MAINTENANCE

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OBTAINING A TRUE MEASURE OF HOW WELL YOUR WIND FARM IS RUNNING REQUIRES A METHODICAL, COMPARATIVE APPROACH

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Usually when I ask someone how their wind farm is running, they respond with an answer containing information related to the wind farm's availability.

Sometimes there is mention of the wind farm capacity factor. Everyone seems to be happy if all their turbines are spinning and not one is down.

I'm of the opinion that the availability response is a great indication of how many hours the turbines brakes are released, allowing the turbine to spin. However, it's not the best indicator as to how the wind farm is *running*. I think capacity factor answer is closer to the real indicator — although difficult to gauge on a daily basis.

Probably the best way to track how well your wind farm is running is to watch the turbines' power curves. I mean, if you take just two turbines with the same availability, they won't have the same power production in most instances. This is because we are able to adjust and improve each turbine's operating performance individually.

Then again, we may find that both turbines are running at optimum efficiency for their individual locations. But you can't tell that by "availability."

In order to determine efficiency, you have to assess each turbine's performance on an individual basis.

Let's take a look at some of the factors that you — as a wind farm owner, operator, or technician — can control when it comes to a turbine's power output.

The first of these determination factors — borrowing from my opening illustration — is the duration of the "brake release." How long was the turbine actually allowed to spin?

This is followed by turbine orientation. Is the turbine responsive to wind direction changes? Is it pointed "dead-on," directly into the wind? Or is it just good enough? How fast does your turbine react to minute changes in direction?

Next, look at the blade pitch. The controller says the blades are at optimum pitch, but have you confirmed actual blade pitch? There are often inconsistencies between the true blade pitch angle and the blade pitch marks on the blades. Are your blades balanced? How do you know? Rotors that are out of balance can result in production losses due to energy needed to raise the heavy side of the rotor. Correcting that rotor imbalance has the potential to improve a turbine's power output.

The next factor you control is the condition of the blade airfoil surface. Dirt, smashed bug build-up, and general blade surface roughness can rob your turbine of production. Many sites have had experiences where the leading edges of the blades have eroded away.

In the turbine performance comparison process, you have two primary informational tools at your disposal — the wind turbine power curve and the wind occurrence matrix.

You're likely familiar with power curve graphs that typically chart the power output vertically and the wind speed horizontally. Most turbines express their power curves with 10-minute averages. This 10-minute averaging is good for general review, but not the best for tracking issues as the smaller issues get smothered in the mix.

Taking a look at your wind occurrence data will tell you when your turbine is in operation the most. Although your turbine's maximum output rating is typically part of the turbine size identifier, the turbine may spend minimal time producing power at that said rating. Instead, the turbine may spend the majority of its time producing power at a percentage of the

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its nameplate rating, due to periods when winds fall below the turbine's wind speed rating.

A wind occurrence matrix tracks how many hours or minutes in a year the wind blows at a specific wind speed. You may find out that out of the 8,760 hours, the wind only blows at the rated wind speed or greater a few hundred hours a year. You may find that your site sees 5,000 hours at wind speeds that produce half of your turbine's output rating. At this site, all of your efforts should be to grab as much power as possible during those most frequent hours.

Some sites may find that they are operating at or above the fleet's wind speed rating the majority of the time. This type of site will find it difficult to perform maintenance services due to a lack of low-wind periods. However, that's a good problem to have!

Reviewing your power curves in relation to your wind occurrence for each turbine can be time consuming, but is worthwhile. Rank all of your turbines from best to worst in terms of production. Then create a chart for each turbine using power curve data from as short of a duration as possible (or from a period that at the very least gives you some comparable data). From there, you can compare all of the turbines against each other using data from the same time frame.

Typically, take the best producing turbine and compare it with the worst producing turbine. Ask yourself questions as to why the two turbines are not the same. Small changes in turbine parameters, mechanical settings, or blades, may make a significant improvement in performance. This practice will help tighten up your unseen losses, and will help you understand your turbines' operating theory vs. practical performance issues.

As always, work as safe as possible and work to prevent surprises.

PRODUCT:

Klüber introduces multi-purpose lubricant for extreme high-temperature applications

Klüber Lubrication, a worldwide manufacturer of specialty lubricants, has introduced Klübertemp GR AR 555, a multi-purpose lubricant offering exceptional corrosion protection and high evaporation stability.

Developed for high-temperature applications (up to 250°C) and applications exposed to aggressive media, Klübertemp GR AR 555 is a white, homogeneous long-term grease based on a perfluorinated polyether oil (PFPE) and polytetrafluoroethylene (PTFE). The product is NSF H1 registered. Common applications include pillow blocks/bearings, seals, rotary joints and ball bearing chains, as well as circulating fan bearings in various textile machinery.

Lubricants based on PFPE and PTFE are inert and generally regarded as neutral towards most elastomers and plastics.

For more information, visit www.klueber.com.

