THE ENERGY INDUSTRY TIMES

June 2013 • Volume 6 • No 4 • Published monthly • ISSN 1757-7365 www.teitimes.com

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Policy indecision threatens EU climate ambitions

Oettinger: Europe could lose many valuable jobs

The Eurozone economic crisis is pushing the need to tackle climate change down the political agenda. At the same time, indecision on post-2020 targets is hampering investment and threatening security of supply. **Junior Isles**

The European Union, which has been leading global efforts to cut carbon dioxide emissions, is becoming increasingly indecisive on energy policy in the face difficult economic conditions.

At last month's EU Summit to discuss energy and tax evasion issues, there seemed to be a shift in energy policy as the EU said it would prioritise the supply of energy at affordable prices over reducing greenhouse gas emissions.

The EU's energy commissioner Günther Oettinger admitted that energy had been made deliberately more expensive in the past. "For one thing, to solve our budgetary problems. And secondly for energy efficiency: one is more frugal with expensive things," he said.

However, high energy costs are becoming an increasing problem for Europe's poor, and also drive European industry elsewhere. Oettinger said gas and electricity are significantly cheaper in the US and that competitive disadvantage should not be simply tolerated, or else Europe would de-industrialise and lose many valuable jobs.

A draft conclusion of the EU leaders' meeting obtained by *Kyodo News* said: "Against the backdrop of high pressure on Europe's competitiveness and increasing energy demand from major economies, the EU's energy policy must ensure the uninterrupted supply of households and companies at affordable and competitive prices."

The draft said investments in new and intelligent energy infrastructure are "vital for jobs and growth and will help enhance competitiveness." The EC calls for "a predictable climate and energy framework post-2020," according to the paper.

The EU remains committed to emissions reduction targets under the 1997 Kyoto Protocol, under which it pledged to cut greenhouse gas emissions by 20 per cent below 1990 levels by 2020. However, it has been slow to set targets further into the future.

Commenting on the region's post-2020 goals, one EU official said: "The European Commission is already in 'do nothing' mode on climate change, and it will obviously put off a decision on ambitious targets."

Market observers have also warned that Europe needs a less fragmented energy policy, particularly in terms of

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Signs of optimism at Bonn climate talks

There were no major breakthroughs at the latest round of climate talks in Bonn, Germany, but there were renewed signs of optimism.

Instead of arguing over the agenda, negotiators got down to work, discussing ways to ramp up countries' emissions reduction commitments now and move toward a 2015 international climate action agreement.

One key issue discussed was 'Spectrum of Commitments'. The idea put forward by the US is that every country should determine its own national "contribution" to curbing global climate change and present it to the international community. A "spectrum" of various commitments would thus emerge, which could be included in some sort of formal agreement.

The idea opened up a much needed conversation about the concept itself and how it would work in practice. One key question that still remains is how to ensure that nationally offered commitments add up to a level of action that keeps global average temperature increase below 2°C.

One important piece of news from the week-long talks was that officials broadly agreed that any new Treaty agreed in 2015 would have to be significantly more flexible than the Kyoto Protocol.

There is a consensus building that the new treaty will incorporate ambitious emissions targets and climate action plans. However, it will also feature mechanisms that allow for these targets and strategies to be made more ambitious as the science demands, or as new emission reduction technologies emerge.

Such flexibility would significantly increase the likelihood of a deal being reached in 2015.

Bonn also saw the launch of a new prototype registry, managed by the UNFCCC, which will provide a central database for recording all the "Nationally Appropriate Mitigation Actions" taken by governments. The database is intended to make it easier for countries to track each others' progress towards cutting emissions and share policy best practices.

The latest round of international climate negotiations resumed as new data showed that atmospheric carbon dioxide hit record levels.

Speaking at the opening of the talks Christiana Figueres, the head of the UN's climate change secretariat, warned diplomats they "must do more and do it faster".

She warned governments had already used a third of the time between the 2011 Durban commitment to finalise a new international treaty and the 2015 deadline for agreeing that treaty.

Talks in Bonn lay the groundwork for this year's UN Climate Summit in Warsaw and more importantly the Paris Summit in 2015 where governments are committed to signing up to a new international climate treaty.

THE ENERGY INDUSTRY TIMES is published by Man in Black Media • www.mibmedia.com • Editor-in-Chief: Junior Isles • For all enquiries email: enquiries@teitimes.com

The answer is in the air

Highview's 300 kW pilot plant in Slough, UK

Liquid air technology has the potential to provide utility scale energy storage and efficiently turn waste heat into power. **Junior Isles** looks at this technology, which could have a tremendous impact on the energy sector.

