Interreg Mediterranean
MAESTRALE
Project co-financed by the European Regional Development Fund
Newsletter n.7
November 2019

MAESTRALE shows the way

MAESTRALE has reached its final stage and the curtain is closing. It has been a great trip with the MAESTRALE partnership, that has shown that it is possible to envision a future that includes Blue Energies (BEs), even in the Mediterranean area. It is true that some of the technologies that aim to exploit BEs are still at the early stage. But the feasibility studies carried out in the Blue Energy Labs thanks to MAESTRALE in the 10 regions and 8 countries of the Med area have shown a great degree of applicability.

Constrains including legal, environmental and landscape issues are often different from place to place and therefore the political will is the key to the real development of BEs. If politicians and policy makers around the MED area are serious on willing to change the pattern of energy production from fossil fuels to sustainable energies, BEs have to enter the picture. MAESTRALE has used a participatory processes, involving citizens in the discussion on BEs: the reactions have been very satisfactory, with curiosity and positivity largely overcoming scepticism or adversity.

So, there is a future for MAESTRALE and for its results, a future even more brilliant than expected at the beginning: wind, waves (offshore and inshore), salinity gradient, thermal gradient, currents, tides can all together contribute to the necessary replacement of fossil fuels. And BEs are rapidly rising on the priority list at the government levels.

Grazie a tutti e arrivederci!

Simone Bastianoni - University of Siena

Summary

This last issue of the MAESTRALE Project newsletter is dedicated to the contents of the Final Conference held in Rimini on 5th November 2019 and to the presentation of the 20 Pilot Projects selected by the 10 project partners.

The results of MAESTRALE, coordinated by the University of Siena Ecodynamics team, were presented on November 5 in Rimini at the Final Conference hosted in the international Ecomondo/KeyEnergy – The Renewable Energy Expo. At the Final Conference were presented the MAESTRALE outcomes and results from each Project Partner and have been put the basis for a project follow-up. In the first work session "The relevance of Marine Energy for the future of the Mediterranean area" the area of interest of the MAESTRALE project was contextualized. In particular, the speakers of CoNISMa and InnoblueGrowth (Horizontal Project), European Committee of the Regions and ENEA explained respectively how MAESTRALE fits into the MED Programme architecture and the situation of Marine renewable energy resources in the Mediterranean Sea. From the

presentations it emerged that some BEs are at a most mature phase, other less and it's necessary to work more to understand its use in the MED area. It was also emphasized that several areas of the Mediterranean Sea do not have the sufficient "physical" conditions to exploit the more profitable sources (mainly wind and wind). In the 2nd morning session (Blue Energy in the Mediterranean area: pilot experiences from MAESTRALE) one representative per Partner presented the results of the 20 Pilot projects that have been selected by each Partner within the 4 Regional BELS that were held in each participating region. In particular, among the 40 Pilots selected by the Partners it emerged that 25% of these foresees the exploitation of marine biomass (especially microalgae), 25% of the marine thermal gradient and 20% that of wave (mainly with devices installed on port facilities). The first afternoon session, "Towards capitalization: how MAESTRALE project impacts on policies and local development", representatives of various institutions (Secretary of the National Association of Minor Islands Municipalities, Maritime Technological Cluster MARE FVG – Italy, the Municipalities of Izola – Slovenia, Valencia, -Spain, Giglio Island – Italy, the Energy & Environment Division at Cyprus Employers & Industrialists Federation (OEB) – Cyprus) in the areas affected by the project told how MAESTRALE was or will be useful for them. A part was dedicated to the teachers and students of the Sarrocchi institute of Siena who assisted the Ecodynamics team in realizing scale models of technologies for the exploitation of marine energies and which recently, for this collaboration, received the Tuscany Region award at the Didacta fair. Finally, in the session "Blue Energy for all" was presented the MAESTRALE COMICS STRIP that seeks to communicate in an easy and compelling way the importance that marine energies will have in the future of our planet and the Mediterranean in particular, and discussed with the audience on how to transfer innovation to general public.

