SOLVING ENERGY CHALLENGES THROUGH SCIENCE™

World-Class R&D Enabled by Fast Neutrons

Why Nuclear?

Energy & electricity demands are increasing worldwide. Meanwhile, nearly a billion people today have no access to electricity, according to the International Energy Agency. Nuclear energy will be part of an integrated solution going forward, helping supply carbon-free power to an energy-hungry world.

10.5%

The amount of nuclear-power-generated electricity in the world. The U.S. is the lead producer, generating 807.1 billion kilowatt-hours of electricity in 2018 (the highest total ever produced).

ENVIRONMENT

- According to the World Health Organization, exposure to air pollution causes up to **4.2 million** premature deaths worldwide per year through cardiovascular and respiratory disease. Using nuclear power for clean-energy generation will help save lives.
- Using nuclear power for generating electricity has a very low impact on the environment compared to other sources at a similar scale.
- **20%** of electricity in the U.S. is produced from 96 nuclear reactors in 29 states. These reactors provide more clean energy to the grid than any other energy source, accounting for **55%** of the country's clean-energy electricity production.

SAFETY & SECURITY

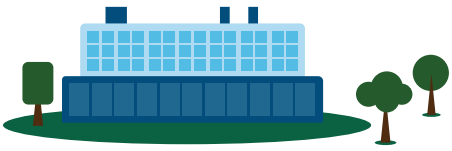
- The ability to positively impact global nuclear safety, security and nonproliferation policy relies upon ensuring a robust nuclear program.
- In the U.S. in 2018, nuclear power plants operated at full capacity more than **92%** of the time – making it the most reliable energy source in America.

ECONOMICS

- The Nuclear Energy Institute estimates each nuclear plant employs **530** employees. For every **100** jobs at a U.S. nuclear facility, **66** jobs are created within the local economy and another **726** jobs are created throughout the country.
- The global market for a nuclear-power-generation capability is estimated to be **$1 trillion**. Nuclear power generation is projected to grow **73%** by 2040, primarily driven by developing countries (especially China and India).
- Nuclear power provides a reliable-energy supply at a reasonable cost—an important factor in the quality of life for Americans as well as our nation's industrial and economic competitiveness.

Why VTR?

The U.S. has long been a leader in the development of nuclear technologies. Currently, there is no fast-neutron testing capability in the country to support advanced reactor research and development. The only capability for fast-neutron testing is the Bor-60 reactor in the Russian Federation. VTR will leverage existing U.S. government and industry investments in nuclear reactors to accelerate its design and construction process, using proven nuclear reactor technology to create a world-class scientific infrastructure.



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WHAT IS THE PROBLEM?

The U.S. lacks a scientific facility to provide fast-neutron testing, which is required for rapid and accurate new-material and nuclear-fuel research and development. Many U.S. companies are working on technologies to make existing and next-generation reactors more economically competitive and reliable. These efforts require continuing research and development of new materials and nuclear fuels.

New Materials & Nuclear Fuels Development

The material-development process uses fast neutrons for each of the following phases prior to being qualified for use in a nuclear reactor:

1. Research
2. Refinement & testing
3. Rigorous safety testing

Fast Neutrons for Testing

Fast neutrons have a higher energy level than slow (thermal) neutrons; therefore, they interact differently with the material exposed to these neutrons. This energy level is necessary for developing and providing accelerated testing of materials, fuels and instrumentation for use in the U.S. Department of Energy's (DOE) existing fleet of reactors as well as advanced reactor concepts.

Potential Impacts

The results of not supporting nuclear technology development includes:

- The U.S. losing its leadership status in nuclear technology
- A diminished ability to compete in the estimated $1 trillion global market.
- A substantially reduced global influence in nuclear safety, security, and nonproliferation policies.

WHAT IS THE SOLUTION?

VTR will use existing and proven nuclear-reactor technology to provide fast neutrons as well as a capability to rapidly insert, conduct and remove state-of-the-art experiments. Additionally, future innovations in experimental capability can be used in VTR without modification to the facility.

The VTR will support progress in several important scientific and technological areas including:

- Testing and qualification of advanced reactor fuels.
- Testing and qualification of innovative structural materials.
- Testing of innovative components and instruments.
- Validation of advanced modeling and simulation tools, and the versatility to support future technical missions.

By using proven technology, existing reactor designs and operating experience, VTR will reduce the risk, cost and timeline for design and construction. VTR will use the best available resources from DOE laboratories, industry and universities to expedite the reactor's design and construction and to develop the scientific infrastructure for a sustained and powerful testing capability for many decades. VTR's specific reactor technology and location are being determined by the DOE in accordance with capital acquisition and the National Environmental Policy Act (NEPA) processes.