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**NEW REPORT HIGHLIGHTING LIQUID AIR'S "HUGE POTENTIAL" LAUNCHED AT
"BIRMINGHAM IN PARLIAMENT" DAY**

Liquid air technologies could help Britain tackle some of its toughest energy challenges, says a new report launched at Parliament today (22nd October). The report, "*Liquid Air Technologies – a guide to the potential*", shows how liquid air could help balance an electricity grid increasingly dominated by intermittent renewables; provide strategic energy storage to keep the lights on; sharply reduce CO₂ and tail-pipe emissions from vehicles; and convert low grade waste heat into usable energy throughout the economy.

Published by the Centre for Low Carbon Futures, Liquid Air Energy Network and University of Birmingham, the report explains how 'wrong time' renewable energy could be used to liquefy air as a means of storing energy, which could then be used to generate electricity when needed, and provide a convenient and low cost fuel for vehicles including buses and lorries. The range of potential applications is so wide that it could even be described as a 'liquid air economy'.

"While the idea of a 'liquid air economy' is no silver bullet," says Professor Richard, Pro-Vice Chancellor, University of Birmingham, "it does offer a unique combination of energy, environmental and economic benefits. What's more, since liquid air is based on existing components and supply chains, a liquid air economy could develop far sooner than some other approaches."

A number of UK technologies are in development and demonstration with significant Government support, including transport applications starting field trials next year. University of Birmingham earlier this year won a £6M grant from the Engineering and Physical Sciences Research Council (EPSRC) to open a dedicated research facility, the Centre for Cryogenic Energy Storage (BCCES) – a world-leading centre for research into the liquid air economy and technologies.

Gisela Stuart, MP for Birmingham Edgbaston, welcomed the report at today's Birmingham in Parliament day. She said "I am very excited to have the Birmingham Centre for Cryogenic Energy Storage exhibiting today in Parliament; this first of its kind centre is another example of Birmingham leading the way in innovation. The centre will be a hotbed of new ideas, including liquid air technology. This new report highlights liquid air's huge potential, not just for Birmingham, but the whole economy."

Transport applications could be first to market where a consortium of the MIRA, Air Products, Loughborough University and the Dearman Engine Company has secured a grant from the Technology Strategy Board, the UK's innovation agency, to build and test a liquid air engine fitted in a commercial vehicle.

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The project will see the Dearman engine - an innovative heat engine that uses liquid nitrogen as a “fuel” – in field trials next summer on a refrigerated truck, where it will provide zero-emission cooling and power. Cooling currently accounts for up to 20% of a refrigerated vehicle’s diesel consumption. Alongside replacing this with a zero tailpipe emission alternative, independent industry research shows that the technology has the potential of a payback in less than 12 months of operation through fuel savings.

Developed by the archetypal British inventor, Peter Dearman - and the man behind the Dearman engine - the concept of ‘liquid air’ sprang to prominence in May 2013 with a ground-breaking report from the Centre for Low Carbon Futures, *Liquid air in the energy and transport systems: Opportunities for industry and innovation in the UK*, launched at the Royal Academy of Engineering. The report, based on contributions from a broad group of industrial and academic experts, found liquid air could for example

- reduce diesel consumption and carbon emissions in buses and freight vehicles by 25% using liquid air / diesel hybrid engines;
- cut carbon emissions from refrigeration on food lorries by more than 90%, and eliminate local air pollution from this source; *and also*
- provide a cost-effective means of storing grid electricity in bulk to help balance intermittent renewable generation, strengthen energy security and reduce grid emissions. A single gasometer-style tank of liquid air could make good the loss of 5GW of wind power for three hours - equivalent to almost 10% of the UK’s peak electricity needs.

The Centre for Low Carbon Futures is supporting the development of energy storage across its network of Universities of Birmingham, Hull, Leeds, Sheffield and York. Director, Jon Price, said “This latest report shows how liquid air technologies can help reduce the costs of the energy system as we move to a low-carbon society, and provide the UK with a lead in a field which will be important globally. To make it a reality will need further innovation in the technology and how it can be integrated in future systems.”