Balancing supply and demand in grids that are having to accommodate an increasing amount of intermittent renewable generation, such as wind and solar, is one of the major technical challenges facing today's power sector.

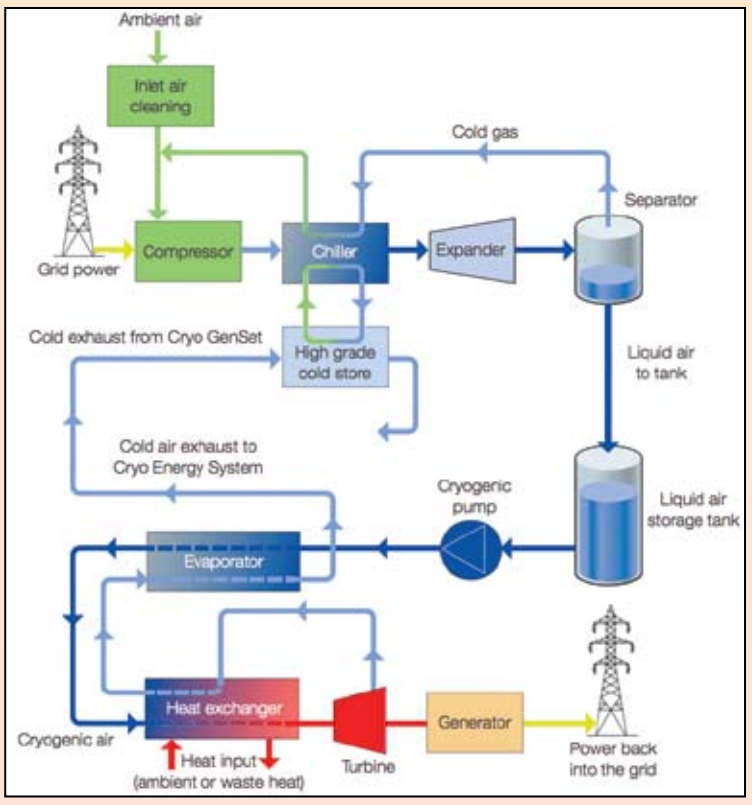
In Spain, for example, between November and February wind farms produced more electricity than any other power source for the first time ever. Although the increasing amount of wind on the grid is good news for decarbonisation efforts, such high wind penetration presents two main challenges: how to generate sufficient electricity when wind output is low or zero; and how to absorb excess generation when wind output is high and demand is low.

While using gas turbine or reciprocating engine-based peaking plants can tackle the first problem, the second requires a new approach. The use of liquid air as an 'energy vector' has the potential to address both issues.

The term energy vector is used to describe the method of transporting energy from one location to another and from one point in time to another. Hydrogen and the 'hydrogen economy', for example, has been a much talked about energy vector. However, its use faces a number of technical and economic challenges that look unlikely to be solved any time soon.

Fairly recent technology breakthroughs make liquid air seem a more viable energy vector, one that can be deployed in the near to mid-term.

As a UK innovation, development of the technology is being supported by the Centre for Low Carbon Futures (CLCF) within the scope of its programme on energy storage.



The cryoenergy system can use waste cold at the front-end of the process when liquefying the air and waste heat at the back-end of the process

A recent report published by the CLFC entitled 'Liquid Air in the energy and transport systems' provides details of the technology and the opportunities for industry and innovation in the UK.

Although there have been numerous attempts over the last century to exploit liquid air, a significant breakthrough came in 2001, when the British inventor Peter Dearman developed and patented the Dearman Engine.

The key to Dearman's breakthrough was the realisation that liquid air could be vaporised inside an engine cylinder using heat supplied by a thermal fluid mixture such as water and glycol, eliminating the need for the bulky and inefficient external heat exchangers of traditional cryogenic engines.

It was not until 2006, however, that the possibilities for Dearman's technology in the power sector began to take shape when UK-based Highview Power Storage began to develop the Dearman Engine technology. Working with the University of Leeds, Highview developed a series of efficiency enhancements to the liquid air cycle by integrating the production and expansion processes to make use of waste heat and cold, so making the concept of a grid scale energy storage system economically viable.

With a working pilot operating successfully in Slough, Highview is now proposing two demonstration projects that will use the technology for power generation in a commercial setting.

