Pilot projects for the marinas of Pescara and Vasto

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(Chamber of Commerce Chieti-Pescara)

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Activity title	Defining pilot projects
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Partners involved	Chamber of Commerce Chieti-Pescara
Status	Final
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Summary

Marina di Pescara Pilot Project

Marina di Vasto Pilot Project

Marina di Pescara Pilot Project

0. Summary description

Short description of the pilot, including: type of blue energy source, nominal power/power production, type of energy output, cost, innovative aspects, potential of application in the MED area.

Marina di Pescara is the designed location for the pilot project, one of the biggest tourist harbours in Italy with 107,000 m^2 of water basin and almost 1000 mooring berths. The pilot project concerns the implementation of two solutions: wave energy converters embedded in piers, including oscillating water columns and oscillating floaters; seawater-based heat-pumps to make a transition to electric systems for climate conditioning of buildings. The proposal takes into consideration the extension of the port according to the Structural Plan instead of referring to the current situation of the Marina. Based on consultations with stakeholders during local hubs, this scenario is under evaluation for implementation by the Marina. Moreover, as suggested by the Regional public authority, a similar scenario has been also hypothesized for the Marina of Vasto (second pilot project).

1. Site of the pilot

Description of the exact location of the pilot project, sea coordinates, manufacturing, logistic facilities involved (ports, substation, etc.). Please include a map and describe the main features of the area.

The port of Pescara is structured besides the mouth of the Pescara River. It includes services for pleasure craft, fishery, commercial and passenger boats. Buildings in the Marina host administrative and commercial activities. The Structural Plan of the port forecasts the extension of the tourist port and the construction and expansion of dams and docks for the mooring of large boats, including cruise ships. This represents an opportunity to embed marine energy technologies in the new plan based on a minimum additional investment, compared to the costs of the new structures.

Figure 1 - Aerial view of the Marina of Pescara.

2. Technical considerations

2.1. Resource

Description of the marine energy potential of the pilot area, referring to the selected energy source.

The Marina of Pescara currently uses 11000 m^3/year of natural gas (corresponding to around 120 MWh heat supply) and 880 MWh/year of electricity. This demand would eventually further increase due to the extension of the port.

The first figure below shows the location of main buildings using natural gas for heating. Heating and cooling can be potentially supplied by seawater based heat pumps; the Coefficient of Performance has been estimated CoP=4 meaning that an additional demand of 30 MWh of electricity would be sufficient to supply the heating/cooling system of the Marina (the current cooling demand is included in the electricity consumption).

The second figure below shows the existing piers. The installation of wave energy converters in two of these piers would produce energy to supply the electricity demand of the Marina. In particular, oscillating water columns (average from literature: 250-500 MWh / yr per 100 m pier) and oscillating floaters (average from literature: 250-450 MWh / yr per 100 m pier) are the selected technologies.

Figure 2 – Identification of buildings with heating/cooling systems and existing piers in the Marina of Pescara.

2.2. Bathymetry

Description of the bathymetry of the pilot area, including a bathymetry map.

The Bathymetric study shows the current situation influenced by the Pescara River. The bathymetric levels range from 2 to 7 meters in the proximity of the piers. It allows accessibility of fishing boats, usually moored in the river basin. Inside the port the bathymetry is almost constant while near the dams it is deeper, with a maximum of 10 meters at the northernmost point.

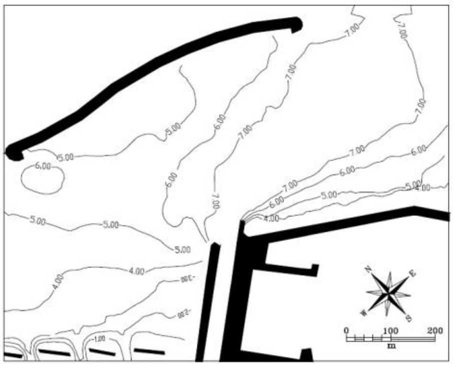


Figure 3 – Current bathymetry levels around the Marina of Pescara (mouth of the Pescara river)

Figure 4 shows the Master Plan overlaying the current configuration of the Marina. The planned structures are expected to contribute to limit the silting phenomena due to the river.

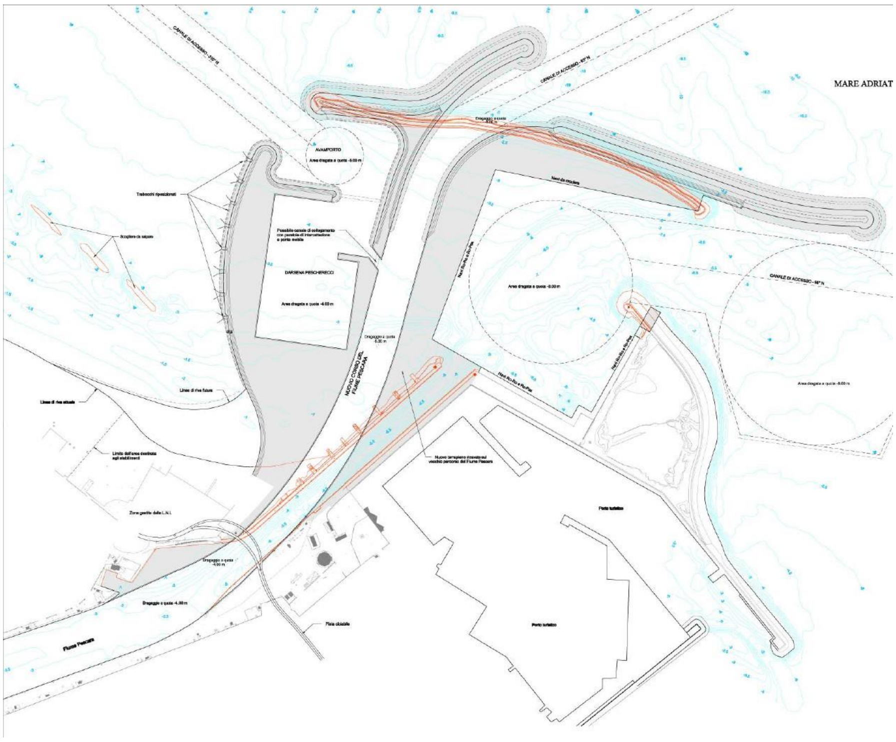


Figure 4 - Overlapping of the existing configuration and the new plan. Source: Marina di Pescara Master Plan.

2.3. Manufacturing facilities/Ports availability

Description of the manufacturing facilities and ports availability nearest the development area.

Local hubs in Pescara have been conducted to engage stakeholders, including SMEs able to provide facilities and technologies for the installation of blue energy plants. One relevant initiative is the Open Innovation Challenge launched by the Marina of Pescara in synergy with the Interreg Med BLUE DEAL Project. The challenge looks for providers in order to facilitate the formation of a local cluster of enterprises to eventually contribute to the design and manufacturing phases of blue energy plants. The Open Innovation challenge is available at this link:

https://www.youtube.com/watch?v=wV0Kn9FG-s4

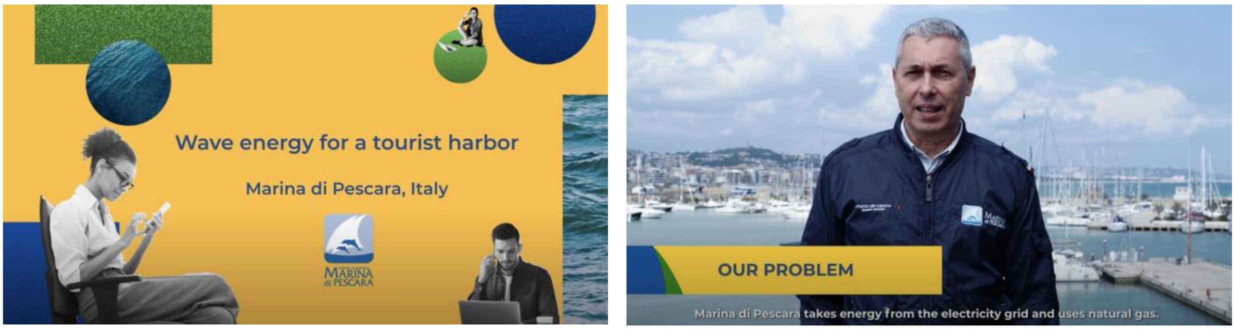


Figure 4 - Open Innovation Challenge launched in synergy with the BLUE DEAL project

3. Non-technical constraints

3.1. Energy policies and spatial planning

Describe how the project is integrated within energy policies (local and regional) and if it complies with the prescriptions of spatial planning instruments (local urban plan, port plan, etc.).

