Innovation Project

Energy Cluster

nordwest2050

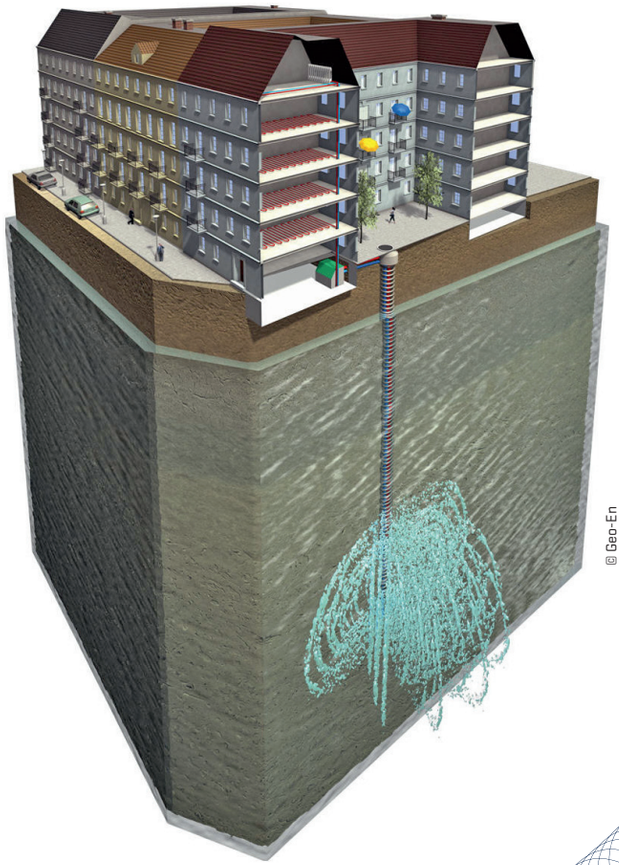
Colocation IX GmbH: Geothermal Cooling of a Data Center

The company Colocation IX GmbH is building a new data center in Bremen, and has decided upon the use of a new innovative cooling technology: Instead of traditional air conditioning to remove the waste heat from the servers, integral wells and geothermal probes are to provide energy-efficient cooling in summer and heating energy for use in winter. The company is working together with the University of Bremen and the company Geo-En GmbH, which has expertise in integral wells. These alternatives to electrically driven compressor cooling will protect the environment through energy savings, help relieve the power grids, and at the same time ensure a decentralized and fail-safe cooling supply. The project has been funded by the Federal Ministry of Education and Research to the tune of €280,000. The co-payment share for ColocationIX GmbH amounts to €315,000.

The Need for Climate Adaptation

The vulnerability analysis of **nordwest2050** has shown that an increase in cooling-requirement days and the increased occurrence of heat waves will have a significant impact on the demand for cooling services. For the operation of data centers, this may be a relevant issue, since a 50 to 150% increase in air-conditioning performance over and above the installed IT performance will be needed. That will on the one hand involve high costs; on the other, traditional cooling equipment requires high-quality and expensive electrical energy in order to remove low-grade waste heat. Ensuring uninterrupted cooling is highly relevant economically, especially considering the very high demands on the availability of a data center.

The use of geothermal sources for cooling and air conditioning, and for heat supply, often also involving the expansion of district-heating supply, provides an opportunity to achieve CO_2 savings to conserve primary energy resources, and reduce peak loads on the grid.



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Method and State of Implementation

One of the selected technology options for the data center consists of a cooling system using well water. Since traditional well-water cooling systems have often suffered technical problems, such as silting, corrosion caused by aggressive media, and iron clogging, the use of an alternative technology was favored.

With these so-called integral wells, the groundwater is not brought to the surface, but is rather circulated by a pump at the base of a bore hole. A heat exchanger integrated into the pump absorbs the heat from the cooling circuit of the data center and delivers it to the cooler groundwater.

In order to comply with the requirements of the redundancy of the cooling systems for the safe operation of the data center and to respond quickly in case of peak loads, it is planned to combine different cooling technologies. In addition to the integral well, traditional geothermal probes are to be used, which operate according to a similar process principle, but work at different drilling depths. The system is supplemented by a conventional roof-mounted cooler. This alternative cooling system promises significant energy-savings potentials with high redundancy, and could be an appropriate way for the data center to reduce energy consumption and CO_2 emissions. At the same time, it is adapted to future climate change.

Results

A feasibility study and a thermal response test were drafted. The results of the thermal response tests prove the fundamental possibility of geo-thermal cooling at this location. However, the integral wells will have to be sunk deeper than would normally be expected, since sufficiently large aquifers are found only at around 90 m depth. Thereafter, an economic feasibility analysis and a sizing of the system and of the system components were carried out on the basis of the test. Currently, the facility has been contracted to the company Geo-En in Berlin, so that after completion of the approval process, the construction of the plant can begin in the near future.

Transferability

Integral wells for cooling or heating are especially recommended for existing and densely built-up residential and commercial areas. Their area requirement is significantly less than that of geothermal probes, and their performance may be higher by up to a factor of 10.

A combination of geothermal probes and integral wells can be designed especially advantageously for redundant cooling systems, with a high potential for energy and CO_2 emissions savings. Data centers and other highly sensitive processes are favorable application sites.

nordwest2050 is one of a total of seven projects funded by the Federal Ministry of Education and Research (BMBF) in the context of the KLIMZUG Program (Klimawandel in Regionen zukunftsfähig gestalten – Creating Climate Change-Ready Regions). In 2012 nordwest2050 was awarded as an official project of the United Nations' World Decade on Education for Sustainable Development. The goal of the adaptation research is to develop strategies and measures by means of which regions and industries can be better prepared for life and business under the conditions of climate change. This is on the one hand designed to strengthen future competitiveness, and on the other to promote the development and use of new technologies and procedures for adaptation to climate change.

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