROPE LEADING BLUE ENERGY

ESCP4i ELBE Partnership

Cluster Energía BASQUE ENERGY CLUSTER

areg Aberdeen Renewable Energy Group

Flanders' Maritime Cluster

OFFSHORE VÄST

OFFSHORE ENERGY.DK

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