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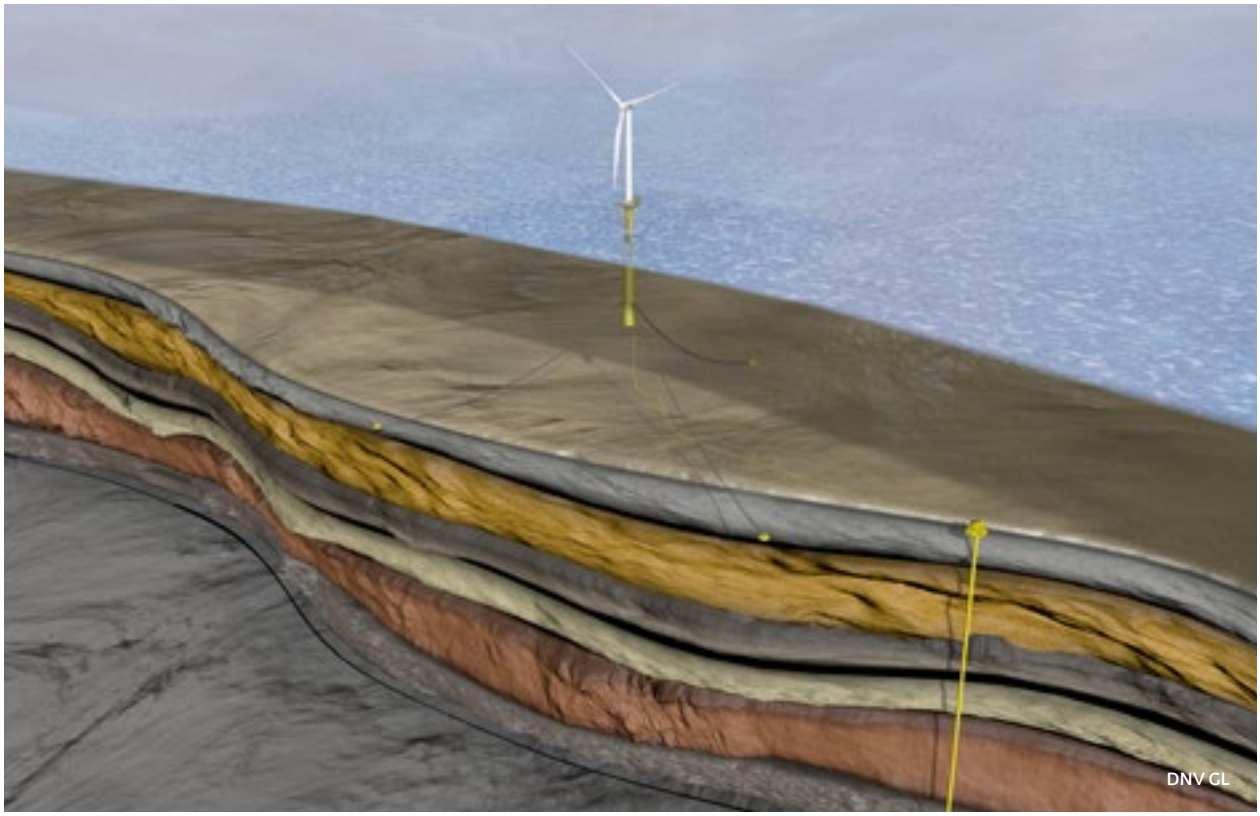
DNV GL-LED PROJECT GIVES GREEN LIGHT FOR WIND-POWERED OIL RECOVERY



The DNV GL-led wind-powered water injection (Win Win) joint industry project (JIP) shows that, for suitable fields, wind-powered water injection is technically feasible, capable of meeting performance targets, and offers a cost-competitive alternative to conventional water injection solutions.

For the past year, participants from both the renewable and oil and gas industries have worked together in the DNV GL-led Win Win JIP to develop the concept of using floating wind turbines to power a water injection system in detail and assess its technical and commercial feasibility. Technical and operational aspects as well as costs have been assessed. The JIP partners include ExxonMobil, ENI Norge, Nexen Petroleum UK Ltd., Statoil, VNG Norge, PG Flow Solutions, and ORE Catapult.

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According to DNV GL, no major challenges have been identified through the JIP's study. Analyses of system performance examining site-specific cases from JIP partners have shown that Win Win is able to meet the operator's key performance requirements that include injection volume targets as well as reliability and minimized downtime.