UNIVERSITÀ DI SIENA 1240

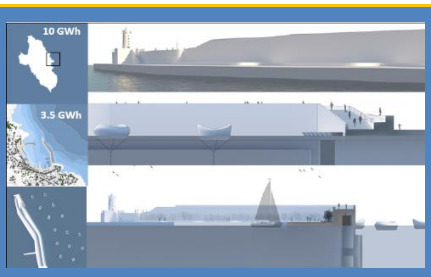
Blue Energy Labs, Training Activities & Open Day: The LP of MAESTRALE, during these three years of the project, has developed an intense activity of dissemination and involvement of the population through multiple activities. Starting from the Blue Energy Lab meetings that took place in Grosseto, Isola del Giglio, Punta Ala and Florence where there was an active involvement of the local population. In addition to these meetings, there was also the Open Day in which in two days UNISI researchers described MAESTRALE project and its achievements to about 200 citizens. In order to reach as many citizens as possible, the LP also developed a questionnaire on Blue Energy distributed online and during the various events in which MAESTRALE was presented obtaining the participation of about 1230 citizens. Moreover, among all the dissemination and transfer activities, the most successful events were the two editions of the researchers' night (i.e. BRIGHT 2018 and 2019) in which, thanks to the collaboration with students of Sarrocchi high school, three prototypes of technologies and the Blue Energies were presented to the citizens.

Interreg Mediterranean
MAESTRALE
Project co-financed by the European Regional Development Fund
Newsletter n.7
November 2019

Pilot Projects of UNISI

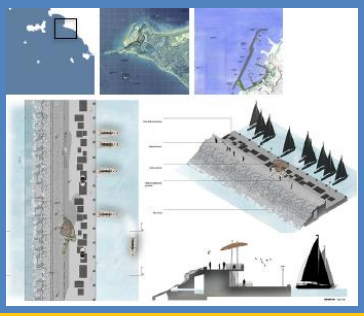
☑ **PP # 1 – *WAVE + Salinity + Wind – Giglio Island Italy***

Giglio island, hosting 1436 residents, besides over 18,000 seasonal tourist arrivals, leads to 10,300 MWh/yr electricity demand. The project forecasts an integrated set of BE technologies: onshore WEC in the breakwater pier (140 m caissons [700-1400 MWh] & 45 m floaters [160-200 MWh]); offshore WEC (100 buoys [2200-2800 MWh]). These will cover Giglio Porto energy demand. To achieve island's energy neutrality, additional BEs should be: osmotic energy from salinity gradients combined with the desalinator; floating wind farm (4 turbines [6400-8000 MWh]).



☑ **PP # 2 – *WAVE + Salinity – Punta Ala Marina Italy***

Punta Ala Marina, hosting almost 900 boats, belongs a residential settlement built in the '60s with over 400 residents, besides consistent seasonal tourist arrivals. The project forecasts an integrated set of BE technologies: onshore WEC embedded in the extended breakwater pier (i.e. 680 m overtopping breakwater system [2700-3400 MWh/yr]); offshore WEC (i.e. 75 fixed buoys [1600-2100 MWh/yr]); osmotic energy system exploiting Salinity Gradient Power Reverse Electrodialysis combined with the seawater desalinating plant (to be built).



University of Cyprus
Oceanography Center - OC

Blue Energy Labs, Training Activities & Open Day: Project MAESTRALE has built a community of stakeholders in the fields of institutional, academia and civil society and industry actors. During the Blue Energy Labs, debates of different technologies were developed and as a result two pilot projects have been drafted. With installation of SWHP local community will reduce heating and cooling costs for two buildings and reduce CO_2 emissions. During training activities entrepreneurs were introduced in the BE sector and they had an opportunity to develop their entrepreneurial idea. At the conclusion of the MAESTRALE project an Open day event was organized during the fair Nature-Health in Ljubljana, where GOLEA disseminated our knowledge and project conclusions among public society.

