

MAINTENANCE

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HIGH-QUALITY REPAIR STATIONS VS. UP-TOWER REPAIR

By Kainon Irons and Keith Plantier



Figure 1: LGE Pitch Ram Facility

In the wind industry, it is well-known that a downed tower results in major financial losses. The question arises: how can turbines get up and running as quickly as possible for as long as possible? When system components fail due to hydraulic rams, yaw drives, and accumulators, for example, choices then become very limited. You are then left with the decision to purchase new units or obtain refurbished or repaired units. Two major pitfalls of buying new units are long lead times that are encountered and the logistical challenges of receiving new units that are manufactured nowhere near wind farms. For instance, wind farms in the U.S. that have turbines manufactured overseas are forced to absorb the cost of obtaining new components from the manufactur-

ers. The high costs of shipping and long wait times have caused wind farms to start looking for regional solutions closer to home. These factors have paved the way for the repair industry. By purchasing refurbished units, the logistical challenges associated with buying new units are eliminated. However, the quality of repair is then called into question. When buying new becomes unfeasible or too expensive, what is the best course of action when deciding which route to take with repaired units?

QUICK FIX OR QUALITY FIX?

Due to the difficulties and costs associated with buying new units, companies that are refurbishing units have found a niche in the wind industry. There is a demand

from wind farms with downed turbines to seek out this route because of the economic advantages of decreasing the costs related to shipping and long lead times. Repaired units have received a mixed reputation due to the sources of repair. Something important for customers to consider when looking at refurbished units is the fine line between the quick fix and the quality fix. There are benefits and drawbacks to consider when looking at each. Up-tower repair companies have stepped into the role of the quick fix. Independent, regional repair facilities, such as Lighthouse Global Energy (LGE), have opted for the quality fix. The greatest benefit of up-tower repair is how quickly it's completed.

This is the quickest way to get the turbine running again, but will the repair last? From the perspective of LGE, the long-lasting repair is more important than the short-term fix, even if the turnaround time takes slightly longer. LGE has taken the time to do the little things right, and it is this attention to detail that leads to long-lasting, high-quality repairs. Furthermore, LGE is strategically located in Abilene, Texas, where wind energy plays a predominant role in the region. A dedicated repair facility is able to focus in and provide areas solely devoted to a particular job, which in turn, allows for specialized fixtures and tools to be fabricated that make the job easier and more efficient, as shown in Figure 1.

This increases workplace safety and allows for consistent practices to be implemented that reduce the risk of damaging components. LGE has extensive knowledge in quality procedures related to ISO 9001. This enables the technicians at LGE to leverage the quality associated with ISO 9001 and address repairs quickly. However, without knowledgeable technicians, quality and speed are

pursued in vain. In comparison of the two repair styles, up-tower repairs are primarily focused with speed, and independent facility repairs are primarily focused on quality. This doesn't mean that one can't produce quality and the other can't produce quickly; it just demonstrates each type's specialty.

THE DIRT ON BUYING USED

Contamination proves to be the leading cause of problems with many turbine components, especially in hydraulic systems. Hydraulic cylinders (or pitch rams) serve as a good example to consider when looking at the two repair philosophies. How does an independent repair company such as LGE approach the solution when compared to an up-tower solution? When a cylinder goes down, contamination is attributed as the primary mode of failure in hydraulic systems due to the effects of dirty oil [1]. Dirty hydraulic fluid not only damages cylinders, it can also damage other major components, such as pumps and valves, as shown in Figure 2.

Turbine hydraulic systems are not exempt from this plague, especially in the windswept plains and farmlands of West Texas. When looking at the repair of a hydraulic cylinder, it is essential to be as clean as possible in order to protect components from dirt and other foreign particles that can wreak havoc on rods, seals, and barrels. This becomes problematic for the up-tower solution. If systems are failing due to contamination up-tower, then an up-tower repair will be done in a contaminated environment. This results in repairs that don't last long, and wind farms quickly fall back to the same predicament as before. Whereas an independent facility devoted to these types of repairs is able to provide a sterilized environment and practice better cleaning techniques

to carry out an effective, long-lasting repair. One improvement LGE has utilized recently is through the use of bellows made of a tougher material with a zip-up design for easier installment in order to protect rods more effectively in dirty environments, as shown in Figure 3.

This allows for the problem to be combated before it occurs. Contamination is important to consider not only in hydraulic systems, but also in gear drives and where oil and moving parts are implemented.

TESTING THE REPAIR

Testing refurbished units to conditions experienced in the field is a proven way to know if repairs are good or bad. Whether it is a leak check in a hydraulic system or a torque test in a yaw drive, the information gathered from testing is essential to developing the best repair solution. It is through this process of testing and R&D that the best repair solutions are developed.

