

# In support of the US offshore wind supply chain



Charybdis, a GustoMSC NG-16000X wind turbine installation vessel design

Meeting the US offshore wind target of 30 GW installed capacity by 2030 will present significant supply chain opportunities. For example, new port upgrade investments could total more than \$500 million and new US factories could be built for major wind farm components. There could be an additional cumulative demand of more than seven million tons of steel, equivalent to four years of output for a typical US steel mill and there will be construction of specialized wind turbine installation vessels (WTIVs) in US shipyards. The construction of the Charybdis WTIV is an important step towards building a supply chain for the US offshore wind industry.





The Charybdis project is led by the American power and energy company Dominion Energy and supported by a consortium of renowned naval engineering and fabrication firms. Dominion Energy is currently working on a 2.6 GW project in Virginia, to be built in three phases from 2024 to 2026 and expects the vessel to be fully utilized on a pipeline exceeding 5 GW of US offshore wind construction by 2027.

With this investment, Dominion Energy will secure availability of the installation asset, minimizing project risk. In addition, the vessel is available for charter when not in use for Dominion's own projects. It has already received a first contract for Ørsted-

Eversource's Revolution and Sunrise Wind projects for a total of 1.6 GW of turbine installations. Charybdis is set to enter into service by the end 2023, based out of the Hampton Roads region of Virginia.

#### **Jones Act-compliant vessel**

The vessel is a GustoMSC NG-16000X design being built at Keppel AmFELS, Brownsville, Texas, a subsidiary of Keppel Offshore & Marine. Seajacks, a subsidiary of Eneti Inc, is assisting Dominion Energy with construction and operations oversight. The concept of the four-legged, self-propelled WTIV evolved over time as a solution of choice to both efficiently transport and

safely install offshore wind turbines from a stable platform while minimizing downtime and complying with the Jones Act. The Jones Act is a federal law that regulates maritime commerce in the US and requires goods shipped between US ports to be transported on ships that are US built, owned, and operated. For the purposes of the Jones Act, a bottom-founded, or fixed, wind turbine foundation is considered a US port.

With turbines of 15+ MW on the horizon later this decade, many WTIV owners have selected designs from the GustoMSC series as a basis, in particular the NG-14000XL, NG-16000X and NG-20000X designs.





Comparison of largest mobile offshore drilling jack-up and largest WTIV

NG stands for Next Generation, self-propelled and DP. The numeral, e.g.14,000, represents the load in tonnes applied to each leg during pre-driving and X indicates a truss leg with X-bracing, a robust structural configuration.

To better understand the scale of these vessels, you can compare the Seajacks Scylla (NG-14000XL design) as the world largest wind turbine installation vessel currently in operation, with one of the largest jack-up drilling units in operation, the Noble Lloy Noble (CJ70 design).

The deck area, DP and propulsion capability, fast jacking, and the ability to repeatedly preload to very large loads distinguish the WTIV vessel from a drilling rig. In fact, the deck area of a WTIV can exceed that of a football field and while preloading each of its legs and jacking system sees loads that far exceed the weight of the Eiffel tower, at approximately 10,000 tonnes, or the thrust of a Saturn V rocket at approximately 3,500 tonnes. This is not just done once but multiple times, since a WTIV is designed to move as well as jack up and down 150 times per year. It is the ability to perform repeated installations in a safe and efficient manner that sets the WTIV apart from other installation solutions. The initial investment on the vessel is spread over thousands of installations throughout its lifetime so the marginal additional cost of installation is only a limited share of the overall cost of each

wind turbine generator and its foundation.

#### Pioneering project and industry impact

As part of the project risk mitigation strategy, Keppel AmFELS and GustoMSC performed significant engineering prior to signing the construction contract. These activities included model testing, noise and vibration analysis, and leg material welding procedures and qualifications. The results, together with the engineering design drawings, were submitted to ABS for review at an early stage of the project. In addition, Keppel AmFELS worked closely with major equipment suppliers to ensure key activities were performed prior to contract.

The overall project cost, inclusive of construction and commissioning and excluding financing costs, is estimated to be around \$500 million, creating nearly 700 direct construction jobs for skilled workers. It will utilize more than 14,000 tons of domestic steel, with nearly 10,000 tons sourced from Alabama and West Virginia suppliers.

Supported by an efficient design, highly-skilled local workforce, state-of-the-art equipment and reliable suppliers across the US, Keppel AmFELS is confident in delivering a high-quality vessel to Dominion Energy safely, cost-effectively and on time.

The insights and experience gained with the concept development, design and construction of Charybdis, will benefit the

next generation turbine installations in the US and worldwide, and promote the collaboration of future wind turbine supply chain development.

#### Powering sustainable development

GustoMSC has been a driving force in the evolution of the offshore energy industry towards renewables and sustainability. As a pioneer, GustoMSC has developed and continues to develop a wide range of new and innovative designs and equipment, share knowledge and expertise, and is involved directly or indirectly in many innovative projects.

The development of Charybdis for Dominion Energy is an excellent example of a pioneering project with a large impact on the offshore energy sector. The construction of the Charybdis not only secures installation capacity for its offshore wind projects, but it lays the foundation for the emergence of a local US supply chain essential for this new industry to develop and thrive in the future.

Collaboration with the consortium of strong and renowned partners was the key to making this project happen. Through early involvement and collaboration GustoMSC as one of the prime contributors, was able to address the essential challenges and support the building of a supply chain for the US offshore wind industry.

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