The pilot project is based on the Port Master Plan and takes the opportunity to promote blue energy technologies as part of the investments forecasted for the implementation of the new plan. The effort to exploit blue energies in the Marina is in line with the EU 2050 target of carbon neutrality. Nevertheless, the proposal will necessarily take into account the low Technology Readiness Level of wave energy converters (seawater heat pumps have higher TRL) and will look for proper incentives for innovation as a necessary condition to eventually implement pilot projects.

4. Technology

Description of the technology to develop, type, size per unit, array dimensions, techniques used, etc. and the minimum environmental conditions for plant operation (wave height, sea-depth, type of seabed, etc.)

Seawater based heat pumps have been successfully implemented in many cases. The heat-exchange with seawater, having lower temperature variations in seasons compared to air, allows for achieving values of CoP > 4. Main reference for the installation in the Marina of Pescara is the Crociferi monumental building in Venice well documented by researchers at IUAV. The case of Pescara will offer two chances by using seawater from the piers or the river water from one side of the harbour. The low distance from the seafront allows for both the solutions. Additional analyses on water temperature levels will provide the best choice.

Wave energy converters will concern two technologies: the oscillating water columns will be likely installed in the eastern pier (already existing) and the oscillating floaters will be installed in the southern pier. The location is based on data on wave motion and power, especially avoiding extreme events that usually are determined by northern winds and can compromise the integrity of the technologies. Despite lower potentials, the exposition to Est and South presents good statistics with waves ranging within the interval 0.5-2.5 m. In the image below a diagram showing wave power referring to their origin and as a graphical summary.

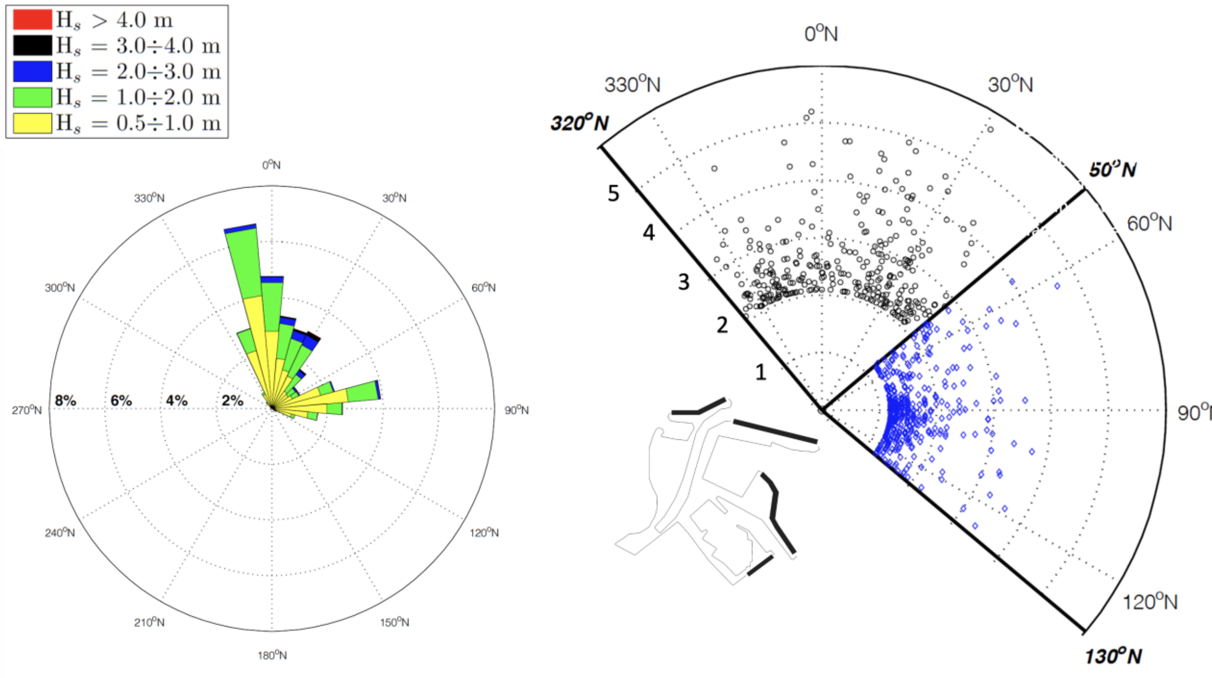


Figure 6 - Directional and quantitative distribution of wave events for the port of Pescara. Source: Marina di Pescara Master Plan.

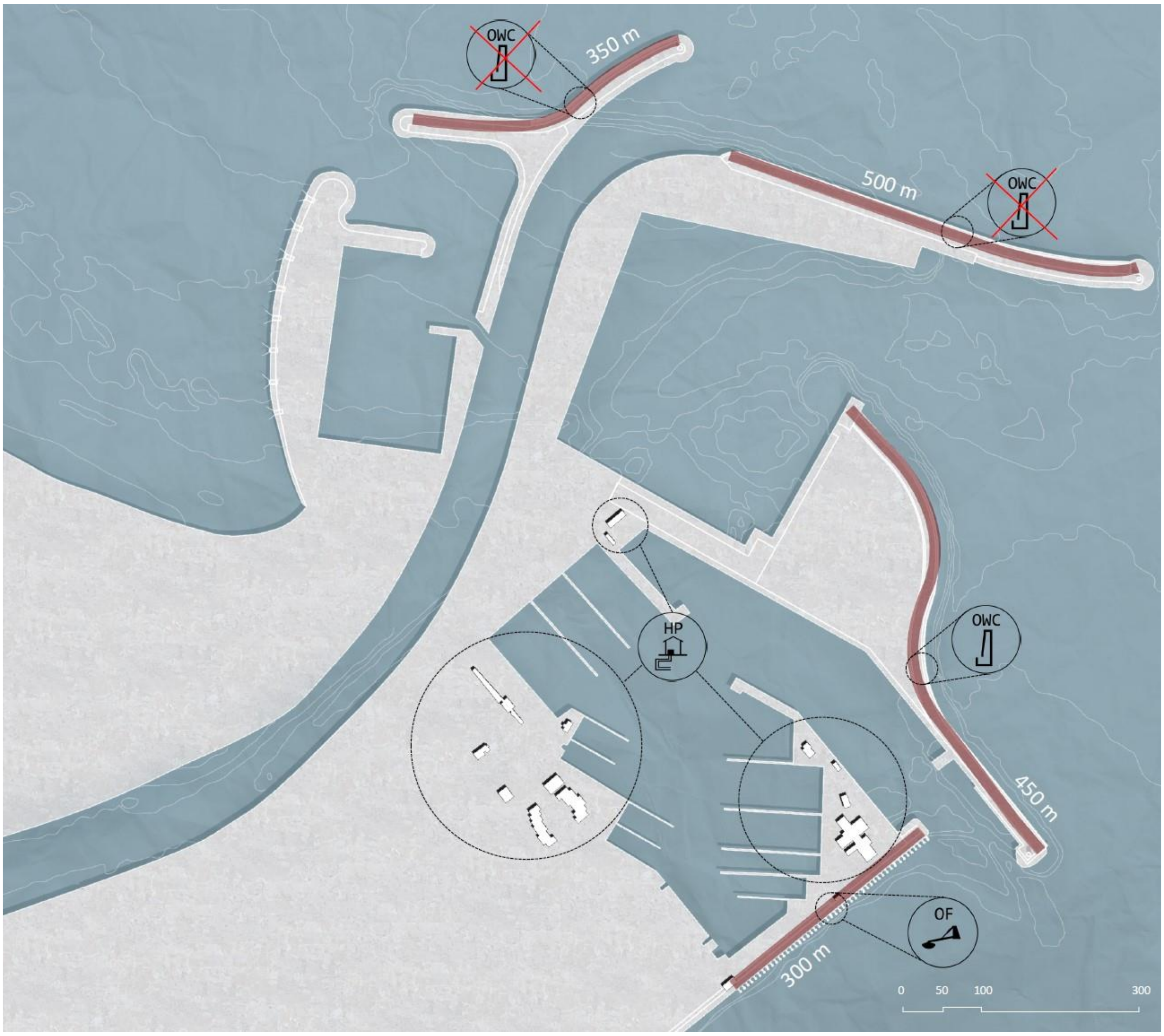


Figure 7 – Marina di Pescara Master Plan with pilot locations.

