Design, Engineering, Product Development & Consultancy for the Offshore and Maritime Industry

Moray Base 2.0 – 15 MW Turbine floater design

The future of wind industry requires development of windfarms in deeper waters or in areas with very soft soils to meet the increasing global energy demand. For this purpose Maridea developed the Moray Base: a most cost effective floater (both Capex and Opex), with excellent motion characteristics and capable of supporting 15 MW turbines and above in harsh environments. The patent pending design focusses on an industrialized fabrication process combined with minimum maintenance requirements.

Economic potential

The size of wind turbines grows rapidly. Shallow water locations in Europe get scarce, while most emerging wind markets (such as California or Japan) lack shallow water locations at all or possess shallow seas with very soft soils (such as China or Korea). The demand for global wind is expected to rise from about 200 MW in development today to 250 GW installed in 2050 (DNV wind outlook). To enable this huge growth, the foundation production will need to be similarly industrialized as the fabrication of turbines and monopiles. The Moray base enables all these developments, in particular the demand for industrialized production.
For comparison reasons a 9.5MW Moray base was developed. In relation to other concepts the industrialized production reduces the foundation investment with 50% to 75% when designed for similar environments.

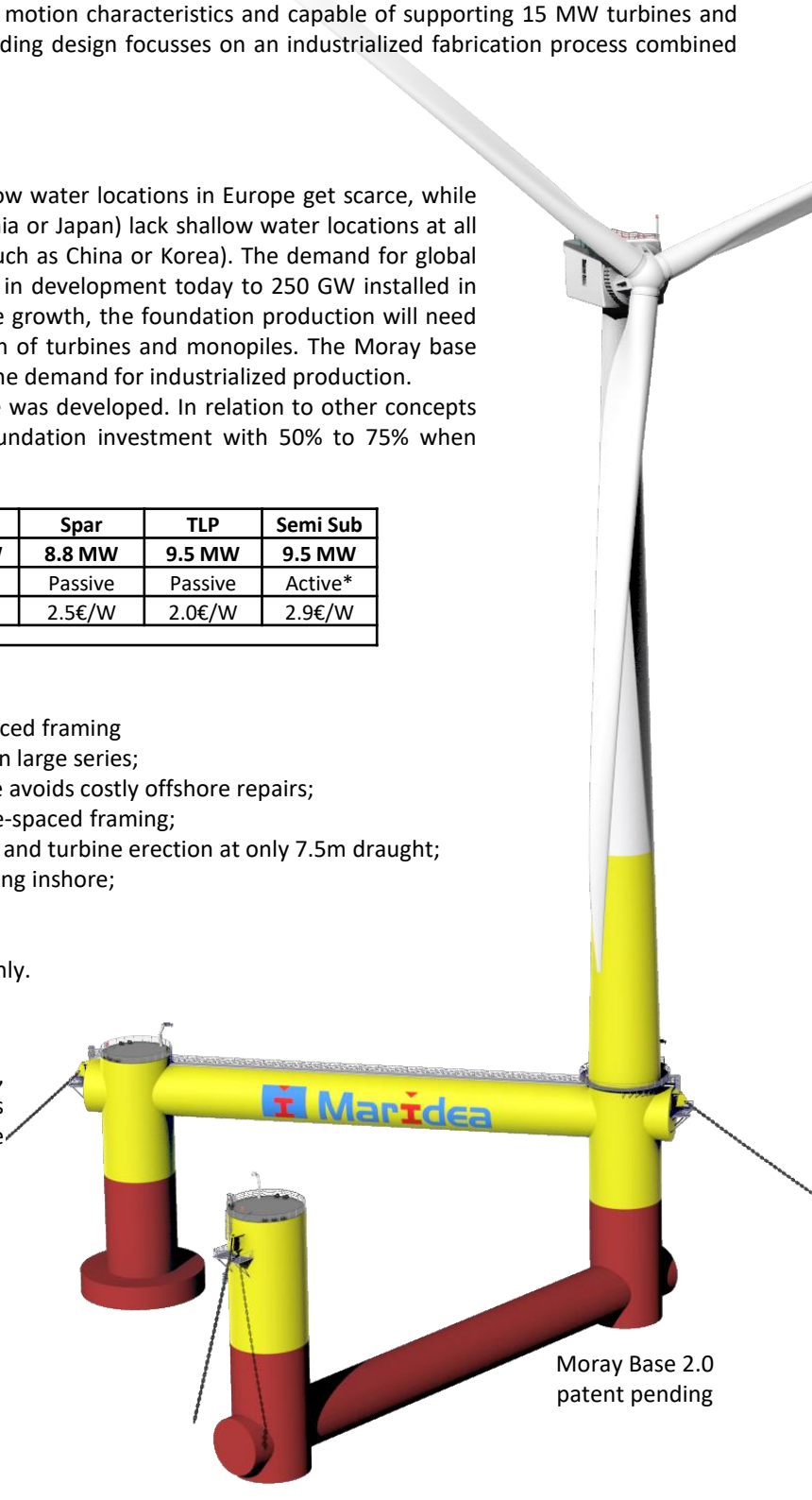
	Moray Base			Spar	TLP	Semi Sub
Turbine	**15 MW**	**15 MW**	**9.5 MW**	**8.8 MW**	**9.5 MW**	**9.5 MW**
Configuration	Passive	Active*	Active*	Passive	Passive	Active*
Cost/turbine rating	1.7€/W	1.3€/W	1.4€/W	2.5€/W	2.0€/W	2.9€/W
* Active: equipped with ballast system to compensate for turbine thrust						

