Changing the game for lifting systems on and offshore

PES Wind had the opportunity to speak with Kent A. Johnson, CEO of CLS Wind, as the company unveils its innovative wind turbine automated assembly solution, suitable for onshore and offshore installations. Kent discusses the company's journey, emphasizing reduced costs, faster installation times, and environmental benefits. Its patented elevating platform system promises to reshape offshore wind installation and operations, making clean energy more accessible worldwide.

PES: A warm welcome to PES Wind Kent. Until now CLS Wind has kept a low profile but all that's changing now. What's the reason behind that?

Kent A. Johnson: We operated in stealth mode until we could really display our capabilities well. In just three years since our foundation in 2021, we have developed onshore and offshore lifting systems for wind turbine installations, including the currently largest size, at 18 MW. As part of this, we have just received ABS Approval in Principle certification, as well as several third party verifications of our designs.

With the above accomplishments, we have been able to establish partnerships with multiple well-recognized global companies. As we began to execute on those partnerships, we needed to increase our presence in the market.

PES: For background then, the company began its wind energy story with a focus on onshore wind, before moving to offshore. Can you explain your beginnings and the reasons for the move further from shore?

KAJ: Around 2009, most onshore wind turbines were small, with a capacity of 1.5 MW or 2 MW. Yet there were a lot of transportation problems, including truckloads of equipment that were stuck on farmland due to badly

compacted roads or lack of matting, and small cranes having problems offloading and installing equipment.

Even though the available cranes were sufficient to perform the jobs required, these issues had a major impact on project budgets and timelines. Around 2019 we witnessed rapid turbine size increases, with a 2020 forecast from the DOE that predicted a growth in size by 2035 from 2.5 MW to 5.5 MW for onshore units, and from 6 MW to 17 MW for offshore.

This growth resulted in large increases in hub heights and massive increases in nacelle weights. Amazingly, in 2023, the industry has already surpassed those predicted capacities, 12 years ahead of time! This means that the lifting requirements have dramatically increased, and now they exceed the readily available crane capacity.

Onshore still makes up approximately 95% of the current wind market, with over 70,000 onshore wind turbines installed in the US, 2,000 or so new installations annually and approximately 10,000 service jobs per year. Since onshore represents such a high percentage of the market, and offshore is still in the early stages in the US, it made the most sense for onshore to be the beach-head market and our initial focus.

It also was easier to learn in the onshore market with the smaller loads and easier sites. We learned that CLS Wind's systems could save an operator or installation company between 30% to 50% on the costs related to cranes and civil works during installation, which amounts to approximately $25m on a 70-unit wind farm of ~3 MW units, each. We also learned that the work could be performed in half of the time. An added benefit of production speed is earlier energy production and revenue generation.

As the offshore market has continued to develop, we have been developing alongside it. Now that offshore is ready for growth, we are poised to execute there as well. And although there are many headwinds in the offshore environment, the current predictions still show a global offshore annual growth of over 15% CAGR to 2032.

It is no secret either that the lack of Jones Act compliant vessels could be the single largest impediment to cost-effective and timely completion of projects in the USA. Once mature, our technology eliminates this problem, by allowing offshore wind assembly with Jones Act compliant vessels already available in the market.

PES: Your company has an interesting vision, to reduce the cost of wind power and increase the number of viable projects, empowering communities to utilize existing local labor and resources. Can you explain more about this vision and how it may be realized?

KAJ: Technology should bring benefits that include safety, cost and time savings, reduction of environmental damage and emissions, and improvements regarding resource utilization. When we thought about our system design, we established those goals as our drivers. With our lifting platform system, we can utilize smaller capacity cranes onshore and offshore, compared to a conventional system.

For instance, due to our platform loading height being low, for a 3 MW we can use a 250 T crane to load the complete nacelle generator, that is nacelle + drive train + hub, versus requiring a 4x larger crane, to perform the 100 plus meters lift to the top of the tower.

Regarding crane availability, these smaller cranes are readily available around the world. Costs are further reduced since these cranes do not need specialized heavy-lift certified operator, will require approximately 75% less truckloads to set up, and thus less emissions,

Kent A. Johnson

and will cost a fraction of what a 4x larger crane rental would cost.