"For the first time, we can now see renewable energy as a large scale source of power to offshore oil and gas operations," said Remi Eriksen, group president and CEO of DNV GL. "By utilizing the recent developments of floating offshore wind turbines, this concept can offer a clean, reliable, and cost-effective alternative for powering water injection in offshore locations. The Win Win project showcases that the oil and gas industry can become a creative force in solving the world's energy trilemma by driving the development of reliable, clean, and affordable technologies. This is a win for both the oil and gas and for the wind power industries."

According to Sara Ortwein, president of the ExxonMobil Upstream Research Company, such technological advances improve the economic feasibility for wind to contribute to the overall energy supply mix.

"We are encouraged by recent advances in wind technology, particularly for niche applications such as offshore oil and gas operations," Ortwein said.

The costs for wind-powered water injection have been compared with a conventional alternative where water is injected through a flow line from the host platform. While the Win Win technology has higher operational expenditures (OPEX) compared to a conventional alternative, the significantly lower capital expenditure (CAPEX) means that it compares favorably over the long term. Therefore, Win Win is a commercially competitive alternative in a range of cases, particularly when host platform capacity is limited or injection wells are located far away.

"For the specific example assessed in the report, we are looking at a potential cost saving of approximately 20 percent compared to a conventional solution, and this will of course vary greatly between cases," said Johan Sandberg, project sponsor and segment leader of floating wind turbines at DNV GL. "To develop the concept further, a next step would be to test critical subsystems in a small-scale physical setup. The key objective would be to gain assurance that the components integrated in this configuration will offer satisfactory performance over time with a variable power input. A potential phase two of the JIP is being explored with some of the current JIP partners."

Source: DNV GL

For more information, go to www.dnvgl.com.

SIEMENS INTRODUCES DIGITAL SERVICES FOR ENERGY POWERED BY SINALYTICS

The Siemens Power Generation Services Division has been advancing the development of digital trends, building upon its more than 20 years of experience collecting and analyzing data as part of its power diagnostics services. The company is deploying projects and devoting significant resources to unlock the full potential of this transformation. Siemens has developed a number of advanced, data-driven service offerings that combine big data with the company's comprehensive domain expertise to support its industrial, oil and gas, electric utility, and wind power customers. Siemens Digital Services for Energy powered by Sinalytics was officially unveiled at the Hannover Messe industrial fair in Hannover, Germany.

Siemens Digital Services for Energy are intelligent knowledge systems that are enabled by advanced algorithms, sophisticated data analytics, and pioneering machine-learning combined with domain know-how to create new business models that are continuously fed by as-operated and as-maintained fleet and unit-specific data. This approach facilitates tailored service solutions designed to meet customer needs for operational flexibility, plant performance, condition-based maintenance, and more. These data analytics also contribute to the development of new and improved processes and provide valuable insights that can be used in future technology design.

"Big data is transforming our industry into a digitally driven, intelligent ecosystem," said Randy Zwirn, CEO of Siemens Power Generation Services. "Siemens is investing significant resources across its various businesses to successfully marry the physical and virtual worlds. With more than 300,000 devices already connected through our powerful Sinalytics platform architecture, we are able to put to work our vast experience and deep know-how to pioneer digital services that create game-changing value for our customers."

These advanced data-driven service solutions are enabled by Sinalytics — Siemens' secure, scalable, and industrial-strength analytics platform architecture, capable of inte-

grating huge volumes of complex data. Over 300,000 devices are connected company-wide through Sinalytics. Beyond simply collecting this data or providing customers with a standalone software platform, Siemens is integrating valuable, insight-driven analytics with field service data, global fleet performance data, and data from other diverse sources.

An important element of Sinalytics is Siemens' cyber security-by-design approach that not only allows confidential data to be collected, transmitted and analyzed in a secure way but also means that cyber security is consistently integrated throughout all lifecycle phases. Cyber security is a critical business driver at Siemens and is thoroughly implemented into the architecture of Sinalytics. Key aspects of cyber security in Sinalytics are the provision of confidentiality and the integrity and availability of infrastructure and data as well as processes. Supporting concepts include the configuration of hardware and software systems using state-of-the-art cyber protection technologies, explicit proof of identity of all kinds of users, strong authentication, strong confidentiality protection of data at rest and data in transit, secure execution of analytical jobs, and auditing of all security-related events.