Pilot Projects of OC - UCY

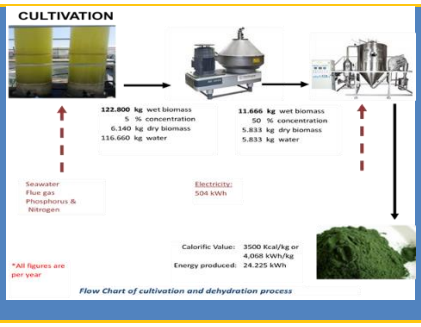
☑ **PP # 1 – *Wave energy -Paphos Cyprus***

The innovative aspect of this project is that it uses a new technology that has neutral buoyancy and moves along the sea surface. This new technological invention is owned by a SWEL (Sea Wave Energy Ltd, Cyprus). The machine is very light, environmentally friendly and cost effective compared with Wave Energy converters currently available in the Blue Energy market. The nominal power of each device is expected to be 18 MW. The machine initial output is water pressure and it will be converted to electricity. This unit will be installed at the southwest coastline of Cyprus.

Interreg Mediterranean
MAESTRALE
Project co-financed by the European Regional Development Fund
Newsletter n.7
November 2019

☑ **PP # 2 – *Marine biomass -Vasilikos Cyprus***

This Marine Biomass Pilot Project examined the possibility of installing cultivation, harvesting and drying of microalgae biomass and co-firing the "end product" (dry microalgae biomass) in existing industrial boilers with fossil fuel to produce thermal energy. The cultivation of microalgae is proposed to take place in closed Photobioreactors (PBR), while the co-firing will be carried out in existing boilers (Vassiliko Cement Works or Vasilikos Power Station).



Flow Chart of cultivation and dehydration process

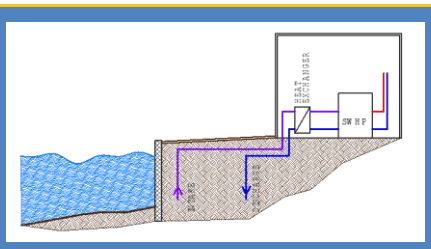
GOLEA
Goriška Local Energy Agency

Blue Energy Labs, Training Activities & Open Day: The first achievement of MAESTRALE was the establishment of a communication channel between key stakeholders. From the resulting communication and discussions, the drawbacks of Blue Energy sector have been identified. In addition, within Blue Energy Labs activities, the inclusion of Blue Energy sector in the ongoing marine spatial planning design has been achieved. The National Energy Plan of Cyprus includes also the Blue Energy potential. The second achievement was the promotion of local SMEs. The networking activities that took place within BELs resulted in the cooperation between local SMEs and external speakers that attended to the events. The third achievement was the engagement of young people and new entrepreneurs in the BE sector through training activities and the student article writing contest.

Pilot Projects of GOLEA

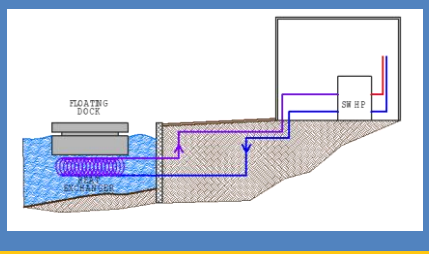
☑ **PP # 1 – *Thermal energy - Sea Water Heat Pump with boreholes***

Pilot project Health care centre Izola introduces the use of thermal sea energy as Blue energy source. Foreseen technology for the extraction of thermal energy is Sea Water Heat Pump (SWHP) with boreholes for intake and discharge of sea water mixed with underground water. Two boreholes are located on the seashore in front of the building. Nominal power of the SWHP is 227 kW, with yearly heat production of 118 MWh, cold production of 192 MWh and yearly electricity consumption of 61 MWh. Total investment costs are estimated to 176,000 € (without VAT).



☑ **PP # 2 – *Thermal energy - Sea Water Heat Pump with closed loop***

Pilot project Verdijeva 1, Izola introduces the use of thermal sea energy as Blue energy source. Foreseen technology for the extraction of thermal energy is Sea Water Heat Pump (SWHP) with closed loop system. The location of closed loop system heat exchanger is under the floating docks in nearby marina. Nominal power of the SWHP is 49 kW with yearly heat production of 49 MWh, cold production of 39 MWh and yearly electricity consumption of 20 MWh. Total investment costs are estimated to 214,000 € (without VAT).



