Argonne NATIONAL LABORATORY

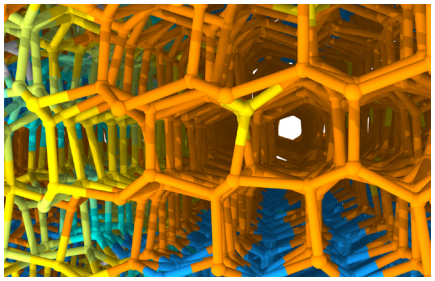
WATER + AI: WATER SCIENCE AND ENGINEERING EMPOWERED BY ARTIFICIAL INTELLIGENCE

Argonne leverages multidisciplinary teams, world-class facilities, powerful scientific tools and strategic partnerships to confront some of the most profound scientific and technological challenges for water-related science.

With its world-class scientific expertise and top-tier facilities, Argonne is emerging as a leading organization for research and innovation in water science and engineering empowered by artificial intelligence (Water + AI).

Water is our most valuable resource, impacting people, infrastructure and industries around the globe. As warming temperatures, changes in precipitation and runoff, extreme weather, pandemics, and rise in sea level continue to create new challenges, there is an urgent need for scientific and engineering solutions. We at Argonne National Laboratory are enhancing our leadership in this space through pioneering research, discoveries and innovations in the following areas to secure America's water resources and deliver economic growth:

- Water-related materials discovery, synthesis, characterization and scale-up manufacturing
- New process technologies for systems that sense, treat and handle water
- Machine learning and artificial intelligence, data science, modeling, and simulation related to new water materials and process technologies



Machine-learned model developed at Argonne shows how grains of ice form and coalesce in supercooled water, which results in ice with imperfections.

FOR MORE INFORMATION
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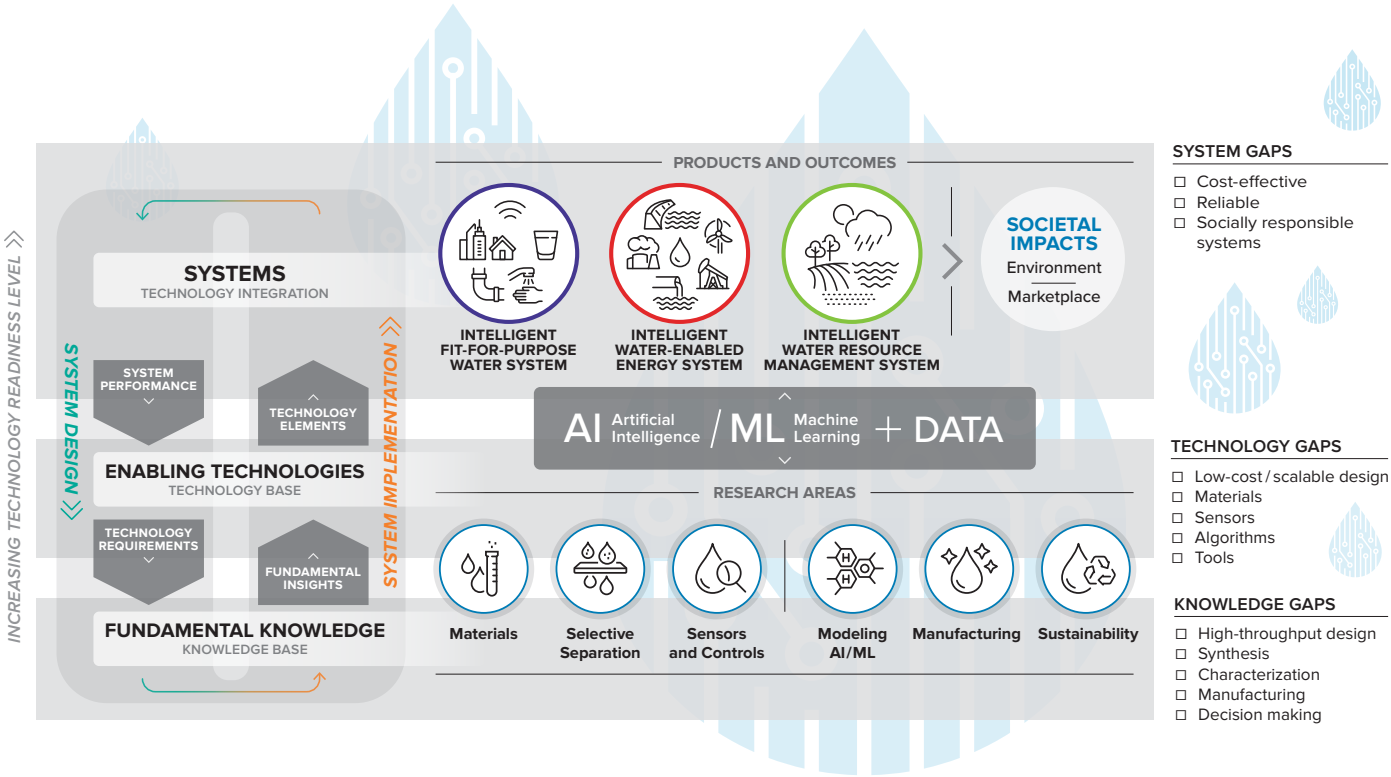

Argonne's ten-year Water + AI strategy: research programs can start with developing fundamental knowledge and advance to one of the three systems, or start with the requirements for a particular system and then develop the needed enabling technologies and fundamental knowledge.

THE ARGONNE ADVANTAGE

With partners in Chicagoland and beyond, Argonne is ideally suited to take materials and process technologies from discovery to application by tapping into our world-class materials and chemistry expertise, analytical capabilities at the Advanced Photon Source (APS), high-performance computing at the Argonne Leadership Computing Facility (ALCF), nanoscience and nanotechnology capabilities at the Center for Nanoscale Materials (CNM) and scale-up manufacturing capabilities at Argonne's Materials Engineering Research Facility (MERF). The APS, ALCF and CNM are U.S. Department of Energy Office of Science user facilities at Argonne.

GLOBAL WATER CHALLENGES

Without water there is no life. Water is continually cycling through extraction from the environment, use and return to the environment. Today this cycle is under threat due to many factors including climate change, increased pollution, skyrocketing demand and wasteful use. Researchers from around the world are searching for innovative solutions to make this cycle more effective and efficient and help secure a plentiful and clean water supply.

OUR STRATEGY

Vital to our nation's future are innovative systems for fit-for-purpose water treatment and distribution, water-enabled energy production, and the sustainable management of all our water resources.

Argonne's water strategy to develop those three systems covers the entire innovation spectrum from fundamental research to enabling technologies and integrated systems that will impact society in terms of both economic growth and environmental improvements. It draws upon Argonne's strengths in water science and engineering (materials research and scaling to the manufacturing level), unique capabilities in artificial intelligence and machine learning, and world-class scientific facilities.

Our ten-year Water + AI strategy has three elements:

- ☐ Developing a fundamental knowledge base in six focus areas — materials, selective separation, sensors and controls, modeling with artificial intelligence/ machine learning, manufacturing and sustainability
- ☐ Developing enabling technologies in those same areas
- ☐ Integrating the two in the creation of three intelligent water-related systems — one for water treatment and distribution, another for water-enabled energy systems and a third for water resource management