id	session code	title	Presenter name	Affiliation
67	B-1-1	Harvesting the wind far offshore – combination of floating offshore wind and offshore hydrogen production.	Dr. Per Christer Lund	Norwegian Embassy in Singapore
70	B-1-2	The Current Situation and Developing Trend of Chinese OffShore Wind Power	Mr. Dechang Shen	Chinese Wind Energy Equipment Association
42	B-1-3	Offshore Wind Farm Planning and Future View in Hokkaido, Japan	Prof. Satoru Shiraishi	Hokkaido University of Science
150	B-1-4	Aero-Hydro-Elastic Analysis of 5MW Semi-submersible Floating Wind turbine in Shallow Waters	Mr. Fuminori Hioki	Wind Energy Institute of Tokyo, Inc.
83	B-1-5	Six new concepts for reducing the cost of offshore wind turbines	Mr. Yasuo Ueno	JWEA (indivdual member)
111	B-1-6	Certification before standards for Innovative Offshore Technologies	Mr. Johan Slätte	DNV GL
149	B-1-7	Outline of the dynamic analysis procedure in NK-UTWind ver5.0 for offshore floating wind turbine certification	Dr. Sho Oh	ClassNK
172	B-1-8	The effect of control logic on wind turbine tower load	Mr. Iman Yousefi	The University of Tokyo
68	B-1-9	Windpower "on the rocks" projects in Scandinavia	Dr. Tore Wizelius	Wind4shore AB

Harvesting the wind far offshore - combination of floating offshore wind and offshore hydrogen production

Per Christer Lund

Norwegian Embassy in Singapore

Abstract:

The world has abundance clean and reneawable energy that with todays technology rather easily be harvested. The challenge is rather on logistics and infrastructre - how to store and transport electricity across large distances. For example: the cost of high voltage subsea cables and associated substations is a limiting factor for how far offshore wind farms can be built. One alternative is utilization of hydrogen as temporary and localized energy storage and as transport media to the markets onshore.

This paper will present the concept for combining floating, unmanned hydrogen production within far-from-shore floating wind farms for temporary energy storage and trasnport. The paper will report on a study comissioned by DNV GL in 2015 by a group of international summer student. The concepts includes technology for water pretreatment and electrolysis; storage as compressed gas and loading concepts.

The presentation will describe the technical solutions and discuss the cost and revenue aspect as basis for a techical and financial feasabilty asessment.

THE CURRENT SITUATION AND DEVELOPING TREND OF CHINESE OFF SHORE WIND POWER

Dechang Shen

Chinese Wind Energy Equipment Association

Abstract:

In 2015, Chinese off shore wind power developed more fast than last year, the new installation capacity of off shore WTGS was more than 360MW. And accumulated installation capacity of off shore WTGS has reached to 1014MW by the end of 2015, all of them have been connected with public grid. About 10 WTGS manufacturers located in China have provided qualified products of WTGS to domestic off shore wind farm market.

A number of 3MW double feed WTGS have been used on off shore wind farms and 2.5MW direct drive WTGS have been used on Inter-tidal wind farms. More and more 4MW and 3.6MW WTGS have been used on off shore wind farms in resent years. Some 5MW WTGS have been installed in off shore wind farms, and a few 6MW WTGS have been tested in off shore wind farms.

WTGS becoming Larger and enterprises becoming internationalization is an inevitable trend.

The plan of Chinese government is that the accumulated on grid installation capacity of off shore WTGS will reach to 10GW by the end of 2020 in China. Chinese off shore wind energy equipment manufacturers will facing a steadily & reasoning development period from now to 2020. The new installation capacity of off shore WTGS is expected 1.8GW each year from 2016 to 2020.

This paper traces the development course of offshore WTGS, analyzes the technical routes of offshore WTGS which are developing by the major Chinese WTGS manufacturers, and put forward the main development trend of offshore WTGS in future.

Offshore Wind Farm Planning and Future View in Hokkaido, Japan

Satoru Shiraishi

Hokkaido University of Science

Abstract:

1. Potential of offshore wind energy in Hokkaido

Hokkaido is located in the most north among the four major islands in Japan. The area is suitable for wind power generation because the annual average wind speed is greater than other area in Japan. The power generation potential in offshore Hokkaido which is estimated by the Ministry of Environment is about 400,000MW in case of annual average wind speed exceeds 6.5m/s. The potential is about 137,000MW where the annual average wind exceeds 8.0m/s.