In summary, we will be able to re-utilize equipment and personnel that is now considered 'idle' or 'obsolete', putting those resources back to work, immediately.

The effects are more pronounced for offshore. There are only around 16 Wind Turbine Installation Vessels (WTIVs), plus about 25 more being built, but only around seven of those will be able to lift the new 15 MW or larger wind turbines. In the USA, there are no Jones Act flagged vessels, except for one WTIV being built in South Texas for Dominion Energy which will not be ready until late 2024 or early 2025. And the DOE has said that at least six such vessels would be required just to meet the goal of 30 GW of offshore wind by 2030 set by the current administration.

When using our low-lift platform system, we have already identified more than one asset, heavy-lift barge crane, that is Jones Act compliant and may be utilized along with its local crew. Moreover, as we can use floating cranes, the 60 m water depth is eliminated.

PES: It's a growing market, but current installation systems are severely limited aren't they?

KAJ: Yes, with the growth in height and size of the larger capacity wind turbines, we now see weights nearing 300 T for a 5 MW onshore nacelle generator, and around 800 T for the new 15 MW offshore nacelles! This means that equipment that was previously utilized to install the 3MW onshore wind turbines is no longer suitable, and globally there are only a handful of WTIVs able to install the new 15 MW nacelles, and the future 20 MW to 25 MW nacelles that may arrive within a few years.

But there is another problem that many people are not even thinking about, and that entails the maintenance or replacement of

these larger generator systems in the future. No vessel that is contracted to build a new wind farm will stop work to repair or replace a broken nacelle generator.

Additionally, the expense of getting a high-lift capable crane to a site means that operators may wait until a high percentage of the wind farm needs repair or replacement. This significantly reduces revenue. With the CLS Wind system, there will be a much larger pool of suitable lifting equipment to bring to site, shortening the repair time, dramatically lowering costs, and expediting the return to revenue generation.

For floating wind, we have already seen at least three cases where floaters have been disconnected and towed-to-port. Unfortunately, they have not been towed to the nearest port in Scotland, but to a port in Rotterdam which is much farther away, because it has sufficient crane capacity and facilities to repair the problem. Thus, the need for improved, more widely available lifting and nacelle replacement systems is urgent, and that is precisely what we aim to solve.

PES: A lack of long reach and heavy lift cranes and vessels causes limits on height and weight. What is the CLS Wind answer to this problem?

KAJ: For onshore, the limitations on the larger cranes that are available result in additional costs given the inability to install the entire nacelle in one complete assembly. For the offshore, there are many articles that talk about 'offshore ship shortages' that cause bottlenecks and project delays. The 'ability to install the ever-larger equipment' is what currently limits the size of offshore wind turbines.

In fact, a recent project cancellation in the USA for Ocean Wind 1 & 2 project was cited by the Orsted's CEO as being mainly because of 'significant delays on vessel availability... in the entire market has now meant that it would implicate a multi-year delay of the entire project.'

We have worked for years to solve this problem, and with our system, if we can handle the weight, we can handle the height! So, we designed the load-carrying platform and supporting track system with sufficient capacity to lift the heaviest component in one complete assembly of nacelle + drive train + hub, and with enough safety margin and redundancy to assure a stable and safe vertical lift and horizontal transfer.

In addition, although we plan to remove our track system, we spent over one year studying the impact of leaving our lift tracks permanently secured on a 15 MW fixed monopole installation, in the worst case, to determine the potential effects. Together with a very experienced engineering third-party partner, who used actual field data from projects around the world, we performed static and dynamic analyses, potential interference verifications (with the blade, for instance, as it bends back), and took into consideration different wind, metocean conditions, water depth, soil types, and many other parameters.

Thanks to the positive result of this verification study, we have pursued and recently received our Approval in Principle certification from ABS; a first of its kind, for this type of application.

PES: Faster, safer and cost-effective, this system utilizes existing equipment and local labor, greatly reducing the environmental footprint. How important was this factor in its development?

KAJ: Offshore wind has an installation cost problem, and both onshore and offshore wind have a maintenance problem. Safely reducing the costs and times in these sectors are the foundational drivers to CLS Wind.

