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Breakthrough in Offshore Wind Efficiency: Greenspur Renewables Debuts “Permanent Magnet Generator”

New technology replaces costly, hard-to-source rare earth magnets with abundant ferrite materials — eliminating supply chain concerns and dramatically reducing costs

Greenspur Renewables Ltd recently unveiled its new low cost Permanent Magnet Generator (PMG) at the ECOWindS conference at OrbisEnergy in Lowestoft. The company’s direct drive generator is groundbreaking in that it completely eliminates the use of rare earth magnets, which its founders claim will facilitate significant cost reductions when scaled to multi-megawatt levels.

Greenspur’s founders have professional expertise in renewable energy and electromagnetic design and their vision is to deliver affordable clean energy to a global market. The company obtained grant funding from the SCORE project run by OrbisEnergy plus equity from private investors. This was used to run a proof of concept project, which culminated in the construction of the prototype demonstrated at the ECOWindS conference. According to Johnathan Reynolds, Head of Business Development at OrbisEnergy, “We have been extremely impressed with the speed of Greenspur’s progress. Within 9 months of their grant award they had completed fundamental research and built a working prototype. Their achievement is testament to setting very clear objectives at the outset alongside the experience and competence of their project team.”

The company’s PMG received widespread acclaim from the offshore wind professionals present at the recent ECOWinds conference. The event focused on the area of cost reduction, which remains a key challenge for the sector. The interest in the Greenspur PMG reflects the fact that many manufacturers, including Siemens, MHI Vestas and Alstom, are looking to upscale their wind turbines to secure reductions in the Levelised Cost of Energy (LCoE). Hugh-Peter Kelly, one of Greenspur’s founders explained, “We are aware that some market participants view the move to large direct-drive PMGs as a means of achieving cost reduction, but as yet I don’t think that any have seriously looked at eliminating rare earth magnets from their machines. The focus of our project was to model the use of cheaper ferrite magnets to see if we could design a direct-drive PMG from first principles that could compete with existing generators. We have identified a topology that can do so and which can be quickly scaled to multi-megawatt level.”

In addition to the cost advantages offered by a ferrite based direct-drive PMG design there will also be significant supply chain benefits. It is estimated that there are 800 billion tonnes of iron ore that could be used to manufacture ferrite magnets. This is enormous when compared directly to the total of all rare earth elements mined each year, estimated to be 190,000 tonnes for 2015.

At the moment all of the direct-drive PMGs used in the offshore sector use the rare earth magnet material Neodymium Iron Boron (NdFeB), which by weight can be 27 times more expensive than common ferrite magnets. It is estimated that approximately 700 kg of NdFeB is required for each megawatt of installed direct-drive PMG capacity. According to Dr Mike Lowden, a Metallurgist working through the UK's GROW:Offshore Wind Project, a move to direct-drive PMGs could result in downstream supply problems. He explained, "At the moment the offshore wind sector is just starting to adopt large scale direct-drive PMGs and Europe is leading the way. However, lots of high growth industries require these rare earth magnets. These include computing, mobile phones, electric vehicles, medical equipment, satellite and missile defence systems. Existing resources are already fully utilised and competition for new supply is intense. If the global offshore wind market takes off in a big way, securing rare earth supplies could become a major problem. A move to a ferrite based PMG would not only reduce cost, but would eliminate rare earth supply concerns and potentially open up the market to wider exploitation."

Greenspur has filed extensive patents with regard to its PMG and has outlined a development roadmap to move to multi-megawatt designs. It is now looking to find an industry partner to work with to bring its technology to market.

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