Power to Gas: Storing the Wind and Sun in Natural Gas

KIT Coordinates HELMETH EU Project in the Amount of EUR 3.8 Million for More Efficient Methane Gas Production from Regenerative Power by Thermal Interlinkage of Chemical Processes

Electricity based on the sun and wind is an important part of the energy mix in Germany. However, there frequently is a big gap between the supply of and demand for weather-dependent power. An option to store this electricity is to use it for the production of chemical energy carriers. Still, the power-to-gas process is far from being economically efficient at the moment. The HELMETH EU project coordinated by the KIT is now aimed at demonstrating that efficiencies of more than 85 percent can be achieved by better using the synergies of existing process steps.

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“Storage capacities of the natural gas network correspond to the power produced from the wind and sun over several months,” explains Dimosthenis Trimis, KIT, coordinator of the HELMETH EU project. “What we need are the technologies to change among energy carriers, if necessary.” Research into the connection of the power grid with the natural gas network is conducted under the heading of Power to Gas (PtG). PtG might be one element of a transformed energy system in Germany.

Within the framework of HELMETH, a two-stage process is developed further. During electrolysis, power is first used to decompose water into oxygen and hydrogen. Then, hydrogen reacts with carbon dioxide or carbon monoxide to methane, the main constituent of natural gas. Methane can be used seamlessly in the existing natural gas infrastructure facilities. Injection of hydrogen would possibly require an increased adaptation expenditure for transportation and application, as the energy density and chemical properties differ considerably.

“Electrolysis and methanation are often analyzed and optimized separately,” Trimis says. However, use of the process heat produced by methanation has a big potential for use in electrolysis, for instance. In particular high-temperature electrolysis at about 800°C is associated with thermodynamic advantages that cause the efficiency to further increase. Under HELMETH, it is planned to build a demonstration plant for the production of methane from renewable energy sources with an efficiency of about 85 percent. In parallel, economic efficiency

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and the climate balance of the new technology will be studied. “Such high process efficiencies would mean a decisive step for the PtG technology towards economic efficiency,” Trimis is certain.

The HELMETH project will start with a kickoff meeting of the project partners at the KIT this week. It has a duration of three years, the budget totals EUR 3.8 million. EUR 2.5 million come from the European Union’s Seventh Framework Programme (FP7/2007-2013) for the Fuel Cells and Hydrogen Joint Technology Initiative. HELMETH is the acronym of “Integrated High-temperature ELectrolysis and METHanation for Effective Power to Gas Conversion.” KIT’s project partners are the University of Turin, the Technical University of Athens, the companies of Sunfire GmbH and Turbo Service Torino S.P.A, the European Research Institute of Catalysis ERIC, and the German Technical and Scientific Association for Gas and Water (DVGW).

Karlsruhe Institute of Technology (KIT) is a public corporation according to the legislation of the state of Baden-Württemberg. It fulfills the mission of a university and the mission of a national research center of the Helmholtz Association. Research activities focus on energy, the natural and built environment as well as on society and technology and cover the whole range extending from fundamental aspects to application. With about 9000 employees, including nearly 6000 staff members in the science and education sector, and 24000 students, KIT is one of the biggest research and education institutions in Europe. Work of KIT is based on the knowledge triangle of research, teaching, and innovation.

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