The offshore wind industry continues to flourish, and it has experienced significant growth in Europe in the last five to ten years. Growth is also visible in Asia (China, Taiwan and Japan), where Royal IHC already has an active presence. The company now provides an integrated approach to jack-up design, which is helping to facilitate further expansion into this market.
At all times, the challenging targets that exist globally must balance with the need to reduce costs. This will eventually create an industry free from its reliance on subsidies.

The correct tools and equipment

Royal IHC has consistently developed its capabilities in renewables, and offshore wind activities in particular, over the last 10 to 15 years (although IHC-built jack-ups can also be deployed in the oil and gas industries). Multiple IHC units have long been involved in either jack-up design, construction of components and/or turnkey jack-up vessels, or specific tools, as well as marine operations engineering for specific projects.

Within these, IHC Motion Control & Automation is constantly researching higher levels of integration for automated systems on board vessels. This will help to reduce the total power requirements, among other benefits.

In addition, IHC IQIP delivers state-of-the-art Hydrohammers®, with a long track record in offshore wind projects. It has consistently developed hammers with increasing diameters and power capabilities, which makes larger monopile foundations for offshore wind turbines feasible.

This also applies to IHC IQIP’s developments in handling equipment for wind turbine foundation installation. Its most well-known equipment includes tools for upending monopiles, and grippers for holding them upright in the first stage of driving them into the seabed.

The EWEA also reports that, in financial terms, investments in offshore wind farms hit a record level of €18 billion in 2015, which highlights the confidence of investors in renewable energy. This has also been bolstered by a reduced perception of risk, opening further avenues for financing. The demand for renewable energy shows no signs of abating, and other countries around the world are expected to follow Europe’s example.

IHC Insight

Today, there are 84 offshore wind farms spread across 11 European countries. The completion of six further offshore projects will take the collective offshore capacity in the region to 12.9GW.

According to the European Wind Energy Association (EWEA), 419 new turbines were erected around Europe in 2015, bringing the cumulative energy production across the continent to 110GW.

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China is a very fast-growing market, and has set itself a concrete target of 10GW by 2020. This is a substantial ambition considering that the average output is around five megawatts per turbine. There are 44 allocated projects, and prospects exist for IHC to supply not only an integrated package, but also critical components. It is probable that demand will take wind farms further offshore into higher wind speeds, or deeper waters.

In Japan, there is a market for nearshore offshore wind, and floating offshore wind in deep waters.

For nearshore operations, jack-ups will take on a different operational profile than those in Taiwan or Europe, where the wind farms operate further offshore in deeper waters, and in harsher conditions.

The USA is also predicted to develop its wind market ambitions and start with smaller solutions. This will most likely see the conversion of barges into jack-ups at first, a scenario comparable to Europe 15 years ago. In both Japan and the USA, potential offshore wind farms will have to factor in deeper waters, so floating wind turbines will be the most common solution.
Vuyk’s involvement in project engineering has led to innovative designs such as the first floating vessel concept capable of transporting and installing six completely assembled wind turbines. Its latest innovation comprises a patented blade installation tool (the Boom Based Blade Manipulator), which provides a higher level of control of the wind turbine blade. This is due to its connection to the crane boom, allowing blade installation in higher wind speeds. This is now a recognised part of IHC IQIP’s portfolio.

In addition, Vuyk has worked closely with IHC Offshore & Marine to develop a jack-up for the Taiwanese wind market, for which Vuyk delivered the concept and basic design. More so than floating vessels, a jack-up can benefit significantly from high levels of integration purely because it is jacked up offshore. The jacking system and legs need to be able to lift the full weight (plus cargo) out of the water and to be able to withstand a 50-year storm while jacked.

Therefore, it is clear that the legs, jacking system and integration in the hull come at a relatively high cost. Reducing the dimensions and weight of the jack-up and appropriate tools is paramount. Furthermore, the legs and jacking system are highly integrated with the vessel structure and systems. Either towed or self-propelled, a jack-up vessel fully integrates naval architecture, and hydrodynamic, structural, mechanical, hydraulic and automation systems. An integrated approach is necessary for a fully functioning jack-up, especially in offshore wind where it also serves as an offshore transport and installation vessel. IHC offers in-house availability of all these skills, and extensive experience in the activities of jack-up vessels and the correct tools. It was a logical progression for IHC’s business units to pool their resources and create a combined approach to jack-up development.