This new report summarises the environmental and economic potential of each of the various liquid air technologies currently available or being developed, and then explores how these could integrate into the wider energy system to form a ‘liquid air economy’. It also presents an indicative timeline showing the progress of liquid air against policy targets, and reaches some broad conclusions about how to maximise the chances that liquid air delivers its potential.

The report also announces the creation of the Liquid Air Transport Technology Group – with members drawn from industry, universities, technology developers and expert consultancies – to identify the market opportunity and future research needs of liquid air transport applications including passenger, commercial and off-road vehicles. The first findings will be published early in 2014 as part of a sector specific report, *Liquid Air on the Highway*, jointly funded by the TSB.

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NOTES FOR THE EDITORS

About Liquid Air

Liquid air is an exciting new energy storage technology that many experts believe could help meet some of our toughest energy challenges, including energy security and zero-emission transport. The liquid air economy is being made possible by the work of UK entrepreneurs, engineers and academics, and plays to British strengths in cryogenic and mechanical engineering. Exploiting liquid air as a mainstream energy vector for use on the grid or in a vehicle presents major opportunities in terms of skills development, manufacturing and jobs, and represents a potentially major economic opportunity for Britain.

Liquid air has two important industrial advantages. First, technologies, including the Dearman engine, can be produced largely from existing components and supply chains, meaning they can be quicker to market than other novel technologies. Second, there already exists a “fuel” production and distribution network throughout the developed world to support first field trials and early commercial deployment. Re-fuelling infrastructure therefore poses no ‘chicken and egg’ dilemma for liquid air - a major advantage over other energy vectors.

University of Birmingham Centre for Cryogenic Energy Storage

The University of Birmingham Centre for Cryogenic Energy Storage (BCCES) is a first-of-its-kind institution with state-of-the-art facilities to pursue innovation in Liquid Air Energy Storage, develop new materials and improve thermodynamic processes. It will also develop economic and policy analysis to understand market opportunities and the policy environment required for successful deployment.

The new centre, jointly funded by EPSRC, is established at the University of Birmingham, a member of the Russell Group of research-intensive British universities. Pro-Vice Chancellor Professor Richard Williams OBE is a leading proponent of energy storage and liquid air. Birmingham is the Times and Sunday Times University of the Year 2014

Centre for Low Carbon Futures

The Centre for Low Carbon Futures is a collaborative membership organisation that focuses on sustainability for competitive advantage. Formed by the University of Birmingham, University of Hull, University of Leeds, University of Sheffield and University of York, we work across the EU, Asia and Latin America. The Centre brings together engineers, natural scientists and social scientists to deliver high-impact research on our 2013/14 themes of Energy Systems, Green Growth and Smart Infrastructure. We provide evidence to inform policy formation, encourage technological innovation and build capacity to improve resource efficiency and promote sustainable leadership in the food-energy-water nexus.

The Centre for Low Carbon Futures will be producing a series of insight reports on ‘Game Changing Technologies’, sponsored by and in conjunction with industry. These insights aim to reduce some of the uncertainties surrounding the vast array of technology options, and compliment the evidence based research reports produced by CLCF, by providing a more practical guide to the potential uses of emerging technologies

Liquid Air Energy Network

Working with the Birmingham Centre for Cryogenic Energy Storage (BCCES) and the Centre for Low Carbon Futures (CLCF), the Liquid Air Energy Network (LAEN) was founded to explore the potential of liquid air as an energy vector, and to ensure Britain maintains its lead in this promising new technology and secures the full energy, environmental and economic benefits. Its research is conducted in collaboration with technology developers, industry, universities and partner organisations. This is the first report in a series of policy and technology guides. For more information please visit www.liquidair.org.uk

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