Interreg Mediterranean
MAESTRALE
Project co-financed by the European Regional Development Fund
Newsletter n.7
November 2019

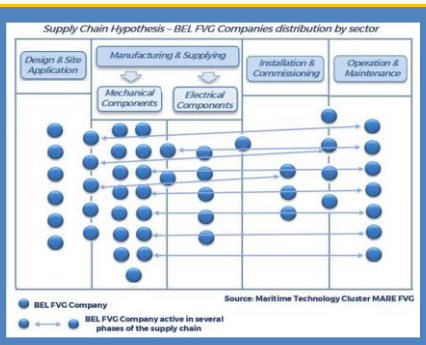
INFORMEST
Agency for Development and International Economic Cooperation

Blue Energy Labs, Training Activities & Open Day: The first 3 BELS were organized between February 2018 and March 2019. The objective of the 4th BEL of the FVG Region (30th October 2019) was to present the two Pilot Projects definitively identified during the previous BELs and to open a discussion. The primary purpose of the Webinar series (Training) was to deepen the theme of BE, to understand the European and Italian experiences already present, and to understand what are the opportunities for the Friuli Venezia Giulia Region. The first webinar (11th November 2010), entitled "*Blue energy: technologies for the production of renewable energy from the sea*", was conducted by the Department of Engineering and Architecture of the University of Trieste. The second Webinar (14th November 2019 - *Offshore Wind Certification in accordance with international codes and standards*) focused on the presentation of the report of the Lloyd's Register which deals with Marine & Offshore and sustainable energies and which was concentrated on offshore wind energy. The Webinar of 21 November 2019, entitled "From the prototype to the realization: what is ISWEC", was conducted by the Turin Polytechnic spin-off "Wave for Energy" which explained the development path of the ISWEC (Wave energy Converter device). On 25th November INFORMEST conducted the 4th Webinar "Experiences and best practices in the Mediterranean and European area in the field of blue energy" during which the issues concerning the applicability of technologies for the exploitation of the Blue Energy in the Mediterranean Sea, in the Italian seas and in the Upper Adriatic in particular. A total of 14 participants were recorded. The Open Day (30th October 2019) was dedicated presentation of the MAESTRALE Project, of the main Blue Energy technologies and their potential for application in the Adriatic Sea. The 2 Pilot Projects (supply chain of components for WEC and biomass production from micro-algae) were also presented.

Pilot Projects of INFORMEST

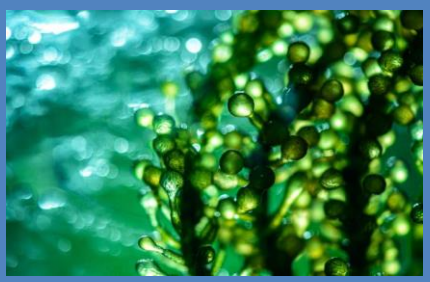
☑ **PP # 1 – *Wave energy – Supply chain for WECs***

The first Pilot looks at the regional chain of naval mechanical components, with the identification of a regional cluster of companies that can "export" their consolidated expertise in the aforementioned sectors to other seas, also thanks to the strong links with the FVG research facilities advanced. It is precisely from our companies that specialize in both mechanical and electrical components - the possibility of contributing directly to the advancement of WEC technology - wave energy converter, a sector on which efforts are focusing the most of research. It is a type of technology destined to find wide use in the seas of other European countries, offering unprecedented market and business prospects for the sector of components in our region.