Real-world outcomes with Siemens Digital Services for Energy are resulting from projects across the globe that are designed to support unique customer needs with innovative, data-supported service offerings, and digitalization projects continue to drive results for Siemens' wind service customers. Remote diagnostics services are the genesis of these digital offerings as the company closely monitors more than 10,000 wind turbines globally. Advanced analytics are constantly evolving and expanding at Siemens' Remote Diagnostic Center in Brande, Denmark, with new developments in areas such as vibration diagnostics and 24/7 alarms notification and management. Siemens is able to remotely address 85 percent of alarms coming into its Remote Diagnostic Center without the need for a visit to the turbines, which translates into higher availability and operational efficiency. Additionally, data-driven upgrades such as Siemens' High Wind Ride Through, which is a software performance upgrade designed to allow turbines to continue operating at reduced power in higher wind speeds, are also providing measurable results. At the West Wind wind farm in New Zealand, the upgrade was installed on all 62 wind turbines at the site, resulting in a marked improvement of 2 percent in annual energy generation and a reduction in high-wind speed losses of 80 percent.

Siemens' wind service technicians use digital tablets on-site to access turbine data and manuals, as well as to communicate back and forth with Siemens' engineering experts.

Through advanced engineering analysis, increased data collection and analysis, and remote monitoring and diagnostics, Siemens Digital Services is providing unique insights that will help the customer better predict operational and maintenance performance for cost-effective and flexible operations.

Source: Siemens

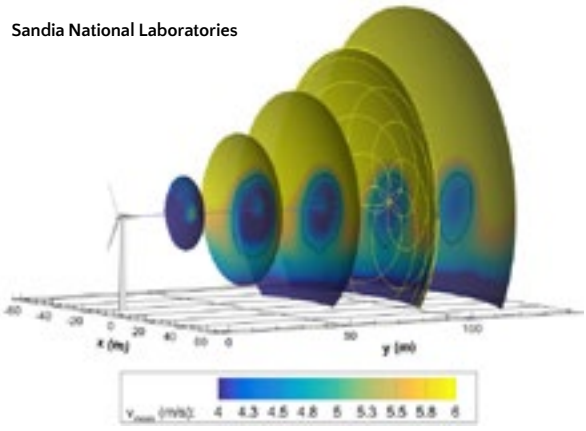
For more information, go to www.siemens.com.

VIRTUAL LIDAR MODEL HELPS RESEARCHERS PLAN FOR WAKE STEERING EXPERIMENT AT SWIFT

A team of researchers at Sandia National Laboratories (SNL) and the National Renewable Energy Laboratory (NREL) are planning a critical experiment at Sandia's Scaled Wind Farm Technology (SWiFT) facility to investigate the use of wind turbine yaw control to direct wakes, a promising approach to increase power production in wind plants. During the multi-month field campaign, researchers will collect data to improve both high-fidelity wind plant simulation software and demonstrate novel control concepts. The industry could then develop advanced controllers for deployment in commercial wind farms to increase power production.

Capturing detailed characteristics of the wake produced by the upwind turbine is a challenging requirement of the campaign. To confirm the model predictions, researchers need long-term continuous measurements of the wake velocity profile downwind of the turbine. The team partnered with the Technical University of Denmark (DTU) Wind Energy Department to leverage their wake measurement expertise and

Sandia National Laboratories



their custom-built SpinnerLidar. Lidar, or light detection and ranging, uses a scanning laser beam to measure wind velocity, and it does so at the resolution required for the SWiFT experiment.

Before deploying the SpinnerLidar, the research team scrutinized the instrument configuration and developed

appropriate data analysis methods. To account for the many variables and complex calculations, the team developed a detailed virtual Lidar model to interrogate data sets from computational fluid dynamics (CFD) simulations of the SWiFT turbines. With the tool, the team is confident in its ability to reduce risk and uncertainty in the instrument, experimental configuration, and data processing before the instrument is deployed at the site, saving both time and money.

