Wind power's pivotal role in the world's future energy supply enabled by New Breakthroughs

Wind is a emerging as a reliable and inexpensive source of renewable energy. Globally, the average cost of wind is $83 per megawatt-hour compared to averages for coal and gas being $84 and $98 respectively. "In the USA, gas is slightly cheaper than wind but this is the only large economy where that is the case. As a comparison, solar photovoltaic energy averages $122 globally for each MW-hour," said Giles Dickson who is CEO of the European Wind Energy Association (EWEA).

The demand of wind power is predicted for big growth in the future, The Global Wind Energy Council and Greenpeace International released the 2014 edition of the Global Wind Energy Outlook in Beijing. The report shows that wind power could reach 2,000 GW by 2030, and supply up to 17-19% of global electricity, creating over 2 million new jobs and reducing CO2 emissions by more than 3 billion tonnes per year. By 2050, wind power could provide 25-30% of global electricity supply.

World just signed the COP21 climate deal in Paris, that implies a steadily rising penalty on carbon emissions. During the recent climate conference in Paris, 70 countries highlighted wind as a major component for their emissions-reduction schemes. "By 2020, wind power could prevent more than 1 billion tonnes of carbon dioxide from being emitted each year by dirty energy – equivalent to the emissions of Germany and Italy combined," said Sven Teske, Greenpeace senior energy expert.

UK and China announce deal to work on the ‘next generation’ of renewable energy tech

U.K. and Chinese researchers will work together on five projects to develop the “next generation” of offshore renewable energy (ORE) technologies.

In an announcement on Thursday, the U.K.’s Natural Environment Research Council (NERC) said that the three-year projects would use environmental science, engineering and technology to tackle “key challenges affecting the development of ORE systems, such as offshore wind, wave and tide facilities.”

The projects – which have been funded as part of the Joint U.K.-China Offshore Renewable Energy program – would also look to maximise the environmental and socio-economic benefits of ORE systems.

In addition the NERC said that the projects would, among other things, demonstrate the potential of ORE technologies to provide island and coastal communities with a stable power supply.

The projects are supported with nearly £4 million ($5.26 million) in funding from the Engineering & Physical Sciences Research Council and the NERC. The National Natural Science Foundation of China (NSFC) is also providing support.

“The U.K. is a world leader in offshore wind, which helps us meet our climate commitments while we grow the economy and create jobs,” Richard Harrington, the U.K.’s minister for energy and industry, said in a statement.

“This £4 million investment will support collaborative research into the next generation of offshore technologies with one of our largest global trading partners, unlocking further opportunities for projects across the UK and the rest of the world,” Harrington added.

The NSFC’s president, Yang Wei, said that further advancing China’s renewable energy sector was a crucial part of its 13th five-year plan and would help to “drive future economic growth and advance the cause of low-carbon development.”

Wind Farm

A wind farm is a group of wind turbines in the same location used to produce electricity. A large wind farm may consist of several hundred individual wind turbines and cover an extended area of hundreds of square miles, but the land between the turbines may be used for agricultural or other purposes. A wind farm can also be located offshore.

The wind farm technology has also become very sophisticated and efficient, world’s biggest offshore wind farm is to be built 75 miles off the coast of Grimsby, at an estimated cost to energy bill-payers of at least £4.2 billion. The giant Hornsea Project One wind farm will consist of 174 turbines, each 623ft tall generating 1.2 gigawatt capable of powering one million homes.

Turbines have aerodynamic ‘smart’ blades made of carbon composite with wireless sensors, and can ‘pitch’ in and out of the wind in response to shifts in air flow. “There has been a huge leap forward in technology even over the last couple of years. They are pushing the boundaries of energy capture,” said Cian Cornroy from the offshore experts ORE Catapult in Glasgow. “They are using new metals in the generators that cut the need for servicing. There are cameras to relay digital data through cloud computing that can reset the turbines. You

have to be bullish," he said.

Study: Tech innovations could cut offshore wind energy costs by a third by 2030

The levelised cost of energy from offshore wind farms in Europe could be reduced by as much as a third by 2030 if a range of technological innovations such as larger turbines and more efficient rotors are deployed.That is the conclusion of a new report released last week by sustainable energy technology investor KIC InnoEnergy and technical consultancy BVG Associates. The study used KIC InnoEnergy's offshore wind cost model to analyse the extent to which 51 innovations could help cut the cost of wind energy through changes to design, hardware, software or processes.