☑ **PP # 2 – *Thermal energy - Sea Water Heat Pump with closed loop***

The 2nd Pilot focuses on the cultivation of microalgae, a sector in which Friuli Venezia Giulia can boast experiences with a very high rate of innovation, thanks to the involvement of institutions such as the National Institute of Oceanography and Experimental Geophysics (OGS) of Trieste. The cultivation of microalgae thanks to the installation of photobioreactors represents one of the most advanced applications of marine biology. This is a sector considered particularly strategic due to the enormous potential of these microorganisms, which are now widely used in industry, from cosmetics to nutrition (superfood). The cultivation of micro-algae in photobioreactors for the production of bio-fuels would represent a further step forward in this innovative chain



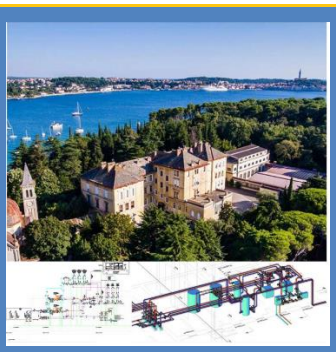
Istrian Regional Energy Agency

Blue Energy Labs, Training Activities & Open Day: Through 4 BELs organized during the projects' implementation, IRENA first wanted to introduce the topic of BE on regional level and then to identify specific issues that could be resolved with use of BE. One of those issues was possibility of integration of BE-based technologies, more specifically sea thermal energy, into complex process of energy refurbishment of heritage buildings that represent significant percentage of total building stock within region. Through BELs and interactive process that included regional and national stakeholders, two such pilot solutions were developed and one of them, energy refurbishment of Hospital Martin Horvat, became nationally recognized good practice which fostered inclusion of blue energy into national heritage buildings energy refurbishment guidelines published in September 2019. MAESTRALE and its outcomes and blue energy potential were also presented to general public during MAESTRALE open days organized as part of 22nd Istrian region chamber of commerce fair. General public unawareness and lack of regionally available expertise determined the topic of MAESTRALE training activities which were organized in cooperation with experts form University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering and regional technical high schools as model of educating students, both high school and university ones, to work in field of blue energy.

Pilot Projects of INFORMEST

☑ **PP # 1 – *Thermal gradient - Hospital Martin Horvat, Rovinj***

This Pilot project was developed for refurbishment of thermotechnical system of one building within 19th century complex of Martin Horvat hospital in City of Rovinj. Pilot project envisages installation of seawater to water inverter heat pumps as visually unobtrusive solution suitable for heritage buildings for production of heating (DHW included) and cooling energy. System is based on two 100 kW heat pumps that extract energy from two sea water pumped from two exploitation and returned to two injection wells.



PP # 2 – Thermal gradient - Kindergarten Radost, Poreč

Kindergarten is located on elevated ground near the coastline (10 m altitude). System is based on extraction of sea water via exploitation well and raising of that water to higher altitude and its storage in underground water storage tank. Water accumulated in that way is used as source for heat extraction/heat dump of the heat pump and as potential energy source of reversible hydro power plant with hydro turbine placed into injection well. Reversible hydro power plant uses exploitation well subversive pump for water accumulation and functions whenever 30 kW heat pump is operational – it returns the water to injection well. Additionally, underground water storage tank can be used for storage of electric energy produced by PV powerplant (transformation of electric into potential energy) or for conversion of grid electric energy into potential energy in period of cheaper (night) tariff.

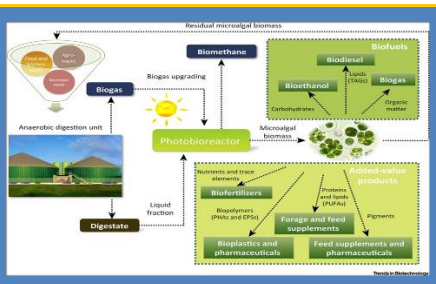
UAlg
UNIVERSIDADE DO ALGARVE

Blue Energy Labs, Training Activities & Open Day: Project MAESTRALE has been extremely important at local and regional levels. The major outputs from MAESTRALE project allowed the setting of tools and methodologies to promote the Blue Energy potential in the Algarve region. This increased knowledge of the sector in the region came from the establishment of permanent coordination networks, at regional and transnational levels, that represented the creation of innovative BE clusters gathering together the key actors of the Quadruple Helix operating within the Blue Energy field. The activities, developed in the scope of the MAESTRALE project, involved R&I actors, enterprises, SMEs, public authorities, NGOs, and public in general, with the task to define a common methodology for building regional networks among the Quadruple Helix actors, to foster Blue Energy start-ups, to monitor and assess the regional network's activities in view of transferring, to carry on international networking activities to promote Blue Energy and increase visibility and effectiveness of regional networks in the MED Area and beyond.