The animation depicted here in a screen-capture image was created from the virtual Lidar model and CFD simulation to depict the Lidar scanning pattern that will be used for the Wake Steering Experiment. The video depicts one of the SWiFT turbines operating in real time and scale while the DTU SpinnerLidar scans a rosette pattern at five distances downstream (1-5 rotor diameters). The contour surfaces at each scanning distance represent the average line-of-sight velocity interpolated from the SpinnerLidar virtual model interrogation of the CFD simulation, estimating the resolution of experimental data that can be expected. The black irregular shape at each distance represents the output of an image-processing method used to determine the center of the wake produced by the turbine. This wake location in time and space will be a key data set to assess and improve the wake steering control model —one of the primary objectives of the experiment. All data from the upcoming experiment will be made public through the DOE Atmosphere to Electron (A2e) Data Archive Portal for other researchers to analyze for their own models and tools.

Source: Sandia National Laboratories

For more information, go to www.sandia.gov.

INGETEAM IMPROVES DFIG'S FAULT RIDE THROUGH (FRT) BEHAVIOR WITH CROWBARLESS SOLUTION

Ingeteam recently introduced its "crowbarless" solution, a modular fault ride through (FRT) system for power converters that will strengthen the grid compliance of doubly fed induction generators (DFIG). Thanks to the modular FRT system, the crowbarless solution offers superior capabilities compared to the active crowbar system traditionally used to protect the power converter from grid voltage transient.

Until recently, most grid codes allowed wind turbines to disconnect from the grid when transients in grid voltage could jeopardize the integrity of their elements, especially the power converter. Due to the ever-increasing wind power penetration around the world, this is no longer the case. Ingeteam has come up with a new way to deal with low capacity transmission lines, or weak grids, and FRT events to remain fully grid compliant.

"The traditional crowbar solution used in DFIG topology presents a poor response to the voltage sags," said Ingeteam's director of research and development, Carlos Gironés. "This is because the machine side converter is disabled when a voltage sag appears in the stator terminal until the inductor generator flux is stabilized. Thanks to new software and hardware implemented in our crowbarless solution, the machine side converter is available at all times during the voltage sag, achieving injection times required by the most restrictive grid codes."

Ingeteam

To date, the most widely used system to protect the power converters from voltage spikes is the so-called "active crowbar," a shunt circuit composed of actively controlled switches and dissipation elements that are connected to shunt the high currents, avoiding damages to the converter. However, this system presents the limitation that, while the active crowbar is connected, the power converter is not in operation, the active and reactive power set points cannot be tracked, therefore, the

wind turbine is not being controlled. Ingeteam's crowbarless power converter, designed to operate in DFIG topology, uses a modular FRT system that removes the need for the active crowbar.

The crowbarless solution presents behavioral advantages in issues related to weak grids or grid fault events, allowing doubly fed induction generators to overcome previous technical constraints and comply with the strictest grid codes. Coupled to a suitable selection of grid filter and control loops tuning, it is able to keep the control of the wind turbine during these transients, achieving the controllability required in order to operate in weak grids.

In addition, the modularity concept of the FRT system allows for a cost optimization for each application. The solution is flexible and offers a cost-optimal power converter option for each wind farm scenario.

Source: Ingeteam

For more information,
go to www.ingeteam.com.

ADWEN'S AD 5-132 OBTAINS TYPE CERTIFICATE FROM DNV GL

Adwen recently obtained the type certificate of its AD 5-132 offshore wind turbine awarded by the independent certification body DNV GL. This milestone marks the culmination of the turbine's certification process and confirms the platform's technology, which, in turn, bolsters the commercialization and industrialization processes.

The AD 5-132 has been designed and certified as special class, covering the most demanding offshore sites worldwide. This wind turbine is tailored for subtropical monsoon climates typical of Asian offshore markets, and it is designed to resist typhoons as well as harsh environmental conditions such as high temperatures and humidity.

This offshore wind turbine is one of the most cost-efficient of its class, allowing a high degree of customization to adapt to customer needs. In addition, its modular design coupled with its high reliability minimizes operation and maintenance costs.

"This type certificate is an important step forward for Adwen as it confirms the technology performance of the AD 5-132, which has been designed to support extreme weather conditions while guaranteeing reliable performance and maximum energy output, thereby optimizing the levelized cost of energy," said Maite Basurto, Adwen's CTO.

According to Mike Wöbbeking, head of the renewables certification body at DNV GL, the wind industry is venturing further into geographic regions with special climates.

"We see a strong increase of new technologies being introduced to the latest turbine types," Wöbbeking said. "Our fact-based type certification process verified that the innovative new system of the AD 5-132 is meeting the highest safety and reliability requirements to deliver high performance even in extreme weather conditions."

Source: Adwen

For more information,
go to www.adwenoffshore.com.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