Harnessing AI for decarbonization

Machine learning techniques using big data from Western Siberia are helping researchers OPTIMIZE FRACKING OPERATIONS.

Scientists at Skoltech have been exploring how artificial intelligence (AI) can help economies to decarbonize while supporting our lifestyles.

Recognizing the urgency of averting the worst outcomes of climate change, countries representing 70% of the global economy pledged in early 2021 to achieve zero net emissions of greenhouse gases by the middle of this century. But in many cases, the specific steps for achieving that goal still need to be determined.

The energy supply sector accounts for 35% of global greenhouse-gas emissions, making it the world's largest contributor. Now, a team at Skoltech has used AI to optimize hydraulic fracturing, known as fracking, a process of injecting water mixed with particles (proppant) and some chemicals into underground formations to release trapped oil or natural gas.

Along with colleagues from Gazpromneft Science and Technology Center, the Skoltech team gathered and processed data from thousands of hydraulically fractured wells in Western Siberia to develop an AI-aided model to maximize production by optimizing fracturing design. Access to data on reservoir properties, fracturing design and production was crucial in building a successful model. "With the advance of AI, we have the opportunity to build data-driven models for optimizing the entire process — from drilling to fracturing and flowback," says Andrei Osiptsov, professor and director of the Skoltech Project Center for Energy Transition and ESG. "This can help meet environmental, social and governance targets by minimizing the carbon footprint as well as the amount of chemicals and proppants used to create the fractures."

The new machine learning techniques improved the efficiency of algorithms aimed at reducing emissions. "There's a great need to reduce the computational resources used to develop and deploy AI models by making them smaller, faster and cheaper," says Ivan Oseledets, director at the Skoltech AI Technologies Center who has helped develop a suite of green AI technologies. "Industry and academia are moving away from a paradigm of using larger models, datasets and supercomputers towards one of using more-efficient learning technologies and of understanding of how AI models learn and comprehend the data."

The researchers believe that, by using AI tools and emission-monitoring technologies such as sensors on carbon landfill, drones and satellites, their approach could be applied to a wide range of industries, including green finance, carbon capture and even the fight against greenwashing — the practice of marketing products as being more benign to the environment than they actually are.

"One of most important directions is monitoring the level of carbon-dioxide emissions across specific regions, which is needed for evaluating carbon tax and the results of climate projects. For that, we need a fusion of multimodal data such as remote sensing images and sensor data, and AI is the right technology for that," explains Evgeny Burnaev, head of the Skoltech center in AI for optimization of management decisions to reduce carbon footprint. "We fuse data on different scales and fidelities, allowing us to accurately estimate current emissions as well as to predict future emissions." ■

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Skoltech scientists are partnering with industry to use artificial intelligence to improve fracking operations in Western Siberia.