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ADELE to store electricity efficiently, safely and in large quantities

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Test station for the research of thermal energy storage

RWE, General Electric (GE), Züblin, and DLR agree on Cooperation in the Development of Compressed Air Energy Storage

Storing electricity efficiently, safely and in large quantities – this is certainly one of the key challenges of future power supply. RWE, General Electric (GE), Züblin, and the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) are rising to this challenge by realising their ADELE project. On 19 January 2010, the project members signed the corresponding development cooperation agreement in Berlin, Germany.

Based on the ADELE concept (adiabatic compressed air energy storage for electricity supply), air will be compressed during periods when electricity supply exceeds the demand; the resulting heat will be buffered in a thermal energy storage, and air will be pressed into underground caverns. When electricity demand increases later on, this compressed air can then be used to generate power in a turbine by simultaneously recovering the heat.

"The massive and deliberate expansion of wind power requires smart solutions to ensure a non-stop continuous electricity supply. By means of the ADELE project, we take the lead to rapidly develop an efficient storage option", said Dr Jürgen Großmann, Chief Executive Officer of RWE AG. A well-balanced

energy mix where all energy sources contribute their unique strengths will be a guarantor - also in the future - of environmentally friendly, safe and efficient electricity supply. In this context, innovations such as ADELE will help to optimize the coexistence and smooth interaction of the individual energy sources.

By means of a feasibility study, the project partners laid the foundations for this development programme that starts now. The aim is to install an initial demonstration plant, which will start operations in 2013; it will have a storage capacity of one billion watt-hours (GWh) and generate electrical power of up to 200 megawatt. This way ADELE will be able to provide backup capacity within a very short time and replace forty state-of-the-art wind turbines for a period of five hours. The German Federal Ministry of Economics is willing to offer state funding, which underlines the special importance of this project. Altogether, the project members will contribute an amount of EUR 10 million.



Research of high-temperature thermal energy storage

"We will support this project through innovative compressors and air turbines. This equipment ensures that compressed air energy storage power stations are extremely reliable and can be operated with outstanding performance. Last but not least, the leading edge technology of these key components is the result of our continuous investments in research and development activities both at our technology locations in Germany and worldwide. In this connection, our European research center based in Garching nearby Munich holds a key position", stated Georg Knoth, GE's CEO and Regional Executive for the German-speaking region.

During the compression process, the temperature of the air will play a decisive role since it rises to more than 600 °C - thus making high demands on the compressor technology. To ensure that the resulting heat will not be lost, it will be extracted from the compressed air, before the air is stored, and absorbed by thermal energy storage. As soon as power is to be generated and before the air is able to drive a turbine, the cold, compressed air must be heated again by the thermal energy storage. This adiabatic approach, whereby the heat of the compressed air is not lost but remains in the process and can be used for power generation, differs from existing compressed-air reservoirs primarily by its significantly higher levels of efficiency. Furthermore, the compressed air will no longer be heated by means of natural gas - thus avoiding CO₂ emissions.

To implement this project, not only advanced turbo machines but also an innovative high-temperature thermal energy storage concept was required. The realization of this key component is supported by Züblin as well as by DLR. "The development of a powerful heat accumulator featuring a very high internal pressure and an operating temperature of more than 600 °C confronts us with completely new challenges with respect to the design of the pressure chamber and the development of suitable storage materials. Such a task can only be solved by a breakthrough innovation because the thermal energy storage will be subject to stresses resulting from the cyclic temperature and pressure loads, which are much higher than usual", explained Jörn Beckmann, Chief Executive Officer of Züblin. Prof. Dr Johann-Dietrich Wörner, Chairman of the Board of DLR, added: "Within the framework of the ADELE project, we

will develop solutions for the conception, design, layout, and dimensioning of storage equipment and high-temperature insulation, which are core components and of key importance for the performance and cost efficiency of the overall structure."

Suitable locations for compressed-air storage power plants are, in particular, regions with adequate geological salt structures, which can then be used to build underground caverns for the absorption of large quantities of compressed air. In addition, such salt structures should be close to wind turbines. Concerning the selection of the location, Erdgasspeicher Kalle GmbH, a subsidiary of the RWE group, will contribute its knowhow for the planning, installation, and operation of underground storage facilities.

General press release of RWE, General Electric, Züblin and DLR

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