2. Development of offshore wind farm in port area

In this paper, the development status and future prospect of offshore wind power generation in Hokkaido are described. Even though the wind power generation potential in offshore area in Hokkaido is high, an offshore wind power generation is only constructed at the port of Setana. Two wind turbines of 600kW were constructed there and the operation was started in 2004.

In Japan offshore wind farm plans are preceded in the port area where the port authority administrates. About ten plans are discussed now at the port area in Japan. Wind farm operators are selected by port authorities of each port through the examination of plural proposals.

In Hokkaido, two plans of offshore wind farms are under discussion at the present time. At the Ishikari Bay New Port, a construction proposal was selected in August 2015 through the examination of two proposals. Environmental assessment, facility design, discussion for electricity grid connection and so on are going now. At the port of Wakkanai, items for proposal are now discussing by the port authority and the selection will be scheduled in the summer or autumn of 2016.

3. Zoning for offshore wind farms

No offshore wind farm planning at area of sea outside port area is developed in Hokkaido. When rich wind energy potential in Hokkaido is considered, future's development is needed. First zoning at the offshore area out of the port of Iwanai was discussed, the local government of Iwanai town announced officially the result of zoning in February 2016.

4. Measures for offshore wind farm developments

In this paper, it was considered about following measures to develop offshore wind farms in Hokkaido.

(1) to reinforce the grid connection.

(2) to predict wind speed more precisely.

(3) to reduce fluctuations of wind energy by means of hybrid system with other renewable energy origins.

(4) to change to the hydrogen energy.

(5) to decrease the construction and maintenance cost by

Aero-Hydro-Elastic Analysis of 5MW Semi-submersible Floating Wind turbine in Shallow Waters

Fuminori Hioki[1], Yoshitaka Totsuka[1], Yuka Kikuchi[2], Haruyuki Namba[2] and Hiroshi Imamura[1]

[1]Wind Energy Institute of Tokyo, Inc., [2]The University of Tokyo

Abstract:

The semisubmersible floating platforms of offshore wind turbine are desirable platforms for deep water offshore wind farms. However, semisubmersible floating platforms have a pitch and roll motion and this motion occurs additional loads to a wind turbine. Therefore, it is necessary to investigate the extremum loads on wind turbine due to the platform motion in storm condition in order to operate the floating offshore wind farms without a hitch.

In this study, we investigated the mechanical effect of a semisubmersible platform motion on the wind turbine structural system at three different water depth 50m, 80m, 100m and with three different controllers of wind turbine, by aero-elastic analysis code FAST developed by NREL. The wind turbine is basically the same as the NREL 5MW model but modified tower mass- and stiffness distribution. Two controllers of wind turbine are designed for a floating offshore wind turbine and the other is for onshore wind turbine as a reference. We performed the aero-hydro-elastic analysis of the wind turbine in both storm (DLC 6.1, 6.2) and operation (DLC 1.2) conditions. In DLC 6.1 and 6.2, we evaluated the statistics of the blade root in- and out- moment, tower base moment and the fatigue loads in DLC1.2.

Six new concepts for reducing the cost of offshore wind turbines

Yasuo Ueno[1] and Tatsuhimo Nagata[2]

[1]JWEA (indivdual member), [2]JWEA

Abstract:

6 new concepts for reducing the cost down of offshore wind turbines.

Offshore wind turbine technology is one of most important forms for renewable energy. Especially VAWT is excellent in conditions such as high winds and effect of waves from different direction. But cost of the offshore wind turbines is too high and it is not practice widely. Now the author, Ueno, will suggest 6 new forms that are effective for reduce the cost. As a result I hope the offshore wind turbine will provide more widely.

1. The starting torque of VAWT should be more stable and able to start revolving in the condition of lower wind speed. Slats (little wings on the top edges of the wings of turbines) are very effective for this purpose.

2. There are many types of offshore float systems.

Constructions of these systems are complex and installing is difficult and takes long time. A tight rope truss and a submerged float structure constitute a new system. It is very simple, low cost and effective way to prevent swaying for a wind turbine system on the ocean.