"The reason we have been able to get the customer base we have is because of our high-quality testing procedures and our ability to accommodate customer delivery schedules," said Ruben Guerrero, LGE's business development manager.

LGE has devoted a lot of time and money into engineering and research for making the best possible tests to simulate the complex conditions experienced in the turbines.

Whether it is looking at the surge in forces components experienced during a windstorm or using computer software to analyze the effects of forces on various components, these factors come into play when developing good tests. This type of attention to detail ensures that long-lasting results will be provided for customers who want turbines to work effectively for as long as possible. If repairs are being done up-tower, the only way to test the



Figure 2: Representative sample of contaminated oil found during disassembly of a pitch ram

unit is to install it. The result of a failed test means that the turbine is again rendered idle. Operating with one bad component in a system puts unnecessary strain on other components that depend on each other, possibly causing a domino failure effect, particularly in the pitch system where a bad pitch ram can lead to pump or motor failure. This is where getting it right the first time becomes especially important, and pre-tested repairs are able to provide the best chance of doing just that.

CONCLUSION

There is a demand for refurbished and repaired turbine components because of the economic and logistical challenges of buying new. The two main avenues of repair that have emerged are up-tower and dedicated regional repair facilities. These two avenues



Figure 3: Zippered bellows for ease of installation in the field and adequate protection from the environment

of repair are able to address the ever-growing need to reduce the cost and minimize the need to transport units over long distances. The main benefit of the up-tower repair is the speed and immediate locality of the repair. The drawbacks are the loss of quality with working in a contaminated area and the inability to carry out effective tests up-tower. A dedicated repair facility can produce higher quality products that last longer in the field, but it will

more than likely take a little longer for the turnaround. The ability to mitigate contamination and test products before installment prove to be big players for quality in the repair arena.

For more information, go to www.lgnrg.com. ↵

REFERENCE

1. <http://www.plasticstoday.com/articles/primary-cause-hydraulic-system-failure-dirty-oil>

HUVR LAUNCHES WITH \$2 MILLION FUNDING; FAA APPROVED DRONE-BASED DATA ANALYTICS COMPANY

HUVRData, LLC, the drone-based data analytics company, officially launched and announced \$2 million in funding from angel investment organizations that include the Central Texas Angel Network (CTAN), Houston Angel Network (HAN), and the Texas HALO Fund, a sidecar angel fund sponsored by HAN. In the past one-and-a-half years, HUVR has built out its technology, secured full FAA approval for its commercial drone applications, and established its value to first target markets of wind, solar, oil and gas, and precision agriculture.

“The response to HUVR to date has truly been astonishing,” said co-founder and CEO Bob Baughman. “Our wind farm inspection packages provide wind farm owners actionable data that can save significant operating expenses and provide this in a way that is much more efficient and cost effective than conventional methods. The investor response was so positive that we raised more than we planned to enable more investors to be involved with HUVR now, which will allow us to expand even more aggressively.”

HUVR delivers valuable data analytics using drone-based inspections and cloud-based services. It was among the first companies to obtain FAA authorization to fly drones for industrial applications. The company has already engaged customers in the wind industry and will expand to oil and gas, solar, and precision agriculture.

As one of the industry’s first business applications of drones, and with HUVR’s unique cloud and data analytics focus, it attracted interest from many investors, including those who were a part of the initial \$2 million raised from CTAN, HAN, and the Texas HALO Fund,

“HUVR combines the vision and technology valuable to the Houston-based oil and gas industry,” said Bill Hughes, deal lead for the HAN. “HUVR’s impact can span the Gulf Coast and beyond. Investors saw the clear value HUVR can deliver in multiple segments of the energy industry.”

Also, according to Gene Betts, CTAN board member and deal lead, Austin is rapidly earning its place as a clean tech hub.

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“Our wind farm inspection packages provide wind farm owners actionable data that can save significant operating expenses and provide this in a way that is much more efficient and cost effective than conventional methods.”

“We see a lot of very interesting businesses at CTAN, and HUVR stands out as one of the first movers in a truly new space run by experienced founders with excellent track records,” Betts said. “They have already demonstrated their capabilities in the wind farm area and are set to launch and expand their services through this raise.”

HUVR is focused on working with wind farm owners and repair companies to perform regular and ongoing turbine assessments of entire wind farms, identifying and diagnosing damage from cracks, lightening strikes, and more. HUVR’s methods are at least four times faster than current manual methods and are much safer. HUVR’s unique cloud-based delivery

systems allows customers to access their information in real-time and have it available in a secure and safe cloud platform.