5. Plant sizing and technical characteristics

Please complete the table.

Seawater based heat pump

Number of devices	*-To be determined*
Device size	*- To be determined*
Distance between devices (maximum or minimum)	*- To be determined*
Total area occupied	*-n.a.*
Distance from the coast (if applicable)	*-From 50 to 400 m*
Technical details (use of transformers; submerged cables; particular construction techniques, etc.)	-

Oscillating water columns

Number of devices	*To be determine*
Device size	*Generally, 6m high above sea level*
Distance between devices (maximum or minimum)	*-Continuum waterfront*
Total area occupied	*-450 m*
Distance from the coast (if applicable)	*- embedded in pier*
Technical details (use of transformers; submerged cables; particular construction techniques, etc.)	*-Air driven turbines (number and MW to be determined)*

Oscillating floaters

Number of devices	*Around 60*
Device size	*-300 m pier*
Distance between devices (maximum or minimum)	*5 m*
Total area occupied	*- 300 m*
Distance from the coast (if applicable)	*- fixed in pier*
Technical details (use of transformers; submerged cables; particular construction techniques, etc.)	*-Oil-dynamic cylinders (number and MW to be determined)*

6. Production/ consumption

Please include the expected production by each device and total farm, annual produce energy and total power, taking into account the production of day and night, as well as the operation window in each season (summer, winter, spring, autumn).
Please specify:

- *Consumption profiles*
- *Demand coverage/storage needs use/auxiliary generation systems*
- *Self-consumption/energy input into the grid*

The current electricity demand of the Marina (including all services) is around 900 MWh/yr. The additional electricity demand for heating/cooling (currently supplied by 11.000 m^3 natural gas equivalent to 120 MWh) is around (CoP=4) 30 MWh/yr.
The potential production of wave energy converters in new piers world include 450 m of Oscillating Water Columns providing 675 MWh/yr and 300m of oscillating floaters providing 450 MWh/yr. We performed a prudential estimate based on minimum production yields of 150 MWh/yr per 100m pier (much lower than the minimum 250 MWh/yr per 100m pier taken from the literature) because of the choice of more protected locations to safeguard devises. Therefore, the Wave Energy Converters would potentially generate around 1000 MWh/yr in total that are sufficient to cover the current demand of the Marina and its transition to electric heating/cooling systems, equivalent to 930 MWh/yr. The hypothetical energy surplus of around 70 MWh/yr can be exported to the city grid or used to supply electric vehicles.

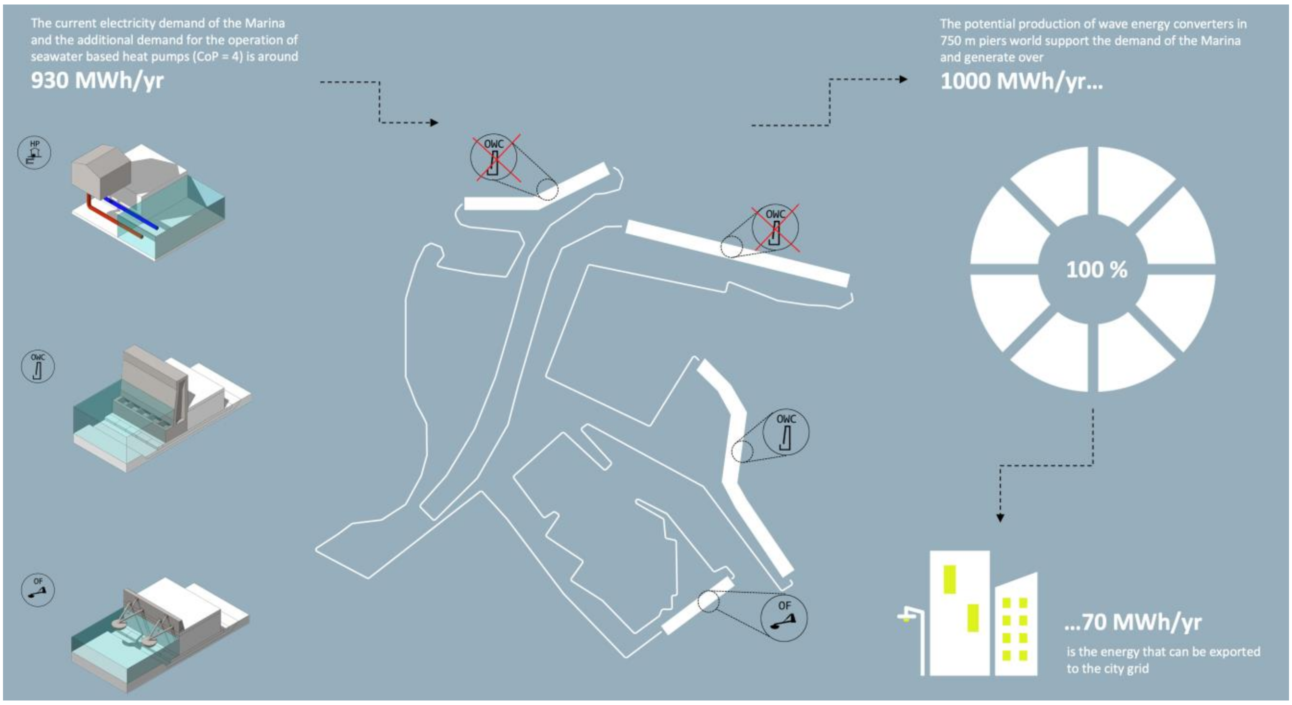


Figure 8 – Possible location of BE devises for the Marina of Pescara and expected production yield (prudential estimate)

7. Life cycle considerations

Please briefly indicate:

- *all components and raw materials necessary to create the device, all the processes involved in the production and their consumptions (e.g. electricity, fuels)*
- *the distance (km) from where technological components are bought or built and the place in which the device will be assembled, specifying for each transport phase the type of transport and consumptions.*
- *how maintenance operations will be carried out for the device, considering their planning in time, material and processes, transport and consumptions.*

WEC-Oscillating Water Columns (OWC)

Raw materials: reinforced concrete for structural elements; steel for air turbines; inert materials for weight.

Lifecycle processes: Manufacturing: construction of caissons (in site or prefabricated modules) and assembling (use of cranes and building machineries), installation of turbines and the electric system (usually 2-3 turbines in 10 m). Maintenance: Periodic maintenance of turbines and electric generators (salinity is among critical factors). End of life: estimated around 10-15 years (extreme events represent a critical factor for the integrity of devices).

WEC-Oscillating Floaters (OF)

Raw materials: steel structural elements; steel for oil-dynamic cylinders; oil-dynamic circuit and electricity generator.

Lifecycle processes: Manufacturing: construction of floaters as prefabricated modules and assembling (use of cranes), installation of oil-dynamic circuit and the electric system. Maintenance: Periodic maintenance of mechanical components, gears, and electric generators (salinity is among critical factors). End of life: Estimated around 10-15 years (extreme events represent a critical factor for the integrity of devices).

8. Environmental and landscape impact

Include graphics and/or maps showing the protected areas near to the pilot area, and describe the level of protection and the environmental restrictions affecting the pilot (if applicable).
Describe the effective or potential impacts of the pilot on the environment and/or the landscape (including visual impact), and how they will be addressed (i.e. describing possible mitigation measures).
Calculate the amount of CO2eq. saved, compared to the use of energy from fossil sources

