PRESS RELEASE

Pilot Project With Cologne-Based Energy Producer RheinEnergie

Digital Twin Optimizes Processes in Combined Heat and Power Plant

The desired heat turnaround focuses not only on district heating, but also on local heating. Thanks to shorter distances from generation to consumers, energy losses in the network are lower. Optimal control of combined heat and power plants can also save energy. In a pilot project with RheinEnergie AG, researchers at the Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern are exploring this potential with the help of artificial intelligence (AI).

Nicolas Kandziora, project engineer »Building Automation« at RheinEnergie, became aware of the Palatine mathematicians:in mid-February 2023 at the »Elektrotechnik« trade fair in Dortmund. »I listened to Dr. Benjamin Adrian's presentation on »Artificial Intelligence in the Control Cabinet,« which dealt with condition monitoring in real time, predictive maintenance and optimized energy consumption.« In the conversation that followed, it quickly became clear that the methods presented were also of interest to the Cologne-based energy supplier. It took only a few weeks until the first meeting; then a joint project was agreed upon.

Condition monitoring in real time, predictive maintenance and digitally optimized energy use: AI-supported technologies for plant operation help to plan ahead and optimally control energy requirements. For RheinEnergie, this is important in order to be able to offer customers an efficient, low-emission and cost-saving energy supply.

Saving Primary Energy

In the pilot project with the Fraunhofer ITWM, the first step is therefore to identify the adjusting screws within the heat generation plant that have potential for optimization. »To do this, we look at the historical data sets of the cogeneration plant and its site-typical specifications. We then use this information to create a digital twin of the plant,« explains Dr. Christian Salzig, team leader »Digital Twins and Predictive Control«

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at Fraunhofer ITWM. »In the second project phase, we implement the developed algorithm in the simulated plant and validate the results.«

After that, it's time to move from the virtual to the real world, i.e., to the control cabinet. There, the control system executes the required action and puts it directly into practice. »With artificial intelligence, we increase our performance in energy and plant management and at the same time reduce the energy consumption and CO2 emissions of our customers,« says Holger Mennigmann, head of the »Energy Services and District Heating« business unit at RheinEnergie.

Heat Optimization in Two Steps

In the first step, the heat energy in the secondary circuit is adjusted to the current and forecast demand of the consumers. In this process, it is ensured that the water in the heat circuit is not too cold and not too hot in order to avoid energy losses.

Afterwards, the Fraunhofer ITWM researchers optimize the primary circuit, i.e., the plant technology. This includes, among other things, gas-fired boilers. These control the boiler operation in such a way that the thermal energy identified as necessary in the first step is available as efficiently and precisely as possible.

The team led by Dr. Christian Salzig provides RheinEnergie with holistic support, from the development of methods to the integration of hardware and software in the control cabinet. The more resource-efficient operation of the Cologne combined heat and power plant is scheduled to start as early as October 2023.

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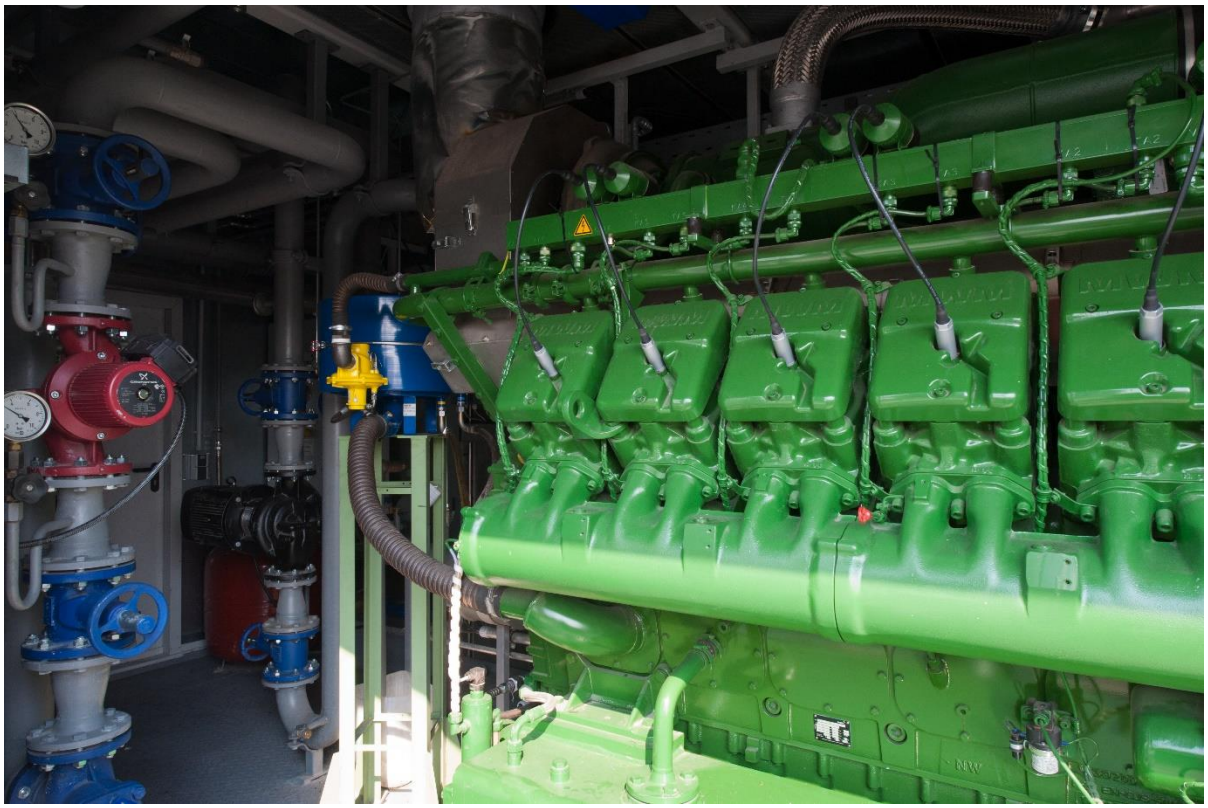
Visuals