Pilot Projects of UAlg

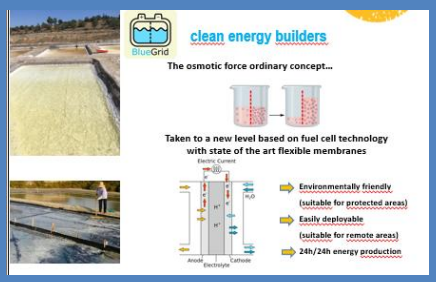
☑ **PP # 1 – *Marine Microalgae Biomass, Olhão, Portugal***

This project aims to implement a sustainable process for the treatment of nitrogen-rich aquaculture wastes using microalgae. In parallel to water treatment, the process will produce microalgal biomass rich in lipids that can be further upgraded to biodiesel. The remaining biomass can be fermented anaerobically, producing biogas, which allows the production of two different biofuels (blue energy from biomass).



PP # 2 – Salinity Gradient, Castro Marim, Portugal

The BLUE GRID project aims to develop a new and innovative solution to energy production for small and off the grid entities, able to value the old concepts of osmotic force induced by salt gradient in salt ponds. The goal is to transfer knowledge in nanomaterials, graphene, fuel cells and textile membranes, capable of going beyond the old traditional mechanical concept of osmotic force conversion into mechanical energy, to a more efficient and flexible direct conversion into electrical power of osmotic gradients transforming salt ponds into solar power storage for day and night electricity production.



ARISTOTLE UNIVERSITY OF THESSALONIKI

Blue Energy Labs, Training Activities & Open Day: AUTH has organized four Regional BELs and one Transnational Blue Energy Lab. During the 1st Regional BEL professionals from research institutes, local business support organizations, regional and national policy and decision makers were introduced to BE. A discussion was held on how such types of RES could be implemented in the Greek context. During the 2nd BEL, attendees got acquainted with existing types of BE technologies and shared some thoughts on possible BE pilots in Greece. The third BEL focused on the final choice of BE technology and their siting. Lastly, in the fourth BEL, Aristotle University of Thessaloniki presented the two pilot projects and BEL members discussed their possible future implementation and collaborations in both local and national level.

During the Third Transnational BEL, organized by AUTH, all PPs got acquainted with various stakeholders from all the participating countries, discussed the progress of MAESTRALE project so far and possible synergies in the field of BE. The Open Day was held in the premises of AUTH. Distinguished speakers informed the attendants about BE technologies, discussed the design and implementation of BE plants, and presented the results of MAESTRALE project, including the two pilot BE projects designed by AUTH. A training activity per topic was organized, recruiting selected speakers from various disciplines. Trainees belong to two different target groups: students and professionals.

Pilot Projects of AUTH

☑ **PP # 1 – *Marine biomass producing system Thessaloniki Greece***

This project aims, with the use of marine microalgae, to implement a sustainable process for the treatment of eutrophicated coastal waters with high loads of nitrogen and phosphorous compounds while producing energy! The process will produce microalgal biomass rich in lipids that can be further upgraded to biodiesel. The remaining biomass can be fermented anaerobically, producing biogas, which allows us to produce two different biofuels (BE from biomass). Microalgal treatment of contaminated coastal waters can help to reduce the environmental load of inorganic nutrients largely responsible for coastal eutrophication and in this case for the city of Thessaloniki and to support the energy demands of the town!

PP # 2 – *Wave energy producing system Thessaloniki Greece*

Trimaran Green Energy it is a Greek patented, floating system which uses sea waves to produce electricity through an electric generator. The system, using a boat carrying a series of floats in both sides, converts waves - ripples to electricity through a mechanical but not hydraulic manner. It needs waves no more than 30cm height (2-3 beaufort) to start producing energy. It operates by taking advantage of the completely irregular behavior of the sea wave movement, whether waves are small or big, by using all possible axial (vertical, horizontal) and torque power. Through its innovative design it manages to multiply the incoming wave power by 6 times!

