German Aerospace Center

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Gulf State builds on renewable energy sources - DLR surveys the options for a combined solar/natural gas power station

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Solar power tower at the Plataforma Solar de Almería (Almeria Parabolic Trough Solar Energy Collector) in Spain

A vision which promises much for the future: Electricity and temperature control from solar power and natural gas. Scientists at the Institute of Technical Thermodynamics at the German Aerospace Center (DLR) are now taking control of the development of a hybrid solar-powered gas turbine system with combined heat and power for Abu Dhabi. The project will be supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

In the first phase of the joint project with the Masdar Research Network (Abu Dhabi), the DLR Institute of Technical Thermodynamics is working on a feasibility study. This will form the basis for a 5-MW gas-fired demonstration plant, also using solar power, to generate not only electricity, but also cooling for climate control.

Good commercial prospects for hybrid solar-powered gas turbine systems

In addition to increasing demand for electricity, countries with a higher-than-average proportion of sunny days need cooling and climate-control due to the high ambient temperatures. This need is, naturally, a function of the available solar radiation to a large extent, and thus offers ideal conditions for the use of solar power. Hybrid solar-powered gas turbine systems combine solar radiation (sunshine) and fossil fuels such as natural gas. In this way, if the sunshine is intermittent or insufficient, the shortfall can be made up by burning fossil fuels. The service is thus largely available on demand. Hybrid solar-powered gas turbine systems are therefore said to have good commercial potential.

The Emirate of Abu Dhabi on the Persian Gulf, with its sizable oil and gas deposits coupled with high solar radiation, offers ideal conditions for deployment of this environmentally-friendly power station technology. DLR scientists were able to demonstrate a similar hybrid solar-powered gas turbine system (230kW) at the Almeria Parabolic Trough Solar Energy Collector.

Increase in energy efficiency of 10 – 25% due to combined heat and power

Masdar City – The template for a carbon-neutral city

Combined heat and power is what makes this project so innovative: The ensuing process heat (temperatures of up to 370°C) generated in the gas turbine will be used for cooling in absorption coolers. The cooling effect achieved can then be used for climate control or for other industrial processes. This means an increase in energy efficiency of 10 – 25%: remember, until recently this energy would have been discharged into the environment and not otherwise used.

In the context of the feasibility study, DLR is going to draw up a matrix comparing the need for cooling and climate control relative to sunshine in the Abu Dhabi region, and simulate the operational behaviour. This will form the basis for the economic evaluation and market analysis.

The USHYNE (Upscaling of Solar-Hybrid Gas Turbine Cogeneration Units) project brings DLR into Abu Dhabi's Masdar Research Network, a research network founded in the past twelve months to develop alternative energy and environmental technologies. The Masdar Research Network is, in turn, one of the building blocks of the 'Masdar Initiative'. Other pillars supporting this initiative include the 'Clean Tech Fund' for clean technologies, a special economic zone for 'progressive' energy, a university, and the development of a carbon-neutral city for up to 47 000 people.

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