The changes included the introduction of mass-produced support structures for use in deeper water with larger turbines, using bespoke vessels and equipment capable of operating in a wider range of conditions, and the use of more upfront investment in wind farm development to improve site investigations and engineering studies.

Two-thirds of the estimated cost savings were found to be achievable through just nine areas of innovation, such as improvements in blade aerodynamics and optimising the layout of arrays. The innovation with the largest potential impact on cost reduction was increasing turbine size from 4MW to 10MW, the analysis found, since using fewer turbines leads to significant savings in the cost of foundations, construction, and operations.

Challenge of turbulent Wind power on turbines design and employment, study finds

University of Delaware researchers report in a new study that offshore wind may be more powerful, yet more turbulent than expected in the North Eastern United States. The findings, published in a paper in the Journal of Geophysical Research: Atmospheres, could have important implications for the future development of offshore wind farms in the U.S., including the assessment of how much wind power can be produced, what type of turbines should be used, how many turbines should be installed and the spacing between each.

The paper's main finding is that atmospheric conditions around Cape Wind are predominantly turbulent, or unstable, which is in stark contrast to prevailing data from European offshore wind farms in the Baltic Sea and the North Sea. Explaining how wind can be stable, unstable or neutral is a tricky business, Archer says." When the atmosphere is stable, winds are smooth and consistent (think of when a pilot tells airline passengers to sit back and enjoy. When the atmosphere is unstable, it is similar to turbulence experienced by airline passengers during a flight—the wind is choppy and causes high winds from above and slow winds from below to crash into each other and mix together, causing a bumpy and unpredictable ride for the air current." Neutral conditions hover in the middle, with an average amount of turbulence and wind speed variation.

An expert in designing offshore wind farms, Archer says the findings may have implication on how future offshore wind farms in the region are designed. "The advantage of these turbulent conditions is that, at the level of the turbines, these bumps bring high wind down from the upper atmosphere where it is typically windier. This means extra wind power, but that extra power comes at a cost: the cost of more stress on the turbine's blades," explains Archer. "If you have

increased turbulence, you’re going to design a different farm, especially with regard to turbine selection and spacing. And guess what? Even the wind turbine manufacturing standards are based on the assumption of neutral stability,” Archer says.

Commercial tankers using sail power to navigate the seas could be the wave of the future.

Norsepower Oy Ltd, a Finnish engineering and technology company in partnership with Maersk Tankers, The Energy Technologies Institute and Shell Shipping & Maritime, announced in March the installation and testing of Flettner rotor sails onboard a Maersk Tankers vessel.

The project, which will be the first installation of wind-powered energy technology on a product tanker vessel, would provide insights into fuel savings and operational experience. The rotor sails will be fitted during the first half of 2018, before undergoing testing and data analysis at sea until the end of 2019.

Maersk Tankers will supply a 109,647 ton Long Range 2 product tanker, which will be retrofitted with two 98 feet tall by 16 feet in diameter Norsepower Rotor Sails. The design would look like narrow smoke stacks. Combined, these are expected to reduce average fuel consumption on typical global shipping routes by 7-10 percent.

The Norsepower Rotor Sail is a modernized version of the Flettner rotor – a spinning cylinder using the Magnus effect to harness wind power to propel a ship. Each Rotor Sail is made using the latest intelligent lightweight composite sandwich materials. When wind conditions are favorable, the main engines can be throttled back, providing a net fuel cost and emission savings, while not impacting scheduling.

Tuomas Riski, CEO of Norsepower, said in a release: “As an abundant and free renewable energy, wind power has a role to play in supporting the shipping industry to reduce its fuel consumption and meet impending carbon reduction targets.”

GE bringing industrial Internet to wind farms

General Electric Co. has announced a new wind farm technology that will improve output by 20 percent – providing the wind power industry with $50 billion in added revenue. “It’s a huge breakthrough for renewable energy and specifically wind power,” Bolze told the Times Union during a telephone interview. “The world wants more wind power. Same wind, 20 percent more electrical output. That’s huge.”