3. Shaft and wings of VAWT are very heavy. The rolling way friction torque of the VAWT should be smaller. A fiction of a new bearing system is very small. Using the new bearing system, starting torque of a VAWT will be reduced by a lot. And the power generated increases will much more. The technique is very important for VAWT.

4. An automatically retractable blades system is prevent excessive force by a strong wind. When the speed of the wind is more than 25m/s these of blades retract automatically and when the speed of wind become less than 15m/s these blades engage automatically.

5.The depth of the seabed increases with the distance from the shore. Many long wires are set from the shore to offshore and fix anchors to the end of wires. And each wires connected with plural parallel wires to the shore.

These wires make web in the seabed and connect turbine systems on each junctions of those wires. Web type wiring system of offshore wind turbines is low cost and these positions are stable. The slope of ground of the seabed is not a problem for this design.

6.Usually generators of wind-turbines are minimizing the cogging torque type. (coreless type) But the type of generator is bigger and heavier than the one of normal type.A centrifugal crutch system makes it possible to use a normal type motor for generator and will make reduce weight and cost of turbine.

Ref : VAWT=Vertical Axis-type Wind Turbine

Certification before standards for Innovative Offshore Technologies

Johan Slätte

DNV GL

Abstract:

Certification to standards is used for building trust and confidence in proven Technology. However, when new and innovative technology is introduced, standards are often missing. This has been identified as a challenge for the offshore wind industry, where new technologies and solutions often are introduced and these innovations are not yet covered by standards. Hence, these innovations are not yet verifiable and certifiable which can mean that projects are delayed, becomes more costly and uncertainty arises among different stakeholders related to the new technology. These challenges are present both in the bottom-fixed offshore wind industry and in the emerging floating wind industry. Technology Qualification however enables assurance of the new innovative solutions even before standards are developed, without relaxing certification requirements. DNV GL will in this presentation provide the background for how new and innovative technologies could be made implemented in a safe and reliable manner, without relaxing any technical requirements and affecting the safety of the systems.

Building trust and confidence: Operators are responsible for safety and reliability. One instrument that Operators and developers can use to help create confidence in Operations is to require certification of equipment and systems. When a relevant standard is available, certification will contribute to providing the necessary confidence that a pre-scribed set of Requirements, including acceptance criteria for testing, pertaining to safety and reliability have been met. That pre-scribed set of Requirements covers the expectations to the equipment or system, with underlying assumptions about Service Context. When equipment or systems are based on Technologies that need to be Qualified, then existing standards that are fully relevant or sufficient will not be available. Certification will, however, be useful to the Operator to build confidence in his approach and operations to other parties.

Validated Requirements: When Functions of an equipment or system are provided by Technologies that needs to be Qualified, then those Technologies can be subjected to the Technology Qualification process as outlined in DNV-RP-A203. The resulting sets of Validated Requirements will be formulated to suit the equipment or system of interest and its use. When Functions are provided by Technologies that do not need to be Qualified, then these elements of the equipment or system will be covered by Requirements contained in existing standards. The Technology Qualification principles are employed in the Requirements Validation process in order to demonstrate that those existing Requirements are relevant and sufficient, in combination with the Validated Requirements developed in the TQ process. Requirements Validation is further applied to identify any Requirements in the existing standards that are not applicable to the particular case, as they may represent a traditional way of providing a Function which is now replaced by the Technologies that will be subjected to Qualification.

Summary:DNV GL will in this presentation describe a process for certification before standards and how the step for new technologies to certification can be bridged. The Technology Qualification process is introduced and how operators and developers can build trust in, and implement innovative solutions in Offshore Wind projects.

Outline of the dynamic analysis procedure in NK-UTWind ver5.0 for offshore floating wind turbine certification

Sho Oh[1], Kimiko Ishii[2], Fuminori Hioki and Hideyuki Suzuki[4]

[1]ClassNK, [2]EXA Inc., [3]Wind Energy Institute of Tokyo Inc., [4]The University of Tokyo

Abstract:

Offshore floating wind turbine is a cost-effective support structure for wind turbines in deep water region and thus has large potential for areas with limited available area in land and shallow water such as Japan. Recently, led by the world's first floating offshore project in Fukushima, Japan, the number of offshore floating wind turbine projects is increasing both in Japan and other countries. ClassNK has been playing the role as the certification body in several of these projects. In the certification procedure, dynamic analysis of offshore floating wind turbine is one of the most important parts. While ClassNK has been accepting the results from existing major analysis tools, an original analysis tool for certification, NK-UTWind has been developed together with the University of Tokyo1). The basic calculation structure of the code is that the aerodynamics of wind turbine rotor is calculated with existing blade element momentum module, the motion of floater is calculated with the originally developed finite element analysis, and the two modules are connected with a parameter iteration process. In the previous studies, the fundamental structure of the code has been developed and water tank tests are conducted for verification. Based on the previously developed code, several new functions have been updated in the new version of the code in order to take into consideration the special cases which may be required in design and certification.

In this study, the details of the calculation scheme for added functions are described together with the fundamental analysis procedure of the new version of NK-UTWind. For the validation of the updated version of the code, several cases of calculations are performed using the floater model which is modeled after the water tank test from the international code comparison project, and the results are compared to those from model test and other analysis codes.

1) Y.Totsuka, H.Imamura, H.Suzuki, S.Hirabayashi, K.Ishii, T.Iwashita, "Development of Design Analysis Code for Rotor-Floater-Mooring-Control Coupled Dynamic Response of FOWT, Grand Renewable Energy 2014

The effect of control logic on wind turbine tower load

Iman Yousefi, Atsushi Yamaguchi and Takeshi Ishihara

The University of Tokyo

Abstract:

The aim of this paper is mainly to focus on studying the effect of controllers on the load of the tower of a wind turbine. Due to the vital effect of the tower's load on a wind turbine safety, it should be considered as one of the most influential factors. According to a previous similar study which was centered the wind turbine modeling, the estimation of wind turbine tower load wasn't accurate enough even though the mechanical representation was of high quality; thus, the problem is about the control logic. The implemented controller in that research was done according to JSCE guideline. Hence, a deeper study on control logic is needed.

To this goal, a completed model for a wind turbine is developed at the first place. Bladed wind turbine simulation tool was used in the previous research to describe the behavior of the studied machine. However, in the present article the mechanical representation of the whole system is established by the fatigue, aero-dynamics, structures and turbulence (FAST) in MATLAB/Simulink, which provides an even more able environment to design and test controllers. Modeling part is completed by implementing a proper controller. That being said, the logic needed to run the wind turbine is carefully explained and simulated. Lastly, an effective algorithm to reduce the tower load is proposed and simulated.

The measurement data of a 2.4MW wind turbine which is located in Choshi prefecture, is used as a basis for evaluating the developed model; i.e. the representation is tested in several different conditions and the output results are discussed. A comparison between the suggested solution, and the outputs of the previous research has also been made. As the last part, the tower load of the proposed solution is compared with the experimental measurements. Results show promising trends in the wind turbine control logic and controller design.

Windpower ”on the rocks” projects in Scandinavia

Dr. Tore Wizelius, Mr. Åke Pettersson Frykberg

Wind4shore AB

Abstract:

The most cost efficient near shore offshore windpower plants are installed on rock foundations. The prerequisite is that there is a sea bottom with hard rock, where subsea rock foundations can be built.

Even better is to install wind turbines on rocks above the sea level, on small islands or islets. Or as in the case of Kemi-Ajo, artificial islands in an harbor.

These windpower plants can be built and installed with well know easily available and comparatively cheap technology, drilling equipment, mobile cranes, etc, and the wind turbines can be transported to and installed from barges.

Four examples will be described, two that have been operating for some years,

Vindpark Vänern, a 30 MW (10 x 3MW) windpower plant in Lake Vänern, in operation 2009.

Båtskär, Finland, a 13,8 MW (6x2,3 MW) windpower plant in Åland archipelago, in operation 2007.

Kemi-Ajo, Finland, a 30 MW (10x3 MW) windpower plant in Kemi harbor, Finland, in operation 2008.

And two which are in the planning stage

Stenkalles Grund, a 60-90 MW windpower plant in Lake Vänern, permission granted.

Vindpark Marviken, a 60-90 MW windpower plant in Norrköping, at the coast of the Baltic sea.

Permission applied for, but not yet granted.

The paper describes the construction of the foundations and the installation of the wind turbines at these sites.