From the environmental aspect, which also impacts costs, for onshore, we can utilize about 75% less truckloads of equipment and reduce emissions over 72% in some cases. Smaller roads can be used which means considerably less vegetation cutting and material movement for roads, and less ground compacting with little/no matting.

For a recent onshore study, we calculated the potential CO_2 emission reduction when using just one system, versus conventional cranes, which results in approximately 2,100 tons less of CO_2 per system.

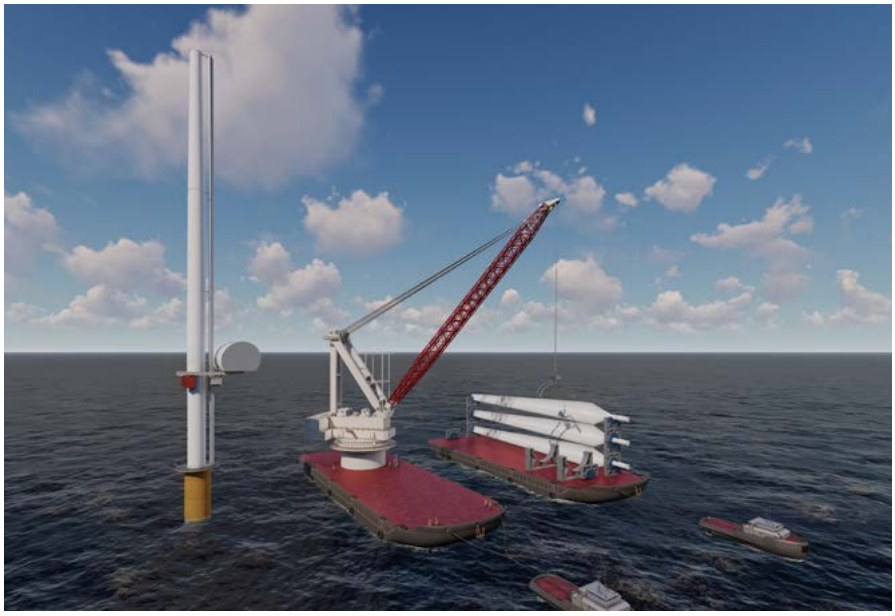
Because our platform can be loaded at a low height, we aim to use existing, smaller capacity cranes and local, trained personnel that today is idle due to lack of lift height and/or capacity.

PES: It appears that your ultimate goal is to install any wind turbine, anywhere, anytime. What solutions are you bringing to the market to help make this a reality?

KAJ: Yes, we want to help expedite the installation process and lower the cost of clean, renewable wind energy across the world. Especially in places such as Latin America, Africa, Southeast Asia, where they may not have access to those high- and heavy-lift onshore and/or offshore cranes, WTIVs, or ring-type cranes at quayside.

In the world, there are many smaller cranes used for infrastructure construction projects, and some high-capacity crane barges that may be utilized. But although that equipment may have enough lifting capacity, over 1000 T in some cases, many times the booms are not long enough to perform the 150m plus installations heights. With our low-height loading platform system, we hope to transform those liabilities into revenue-making assets. In addition, our solution increases the ability to install at greater water depths, beyond 60 m, which also increases the potential growth of fixed wind installations, several times.

We also need to mention that because our lifts are made to a lower height, both onshore and offshore, and that the equipment is fully secured to the lifting platform, versus hanging from a hook/block assembly when lifted with conventional cranes, we do not have 'pendulum' effect issues, greatly extending the installation 'weather window'.



PES: Your high-capacity elevating platform system is a patented, true innovation based on proven Oil & Gas lifting. Tell us more about it, how it works and the benefits for offshore wind?

KAJ: At first, we did the same as many others, working with crane-based designs, which include winches, wire rope, sheaves, blocks, and other components. But soon enough we realized that as we tried to lift bigger loads, our system design would become so large that it would be expensive, cumbersome to move, difficult to install, and limited in many ways. So, we threw everything out and started with a brand-new approach.

The basis for our patented system comes from the rack- and-pinion mechanisms that elevate the legs in an offshore jack up rig; these units are field-proven, have been working in very harsh offshore conditions since 1956, and can lift up to 6000 T each leg. We took that concept and designed our elevating platform to also lift heavy loads, but in a different manner, adding a self-elevating platform, automated controls, and most importantly, a counterbalance system, so that all the loads are always balanced.

