



Andreas Jagtøyen

Be empowered

PES caught up with Andreas Jagtøyen, Senior Vice President, Energy Division, Kongsberg Digital AS, who gave us a full account of their EmPower software suite. A way for wind farm asset managers to make informed choices to maximise production and reduce costs.



PES: Welcome to PES Wind magazine. Thanks for talking with us. Would you like to begin by explaining a little about the background of Kongsberg and the importance of the offshore wind industry to you?

Andreas Jagtøyen: Kongsberg finds the offshore wind industry highly interesting, especially seen in the light of increased need for renewable energy. One of the main reasons for our interest is that the offshore wind market shares many interesting commonalities with what we're doing in both the maritime area and in the oil and gas area.

In addition, the offshore wind market is experiencing exceptional growth, and, although it is little known, Kongsberg has long experience with the offshore wind industry, having supplied sensor systems and services to the wind sector for more than 20 years.

In 2012, we had a large strategy project which pointed out the importance of renewables, and in combination with our activities within offshore wind, this led to the establishment of Kongsberg's wind farm management department the same year.

Kongsberg Renewables Technology was established in January, 2015, and lead to our current work in the wind sector. Today, Kongsberg Renewables Technology has become the Renewables and Utilities business unit in Kongsberg Digital.

PES: Please can you tell us about EmPower, how is it used and the 4 modules?

AJ: EmPower is a complete software suite for all kinds of data management and decision support on wind farms, both land- and offshore-based. EmPower collects all operational data from the turbines and from the supporting systems around the turbines and integrates them into one unified system, creating value out of the operational data with our advanced analytic algorithms.

One of the four modules optimises farm performance. This is done by regulating the turbines as a farm as opposed to individual turbines and provides a greater combined power output from the farm. Today, turbines are more or less regulated autonomously, leading to a lower total outcome for the farm.

Another module provides production forecasting and identifies the best weather windows and time frames for maintenance. Obviously, wind is an important factor for any wind farm, and accurate predictions of the weather and the production of the farm are of paramount importance to save imbalance costs. These are a huge cost driver for wind farm owners.

A third module provides condition monitoring and predicts the future condition of important components in the turbine. This facilitates maintenance planning through calculating Remaining Useful Life (RuL) of the components and hence reduces the risk of seizure, an important issue on any type of rotating machinery.

The fourth module offers KPI functionalities, allowing the owner to track all kinds of farm and turbine parameters and providing an excellent overview, all in one system.

Operation planning is a huge cost driver for offshore wind farms, and we are now working on integrating maritime operation planning with turbine maintenance. This integration will enable route planning for a vessel, taking elements such as sea state and winds into consideration.

On large offshore windfarms, the weather conditions in the different parts of a farm vary. Knowing the need for maintenance in all your turbines enables you to make an optimal routing of the vessels that take

people on board the turbines.

Today, you normally buy a SCADA system with the wind turbine, and you buy a KPI system on top of this. We are working on combining both systems in an OEM independent farm management system, utilising all data available from the farms to maximise production and reduce operational cost.

Also, technologies developed from other parts of Kongsberg will be integrated into EmPower. There are several products from our Maritime business segments that can be implemented like AIS-systems, seabed monitoring, ship communications and walk-to-work solutions amongst others.

PES: Is it important to have all 4 modules or is it a case of select which module most suits the customer?

AJ: The modules serve different purposes for different operators and owners who do not operate their turbines themselves may not be able to utilise all the modules.

However, for companies that handle all operations by themselves it is a great advantage to have all four modules because each module serves a different purpose, and the data from the different modules can be combined to provide more advanced analyses enabling the company to have optimal asset management on their turbines.

As an example, a wind farm operator may need to estimate the production at least 24 hours before supplying the power. A good weather forecast is an important input to the prediction of power produced in the future. But if this is combined with the condition monitoring module, the owner will also know beforehand which turbines will be down for maintenance in the next period, and which turbines they need to run on reduced load in order to avoid trouble with certain components. Combining all the modules reduces the imbalance cost significantly.

PES: This seems to be a new approach what are the benefits to the customer?

AJ: There are numerous benefits. All data are available in one interface, in one system plus it's easy to use, you can build your own dashboards with the KPIs you are interested in watching. This is something that varies a lot from operator to operator.

The multi-turbine and multi-farm integration allows for better weather predictions because you can track the weather coming in on the coast and through your own farms. Having more turbines in the same system enables you to benchmark your turbines compared to each other and to use historical data from one turbine to make estimates for another based on advanced analytics.

For instance, if one of your turbines has had a seizure in a bearing, you will be able to

recognise the pattern in any other turbines before the seizure actually happens. The more turbines you have, the easier it will be for you to spot upcoming seizures and do preventive maintenance work. This is a huge cost saving potential.

EmPower has highly advanced analytics that helps predict future damages to machinery, especially when supported by data from advanced Kongsberg sensors. With a normal alarm system, you will get a reactive alarm when some kind of damage occurs, but our predictive maintenance analytics may show indications of upcoming issues up to eight months in advance, enabling you to do maintenance work to prevent the damages.

Predictive analytics improves maintenance planning, because advance knowledge of expected damages in a turbine enables you to optimise operations and reduce degradation of components and prolonging the time to next maintenance call. This minimises the number of extra trips to

your model to recognise these differences is crucial for the prediction capability of the system. Over time, EmPower trains the digital twin of each turbine to be an exact fit for the normal state of that turbine based on historical data.

EmPower can trigger events in the ERP system, for instance automatic requests for spare parts to ensure that they are available for maintenance on a specific day. To do this, you must integrate EmPower with the maintenance and the work order system of the turbines. We have drawn on our long experience within oil and gas to do this, as the vast amount of interfacing that is needed to trigger events is exactly the same for oil and gas.

