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HORIZON SCANNING SR017

HSE HORIZON SCANNING SHORT REPORT

COMPRESSED AIR ENERGY STORAGE

1. Issue

The use of compressed air as a means of storing energy generated by wind, wave or solar sources.

Status: Review in 2010

2. Background

A common criticism of renewable energy sources such as wind, wave and solar power is that they are at the mercy of the weather and cannot cope with peaks and troughs in demand. Thus they cannot provide a 'baseload' capability or peak shaving in electricity supply. A solution to this is to store the energy generated when demand is low and then release it when demand is high. There are several ways of doing this,¹ including generating hydrogen [link], but another means that has not yet been widely used is starting to attract more interest.

In compressed air energy storage, energy produced from various sources is used to compress air, which is stored under pressure in vast underground caverns. The energy stored in this way can be released when required by using the compressed air to improve the efficiency of gas-powered generators or to drive electricity generators

So far only two commercial plants are operating in the world - one in Germany, which opened in 1978 and one in Alabama, which opened in 1991.¹ Neither of these was built to store energy from renewable sources, but to store off-peak electricity.²

Now two plants are under development in the United States, which will store energy generated by wind. In Des Moines, Iowa a 100 MW wind farm combined with a 200MW CAES facility is planned to be in operation by 2010. In Attelboro, Massachusetts development is under way of a wind farm that will compress air direct, cutting out the need to convert wind energy into electricity to drive a compressor.³ Other potential sites are being investigated.

No compressed air energy storage facilities are planned in the UK at present, but work is under way at Nottingham University into the feasibility of storing compressed air in huge bags under the sea.⁴

¹ Case studies: Energy Storage Technologies, US Department of Energy, http://www.eere.energy.gov/de/cs_energy_storage.html, 2006.

² Squeeze the breeze, Daniel Pendick, New Scientist Vol 195, No 2623, 29 September 2007, pp44-47.

³ Trapped wind, The Economist, 26 July 2007, http://www.economist.co/science/displaystory.cfm?story_id=9539806

⁴ The man making 'wind bags', Brady Haran, BBC News, 26 March 2008, <http://news.bbc.co.uk/g0/pr/fr/-/1/hi/england/nottinghamshire/7315059.stm>

3. Relevance to occupational safety and health

The health and safety hazards associated with compression of air on this scale will be similar to those associated with carbon capture and storage, i.e. related to the integrity of pipelines and storage structures, and to the associated electrical and mechanical equipment. However stored compressed air does not have any hazardous toxic or asphyxiant properties, which is a significant advantage over some other stored energy concepts.

4. Recommendations

There are no signs that introduction of this technology is imminent in the UK, but there is clearly the potential that it could be. Potential sites exist in the UK – a recent HSE Research Report, which considered the storage of natural gas, identified a range of sites for underground gas storage.⁵ HSE needs to be aware of this possibility and to take it into account in longer-term planning.

Peter Ellwood, Futures Team, HSL

⁵ An appraisal of underground gas storage technologies and incidents for the development of risk assessment methodology, HSE Research Report 605, <http://www.hse.gov.uk/research/rrhtm/rr605.htm>