CEEI VALENCIA
European Center for Innovative Companies of Valencia

Blue Energy Labs, Training Activities & Open Day: along this year, CEEI Valencia has made 4 Blue Energy Labs, 1 Training Day and a final Open Day with the presentation of the results of the MAESTRALE project in the Valencian Region. A total of 6 events attended by more than 300 people interested in the development of marine renewable energy. During these activities, attendees were able to discuss and exchange information and opinions on the use of blue energies, their technology, the consequences of its possible implementation at Mediterranean Sea, the redefinition of many business models using these new technologies and the creation of new professional profiles.

Interreg Mediterranean MAESTRALE

Project co-financed by the European Regional Development Fund

Newsletter n.7

November 2019

Pilot Projects of CEEI

☑ **PP # 1 – *Isolated Floating Hybrid Waves and PV, Gandia Spain***

Butterfly solution, is a Wave-To-Wire (W2W) system that aims to produce blue energy to be integrated with other renewables and traditional electrical supply of coastal regions. This innovative solution is composed of a Wave Energy Converters (WEC) that capture the energy from waves, and a Power Take-Off (PTO) system that converts the energy into electricity. The device comprises a set of floats that make the shaft to turn along the path of the wave. Wave in combination with PV panels can reduce significantly the fuel use in gen-sets, or renewable generation system.

PP # 2 – *Bottom Fixed Offshore Wind - Gravi3, Vinaroz Spain*

Fixed foundations are the most established blue energy solution, although little experience exists in the Med area. One suitable solution is the GRAVI3 concept, that consists on a mixed concrete-steel selfbuoyant gravity-based structure (GBS) made by three concrete caissons supporting a steel tripod. The main aspect of this solution is that it tries to minimize the use of Heavy Lift Vessels during all phases of project's deployment. The concrete caissons are built using slipforming systems inshore (floating docks with high construction rates).

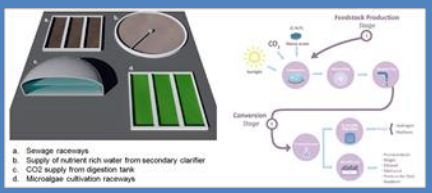
MIEMA
Malta Intelligent Energy Management Agency

Blue Energy Labs, Training Activities & Open Day: the four Maltese Blue Energy Labs (the last one embedding also the training and the Open Day) took place between April 2018 and September 2019, and were attended by a total of 53 persons belonging to 23 organizations, including 8 national public authorities, 3 local councils, 5 SMEs, the NGO Nature Trust Malta, and the University of Malta - the most important academic institution in the country. Considering the size of the Maltese Islands, attendance to the BELs was notable, and the whole experience can be considered fruitful, since it succeeded in transferring and exchanging knowledge on Blue Energy, and in activating a debate on the subject, thus paving the way towards the promotion of changes at the policy and regulatory level to enable the development of the sector in Malta.

Pilot Projects of MIEMA

☑ **PP # 1 – *Open land-based system for the cultivation of marine microalgae integrated with wastewater treatment plants – Maltese Islands***

In Malta, nutrient enriched brine is produced from desalination of secondary treated water derived from sewage. This brine contains nitrogen and phosphorus, so discharging it into the sea can have negative environmental impacts. Instead it can be used for microalgae culture: algae can help reduce waste water's nutrient content and can then be used to produce biofuel. An open land-based system (using open raceways or shallow mixed ponds) can be installed near one of the 3 existing Maltese urban wastewater treatment plants located at the seashore (Ic-Cumnija, Ta'Barkat and Ras il-Hobz). Estimated production of one plant can amount to 3,650 L/ha of biofuel per year



PP # 2 –*Marine thermal energy for the heating & cooling of accommodation structures along the Maltese waterfront*

In Malta, sea water can be used as a fixed temperature source in heat pumps/refrigerators to provide for heating & cooling requirements of waterfront hotels (open-loop cooling), especially when located within 50 m distance from the shoreline. Plants can be implemented outside areas of natural value, and the system inlet/outlet must be deployed so as to not interfere with seagrass, Mearl beds or other important marine ecosystems.