



# Digitalization and Artificial Intelligence for Energy Management 2.0

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Whether as an action to contain the climate crisis, to reduce energy imports or simply to save money: Saving energy is more necessary than ever. With the help of digitization and artificial intelligence (AI), researchers at Fraunhofer ITWM are working on an integrated energy management system that reduces energy consumption and increases the share of renewable energy. Both in industry and in private households.

Energy management 2.0 is the goal of the ENERDIG project. To this end, researchers from the divisions "Optimization" and "High Performance Computing" as well as the departments "Transport Processes" and "System Analysis, Prognosis and Control" are bringing their expertise together to develop new digitization and AI-based strategies. The project is located in the High Performance Center Simulation- and Software-based Innovation.

"The team's research work addresses four topics," explains project leader Dr. Dietmar Hietel. "Energy management in residential buildings and industry, in plastics production, in chemical production and in nonwovens production."

## Electricity, Heat and Mobility in Residential Buildings and Industry

An important way to reduce greenhouse gas emissions in the residential and commercial sectors is to use renewable electricity in conjunction with heat pumps and solar thermal energy. "In doing so, people ask themselves, for example, what their consumption will be tomorrow and what their photovoltaic and solar thermal systems will do then. And what role the weather plays in this," said Hietel.

"To answer that, we're developing new methods of AI to use forecasts to charge electricity storage systems, which in turn can charge heat pumps and electric cars with as much renewable energy as possible."



*Within the framework of ENERDIG, Fraunhofer ITWM is developing new AI methods and procedures to manage the coupling of electricity and heat in buildings and industry on the basis of forecasts.*



*Ministerial Director Daniel Stich presents Prof. Dr. Anita Schöbel and Dr. Dietmar Hietel with the funding decision for the ENERDIG project amounting to around 1.8 million euros. The funding comes from the European Regional Development Fund.*

### Optimization of Aerodynamics in the Nonwoven Production

There is also great potential for savings in industrial production, for example in nonwovens production. The challenges in nonwovens production are very high production speeds and turbulence in the production process. Both often lead to fluctuations in fabric quality. With the help of different software solutions, Fraunhofer ITWM contributes to the aerodynamic optimization of nonwoven production. This leads to a more stable product quality and to significant energy savings.

erator of the demand-side management system thus contributes to increasing the share of renewable energies. With the aim to support especially SMEs on their way to an energy management 2.0, Fraunhofer ITWM develops algorithms for the identification and evaluation of energy consumption and flexibility based on digital twins of machines and production facilities. Innovative methods of machine learning (ML) with deep neural networks are used.

### Flexibilization of Energy Use in Plastics Production

High cost pressure and growing complexity in production outline the area of tension in plastics production. By controlling the demand for electricity through the targeted switching off and on of loads, so-called demand-side management, the electricity required for production can be purchased more cheaply on the energy market and the product can be manufactured more cheaply accordingly. In addition to strengthening the market position, the op-

### Energy Efficiency in Chemical Production Through Real-Time Optimization

A similar solution approach applies in the energy-intensive chemical industry: "Making energy consumption more flexible here means that the company adapts its processes to changing energy costs at short notice," explains Hietel. "In addition, there are other variables that must be reacted to at short notice, such as the availability of raw materials." Systematically taking these fluctuations into account when optimizing plants is one of ENERDIG's goals. "Through improved real-time optimization of chemical processes alone, we can expect energy savings even in the double-digit percentage range."

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