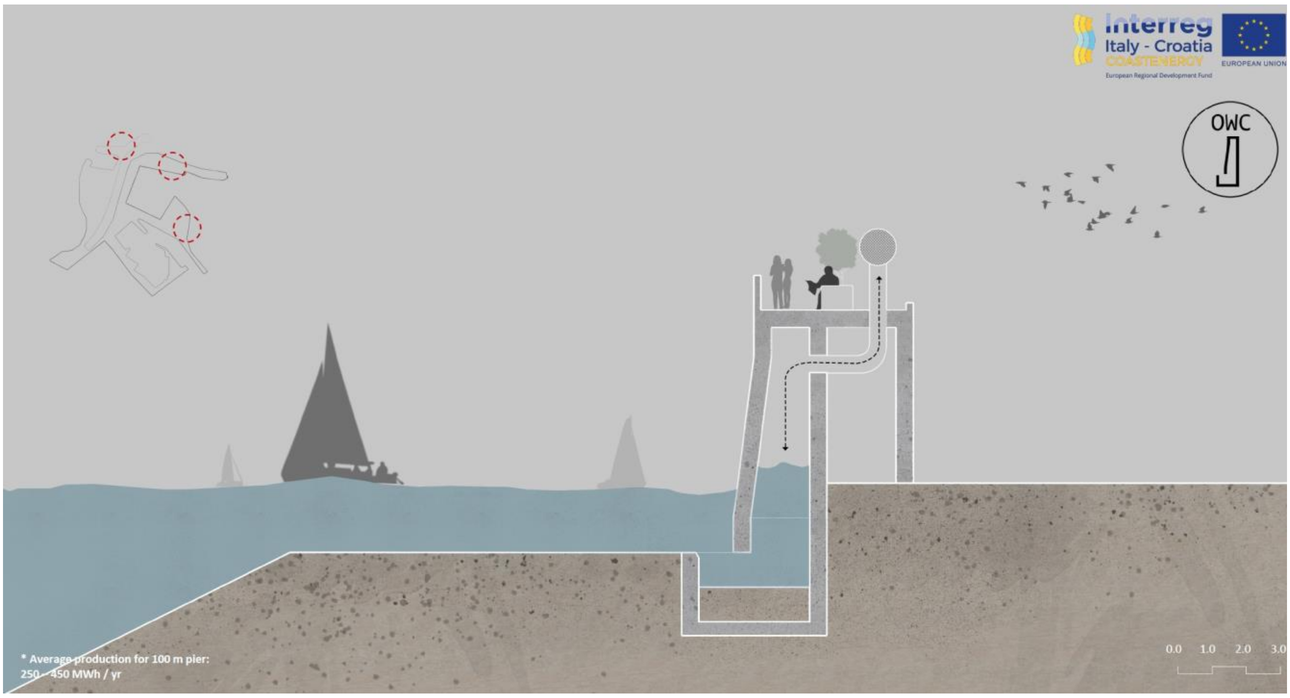
WEC-OWC

The installation has the same size and visual impact of typical breakwater walls. Turbines are visible as outcoming pipes from the caissons and can produce noise; the acoustic impact should be mitigated by embedding turbines within accessible boxes. Other impacts are due to lifecycle processes. The carbon intensity per kWh of electricity produced by the WEC is uncertain.

WEC-OF

The installation has a visual impact that can be mitigated by design. The risk of damage of the devises can be avoided by lifting buoys in case of high waves or maintenance. Other impacts are due to lifecycle processes. The carbon intensity per kWh of electricity produced by the WEC is uncertain.

Blue energy technologies may offer the opportunity to redevelop piers both from an energetic and functional point of view, by integrating public spaces and promenades. One design option is represented by the replacement of materials and constructive elements to decrease lifecycle impacts and improve the design, besides playing with shapes, colours and lights.



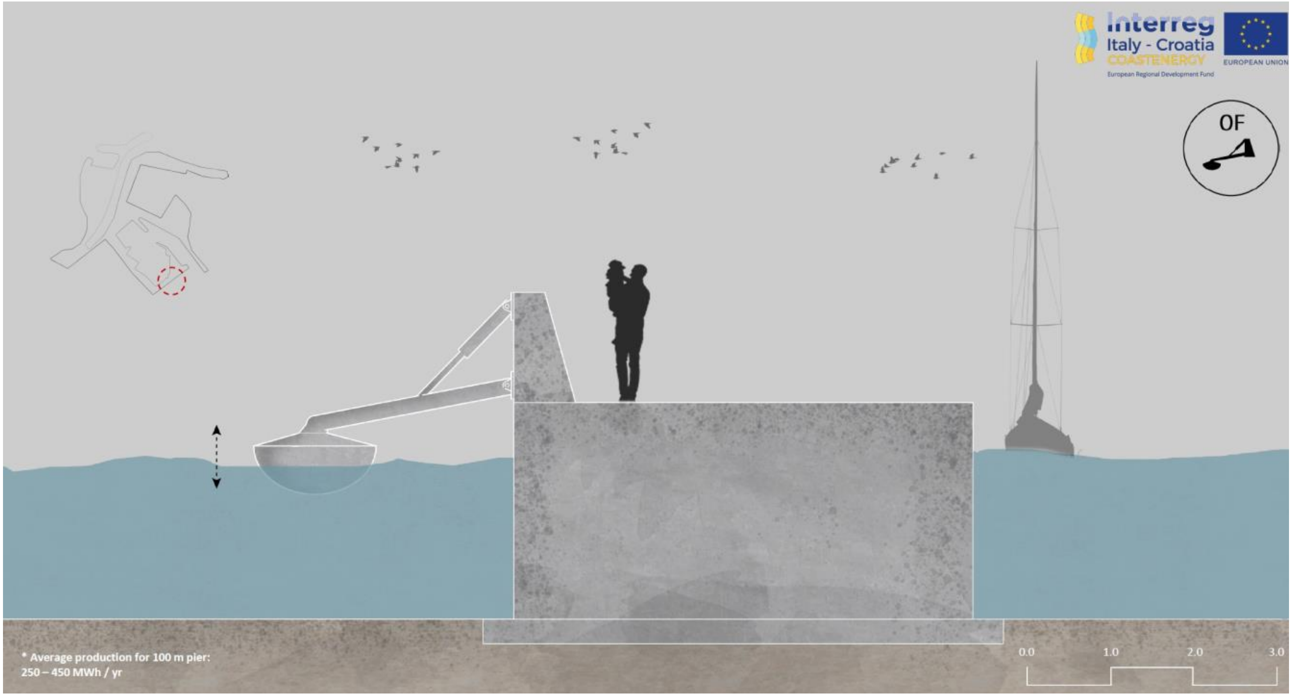


Figure 9 – Sections of piers embedding Wave Energy Converters: OWC above and OF below.

9. Socio-economic impact

Socio-economic impact		
Positive impact *(Please describe any relevant positive impact on the population, employment and/or other economic activities)*	**Population**	New waterfront and well-designed piers, eventually accessible to people.
	Employment	New jobs in the blue energy sector for design, manufacturing and maintenance.
	Other economic activities	Valorisation of the services and commercial activities of the Marina in terms of green marketing (e.g. renewable electricity provided to boats and all users)
	Economic savings	The inclusion in the Master Plan will offer the opportunity to minimize the investment as a little additional cost compared to the cost of port infrastructures. Costs (€/kWh) of energy (electricity and heating/cooling) must be properly investigated.
Negative impact *(Please describe any relevant negative impact on the population, employment and/or other economic activities)*	**Population**	Eventually, noise of air turbines must be mitigated.
	Employment	Risk of relevant damages of devices in case of extreme events. Need of a consistent insurance coverage to guarantee replacement and continuity of activities and jobs in case of damage.
	Other economic activities	
Social acceptance issues	The visual impact from the coast and the sea is very limited and should not represent a critical issue. Oscillating floaters can potentially become characterisation factors for the new Marina.	

10. Project Cost

Insert the total cost in EUR of the pilot project implementation (in addition, you can also specify the cost per unit), taking into account: distance from shore and nearest port, number of required maintenance operations, electrical connections, etc. Use the "Notes" column to highlight important aspects or explain the cost calculation methods.

Type of cost	Cost in EUR	Notes
Manufacturing devices cost		
Electrical connections cost		
Maintenance operations cost		
Decommitment cost		
Other cost (design tax permitting etc.)		
TOTAL		

11. Payback period

Please quantify (in number of years) the time required to recover the initial investment for the pilot implementation.

12. Permitting procedure

Please describe the steps to undertake to get administrative authorization of the pilot, specifying the types of permits to obtain, the institutions that release them, and, if possible, the approximate time to complete the procedure.

According to Italian legislation, blue energy plants may require an EIA (Environmental Impact Assessment) as per Legislative Decree no. 152/2006. The EIA is not compulsory but an option in the context of planning activities for the commissioning of public works.

If the port, or some of its structures, are subject to restrictions, a landscape authorization must also be requested, as per Legislative Decree no. 42/2004.

The standard time to obtain the EIA based authorization is 60 days and must be drawn up by a professional technician enrolled in the respective professional order. Depending on the size of the project, both the Ministry for Ecological Transition and the regional authorities must release the authorization.

13. Other considerations

Please use this section to highlight any other aspect that is relevant to better describe the pilot and/or the results of the study, including lessons learnt and additional analysis or data that would be necessary to increase the feasibility of the pilot.

The design of blue energy devises embedded in piers gives the chance to deal with historical (e.g. wooden structures for fishing, namely trebuchet) and social issues (accessibility to the piers for walking).