We were careful not to transfer the loads to the wind turbine tower itself, but rather that they travel down the racks to the supporting ground or monopile/floater structure. Our attachment points to the wind turbine tower are only at the flange connection level via special adaptors, which are meant to keep the rack straight and prevent buckling, but not to be the main load- carrying or -transfer members.

We also do not modify the WT OEM tower at all; we adapt to it. We have spent thousands of engineering hours on this, to assure safety and proper load handling. This will become a game-changing proposition.

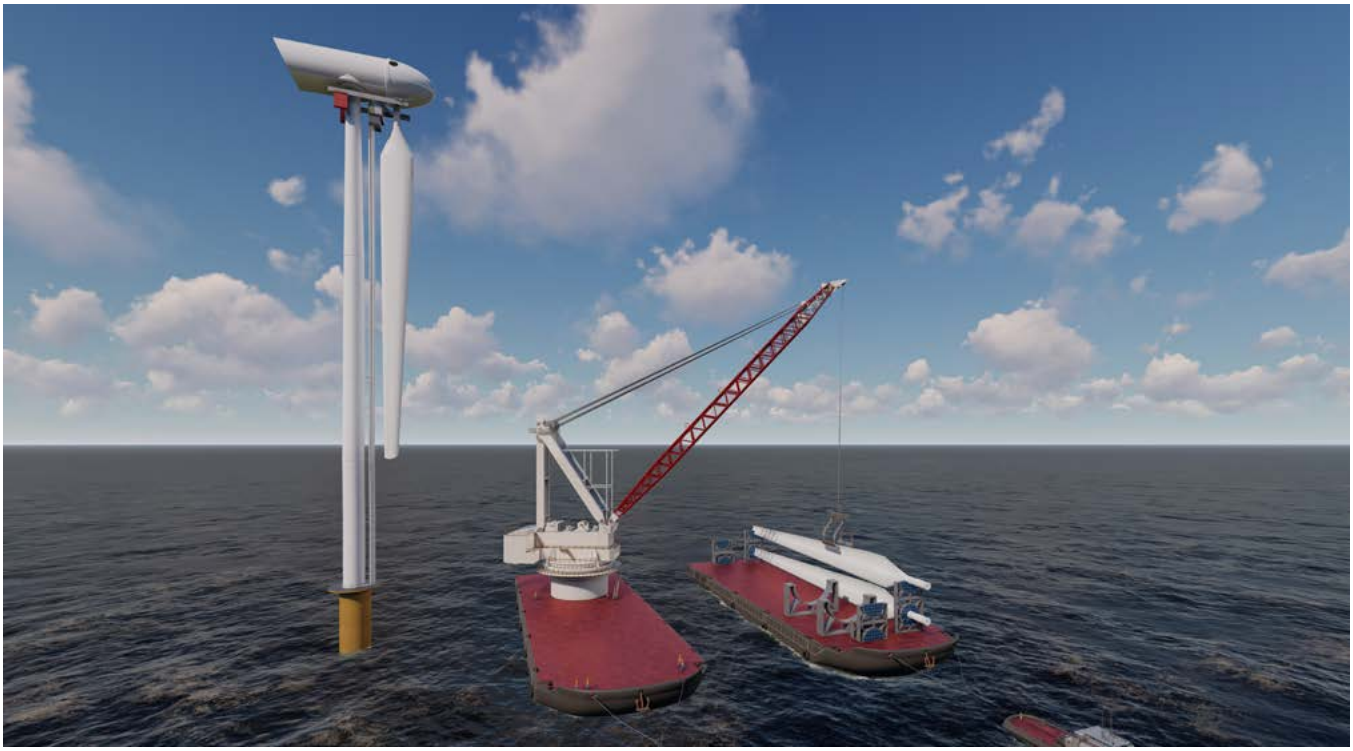
The lifting platform will also have the ability to be used with a small crane jib, for O&M activities, which may be added/removed depending on the need, as well as with an adapter for the blade, which are the subject of our patents. This blade-adapter will be self-aligning, and will install the blades vertically, from the bottom, which is a better way to install them and is now being seen in the most advanced offshore systems being developed.