Biogas Plant at Randkanal-Nord, Engine of the Combined Heat and Power Plant (CHP). ©RheinEnergie AG / Joachim Rieger

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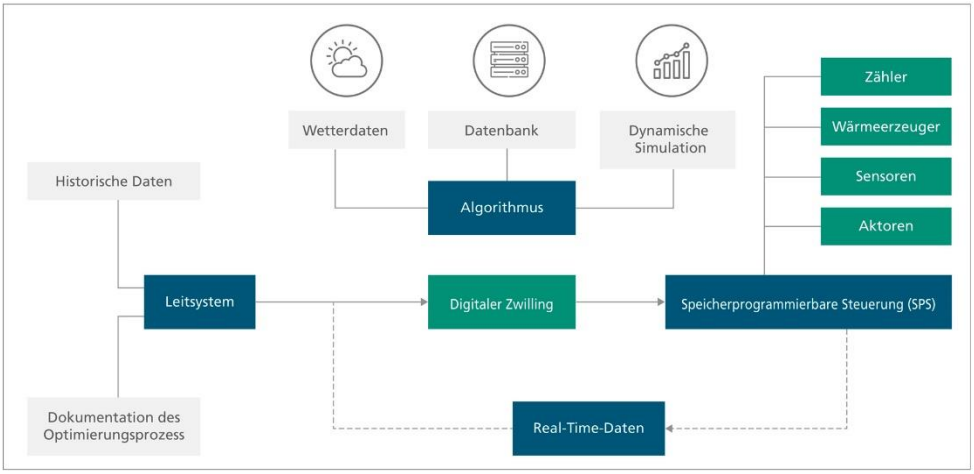
Block-Type Thermal Power Station in Cologne Merheim ©RheinEnergie AG



A Lot of Data Is Needed to Optimize Heat Generation Systems. Concept Sketch: Process Optimization of Heat Generation Plants. © Fraunhofer ITWM

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About the Fraunhofer Institute for Industrial Mathematics ITWM

The Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern is one of the largest research institutes for industrial mathematics worldwide. We see our task in further developing mathematics as a key technology and providing innovative impetus. Our focus is on the implementation of mathematical methods and technology in application projects and their further development in research projects. The close cooperation with partners from industry guarantees the high practical relevance of our work.

Their integral components are consulting, implementation and support in the application of high-performance computer technology and the provision of tailor-made software solutions. Our various competencies address a wide range of customers: automotive industry, mechanical engineering, textile industry, energy and finance. This also benefits from our good networking, for example in the High performance center »Simulation- and Software-Based Innovation«.

About the Fraunhofer-Gesellschaft

The Fraunhofer-Gesellschaft, based in Germany, is the world's leading organization for application-oriented research. With its focus on future-relevant key technologies and on the exploitation of the results in business and industry, it plays a central role in the innovation process. As a guide and stimulus for innovative developments and scientific excellence, it helps shape our society and our future. Founded in 1949, the organization currently operates 76 institutes and research facilities in Germany. Around 30,800 employees, most of them trained in the natural sciences or engineering, generate an annual research volume of around €3.0 billion. Of this, €2.6 billion is spent on contract research.

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