Participatory processes usually contribute to increase social acceptance and interdisciplinary approaches are always recommended.

Marina di Vasto Pilot Project

This factsheet is intended to provide the minimum contents of the (pre)feasibility studies of the pilot projects, in order to make them comparable and ease the implementation of WP5 activities.
Please note that the maximum characters per section are indicative; the factsheet as a whole should not exceed 15,000 characters. The inclusion of tables and graphics is highly recommended.

14. Summary description

Short description of the pilot, including: type of blue energy source, nominal power/power production, type of energy output, cost, innovative aspects, potential of application in the MED area.

Marina di Vasto is the second site designed for pilot project, an operative commercial harbor in the Abruzzo region. The pilot project concerns the implementation of Wave Energy Converters, i.e. oscillating water columns and oscillating floaters, in combination with seawater-based heat-pumps to make a transition to electric systems for climate conditioning of buildings. The proposal is focused on the extension of the port according to the Structural Plan, instead of its current configuration, and takes into consideration the presence of historical wooden structures for fishing, namely Trabocchi.

15. Site of the pilot

Description of the exact location of the pilot project, sea coordinates, manufacturing, logistic facilities involved (ports, substation, etc.). Please include a map and describe the main features of the area.

The Port of Vasto (figure 1, Lat. 42° 10’ 05” N - Long. 014° 43’ 07” E), is a commercial hosting activities of loading, storage and logistics of goods. It is located in Punta Penna in the municipality of Vasto, 8 km far from the city center and bordering the nature reserve of Punta Aderci (figure 2). The port is formed by a basin of about 90,000 m² and units that carry out commercial loading/unloading operations for a total of 500-600,000 tons/year.
Developmental priorities for the port include dimensional adjustments of the quays, adaptation of breakwaters for protection from marine events, completion of the railway near the port.

As shown in Figure 3, large industrial areas have been developed near the port and a residential buildingarea is located on the promontory of Punta Penna.

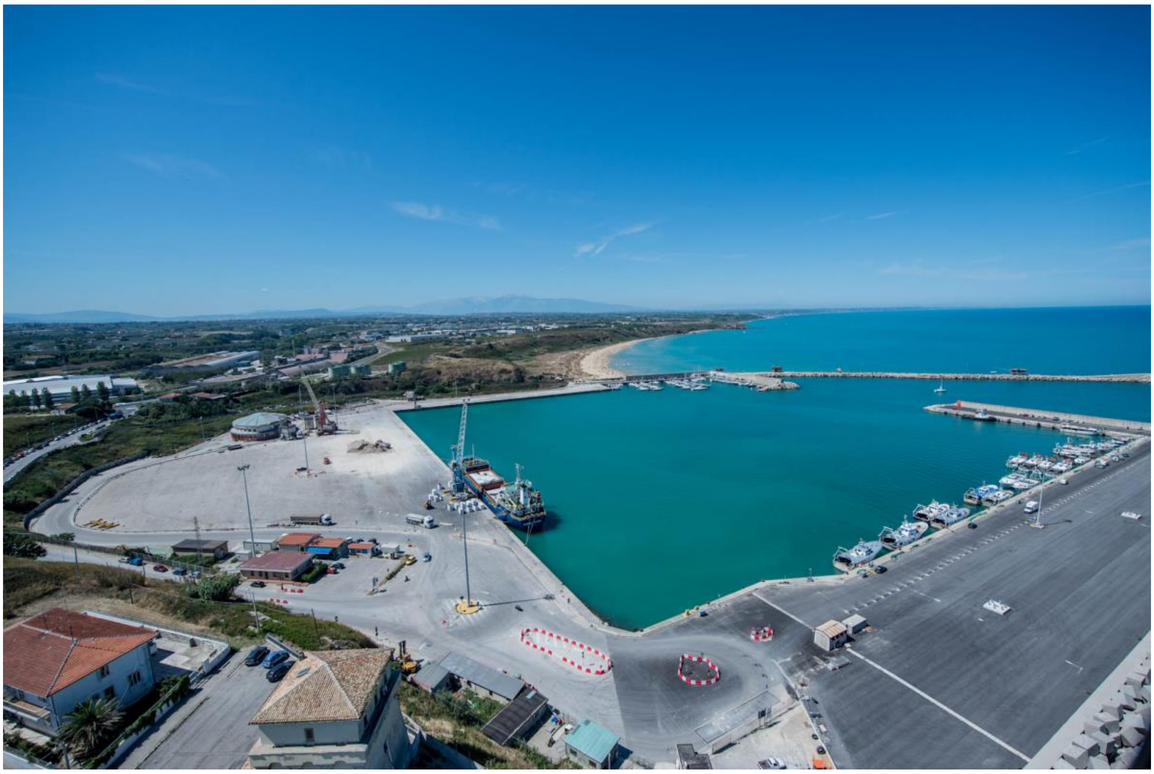


Figure 5 - The port of Vasto. Source: Aspo Ortona and Vasto website.

Figure 6 - Punta Aderci Natural Reserve. Source: Abruzzo Region website.

Figure 7 - Main features of the area with industrial areas, roads and other buildings.

16. Technical considerations

16.1. Resource

Description of the marine energy potential of the pilot area, referring to the selected energy source.

Considering the interventions planned in the Master Plan, the port of Vasto has the opportunity to exploit marine energy.

Figure 4 shows a set of residential buildings (around 10000 m3) whose heating/cooling demand could be eventually supplied by the installation of seawater based heat pumps, given the proximity to the sea.

Figure 5 shows the existing piers. The installation of Wave Energy Converters embedded in the northern pier would produce energy to supply part of electricity demand of the Marina. In particular, oscillating water columns (average from literature: 250-500 MWh / yr per 100 m pier) and oscillating floaters (average from literature: 250-450 MWh / yr per 100 m pier) are the selected technologies.

Figure 8 - Buildings for heat pumps installation (about 10.000 m^3). Image source: ASPO Ortona and Vasto website.

Figure 9 - Suitable places for Wave Energy Converters (WEC). Image source: ASPO Ortona and Vasto website.

16.2. Bathymetry

Description of the bathymetry of the pilot area, including a bathymetry map.