Today, traditional labor-intensive inspection methods allow for approximately 30 percent of a fleet of turbines to be inspected annually. Now, an entire wind farm can be monitored frequently and thoroughly with problems spotted immediately. This provides a revolutionary new operations and maintenance method that wind farms can now take advantage of to reduce costs and keep the turbines turning. ↵

— Source: HUVRData, LLC

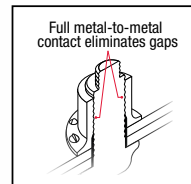
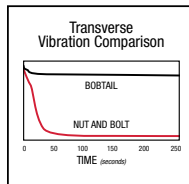


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www.completewind.com**Could you give us a general overview of the Complete Wind Corporation?**

Complete Wind Corporation (CWC) has a depth of hands-on knowledge that originates from the manufacturing of wind turbine rotor blades. The CWC team has leveraged that knowledge to make the transition to a provider of rotor blade technical and field services. Being incorporated in Canada and the United States allows CWC to offer consistency in services to owners and operators with cross-border assets. Collectively, CWC has inspected over 6,500 rotor blades ranging in size from 24 meters to more than 50 meters, comprising multiple rotor blade manufacturers and rotor blade designs.

I am the president of CWC and have more than 20 years of experi-

ence in the rotor blade industry. My wind career began as a manufacturing engineer with Canada's first large rotor blade manufacturer. CWC was founded in 2010.

Tell us about the services your company offers the wind industry.

CWC exclusively serves wind farm owners and operators, providing a comprehensive range of rotor blade services with specific focuses on:

- Rotor blade inspections; at factory, incoming at site, end of warranty, and post warranty — all as part of a comprehensive long-term inspection and maintenance program
- Remediation and composite repairs, both on- and off-turbine
- Quality assurance of in-field repairs as a third-party representative for owners and operators
- Audits of rotor blade manufacturing facilities
- Rotor blade damage and failure analysis
- In situ dynamic rotor balancing and vibration analysis

The CWC safety program is reinforced by years of experience both on- and off-turbine and recognizes the respective governing Canadian and American occupational health and safety legislation.

What can people gain from doing business with Complete Wind? What does your company offer that makes it stand apart from your competition?

Owners and operators can use CWC's knowledge and experience on rotor blades to their benefit to supplement their own engineering and technical groups on an as-needed basis. It allows the owners and operators to bring in a level of expertise it may not have available in-house. CWC does not offer its services to the OEMs in order to avoid conflict of interest as a representative of owners and operators. The ability of the CWC team to draw on its own rotor blade manufacturing experience and to stay current in today's advancing technologies in rotor blade manufacturing allows the company to serve a unique market.

What steps can be taken with new blades to lower future maintenance costs?

It is recommended that owners and operators become involved at the start of a wind project by performing a manufacturing audit at the factory as the blades are built. Gaining an understanding of the level of quality at the factory will prove beneficial. One way to do that is to follow the factory visit with thorough incoming inspections to fix problems before

the rotor is assembled and raised. It is far more economical to repair blades on the ground than on-tower after installation. The incoming inspections establish a baseline for owners and operators to make comparisons on future inspection findings as a part of an ongoing maintenance plan.

Does geographic location have any impact on inspection and maintenance schedules?

Yes, there are many things to consider, including peak wind seasons and if the wind farm sees a high frequency of lightning storms throughout the summer months. Planning inspections around the project's local climate will allow for the most value. Inspection frequencies can be increased or decreased as data is collected over the life of the wind farm and as the owners and operators gain insight to common defects and

rates of propagation. As an example, some owners and operators are using lightning strike data collected around the wind farm to perform targeted inspections following the passing of severe weather. These same owners and operators maintain regular inspection intervals, but the targeted inspections allow for early detection of lightning damage, and effective maintenance planning, should repair priorities need to be reallocated.

What specific elements have the most negative impact on blades?

There are varying levels of quality in the different blade manufacturers, so CWC witnesses a wide range of defects. However, some of the most prominent wear and damage is found in regions that see frequent rain and severe lightning storms or are located near sandy soil. Ice damage is more relevant in colder climates.

With President Obama and the EPA supporting the Clean Power Plan, the U.S. is at a point in its history where wind power could be a major source of energy. Where do you think the wind industry is headed?

Toward improved technology. Having the benefit of being in the industry for more than 20 years, I have been able to watch the industry evolve and grow. As the turbine manufacturers continue to develop larger turbines with higher power output, consideration must be given to replacing older technology onshore through the repowering process. This would follow the European model. Offshore has the potential to support even larger turbine models, but ongoing maintenance will create new challenges for service providers. ✎

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