EnerQuant: Quantum Computing for the Energy Industry

Complex optimization problems with many variables are difficult for classical computers to solve. Only recently have certain quantum computers achieved promising results in solving optimization problems – with the potential to handle even discrete variables. In the joint project "EnerQuant: Energy Economics Fundamental Modeling with Quantum Algorithms", our researchers from the departments "Financial Mathematics" and "High Performance Computing" are exploiting advantages of quantum computing for the energy industry.

Optical system for laser cooling and control of ultracold sodium atoms in the laboratory at the Kirchhoff Institute for Physics Heidelberg

"In short, in the EnerQuant project we are developing algorithms for qubit-based quantum computers and quantum simulators for the solution of a fundamental model of energy economics with stochastic influencing variables," explains Kerstin Dächert, member of the "Financial Mathematics" department at Fraunhofer ITWM and project coordinator. Together with colleagues from the department "High Performance Computing", she and her team are conducting research in the joint project with universities and companies from industry.

As a basis, the researchers define a simple fundamental model that can be translated into a quantum mechanical problem and realized on a quantum simulator. This is implemented in a prototype made of cold atoms and tested for its performance in order to successively further develop the fundamental model and quantum simulator. The long-term goal is to model the German electricity market with sufficient stochastic accuracy.

Exploiting new potential

EnerQuant makes it possible to exploit the potential of new computing technologies for energy-economy modeling. The researchers show how fundamental models can be formulated to use the computing power of quantum simulators and thus make a long-term contribution to the further development of energy system modeling. The results will be incorporated into the software platform of the partner JoS QUANTUM and will be available to industry after the end of the project. Furthermore, EnerQuant provides an analysis of the potential of quantum computers and compares their efficiency with classical hardware and alternative approaches to solve optimization problems.

EnerQuant started in September 2020 with a duration of three years and is funded by the German Federal Ministry for Economic Affairs and Energy (BMWi). In addition to Fraunhofer ITWM, Fraunhofer IOSB-AST, the Universities of Heidelberg and Trento, and Jos QUANTUM are also part of the network.

More information at www.itwm.fraunhofer.de/enerquant_en

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