

# PRESS RELEASE

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**PRESS RELEASE**07.February 2024 || Page 1 | 5

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## Fraunhofer ITWM at the E-World Energy and Water 2024 **Saving Energy With Artificial Intelligence**

**The energy transition is a major challenge; the leading trade fair E-world energy & water from February 20 to 22, 2024 in Essen will show which innovative methods and technological advances are giving it momentum. The Fraunhofer Institute for Industrial Mathematics ITWM will be among the exhibitors with exciting projects for the energy sector.**

Energy supply is rethought here: E-world energy & water is the meeting place for the European energy industry. The Fraunhofer ITWM will also be on site again, demonstrating with innovative projects how mathematical models can contribute to the energy transition and the achievement of climate targets. Researchers from the departments »System Analysis, Prognosis and Control« and »Financial Mathematics« as well as the division »High Performance Computing« with the »Green by IT« team can be found in the **Innovation section in Hall 4**.

### **Resource-Optimized Production**

Every production plant can be optimized in many different ways. The researchers from Kaiserslautern have developed an artificial intelligence (AI) that ensures sustainable production and intelligent energy generation and distribution.

In this way, they determine how the energy requirement changes depending on the production steps and operating points of the systems. The aim is to plan energy requirements in advance and control them optimally. However, the researchers always take into account various other production-relevant target variables: Product quality and throughput, energy use, use of the raw materials used and the condition and availability of the production facilities. The processes developed lead to sustainable, more resource-efficient plant operation.

### **Digital Twin Optimizes Processes in Combined Heat and Power Plant**

One current example is a project for RheinEnergie AG in Cologne, which can now operate some of its local heating systems more energy-efficiently – i.e. more economically. In the first step, the researchers used machine learning methods to identify the system-specific, time- and outdoor temperature-dependent load profile of the systems and linked this to the weather forecast from the German Weather Service. In addition, they implemented a predictive controller that ensures precise tracking of

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the temperature specifications. With these two components, it was then possible to implement precise regulation of the flow temperature in line with demand, which, according to current test runs, saves six to seven percent of primary energy.

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**PRESS RELEASE**07.February 2024 || Page 2 | 5

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**Artificial Intelligence in the Control Cabinet**

The range of services offered by the technologies includes the derivation, adaptation and implementation of the algorithms through to the selection and integration of hardware and software in the control cabinet. Predictive maintenance, i.e. reducing downtimes and maximizing the availability of systems through machine learning, plays a major role here. The Fraunhofer ITWM has developed an AI for this purpose that uses smart sensor data and digital twins to help avoid downtimes and keep them to a minimum, plan maintenance at optimum cost and reduce energy and production costs while maintaining optimum quality. At E-world, the researchers will use a demonstrator to show how this AI can be installed in the control cabinet of machines and systems.

**Flexible Loads on the Energy Market**

The department »Financial Mathematics« of the Fraunhofer ITWM will also be there to present some of its projects. In energy research, their focus is on the German electricity markets, especially on the flexibility of loads on the energy market. As an example, they investigated a virtual battery with flexible charging and discharging times in order to optimize its bidding strategy across various short-term markets. This led to the creation of an optimal battery schedule.

The department's research also extends to long-term markets. It is currently working with a municipal energy supplier to optimize its long-term procurement strategy. It is also marketing a simulation-based risk manager for electricity, gas and CO<sub>2</sub>, which has been in use in industry for several years.

**Cross-Location Optimization of Energy Flows in Real Time**

In Essen, the »Green by IT« team is presenting a sector-linked energy management system that optimizes energy flows across locations in real time. This innovative solution takes into account both local optimization targets and the dynamic networking of locations. By managing virtual balancing groups in real time, consumption is no longer viewed »in the rear-view mirror« but actively controlled. This allows companies to supply themselves with self-generated and stored energy across all locations.

This saves costs and increases sustainability - a significant advance in sector-linked energy management for companies in all industries.

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### **Digital Twins Make Charging Stations More Efficient**

The Fraunhofer ITWM's »Green by IT« team developed a generic method for creating digital twins for battery storage systems and DC (BiDi) charging stations for electric vehicles. Using data-driven AI modeling, the researchers succeeded in developing detailed individual models that describe the specific losses across all operating points of a specific inverter. These efficiency models offer great advantages for energy management systems by enabling efficiency-optimized control and thus significantly reducing conversion losses of inverter-based devices. The method was tested on heat pumps, where it enables heat to be generated at the most efficient times.

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**PRESS RELEASE**

07.February 2024 || Page 3 | 5  
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**The Fraunhofer ITWM will be presenting these and other projects starting February 20 in Hall 4 (booth numbers 4G111, 4H112 and 4H114).**

You can find more information about our exhibits [here](#) .



**Intelligently controlled combined heat and power plants consume significantly less primary energy.**

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**PRESS RELEASE**

07.February 2024 || Page 4 | 5  
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**AI in handheld format: the intelligent microcontroller for the control cabinet**  
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**PRESS RELEASE**07.February 2024 || Page 5 | 5

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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 applied mathematics in the world. We see it as our task to further develop mathematics as a key technology and to provide innovative impulses. 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 building blocks are consulting, implementation and support in the application of high-performance computing technology and the provision of customized software solutions. Our various areas of expertise address a wide range of customers: the automotive industry, mechanical engineering, the chemical industry, energy and the financial sector. This also benefits from our excellent networking, for example in the Simulation and Software-based Innovation Center.

**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-oriented key technologies and the utilization of results in business and industry, it plays a central role in the innovation process. As a guide and driving force for innovative developments and scientific excellence, it helps to shape our society and our future. Founded in 1949, the organization currently operates 76 institutes and research facilities in Germany. More than 30,000 employees, most of whom are trained in the natural sciences or engineering, work on the annual research volume of 2.9 billion euros. Contract research accounts for 2.5 billion euros of this total