Taking the long view

Up until recently in the wind industry, the aim of many players when affecting the choice of technology seemed to be based on making the wind turbine as cheaply as possible. PES gets a different perspective from Jukka-Pekka Mäkinen, President and CEO of The Switch.

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President and CEO of The Switch

"We believe looking only at upfront costs is extremely short-sighted," states Jukka-Pekka Mäkinen. "The stumbling block, especially in emerging markets that are more sensitive to prices, is how project return is approached. Investors are almost exclusively focused on increasing the project return on investment to anywhere between six and eight years. In reality, the lifetime of a modern wind turbine and its associated project value, however, is 25 years."

When it comes to selecting critical components, like drive trains, decisions driven by CAPEX reduction will eventually lead to higher operation and maintenance costs. Price-led decisions most often than not lead to a backlash when turbine owners realise that long-term reliability is inadequate.

As engineers of advanced drive train technology, the number one objective at The Switch is to ensure that wind farms can produce the maximum amount of power over their entire lifetime, rather than lock into the lowest initial investment costs. Although this idea may seem to be common sense to most, it is a departure from the recurrent investment mentality that has dominated the wind industry throughout its relatively short history.

Assessing your true O&M costs to avoid nasty surprises

The claim that permanent magnet generator (PMG) and full-power converter (FPC) drive trains are more expensive than double-fed induction generator (DFIG) drive trains is fundamentally wrong.

"It is based on a gross underestimation of the required servicing and total reliability of the drive train, which also must be taken into consideration to get a full picture of the overall costs of a wind turbine over its entire life cycle," Mäkinen explains.

When assessing failures, the main criterion is downtime. What matters is the impact of failures on the relative extent of the downtime they cause. Although potential failures over a 25-year lifetime are not easy to forecast with great accuracy, the wind industry's practical experience has shown that the gearboxes associated with DFIG drive trains are a primary cause for failure.

Wind turbine failures are likely to occur every eight or ten years, which is unfortunate given that in most cases the warranty runs for only five years. Beyond this time, the likelihood of failures increases even further. For example, when looking at high-speed solutions, the costs associated with gearbox repairs or replacements must also be taken into account. Such maintenance requires cranes that can often take days. This means a project can face major downtime and potentially catastrophic financial losses.

More surprisingly, the costs and uncertainties of the entire EPC contract are not often properly considered, including, for instance, the other components needed to support the grid and the operational costs of using a DFIG drive train.

Some OEMs only sell standalone turbines along with their maintenance and warranty contract without proper assessment of changing grid performance levels, and thorough consideration of the growing post-warranty servicing needs related with DFIG designs.

A lifetime without failures with simpler solution

Advanced drive train designs based on the use of a permanent magnet generator significantly improve the reliability of the overall system. With PMG designs, there are virtually no weak parts. The project owner can reasonably expect the machines to reach their full 25-year lifetime without any failure. In fact, the reduced servicing costs alone can sometimes be enough to justify the selection of high-efficiency PMG drive train technology.

"Reducing the number of components is important, because this leads to reduced risk. The Switch's PMG drive trains eliminate two bearings and couplings, and avoid alignment problems, producing a simpler and more reliable machine," continues Mäkinen.

Unlike DFIG drive trains, PMG designs don't include slip rings and brushes that are also prone to failure. From an engineering perspective, one fact remains undisputed: PMG technology is more robust and enduring than DFIG machines. This offers a good shield to owners to protect them from nasty post-warranty surprises.

What's more, PMG drive trains offer a high level of serviceability. Operators need to be able to service turbines as easily as possible in case of failures, especially offshore. They need to be able to execute all repairs onsite, without taking the components out of the nacelle. And they certainly don't want to take the whole drive train down to replace it with a new one, since this is expensive and time consuming.

Reaching longer-term goals with the right choice

The Switch has built a robust and advanced drive train based on PMG technology that has allowed the company to penetrate into a traditionally conservative market. The touchstone of its key components' reliability has always been the simpler, the better.

"By achieving this ambitious vision, we have been able to show the wind power industry and other traditional industries as well, such as the conservative marine industry, that the choice of the right technology does indeed lead to lower costs and greater profitability over the long run," affirms Jukka-Pekka Mäkinen.

4 ways that The Switch lowers the cost of energy

"We are committed to improving annual energy production (AEP) and minimising total life cycle costs (TLC), along with cutting back on operational costs. This

formula works even better with renewables – as the cost of wind, wave and tidal, and solar is free," Mäkinen says.

1: Increase annual energy production

High availability and great efficiency curves make a winning combination to boost annual energy production (AEP). The simplest way to increase AEP is to keep turbines or solar plants up and running to produce a constant stream of high-quality energy.

The Switch permanent magnet generator (PMG) technology ensures fewer failures and requires less maintenance while delivering superior efficiencies over a wide range of wind speeds. All of The Switch products feature a highly serviceable design to minimise the need for maintenance and increase production time, leading to the highest possible availability. The company's product portfolio covers all wind power applications from 1 MW to 8 MW and higher.

2: Minimise total life cycle costs

Cutting back on total life cycle costs means scrutinising the expenses associated with both the initial capital investment as well as the operating and maintenance costs over the lifetime of the equipment.

Permanent magnet generator (PMG) solutions may involve slightly higher investment costs than conventional solutions, but they impress with extremely low expenses for operation and maintenance. All products from The Switch require minimal maintenance and feature a highly serviceable design to speed up maintenance routines.

3: Extend lifetime of the equipment

A good purpose-built design, well-selected materials and components, and a carefully planned maintenance program can lengthen the lifetime of the equipment substantially.

For example, a well-designed drive train minimises cogging torque, reducing the amount of vibration and lengthening the lifetime of all components. Current designs from The Switch have already been calculated to last longer than 20 years.

4: Boost the quality of electricity

The success of renewable energy depends on the quality of electricity it feeds into the grid. The Switch renewable energy solutions have always demonstrated superior grid connection behaviour. Our full-power converters (FPC) support fault ride-through and fulfil the world's strictest grid code requirements, including the German BDEW 2008.

The Switch 3 MW units have been tested on site and passed all grid code requirements, even for the latest Chinese regulations. Low flicker, electrical noise emission and THD of <1.5%, the lowest of any in the entire industry, also support the final quality of electricity fed to the grid. ■

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