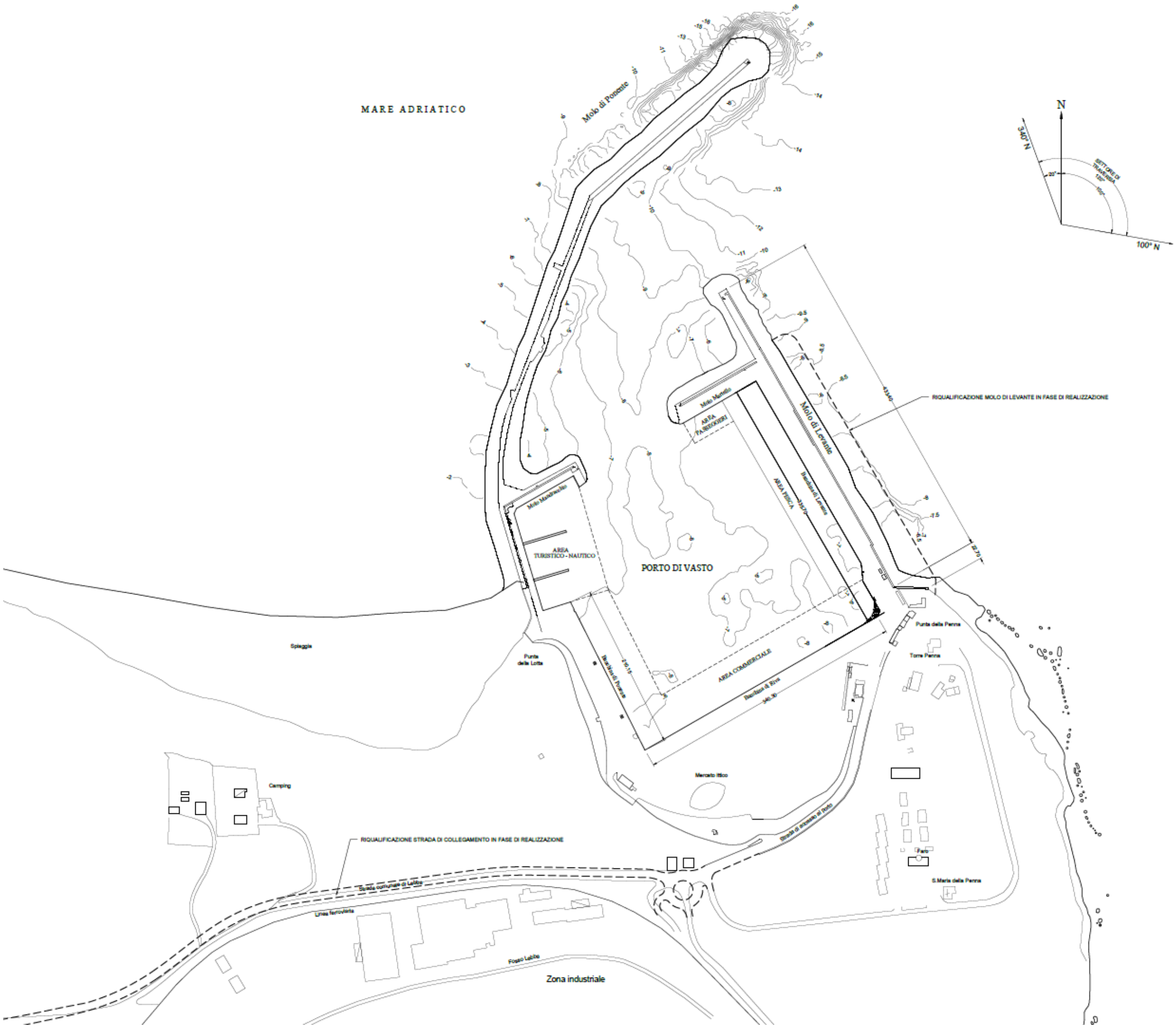


Figure 10 - Current state and bathymetry. Source: PRP 2007 of Vasto.

The Bathymetric studies conducted in 2007 show the current situation of Marina di Vasto (Figure 6). The Port Master Plan will contribute to limit the impact of waves from the North - West.

A few characteristics of the port follow:

- the surface of water basin is approximately 198,000 m^2 of which 121,000 m^2 of

inner basin and 77,000 m^2 of outer harbor.

- the maximum depth of the seabed is about -13.0 m at the mouth of the

port;

- the average depth of the seabed in the inner basin is about -7.0 m a.s.l. with

minimum of -6.0 m and maximum of -8.00 m;

- the land area of the port is approximately 76,000 m^2;

- operational quays are approximately 1000 meters.

16.3. Manufacturing facilities/Ports availability

Description of the manufacturing facilities and ports availability nearest the development area.

The port of Vasto is the largest and most important infrastructure for the storage of bulk materials.

Main available services are listed below:

- moorages
- tugs
- port cranes of 30,40 and 100 t with arms from 20 to 40 m
- buckets with a maximum capacity of 10/18 m^3 of water
- hooks for unloading coils, maximum pruning 30 t
- mechanical shovels of various sizes
- forklift
- two hoppers
- bunker
- health services
- goods storage
- water supply.

In addition, historical "Trabocchi" used for fishing. These are protected as a monumental heritage of the Adriatic coast. Their presence provides limits for the installation of blue energy technologies, as the functionality of these ancient appliances must be maintained.

Figure 11 - Trabocchi locations in Marina of Vasto. Image source: ASPO Ortona and Vasto website.

17. Non-technical constraints

16.4. Energy policies and spatial planning

Describe how the project is integrated within energy policies (local and regional) and if it complies with the prescriptions of spatial planning instruments (local urban plan, port plan, etc.).

The pilot project is based on the Port Master Plan and takes the opportunity to promote blue energy technologies as part of the investments forecasted for the implementation of the new plan. The effort to exploit blue energies in the Marina is in line with the EU 2050 target of carbon neutrality. Nevertheless, the proposal will necessarily consider the low technology readiness level of wave energy converters (seawater heat pumps have higher TRL) and will look for proper incentives for innovation as a necessary condition to eventually implement pilot projects.

The environmental context of the Marina of Vasto provides, more than restrictions, additional reasons for the exploitation of marine energy sources in the port:

- a site nearby of community importance (SIC), part of the "Natura 2000" network. Visual impacts on the landscape must be considered but also renewable energy sources are in line with the environmental vocation of the site;
- the historical memory of the "Trabocchi" avoids operations that limit their functionality but also shows how coastal infrastructures can contribute to characterize the landscape;
- the "Via Verde" is a cycle road that crosses the entire promontory and the use of electric bikes can be eventually supplied by renewable sources (Figure 8-9).

Figure8: Via Verde cycling road and aTrabucco

Figure9 : Via Verde cycling road

18. Technology

Description of the technology to develop, type, size per unit, array dimensions, techniques used, etc. and the minimum environmental conditions for plant operation (wave height, sea-depth, type of seabed, etc.)

Seawater based heat pumps have been successfully implemented in many cases. The heat-exchange with seawater, having lower temperature variations in seasons compared to air, allows for achieving values of CoP > 4. Main reference for the installation in the Marina of Vasto is the Crociferi monumental building in Venice well documented by researchers at IUAV. The case of Vasto offers the possibility of installing seawater based heat pumps for heating and cooling of residential buildings (as shown in figure 4).

Wave energy converters will concern two technologies: the oscillating floaters (OF) will be likely installed in the Southern pier (already existing) and the oscillating water columns (OWC) in the Northern pier. The location is based on data on wave motion and power as shown in Figure 10. While OWC to the north acts as a typical breakwater wall, the OF to the south are protected from extreme events that would compromise the integrity of the technologies. The exposition to South-Est present good statistics with waves within the interval 0.5-2.0 m.

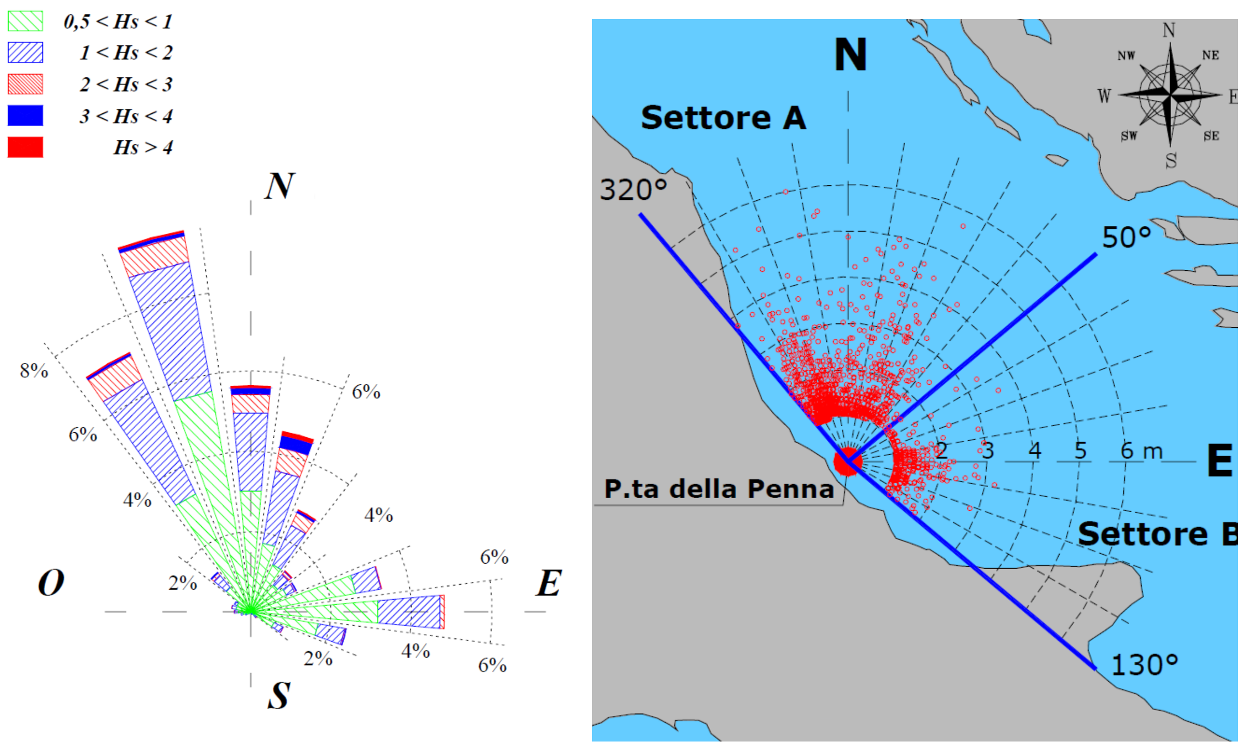


Figure 10 - Directional and quantitative distribution of wave events for the port of Vasto. Source: PRP of Vasto, 2007.

