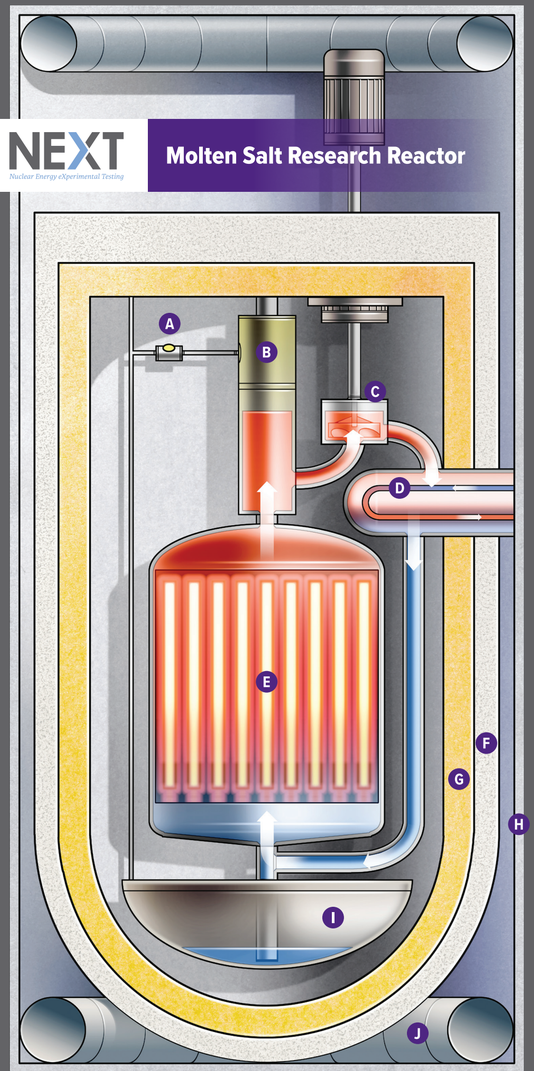
NEXT
Nuclear Energy eXperimental Testing

Molten Salt Research Reactor



ABILENE CHRISTIAN UNIVERSITY

The Molten Salt Research Reactor (MSRR) is the first advanced university research reactor.

Key features include:
- 1 MW_{th} power output
- Molten salt cooled
- Liquid fueled (^{235}U)
- Graphite moderated

A – Reactor Trip Valves
B – Access Vessel
C – Pump
D – Heat Exchanger
E – Reactor Core
F – Shielding
G – Insulation
H – Reactor Enclosure
I – Drain Tank
J – Helium Tank (one of two)

Sponsor of ACU's NEXT Lab

Natura Resources

"At Natura we're producing safe, scalable nuclear power to meet global sustainable energy goals, and the deployment of the MSRR at ACU is a critical step in achieving that mission."

– DOUGLASS ROBISON
Founder and President
Natura Resources LLC

The MSRR at ACU is a collaborative effort with

TEXAS
The University of Texas at Austin

Georgia Institute of Technology

TEXAS A&M UNIVERSITY

40
The percentage of people on Earth who use animal dung or other waste products to heat their homes and cook their food

1 in 2
The number of people at risk of developing cancer in their lifetime

1 in 4
The number of people at risk of dying from cancer

1 in 3
The number of people who do not have access to the water needed for proper hygiene and sanitation

Cross-section view of the Dillard Science and Engineering Research Center at ACU

NEXT *POWERED BY* Natura Resources

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ABILENE CHRISTIAN UNIVERSITY

FINDING GLOBAL SOLUTIONS TO THE WORLD'S MOST CRITICAL NEEDS

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CHANGING THE WORLD

The mission of Abilene Christian University is to educate students for Christian service and leadership throughout the world. ACU's 21st-Century Vision is to be a premier university for the education of Christ-centered, global leaders – a unique position in higher education where students and faculty work together in a mentoring relationship while addressing real-world problems with global impact.

The mission of ACU's NEXT Lab is to provide global solutions to the world's need for energy, water and medical isotopes by advancing the technology of molten salt reactors while educating future leaders in nuclear science and engineering.

The key technologies of these advanced reactors are cooling them with molten salt and providing fuel in a liquid form. Nuclear power is already the safest and cleanest energy source in the world, but it can still be improved. By adding these two critical design features, advanced reactors will be even safer than current nuclear reactors, produce no carbon emissions, increase efficiency and decrease waste, all while making electricity more affordable and meeting other critical needs.

NEXT Lab, sponsored by Natura Resources, is building the first advanced university research reactor, the Natura MSR-1. The Natura MSR-1 is a 1 MWth liquid-fueled molten salt reactor being licensed at ACU as the Molten Salt Research Reactor (MSRR). Natura Resources brought together ACU, Texas A&M University, The University of Texas at Austin and the Georgia Institute of Technology to form the Natura Resources Research Alliance to design, build and license the MSR-1 system.

Considerable research is being done at ACU to deploy the MSRR, including testing advanced instrumentation, evaluating salt properties, making fundamental data measurements, and testing hardware that can be used with molten salts. This work is taking place in three of ACU's research-focused facilities.

ACU: The right place, the right time

Abilene Christian is well positioned to contribute to advanced nuclear in significant ways. The university is widely recognized for involving undergraduates in world-renowned research alongside its distinguished faculty and collaborating across disciplines, having been named among the top 50 universities nationally for undergraduate research by *U.S. News & World Report*.

The NEXT Lab fits perfectly into this model, as students provide invaluable help in developing molten salt test systems. Collaboration at the NEXT Lab has already successfully engaged undergraduates majoring in physics, engineering, chemistry, mathematics, computer science, finance and advertising/public relations.