Moray Base 2.0 at a glance

- Large single curved tube without close-spaced framing
- Suitable for highly automated production in large series;
- No nodes: reducing fatigue hotspots hence avoids costly offshore repairs;
- A thick walled steel structure without close-spaced framing;
- No need for expensive drydocks, assembly and turbine erection at only 7.5m draught;
- Allowing turbine erection and commissioning inshore;
- Easy inspectable;
- Well accessible with installation vessels;
- Manufactured out of cylindrical sections only.

Moray Base 2.0 versus 1.0

While maintaining the production philosophy, the Moray 2.0 replaces the segmented elbows of the Moray 1.0 by even easier producible elbow connections.



Moray Base 2.0
patent pending

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Efficient, flexible and industrialized fabrication

The Moray Base is granted "Approval in Principle" by LR following DNV standards. The tubes allow for efficient and high quality serial production with a high degree of automation, much like monopiles. The elbows, consisting of penetrating horizontal tubes in the vertical columns, contribute to the effective production process. The main sections are built in a dedicated factory, while assembly can be all over the world, close to the wind farm. The size and weight of the sections allow for transportation in common general cargo vessels. The Moray Base allows for assembly, turbine installation and commissioning afloat at shallow draught inshore. The latter reduces costs and installation times offshore significantly.