**A fresh approach**

IHC’s proposition allows for the fully integrated design of any jack-up to be realised in-house. This starts with advising potential customers on the required dimensions and capacities, covering both the jack-up construction and the key systems.

The company has expertise in all aspects: specifying the requirements, designing, building and offering services such as modifications or upgrades, but also training. This means that IHC can cover the full range of jack-up systems and jack-up activities. Its vision is that, from the first stage of the design process, all of the company’s capabilities can be seamlessly integrated to offer a complete package.

IHC has the expertise to assess the exact requirements for any situation or condition. It can also draw up plans for the structural elements in the design of the jacking system, identify adequate tools for installation and integrate these in the design. Specific tools and engineering practices are required to ensure the jack-ups are suitable for offshore wind turbine and foundation installations. Marine operations, including the supply of project-specific tools – such as piling hammers, NMS and lifting and spooling tools – can also be delivered by IHC. This means that IHC can ensure that the jack-up will be able to withstand the varying loads of any equipment.

To enhance cost effectiveness, IHC’s combined knowledge can be introduced at the earliest possible stage of the design process, encompassing both structural and mechanical design, and automation and electrical systems. The latter makes it possible to identify areas within the system where interfacing can be accommodated, which is becoming a common practice. Ultimately, this can reduce crew requirements, power output and total vessel weight, while maximising uptime.

**Added value**

One of the main advantages is flexibility. IHC can deliver these services separately and efficiently through its different business units or provide a completely integrated solution. Moreover, IHC can either build a new jack-up at one of its yards in The Netherlands or manage the build abroad to supply integrated packages. When building abroad, IHC’s experience in managing the build of complicated vessels guarantees the on-time delivery of a high-quality vessel.

The latest development in bringing IHC’s integrated process full circle comes from MTI Holland (IHC’s technology development centre). This concerns an advanced tool for site-specific assessment. The results it yields will provide an improved model for analysing difficult and multi-layered soils, allowing for more accurate predictions of soil complexity. This is the last area of expertise relating to jack-ups, and will add vital geotechnical understanding to IHC’s existing skills.

This knowledge has potential implications in the optimisation of jack-up design, or operation, by taking into account leg fixity in the design. This is opposed to the standard approach of a pinned leg model where the leg support on the seabed is assumed to be a hinge. Although leg fixity results in lower leg bending moments, it also results in a lower natural period of the jacked-up vessel. Depending on the distribution of wave periods, this may result in higher leg loads.

IHC’s existing knowledge, in combination with comprehensive understanding of seabed support capacity will allow the company to further optimise the jack-up.

**Global presence**

IHC’s strongest leads for its services are currently in the Far East, with interest from companies in Taiwan and Japan. In particular, the proposed offshore wind project for a Taiwanese contingent was the catalyst for IHC’s integrated approach. The result is an ABS-approved jack-up design, and IHC is in negotiation with the same companies for supply.

If completed successfully, the project will see IHC take responsibility for 90% of the building installations: the crane integration, systems, housing, legs, generator, engine, electrical systems and hydraulics.

“This will really be a big step for us,” says Richard Agema, Product Manager Heavy Lift. “This project covers the whole jack-up and sees all aspects coming together: services, design, electrics and hydraulics. We also offered the customer a training package. One of the reasons they chose IHC was because we could take them from the beginning of the process through to operational status.”

IHC could potentially supply the tools for this project, in addition to the Hydrohammers® IHC IQIP rents out for the installation of the customer’s met mast.

**A positive outlook**

IHC has confidence in both the renewables and offshore wind industry, and its integrated approach is already garnering interest from several quarters. Building on a proven track record in delivering all the key elements for jack-ups, the company is now mobilising its accumulated knowledge.

The teamwork between all IHC units will also be an important factor in the success of the proposition. Offering the full range of processes under one roof, and guaranteeing flexibility to customers will ensure the company is a leading player in jack-up design, engineering and building as the offshore wind market continues to expand and cost reductions need to be established.