Cheap and green -- new Nottingham spin-out to revolutionize sustainable energy

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Zero-carbon, renewable energy which is cost-competitive with fossil fuel generated sources is surely the Holy Grail of the engineering world.

Now, a new spin-out company from The University of Nottingham is aiming to prove that far from being just a pipe dream, one new form of green energy could be in widespread use within 15 years and at a fraction of the cost of its nearest competitor.

NIMROD Energy Ltd is being launched this week by Professor Seamus Garvey, based on the Integrated Compressed Air Renewable Energy Systems (ICARES) research which he has been developing since early in 2006.

The technology is centred on a simple premise — using giant wind turbines to compress and pump air into huge undersea Energy Bags™ anchored to the seabed — or geological formations where deep water is not available. The high pressure air would be expanded in special turbo-generator sets to provide electricity as required — not just when the wind is blowing. It would see vast floating offshore 'energy farms' created off the coastline around the UK.

Professor Garvey said: "The UK has abundant offshore renewable energy resource — enough to supply all of our energy several times over. We also have a strong internal energy market — worth well over £60 billion per year. We have an economy desperately in need of rebooting its manufacturing base and an engineering capability which is the finest

in the world.

"Without an initiative like this, the UK will send vast amounts of money (several times £10 billion) abroad even before 2020 to buy offshore wind turbines and much manufacturing activity will go abroad with that. Worst of all, we will pay substantially higher prices for that equipment than we really need to and the UK energy consumer is going to feel that with sharp rises in unit energy costs over the next 10 years."

Over the past year, Professor Garvey's research has proven that by taking offshore wind turbines to a scale never before imagined — 230m diameter is the baby of the family — and considering some radical redesigns, the total amount of structural material per kW of rated power can be slashed, effectively cutting costs by a factor of four or more. He believes it is possible to store energy at costs well below £10,000/MWh — less than 20 per cent of pumped hydro energy, the cheapest competing technology.

Testing of scale-model prototype Energy Bags has already commenced. A research project funded with €310,000 from the EON International Research Initiative has already funded the development of analysis and design tools for the energy bags and will provide further prototype testing in seawater leading to an energy storage product that will be ready for use in energy systems by May 2011.

Professor Garvey added: "This is a classic case of a little foresight leading to technology becoming available exactly when the demand appears. The signals have been out there for years that offshore wind turbines need to grow much larger and that energy storage is going to become the key to integrating large amounts of renewable energy into the UK and world electrical power systems. Moreover, the fact that wind turbine diameters were growing exponentially up to 2005 and then stopped fairly abruptly is a strong indication that conventional designs

have come to the natural limit of size and that a major rethink is needed. While wind power contributes only a few per cent of total UK electricity, we don't really need to be able to store energy coming from the wind. By 2020, that will have changed profoundly for the UK — so much so that if we do not implement such storage in large measure, we will have to stop putting up wind turbines."

The University of Nottingham has previously invested in the technology and patents to protect it and further commercialisation will now be taken forward by the development of the new spin-out venture. The company has ambitious visions for the future and is predicting rapid growth.

"I believe that the ethical/green investment market is effectively waiting for precisely this company to appear. We have already demonstrated that the energy storage system can work. We have not yet built a 230m diameter turbine, but we know what it looks like. A neat mechanical engineering concept called 'structural capacity' shows directly and quantitatively why these new machines will be far more cost effective," added Professor Garvey.

"I foresee that at least 25 per cent of offshore wind power in the UK will use this integrated compressed air approach by 2025. Although I expect that the direct-generating wind turbines will catch up with us on cost per unit power output, the role for systems which put energy directly into store is clear. If you have 1MW of integrated compressed air system (including large energy stores) for every 3MW of conventional generation, then the whole set of offshore wind equipment starts to look like a very versatile power generating system which can adjust its output to match demand — notwithstanding what the wind is doing."

NIMROD Energy Ltd's close relationship with The University of Nottingham will give it access to patents relating to floating supports for offshore turbines, special main bearings for ultra-large offshore

machines and cable-braced rotor designs — all essential elements of the 230m+ direct compression wind turbines but also important cost-reducers for the existing direct-generating designs. The energy storage system is also compatible with conventional schemes for CAES (compressed air energy storage) where power flows in both directions between the energy store and the grid and so the technology can be exploited directly in addition to the important role it plays in the development of the integrated offshore energy systems.

Provided by University of Nottingham