PES: In terms of cost is it affordable or does the gain in uptime and efficiency offset the costs?

AJ: EmPower is available through software as a service or as an on-site solution. Many of our customers prefer the business model where we are paid by megawatt-hours

but rely on their system vendor to help them and system vendors often charge heavily for their help without imparting their knowledge about an issue. This forces the customer to contact their vendor when the same issue arises again and again.

We want to provide our customers with the full value of our system and to ensure they minimise their maintenance costs we help them make the operational changes that will transform their business. This includes providing them with the second line support they need when they face challenges.

In the future, Kongsberg will be taking still more responsibility for keeping assets running.

PES: What has becoming part of Kongsberg Digital (KDI) meant to Kongsberg Renewables Technology?

AJ: It's a huge benefit, mainly because we have gained a much larger software development environment. KDI's open ecosystem digital platform, Kognifai, is in



damaged turbines. In this way, you can stick to your maintenance schedule and keep the costs of maritime operations down.

EmPower provides you with in-depth knowledge of each machine by enabling you to set up your own data tags and analytics in real-time data streams. In this way, you can obtain the specific data you need to fine-tune the turbines. EmPower also provides a digital twin or a process simulator to match the exact behaviour of each turbine.

From the outset, the digital twin of a turbine is a generic model consisting of, for instance, a simple turbine model with a generator, a gearbox, a rotor and some supporting systems. However, up to ten per cent of a turbine's normal behaviour differs from that of other turbines – and training

produced as this ensures that our target is the same as theirs: to produce more megawatt hours. When a customer prefers to have fixed costs, we charge per turbine.

The simplest version of EmPower costs the market price for similar KPI systems from other vendors. There is a vast potential in using our system though: If a customer buys all the modules then predictive maintenance, predictions of future challenges for the machinery, and reduced imbalance cost could influence the Cost of Energy by up to 8 per cent and even more in some cases.

Our system can support a lot of decisions, but turbines are complex machines, and the owner needs some basic technical know-how to understand their turbines and make the smartest decisions.

Many owners do not have this know-how,

itself a huge benefit for EmPower, because it allows us to focus on developing the applications.

Previously, our developers had to spend a lot of time on the infrastructure. We are now able to focus on giving our customers additional value when they use EmPower, for instance by adding advanced algorithms and analytics from the oil and gas area to EmPower and vice versa.

We can share project resources, and we have established a business transformation team in the energy division, which serves the oil and gas area as well as the wind, renewables and utility area.

Generally speaking, we have a lot of potential and a lot of common challenges in the energy sector. Many of our customers



are present in both the renewables sector and the oil and gas sector, and we are now able to develop functionality that will work in both areas.

This means our customers will recognise the KPIs and the system, and receive the same visual overview of their asset whether they select an oil platform or a wind turbine when they log on.

PES: Do the bigger turbines pose specific challenges to your systems?

AJ: I would rather say that the bigger turbines represent great opportunities for using new technology. They are growing ever more complex and some of their components have great value, which makes it beneficial for their owner to do more instrumentation and invest more in predictive maintenance.

The bigger the turbine, the bigger the benefits you get from a system like EmPower. It is perfect for reducing operational costs.

PES: How important is training to you as a company in view of the stringent health and safety regulations?

AJ: Training is very important, but there are two sides to this:

Firstly, the strict safety regulations demand that field service engineers receive the same training as service technicians who enter transformer stations onshore. As they enter the turbines from a ship, we have a first-class training regime where they receive training in both the maritime operation and in the safety issues in the turbines.

Due to the height, the high voltage, and the

rotating machinery in a turbine, we have a separate training program that certifies field service engineers to climb turbines.

Secondly, we have simulators which our customers can use to train their own people for operation before they enter a turbine. In the future, we expect that maintenance personnel will need to enter the turbines for maintenance once a year or every second year and in these cases, training is highly beneficial.

They can use the simulators to see the location of any failures they need to look at, they will know exactly what spare parts and tools are needed and they will have the knowledge they need to fix the issue. Among features to come, will also be a time estimate for maintenance work making any maintenance planning even more exact.

PES: What singles you out from the competition?

AJ: We have integrated all functionality in one suite of software with highly advanced analytics. We have the most advanced predictive maintenance system for turbines like this, likely the most advanced system in the world.

We will also let our customers own their own data and do with it what they want. This centralises the data and disrupts the old chain of command by going between the customer and the vendor, providing the vendor with only the data they need to make their next turbine better.

Today, customers of other systems receive a report with historical data weeks after the data has been collected. Our customers will own their own data, they can base their

decisions on it, and use it to reduce their maintenance costs.

This is where the real cost benefit is 30 per cent plus of all costs of a windfarm are related to maintenance and with predictive maintenance you can reduce these costs by up to 30 per cent.

PES: Where do you operate and where are the key markets for Kongsberg and are there any areas, geographically speaking, that you would like to break in to?

AJ: Today, we operate mostly in the Nordic countries and northern Europe. But we are on our way into the US and China.

PES: As we move towards mid 2017 how is the year looking for Kongsberg?

AJ: We are still in a development phase based on the offshore functionality and 2017 is a year of further development and market expansion. Considering our market potential, I believe it will prove to be a good year.

The interest in the market is there, we just need to find the owners that are willing to start investing, change their organisations and train some people to handle a new tool like ours.

The technology is already there, but our customers need an organisation and a setup to utilise it. We are happy to help them with their business transformation, and are ourselves in a transformation phase.

For us, 2017 is all about market expansion and business transformation and a lot of development.

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