PES: Without extensive quayside reinforcements or mega-size cranes, the system opens many more port options and lowers expenditures. What other advantages does it offer?

KAJ: Currently, the major pain points and construction bottlenecks for floating wind are a) the need for extensive quayside reinforcements and massive ring-type cranes at port, and b) inability to perform major component replacement while connected offshore, resulting in the need to disconnect and tow-to-port. Solving these two critical issues is very important for growth and cost reduction in the floating wind industry.

For floating wind, we have also performed a study that will allow floating wind companies to install several units in parallel, vastly improving port throughput; in turn, being able to assemble enough units to install an entire wind farm in one season. This is currently not possible with a single, mega capacity ring-crane.

In summary, for a 15 MW nacelle generator, or bigger lift, we will be able to perform the same lifts utilizing, for instance, a commercially available 1600 T rail-mounted gantry crane that needs limited quayside reinforcement in a small swath of area, versus a massive, fixed 6000 T ring-crane that needs about 2.5 acres of hard-to-find,



expensive, dedicated quayside area. This setup will not only improve productivity, but also free very valuable area for other port activities, while improving component flow and reducing capex. This may even allow more ports to support offshore wind projects, reducing this growing bottleneck.

For the second case, in the recent past we have already seen more than one case of disconnect and tow-to-port, in two of the Scottish floating wind farms. Beside the tens of millions of dollars required for these disconnection and reconnection operations, if we add the loss of revenue due to a system being out of commission for several months, the numbers are even larger. We are now working towards solving this issue and we expect to have a solution to replace a major component while 'onsite'.

PES: Can you give us one or two examples of when your system may be particularly beneficial?

KAJ: Onshore, real estate is crucial. In one potential repowering project where a customer wants to replace 100 units of 1.5 MW for 25 units of 5 MW each, the high costs and negative impact of creating access roads and cutting vegetation required for large conventional crane transit would be prohibitive from both a financial and environmental standpoint. With our system, the developer would be able to perform the new lifts with a much smaller crane, little new road construction, and minimal footprint.

For offshore, we are looking at a fast-track decarbonization demonstration project where two 15 MW floaters will be utilized, to provide power to an oil and gas platform, but there is no way to install those units with the given available port facilities. With our system, we will be able to install those units at quayside, and to service the units in the future. We will start with an oil & gas asset decarbonization project, to later go into electrification projects in the country.

PES: What about customer support? Is there a technical team in place to assist?

KAJ: Coming from a background in large capital equipment sales and service, we realize that the technical and service support network is critical to any new technology and/or large piece of capital equipment. Therefore, putting this technical support and service structure in place is a top priority for us.

We are now having discussions with several potential strategic partners with global footprints and networks, to assist us with service and support, once we roll out the equipment in the market.

We also understand that there will be different needs onshore and offshore, and thus the service teams and personnel will be complementary but also different. Partnering with the right installation and service companies will be key for the success of CLS Wind, and that process has already started.

PES: What has take-up of the system been like for you so far and what is your outlook for the future?

KAJ: Any new technology is hard to deploy, especially those that are capital intensive and game changing. Plus, the wind industry is conservative by nature due to the high capital costs and long project timelines. Many players come from oil and gas backgrounds, so we realize that it is not easy to win the confidence and support until some concrete results are achieved, and that is what we are doing. Step-by-step, we are winning new supporters and allies.

We also realize the value of working closely with the wind turbine OEMs, and we stayed connected to the major players since before the company was formed, keeping them informed of our progress and eliciting feedback. This strategy is also paying off, and we will continue to build stronger ties with them.

Finally, the biggest gains will be for the wind farm owners and operators, since the benefits of our system are meant to be for the entire life-of-the-farm, and not just during installation. We have good traction with many onshore and offshore owners and developers, both domestically and internationally. We are now looking for onshore partners to roll out our system, as well as offshore companies to implement/pilot/benefit from our fixed and floating wind solutions.

We have a very optimistic outlook, regardless of the currently painful issues in offshore wind development. We need to keep working together, building bonds between private and public partners and industry, and investing in technology development and application, so that we can build a legacy of clean, renewable wind energy for many new generations to come!

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