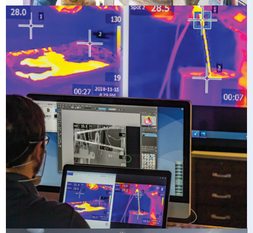
The molten salt test loop was the first system to flow salt and is housed in the Bennett Engineering and Physics Laboratories, a historic and renovated facility where classes and labs meet. This system was critical to testing the first patent produced by NEXT Lab, a high temperature flow meter.

ACU's on-site test facilities are providing unprecedented access for students and faculty to collaborate in this cutting-edge research to solve one of the world's most pressing problems: the need for clean, safe and affordable energy.

Students at ACU, led by outstanding faculty and collaborators at consortium institutions, will be well prepared to serve and lead around the globe in the fields of nuclear physics, chemistry and engineering.

Science education and research have been long-standing priorities at ACU and were enriched in 2018 by a $45 million investment in Bennett Labs, Onstead Science Center and Halbert-Walling Research Center. The Dillard Science and Engineering Research Center, opened in 2023, is the nation's first advanced reactor demonstration facility. The $23 million, 28,000-square-foot building on the ACU campus features a 6,000-square-foot research bay with a 25-foot-deep by 80-foot-long shielded trench and a 40-ton crane, as well as a training control room, conference room, office spaces, machine shop, and a series of specialized labs for radiochemistry, molten salt systems and instrumentation. A public foyer highlights the research within the facility.

Abilene Christian's state-of-the-art science facilities and world-renowned programs make ACU the right fit to lead and house the NEXT Lab.



THE NEED FOR ADVANCED REACTORS

Energy is essential for the delivery of drinking water, high-quality health care, security, commerce, communication, artificial intelligence and virtually every other part of our modern life.

In many parts of the developing world where the supply of energy is expensive, intermittent or unavailable, quality of life is greatly decreased. The living standard of people around the world is directly related to the amount of energy that is available for consumption.

Advanced reactors, such as the Natura MSR-1, have never been more essential to addressing the critical needs of the world's population.

Safer, cleaner and less-expensive energy

Advanced reactors modeled after the Natura MSR-1 are the preferred reactors to use in the quest for improving energy supply for several reasons.

SAFE AND CLEAN: Nuclear power is the safest and cleanest method to generate electricity on a commercial scale. The safety record of nuclear power is far superior to any other electricity-producing method, and advanced reactors will be even safer. Advanced reactors like the Natura MSR-1 only produce a few percent of the total waste that current reactors produce, and this waste will be relatively short-lived. In addition, nuclear power produces zero carbon dioxide emissions.

INEXPENSIVE: With new advanced reactor designs, the cost of power plants can be significantly reduced. Electricity can be produced at a true cost that is cheaper than any current energy source including coal, natural gas, solar or wind.

AVAILABLE ON DEMAND: Intermittent sources of electricity, such as wind or solar, can't be depended on to supply electricity in a meaningful large-scale manner. Conversely, nuclear reactors are designed to naturally produce more energy when there is a higher demand for electricity.

Pure and abundant water

The reactor is designed to operate at high temperatures (above 600° C), and commercial reactors using this technology will be an efficient heat source for industrial applications, including the desalination of water. Given that one in three people around the world suffer from a shortage of fresh water, this addresses a fundamental global need.

Medical isotopes for diagnosing and treating cancer

The Natura MSR-1 will naturally produce isotopes that are needed for treating cancer but are not found in nature. Molybdenum-99 (Mo-99) and bismuth-213 (Bi-213) are two radiopharmaceuticals showing great promise for diagnosing and treating cancer. Mo-99 allows doctors to make diagnoses quickly without the need for an invasive procedure.

Bi-213 provides a new treatment option, one that would spare patients from the pain caused by chemotherapy and has been amazingly effective in limited trials.

With the current unstable and limited worldwide supply of Mo-99, doctors are sometimes forced to make choices on which patient has a greater need for the procedures. To solve this shortage problem, people around the world are searching for a reliable supply of Mo-99. Currently, there is no source for Bi-213.

In both cases, the Natura MSR-1 is the first critical step to a solution. Many medical isotopes are formed efficiently in the natural nuclear processes inside the reactor.

NEXT LAB HISTORY

2015 After several years of research into sustainable energy sources, Dr. Rusty Towell, ACU professor of engineering and physics, presented findings at a TEDxACU talk titled "Why Making Energy From Dirt Might Save the World." His talk sparked interest in funding and support for future research.

2016 NEXT Lab officially formed.

2018 The Development Corporation of Abilene approved $300,000 in research and development funding for NEXT Lab, and the first full-time staff member was hired. Just a few months later, $3.2 million was contributed by the Robison Excelsior Foundation, and salt flowed through a molten salt test loop for the first time. Officials from the U.S. Department of Energy toured NEXT and requested follow-up visits in Washington, D.C.

2019 ACU hosted research workshops for partner universities in March and October. In November, the U.S. Department of Energy issued a Letter of Support for the MSRR.

Natura Resources

2020 Natura Resources announced funding of $21.5 million to ACU. NEXT Lab submitted a Regulatory Engagement Plan to the Nuclear Regulatory Commission (NRC).

2021 NEXT Lab installed a second molten salt test system in its on-campus facility in Abilene, Texas.

2022 ACU submitted the construction permit application to the NRC – the first advanced reactor construction permit application accepted for a university research reactor.

2023 The Gayle and Max Dillard Science and Engineering Research Center opened.

6,000-square-foot SERC research bay

2024 The NRC approved the construction permit for the MSRR, marking the first liquid-fueled molten salt reactor ever approved for construction by the NRC.

Dillard Science and Engineering Research Center