The first would see Highview working with National Grid and UK-engineering company Costain to build the UK's first grid scale liquid air energy storage plant at National Grid's Grain Liquefied Natural Gas (LNG) import terminal on the Isle of Grain in Kent.

For the second project Viridor, one of the UK's leading recycling and waste management companies, would host a 'cryogenset' alongside a landfill-gas power generation plant in Canterbury.

Both projects have been proposed under an energy storage demonstration competition being run by the Department of Energy and Climate and Change (DECC). The two projects are already on a shortlist of projects that will receive some funding from DECC to allow detailed design work to be completed. Full funding – which would cover 100 per cent of the winning project(s) cost – is expected to be awarded towards the end of this month (June).

Commenting on the National Grid project, Gareth Brett, CEO, Highview says there are two main reasons why their technology fits well with National Grid's Grain facility.

"An advantage of our system is that we can use waste thermal streams at either end of the process – we can use waste cold at the front end of the process when we are liquefying the air and we can use waste heat at the back-end of the process when we are boiling the liquid air, ready for expansion in the turbine. At Grain, we have access to heat and cold. When the LNG is being evaporated from less than -160°C back to ambient temperature, there's a lot of excess waste cold that we can use in a liquid air refrigeration process. This reduces the amount of power we need to refrigerate the air in the first place, which enhances the overall efficiency of the system," he said.

Brett: the system provides pumped storage hydro capability where the demand is

Grain also has a large electrical demand that fluctuates. "National Grid cannot wait until the price of electricity is low to unload tankers as they come in. By having [electricity] storage on site we can manipulate their overall electricity demand curve to help save them money in operating the terminal," added Brett.

Highview will install three main components at Grain: a liquefier, which predominantly comprises compressors and heat exchangers; large tanks to store the liquid air; and to get the energy back, heat exchangers to evaporate the liquid air and a power turbine that expands the gaseous compressed air to drive a generator.

The turbine is not the traditional industrial or aeroderivative gas turbine that is commonly used in the power industry. It is a process gas expander-type turbine, with no combustor or compressor. These simple machines, which run on gases at ambient temperature, are widely used in the chemical process industry for capturing energy from compressed gas streams.

At an estimated installed cost of around £3000/kW, the energy storage system would have a power output of around 5-6 MW depending on the final choice of power turbine. Highview says this should give it around five hours of operation (about 25-30 MWh) from 300 t of liquid air, making it the largest demonstration of new energy storage technology in the UK.

After considering parasitic loads, Highview expects the system will have an overall electrical efficiency of 50-60 per cent. Fixed operating costs are expected to be "similar to the cost of having an open cycle gas turbine on standby, ready to run". According to Brett, this is in the region of "the low teens per kilowatt/year". He added: "That's the fixed opex but the main opex will be the cost of electricity needed to charge the system up."

A big plus for the technology is its scalability. According to Brett, it is "totally capable" of being scaled up. "The supply chain as it stands today could deliver a 100 MW, 1000 MWh system without any problem," he said.

Brett added: "One of the huge advantages of this system is that it gets you pumped hydro capability 30 miles from London. One of the big drivers is that it can be located where the demand is, rather than where the geography tells you to put it."

Highview also hopes to demonstrate the system's pure power generation capabilities through the project for Viridor. This installation would use waste heat from an existing reciprocating engine that runs on landfill gas to boost the generating capacity of the site from 7 MWe to 12 MWe.

Unlike Grain, this installation will not have the liquefier onsite; Highview will supply tanks of liquid nitrogen, instead of liquefying air. The tanks will be filled with liquid nitrogen delivered by tanker from a big industrial gas company. Highview will also install a 5 MW (approx.) process gas expander power turbine for utilising heat from the landfill gas engine exhaust.

If this and the Grain energy storage project are successful in the DECC competition, Highview will order the long lead-time components, such as the power turbine and expects the projects to be completed in early 2015.

Although the increasing need to manage renewables integration into the grid will drive the technology, the right regulatory framework has to be put in place if storage technologies are to be rolled out quickly in the UK and in countries like Germany where the need is more pressing.

During the conference launching the CLCF report Tim Evison, Senior Vice President of German industrial company Messer Group GmbH, said: "The [German] market does not provide adequate commercial rates for storage services and so there needs to be some support. There is considerable interest in supporting the development of energy storage and this technology is an interesting alternative to pumped hydro and compressed air energy storage."