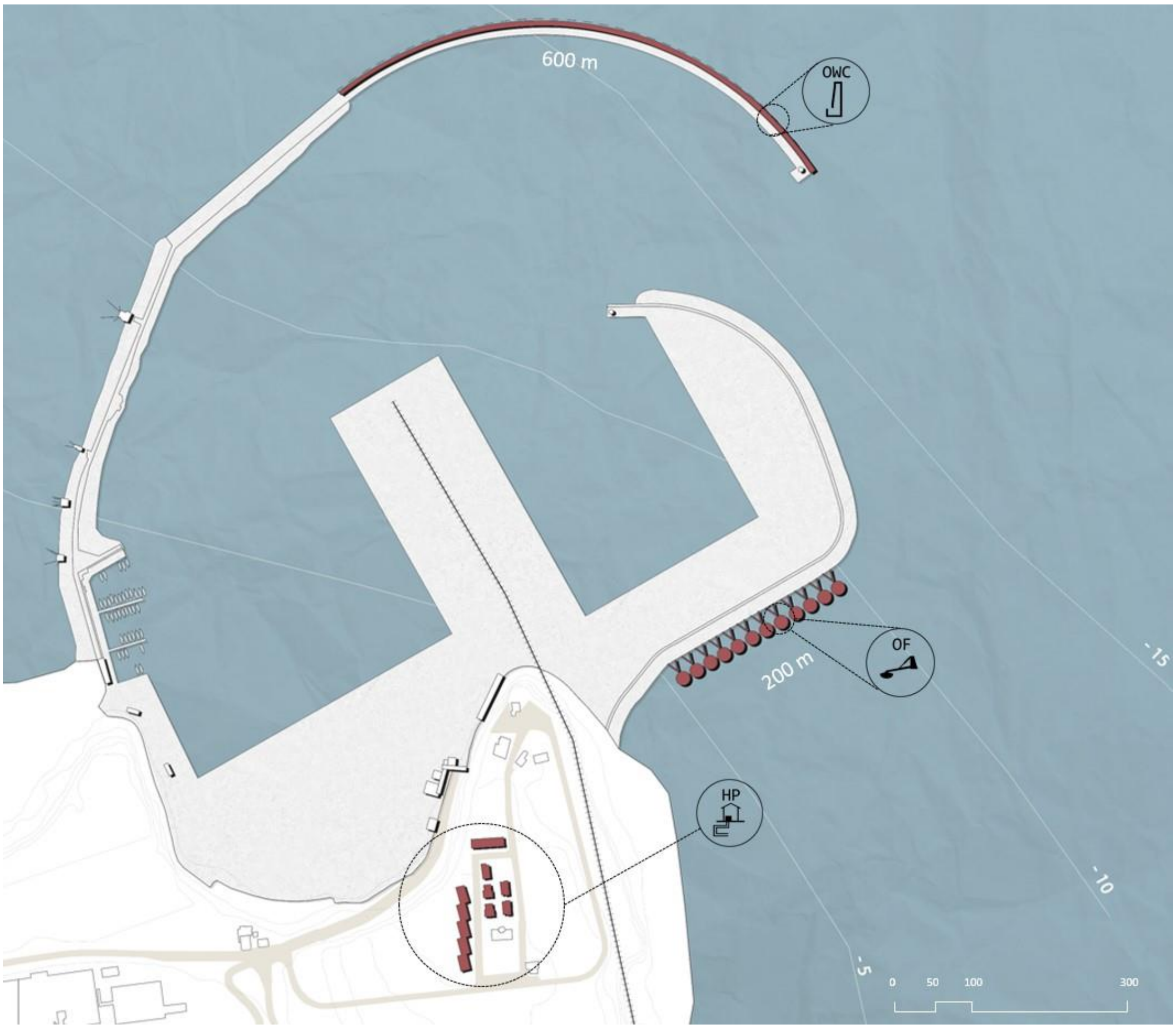


Figure 11 - Vasto Marina Structural plan with pilot locations (1:3000).

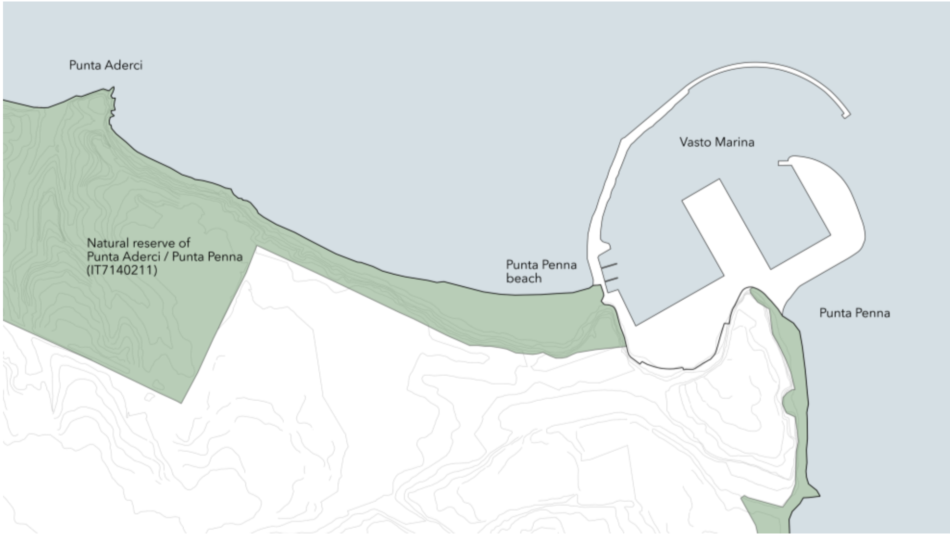


Figure 12 - Location of Natural Reserve (SIC). Source: Database of Abruzzo website.

19. Plant sizing and technical characteristics

Please complete the table.

Seawater based heat pump

Number of devices	*-To be determined*
Device size	*- To be determined*
Distance between devices (maximum or minimum)	*- To be determined*
Total area occupied	*-n.a.*
Distance from the coast (if applicable)	*-From 50 to 400 m*
Technical details (use of transformers; submerged cables; particular construction techniques, etc.)	-

Oscillating water columns

Number of devices	*To be determine*
Device size	*Generally 6-7 m high above sea level*
Distance between devices (maximum or minimum)	*-Continuum waterfront*
Total area occupied	*-600 m*
Distance from the coast (if applicable)	*- embedded in pier*
Technical details (use of transformers; submerged cables; particular construction techniques, etc.)	*-Air driven turbines (number and MW to be determined)*

Oscillating floaters

Number of devices	*Around 30*
Device size	*-300 m pier*
Distance between devices (maximum or minimum)	*5 m*
Total area occupied	*- 200 m*
Distance from the coast (if applicable)	*- fixed in pier*
Technical details (use of transformers; submerged cables; particular construction techniques, etc.)	*-Oil-dynamic cylinders (number and MW to be determined)*

20. Production/ consumption

Please include the expected production by each device and total farm, annual produce energy and total power, taking into account the production of day and night, as well as the operation window in each season (summer, winter, spring, autumn).
Please specify:

- *Consumption profiles*
- *Demand coverage/storage needs use/auxiliary generation systems*
- *Self-consumption/energy input into the grid*

The additional electricity demand of around 10000 m^3 residential buildings, including 35 households, is 140 MWh of electricity and 408 MWh of heat currently provided by natural gas. Given a CoP=4, an hypothetical transition to electric systems based on heat pumps would require around 100 MWh/yr of electricity. The total demand of the fully electric system would therefore be around 250 MWh/yr.
The potential production of wave energy converters in new piers world include 600 m of Oscillating Water Columns providing 1500 MWh/yr and 200 m of oscillating floaters providing 500 MWh/yr (average 250 MWh/yr per 100 m pier). The hypothetical energy surplus can be exported to the city grid or used to supply the activities of the Marina.