Steve Bolze, the CEO of GE Power & Water, said the new product – called the Digital Wind Farm – has been in development for the past 18 months and combines the company’s two-megawatt wind turbines with GE modeling software, sensors and the industrial Internet, which allows machines to exchange data, or “talk” to one another.

Integral to achieving all this has been the development of more precise, accurate, robust, and responsive wind energy forecasting algorithms, Grid-scale batteries built into the turbines and real-time wind turbine networking, and power management. Industrial internet communicates with grid operators, to predict wind availability and power needs, and helping to manage wind’s variability and provide smooth, predictable power.

GE’s next generation of wind turbines is a Game changer

The latest in GE’s line of wind turbines is introduction of 2.2-107 machine that has improved the capacity factor (a measure of energy efficiency) from 35% ten years ago to over 50% today. GE turbines are operating at close to 98% availability, at cost of five US cents per kWh comparable or less than the thermal coal power plants and natural gas combustion turbines.

Moreover, all that energy is produced without all the emissions, land and water contamination, with negligible environmental impact and footprint than associated with coal and natural gas production and power generation.

The Vortex Bladeless Micro Wind Turbine

The startup Vortex Bladeless is developing a micro wind turbine shaped like a pole-like structure without blades or other moving parts. Vortex Bladeless relies on an aerodynamic phenomenon called vorticity, in which wind flowing around a structure creates a pattern of small vortices or whirlwinds. When these mini-whirlwinds get large enough, they can cause a structure to oscillate, and turbine converts this mechanical energy into electricity.

However, the individual structure will only oscillate at particular frequencies. The Vortex have developed a “magnetic coupling system” that results in broadening the range of frequencies and allows maximization of generation of energy. The microturbine can automatically vary rigidity and “synchronize ” with the incoming wind speed, in order to stay in resonance without any mechanical or manual interference.

The plus side is turbine’s ultra-slim silhouette that could

enable it to fit into all sorts of tight spaces where larger turbines can’t, however the main point of contention is the cost effectiveness of micro wind turbines. The initial product line consists of two models, a 1-megawatt Gran and a 4-kilowatt Mini. France’s Eiffel Tower recently got a full on green makeover, including a pair of high visibility vertical micro wind turbines embedded in the tower itself.

Wind Lens

The Wind Lens is the brainstorm of researchers at Kyushu University that would generate more than traditional wind power using a unique design. The Wind Lens focuses airflow just like a lens focusing light.

The circle made up of the turbine blades has a ring that curves inward, and this directs the flow of air, and accelerates the speed. The team leader states that by using an inlet shroud, diffuser and brim in the inward ring, these cause the air to be drawn in more quickly. This means that it generates more power. The researchers have claimed that using this new wind turbine technology will allow turbines to triple their output, while even reducing the noise that the turbines cause.

Wind Lens holds great promise for Japan as a source of green renewable energy. Since Japan is an island, it will be able to make full use of offshore wind farms, since that is where researchers feel the new technology will perform the best. The Wind Lens can float on platforms shaped like hexagons, and at sea will not be subject to large waves or tsunamis, since these achieve their destructive power only upon nearing a shoreline.

Breakthrough Magnetic Alloy Could Lead To Cheaper Cars, Wind Turbines

Scientists have created a promising new magnetic material that could lead to cheaper cars and wind turbines. The new magnetic alloy is a viable alternative to expensive rare-earth permanent magnets, the U.S. Department of Energy and Ames Laboratory reported. The material could eliminate the need for one of the "scarcest and costliest" rare Earth elements, dysprosium, and replace it with abundant cerium.

The alloy is composed of neodymium, iron and boron "co-doped "with cerium and cobalt. Recent experiments demonstrated the cerium-containing alloy boasts intrinsic coercivity (the ability of magnetic material fight demagnetization) that is even greater than dysprosium's containing magnets of high temperatures. This material is also between 20 and 40 percent cheaper than magnets containing conventional dysprosium.

"This is quite exciting result; we found that this material works better than anything out there at temperatures above 150 [degrees Celsius]," said study leader Karl A. Gschneidner. "It's an important consideration for high-temperature applications." Past attempts to use cerium in rare-earth magnets were unsuccessful because the element reduces the Curie temperature (the temperature at which an alloy loses its magnetic properties). This new co-doping method coupled with cobalt allowed the scientists to substitute cerium for dysprosium without reducing the magnetic properties of the material.

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