



Project update

Seabed air bags deliver energy for power plants

Project details		Key aims
Project title	Harvesting and Storing Energy Offshore in the Form of Compressed Air	
Participant	University of Nottingham, United Kingdom	
Start date	2007	<ul style="list-style-type: none"> • Development of inflatable underwater containers to store offshore wind energy as compressed air • Provide a cost-effective energy storage technology which is hidden and unheard on the seabed • Facilitate the wider harvesting of renewable resources, such as tidal and wave power, as compressed air.
Project summary		
<p>Huge underwater bags filled with compressed air are seen as potential storage facilities for offshore wind energy in a project supported by E.ON's International Research Initiative.</p> <p>The bags, attached to the seabed, would inflate and shrink as flexible containers that can power turbines to generate electricity.</p> <p>These so-called energy bags could help overcome the intermittency of renewables power. They would also be well matched to a possible change in renewables technologies</p>	<p>if energy is 'harvested' – collected – as compressed air instead of electricity. Storing energy in this way is also seen as an option for tidal and wave power schemes. This project comes from Professor Seamus Garvey, Professor of Dynamics in the Department of Mechanical, Materials and Manufacturing Engineering, the University of Nottingham.</p> <p>The main part of the project is to design, develop and test energy bags, including a small experimental offshore device.</p>	<p>The proposal sets down three benchmarks for the ideal system:</p> <ul style="list-style-type: none"> • The ability to retain several GWh of energy in storage facilities with a 25-year life • An effective turnaround efficiency of better than 90 percent • The ability to achieve repeated minimum to maximum load changes in about 20 seconds.

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Design, development and prototype manufacturing activities for energy bags all began in the initial stage of this project.

Work to identify specifications for the energy bags was carried out by developing four models for simulating fabric structures on the seabed.

These are enabling the project team to:

- Simulate the performance under load of the energy bags' doubly-curved surfaces
- Set parameters for the energy bags' design
- Create visuals of the inflated structures
- Prepare for the initial design, analysis and optimization of a 0.2GWh energy bag.

One challenge tackled in this area was to use the symmetries in the shape of the energy bags to scale down the size of the modeling requirements. This will allow the inflated –'deformed' – shape of the energy bags to be found more efficiently.

Another important step was work to determine the optimum shape for an energy bag, which was done by calculating the maximum ratio of stored energy to cost.

Three prototype energy bags were designed by the team and made by a Canadian company which builds fabric-based structures for the space exploration industry.

The completed bags will first be assessed in a tank being assembled in

the UK to allow repeated cycles of inflation and release of compressed air. Testing in a real-life marine environment will take place later.

Substantial progress has also been made in economic simulations of how the energy bags would perform, using a range of capacities for energy storage and power generation.

These activities include the development of 'control laws' which give general guidance on when production from offshore wind farms should be stored in the energy bags or exported directly to the power network. The laws are being applied in a simulation over a one-year period to find the approximate value which is added to stored energy.

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