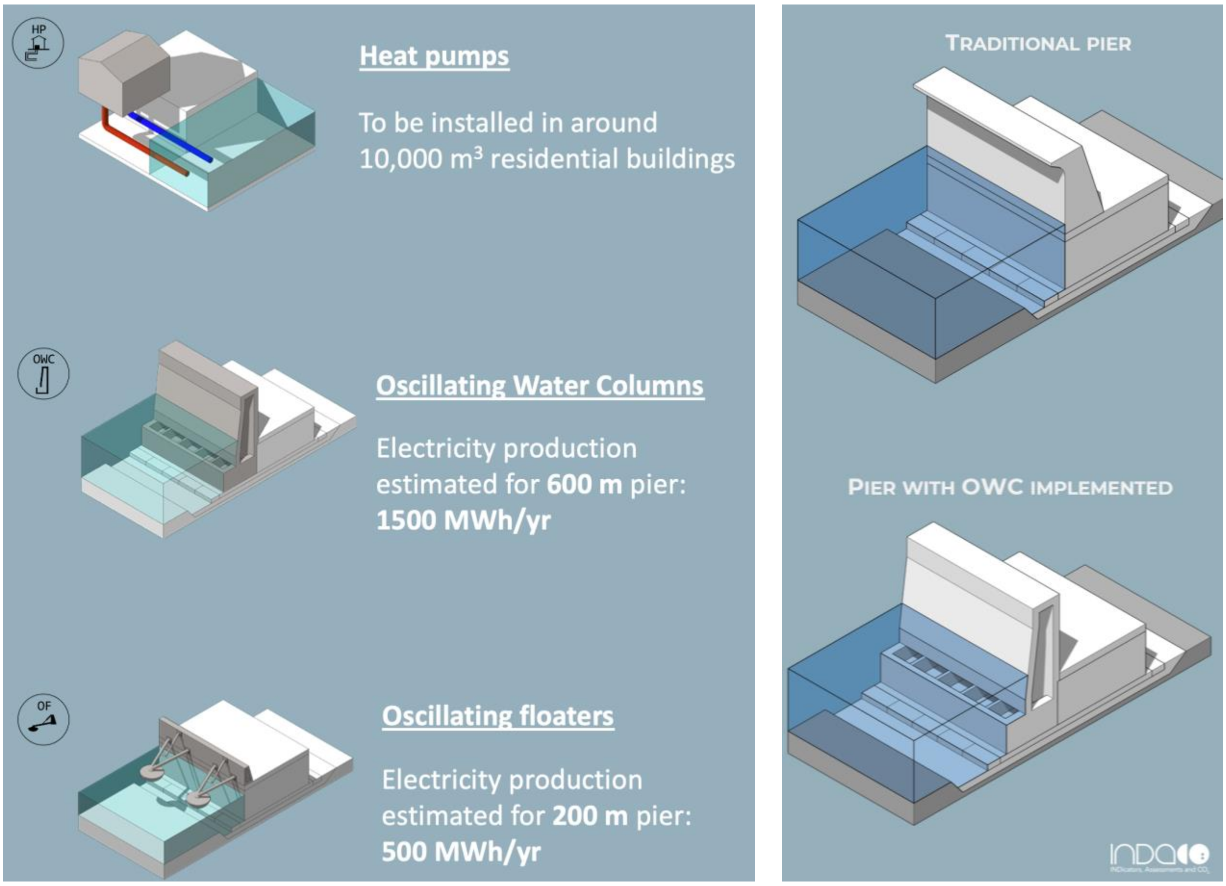


Figure 13 - Selection of BE for Vasto Marina.

21. Life cycle considerations

Please briefly indicate:

- *all components and raw materials necessary to create the device, all the processes involved in the production and their consumptions (e.g. electricity, fuels)*
- *the distance (km) from where technological components are bought or built and the place in which the device will be assembled, specifying for each transport phase the type of transport and consumptions.*
- *how maintenance operations will be carried out for the device, considering their planning in time, material and processes, transport and consumptions.*

WEC-OWC

Raw materials: reinforced concrete for structural elements; steel for turbines; inert materials for weight. Lifecycle processes: Manufacturing: construction of caissons (in site or prefabricated modules) and assembling (use of cranes and building machineries), installation of turbines and the electric system (usually 2-3 turbines in 10 m). Maintenance: Periodic maintenance of turbines and electric generators (salinity is among critical factors). End of life: Estimated around 10-15 years (extreme events represent a critical factor for the integrity of devices).

WEC-OF

Raw materials: steel structural elements; steel for oil-dynamic cylinders; oil-dynamic circuit and electricity generator.

Lifecycle processes: Manufacturing: construction of floaters as prefabricated modules and assembling (use of cranes), installation of oil dynamic circuit and the electric system. Maintenance: Periodic maintenance of mechanical components, gears and electric generators (salinity is among critical factors). End of life: Estimated around 10-15 years (extreme events represent a critical factor for the integrity of devices).

22. Environmental and landscape impact

Include graphics and/or maps showing the protected areas near to the pilot area, and describe the level of protection and the environmental restrictions affecting the pilot (if applicable).

Describe the effective or potential impacts of the pilot on the environment and/or the landscape (including visual impact), and how they will be addressed (i.e. describing possible mitigation measures).

Calculate the amount of CO2eq. saved, compared to the use of energy from fossil sources

WEC-OWC

The installation has the same size and visual impact of typical breakwater wall. The acoustic impact should be mitigated by embedding turbines within accessible boxes. Other impacts are due to lifecycle processes. The carbon intensity per kWh of electricity produced by the WEC is uncertain.

WEC-OF

The installation has a visual impact, near the Natural reserve (Figure 14), that can be mitigated by design, eventually integrated with the historical imaginary of ancient “trabocchi”. The risk of damage of the devises can be avoided by lifting buoys in case of high waves or maintenance. Other impacts are due to lifecycle processes. The carbon intensity per kWh of electricity produced by the WEC is uncertain.

Blue energy technologies may offer the opportunity to redevelop piers both from an energetic and functional point of view, by integrating public spaces and promenades. One design option is represented by the replacement of materials and constructive elements in order to decrease lifecycle impacts and improve the design, besides playing with shapes, colors and lights.

23. Socio-economic impact

Socio-economic impact		
Positive impact *(Please describe any relevant positive impact on the population, employment and/or other economic activities)*	**Population**	New waterfront and well-designed piers, eventually accessible to people.
	Employment	New jobs in the blue energy sector for design, manufacturing and maintenance.
	Other economic activities	Valorisation of the services and commercial activities of the Marina in terms of green marketing (e.g. renewable electricity provided to boats and all users)
	Economic savings	The inclusion in the Master Plan will offer the opportunity to minimize the investment as a little additional cost compared to the cost of port infrastructures. Costs (€/kWh)of energy (electricity and heating/cooling) must be properly investigated.
Negative impact *(Please describe any relevant negative impact on the population, employment and/or other economic activities)*	**Population**	
	Employment	Risk of relevant damages of devices in case of extreme events. Need of a consistent insurance coverage to guarantee replacement and continuity of activities and jobs in case of damage.
	Other economic activities	
Social acceptance issues	The visual impact from the coast and the sea is very limited and should not represent a critical issue. Oscillating floaters can potentially become characterisation factors for the new Marina.	

24. Project Cost

Insert the total cost in EUR of the pilot project implementation (in addition, you can also specify the cost per unit), taking into account: distance from shore and nearest port, number of required maintenance operations, electrical connections, etc. Use the "Notes" column to highlight important aspects or explain the cost calculation methods.

Type of cost	Cost in EUR	Notes
Manufacturing devices cost		
Electrical connections cost		
Maintenance operations cost		
Decommitment cost		
Other cost (design tax permitting etc.)		
TOTAL		

25. Payback period

Please quantify (in number of years) the time required to recover the initial investment for the pilot implementation.

26. Permitting procedure

Please describe the steps to undertake to get administrative authorization of the pilot, specifying the types of permits to obtain, the institutions that release them, and, if possible, the approximate time to complete the procedure.

According to Italian legislation, blue energy plants may require an EIA (Environmental Impact Assessment) as per Legislative Decree no. 152/2006. The EIA is not compulsory but an option in the context of planning activities for the commissioning of public works.

If the port, or some of its structures, are subject to restrictions, a landscape authorization must also be requested, as per Legislative Decree no. 42/2004.

The standard time to obtain the EIA based authorization is 60 days and must be drawn up by a professional technician enrolled in the respective professional order. Depending on the size of the project, both the Ministry for Ecological Transition and the regional authorities must release the authorization.

27. Other considerations

Please use this section to highlight any other aspect that is relevant to better describe the pilot and/or the results of the study, including lessons learnt and additional analysis or data that would be necessary to increase the feasibility of the pilot.

The design of blue energy devises embedded in piers gives the chance to deal with historical (e.g. wooden structures for fishing, namely trebuchet) and social issues (accessibility to the piers for walking). Participatory processes usually contribute to increase social acceptance and interdisciplinary approaches are always recommended.