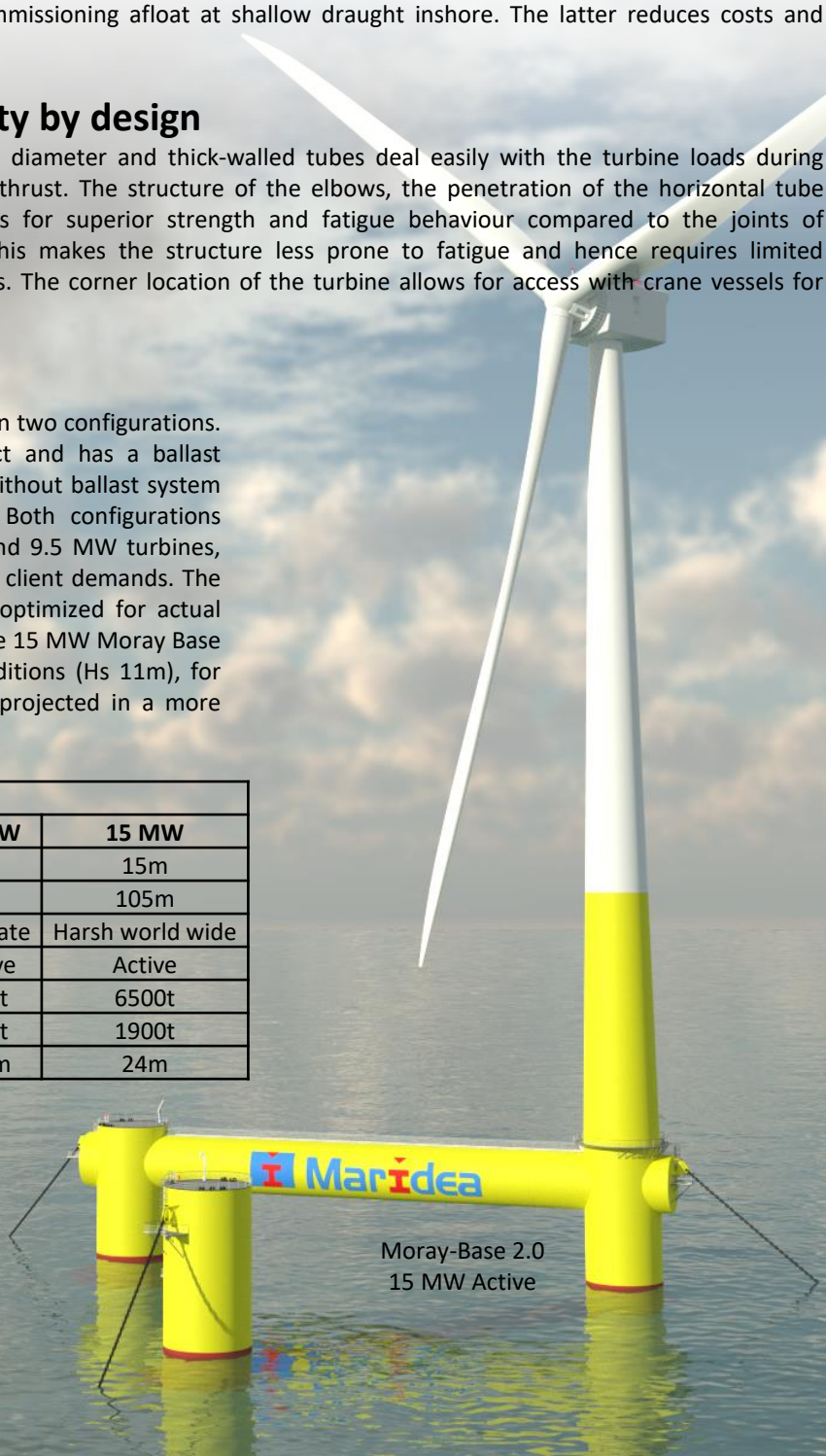
Robustness and simplicity by design

Besides efficient fabrication, the large diameter and thick-walled tubes deal easily with the turbine loads during severe storms and maximum turbine thrust. The structure of the elbows, the penetration of the horizontal tube through the vertical column, provides for superior strength and fatigue behaviour compared to the joints of traditional submersibles or jackets. This makes the structure less prone to fatigue and hence requires limited inspections and avoids offshore repairs. The corner location of the turbine allows for access with crane vessels for turbine repair and maintenance.

Typical designs

Maridea designed the Moray Base 2.0 in two configurations. The "Active" configuration is compact and has a ballast system. The "Passive" configuration, without ballast system is even more maintenance friendly. Both configurations were developed to support 15 MW and 9.5 MW turbines, but the range can be expanded to suit client demands. The scantlings of the foundations will be optimized for actual project locations. In the table below the 15 MW Moray Base is designed for harsh world wide conditions (Hs 11m), for comparison the 9.5 MW designs are projected in a more moderate environments (Hs 6.5m).

Design: Moray Base 2.0			
Turbine	**9.5 MW**	**9.5 MW**	**15 MW**
Diameter	9.3m	12m	15m
Centre spacing	61m	84m	105m
Environment	Moderate	Moderate	Harsh world wide
Configuration	Active	Passive	Active
Lightweight	2300t	3600t	6500t
Turbine weight	1050t	1050t	1900t
Operation draught	18.6m	18.6m	24m



Moray-Base 2.0
15 MW Active

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