Advances in technology will continue to lower wind O&M costs, according to market report

Operations and maintenance segment of wind energy expected to reach $19 billion by 2020

Direct drive technology and tension control measurement technology for turbine bolts are among the innovations that considerably reduce wind O&M costs.

The O&M market's growth is currently restrained by a lack of skilled manpower, and the cost of logistics. However, the increase in the wind power O&M market is leading to an increase in companies providing specialized wind turbine O&M services, which in turn is decreasing the cost of O&M services. Taking these factors into consideration, the wind power O&M market is expected to reach $19 billion by 2020.

The global wind power market has grown rapidly in the past few years, with annual installations increasing from 14.8 GW in 2006 to 44.8 GW in 2012. Annual additions peaked in 2009, but the industry was then heavily affected by the economic slowdown in the major wind markets. Global wind installed capacity has almost doubled every three years since 2001 at a CAGR of 24.8 percent during 2001 to 2012.

GlobalData's report "Wind Operations & Maintenance Market, 2013 Update - Global Market Size, Share by Component, Competitive Landscape and Key Country Analysis to 2020," provides an understanding of the technology, key drivers and challenges in the global wind power market. It also provides historical and forecast data to 2020 for installed capacity and power generation. The report furnishes information on global market size of wind Operations and Maintenance (O&M) market, market share by company type (original equipment manufacturers, independent service providers and in-house), O&M market share by onshore - offshore wind market segments and key company profiles. The report also provides market data on out of warranty turbines, gearbox repairs and refurbishment market, blade repairs and generator repairs during the period of 2012-2020. Major countries analyzed in the report include the US, Germany, Spain, the UK, China and India.

—Source: GlobalData

Comparing the alternatives in wind turbine oil changes — interval-based versus condition-based

In recent years, the world is seeing expansive development of wind power. Sage Oil Vac recently exhibited its products at AWEA's WINDPOWER 2014 Conference and Exhibition in Las Vegas. While visiting with a broad range of customers, vendors, and attendees, one widely discussed topic was the growing trend of condition-based oil exchanges for wind turbines.

"Based on discussions and insights, it's apparent that condition based oil changes are quickly becoming recognized as a proactive approach to addressing market demand and efficiency needs, but without the investment in dynamic condition-based wind turbine oil changes there is a significant and extended risk for negative and costly results," said Dallas Dixon, Sage Oil Vac's sales and marketing manager for wind.

A condition-based wind oil change (CBW) is an oil change that only occurs after a series of tests and analysis has taken place, therefore constituting a need for an exchange. These tests are usually conducted by a third party provider at an additional cost.

This potential trend goes against the traditional method of interval-based oil changes. Interval-based oil changes are generally based on factors such as: time span (1-2 years); number of operating hours; number of rotations; change of product (e.g. Mobil to AMSOIL, or vice versa); or scheduled OEM maintenance.

With industry expansion, business growth involves analysis and management of operating costs, and oil changes are not an exception. Operating costs involved in interval-based oil changes can include lost production (wind turbine is not operating), paperwork, labor, equipment cost, oil disposal cost, and lubricant cost. Condition-based oil changes are not an exception to this rule. However, businesses may also find they will require the use of additional equipment such as expensive diagnostics and costly laboratory analysis expenses.

One area that interval-based wind oil changes naturally address, that many overlook with CBW oil changes, is the variation in weather and how that affects the intervals or "condition" of the system. Interval-based oil changes are a "proactive" approach to caring for a multi-million dollar piece of equipment.

"Proactive" in the sense that many possible expensive issues can be prevented if routine maintenance is executed. In addition to the oil change itself, owner/operators and manufacturers have the opportunity to inspect other elements of the wind turbines and complete routine maintenance, before a diagnosis notifies of a problem that might be beyond repair. While a condition based oil change has benefits such as reduced usage of expensive oils and analysis based feedback, the process of obtaining the oil sample can be a problem in itself. While extracting the oil analysis, re-suspension of settled contaminants can occur. Also, the oil sample may vary depending on where inside the gearbox the sample is drawn.

According to its research, Sage Oil Vac believes that while technology and CBW is evolving, there is a general need for quantitative planning methods and measurement techniques which will make detection of failures possible. However, these methods need expensive sets of input data. The location of laboratories may not be geographically convenient due to remote locations and it is very costly to have these analysis conducted by a third party. A condition-based oil change can be viewed as a "reactive" course of action, if not dynamic and can significantly decrease ROI when it comes to preventative maintenance, because this type of oil change is typically done only after a problem surfaces — once the analysis is complete. Often when a problem is detected, it can often be too late and maintenance equipment and suppliers can be more expensive to mobilize depending on weather and location variations.

While technology advancements and dynamic condition based maintenance may be our future, interval-based oil changes and proactive prevention guarantees efficiency and safety today. We look forward to technology advancements in predictions, as you can't prevent what you can't predict. But when multi-million dollar investments are at stake, "An ounce of prevention is worth a pound of cure," as Benjamin Franklin wisely stated.

— Source: Sage Oil Vac